1. Cost of congestion to the trucking industry: 2017 update
   Torrey IV, W Ford, 2017, 41
   In this report a standardized methodology developed by the American Transportation Research Institute (ATRI) is applied to 2015 data to examine the impact to motor carriers of time delays on the National Highway System. Data inputs include: Federal Highway Administration (FHWA) Freight Analysis Framework Version 4, FHWA's National Performance Management Research Data Set Version 2015Q4, ATRI's 2015 national average operational cost of trucking, and ATRI commercial motor vehicle global positioning system (GPS) data from 2015. The results of the analysis show that in 2015 the trucking industry experienced more than 996 million hours of delay due to congestion. This delay equates to more than $63.4 billion in added operational costs or an average congestion cost per truck of $5,664 (based on 11.2 million registered large trucks). Congestion costs increased by an average of $0.23 per truck vehicle miles traveled from 2014 to 2015. Additional trends and statistics related to cost of congestion are presented in this report including top ten states, metropolitan areas, and counties with largest congestion cost increases. (TRID)

2. Designing electronic waybill solutions for road freight transport
   Bakhtyar, Shoaib, 2016, 210 p. (Thesis)
   In freight transportation, a waybill is an important document that contains essential information about a consignment. The focus of this thesis is on a multi-purpose electronic waybill (e-Waybill) service, which can provide the functions of a paper waybill, and which is capable of storing, at least, the information present in a paper waybill. In addition, the service can be used to support other existing Intelligent Transportation System (ITS) services by utilizing on synergies with the existing services. Additionally, information entities from the e-Waybill service are investigated for the purpose of knowledge-building concerning freight flows. A systematic review on state-of-the-art of the e-Waybill service reveals several limitations, such as limited focus on supporting ITS services. Five different conceptual e-Waybill solutions (that can be seen as abstract system designs for implementing the e-Waybill service) are proposed. The solutions are investigated for functional and technical requirements (non-functional
requirements), which can potentially impose constraints on a potential system for implementing the e-Waybill service. Further, the service is investigated for information and functional synergies with other ITS services. For information synergy analysis, the required input information entities for different ITS services are identified; and if at least one information entity can be provided by an e-Waybill at the right location we regard it to be a synergy. Additionally, a service design method has been proposed for supporting the process of designing new ITS services, which primarily utilizes on functional synergies between the e-Waybill and different existing ITS services. The suggested method is applied for designing a new ITS service, i.e., the Liability Intelligent Transport System (LITS) service. The purpose of the LITS service is to support the process of identifying when and where a consignment has been damaged and who was responsible when the damage occurred. Furthermore, information entities from e-Waybills are utilized for building improved knowledge concerning freight flows. A freight and route estimation method has been proposed for building improved knowledge, e.g., in national road administrations, on the movement of trucks and freight. The results from this thesis can be used to support the choice of practical e-Waybill service implementation, which has the possibility to provide high synergy with ITS services. This may lead to a higher utilization of ITS services and more sustainable transport, e.g., in terms of reduced congestion and emissions. Furthermore, the implemented e-Waybill service can be an enabler for collecting consignment and traffic data and converting the data into useful traffic information. In particular, the service can lead to increasing amounts of digitally stored data about consignments, which can lead to improved knowledge on the movement of freight and trucks. The knowledge may be helpful when making decisions concerning road taxes, fees, and infrastructure investments. (TRID)

3. **Development of active safety software of road freight transport, aimed at improving inter-city road safety, based on stereo vision technologies and road scene analysis**
   Prun, VE, Postnikov, VV, Sadekov RN, Sholomov, DL
   The article considers the active safety system of road freight transport. The stereoscopic computer vision is the core of the system. The article also describes the major algorithms of active safety and the accuracy characteristics of algorithms' application. (Springer)

4. **Development of tools for processing truck GPS data and analysis of freight transportation facilities**
   Dulebenets, Maxim A, Pujats, Karlis, Deligiannis, Nikolaos, Golas, Mihalis M, Mishra, Sabya
   Transportation Research Board 96th Annual Meeting
   Increasing volumes of trucks on roadways cause increasing congestion and product delivery delays to the customers. Nowadays public and private stakeholders seek for efficient methodologies that may assist with identification of congested roadway segments and further allocation of the available monetary resources among the segments that require future improvements. This study presents two new applications that process the raw Global Positioning System data, collected from trucks, and efficiently calculate a wide range of performance measures. A case study is conducted to demonstrate how the developed applications may be used by decision makers in identification of the congested roadway segments, reliability of freight corridors, estimation of truck trips, analysis of rest areas and freight facilities, and freight transportation planning. (TRID)

5. **Evaluation framework in Cooperative Intelligent Transport Systems (C-ITS) for freight transport: the case of the CO-GISTICS speed advice service**
   Josep Maria Salanova Grau, Andrea Rusich, Evangelos Mitsakis, Walter Ukovich, Maria Pia Fanti, Georgia Aifadopoulou
   The transport sector has relevant impacts on economic and social aspects in the European Union. Freight transportation had an increasing role in this context with road transport that covers 45% of the total billion ton-kilometres in 2012. Cooperative intelligent transport systems (ITS) are promising solutions to adopt in order to increase the efficiency and reduce the environmental impacts of freight road transportation. In recent years, the European Community has founded several projects concerning C-ITS applications in freight transportation. A valuable evaluation of their impacts represents a new challenge. The current paper overviews the impact assessment methodologies applied in recent founded projects with the aim of defining an evaluation framework for the ongoing 7th Framework Program project “COoperative IoGISTICS for sustainable mobility of goods (CO-GISTICS)”. Moreover,
a complete case study of the Priority and Speed Advice service is detailed, highlighting both qualitative and quantitative aspects. (Taylor & Francis)

6. Emerging hot spot analysis: Estimating the development in the speed of freight in a region using tracking data from logistics companies
Reinau, Kristian Hegner
Traditionally, focus in the transport field, both politically and scientifically, has been on private cars and public transport. Freight transport has been a neglected topic. Recent years has seen an increased focus upon congestion as a core issue across Europe, resulting in a great need for knowledge about how congestion influences freight transport. This article presents an analysis of how fast freight move in Northern Jutland Denmark and how this has developed through time, and the analysis contributes to the state of the art in two ways. First, the analysis is based on unique data, tracking data from two major Danish logistics companies, and thus tracking data from thousands of trucks. Current speed statistics in the region rely on sensor networks which cannot distinguish clearly between trucks and other vehicles, which means that there are significant uncertainties regarding the current speed data for freight. Secondly, the analytical methods used, space-time cubes and emerging hot spot analysis, are also new in the freight transport field. The analysis thus estimates precisely how fast freight moves on the roads in Northern Jutland and how this has evolved over time.
http://www.forskningsdatabasen.dk/en/catalog/2389685773

7. Feasibility study for the introduction of synchro modal freight transportation concept.
Agbenyegah Agbo, Wenfeng Li, Charles Atombo, Gabriel Lodewijks & Lanbo
Journal Cogent Engineering, 2017, Vol.4, No.1
The current weaknesses of the conventional intermodal freight transportation system have led to the development of the synchro modal freight transportation concept introduced and piloted in the Netherlands. The innovative concept has the advantage of adding flexibility, cost reduction, and sustainability among other things, into the freight transportation system. The synchro modal system has not been started in any developing country yet due to its newness. In this study, we used multiple methodologies to conduct a feasibility study for the possibilities of introducing the concept in a developing country, Ghana. An intensive literature review was performed using the Grounded Theory and the Critical Success Factors (CSFs) method to identify the key factors for the introduction of the synchro modal concept. Questionnaires were administered to the primary stakeholders in the maritime-hinterland transportation sector to solicit their views about the factors necessary for the implementation. We next carried out SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis to catalogue the strengths and weakness of the country in introducing the concept. The multiple regression analysis method was used to analyse the experience of stakeholders in the freight transportation business and their knowledge about the synchro modal freight transportation system. The results of the study show that it is possible to introduce the concept in the country. However, there is the need to improve the current transportation and ports infrastructure of the country considerably for successful synchro modal system adaptation. There is also the need for stakeholder’s education on the concept. (Taylor & Francis)

8. Heavy vehicle management: restriction strategies
Al Eisaeea Mohammed, Moridpour Sara, Tay Richard
2016 International Symposium of Transport Simulation (ISTS’16 Conference), pp. 18-28
Road freight transport is considered as an important aspect of the Australian economy. Due to the operational characteristics (e.g. acceleration/deceleration, manoeuvrability) and physical specifications (e.g. length, size) of heavy vehicles, they impose negative impacts on surrounding traffic. These negative impacts include increasing traffic congestion, reducing traffic safety and increasing air and noise pollution. The negative impacts imposed by heavy vehicles would be intensified at arterial roads due to the presence of traffic lights when heavy vehicles have to decelerate at the red light, stop and then accelerate again. Considering the negative impacts of heavy vehicles on their surrounding traffic, suitable management strategies should be implemented to accommodate the increase in number of heavy vehicles. A typical method of managing heavy vehicle movements is through implementing alternative heavy vehicle restriction strategies. The main focus of this paper is to address the influence of heavy vehicle space restriction strategies for different classes of heavy vehicles on traffic congestion. In this research heavy vehicles have been classified into three classes including Rigid,
9. Inverse vehicle routing for activity-based urban freight forecast modelling and city logistics
Soyoung Iris You, Joseph Y. J. Chow, Stephen G. Ritchie
Goods movement is one of the fastest growing transportation sectors, affecting both economic and environmental sustainability, particularly in dense urban areas with traffic congestion and air pollution. To meet this challenge, urban public agencies have paid attention to policies and systems to facilitate efficient and sustainable city logistics. This paper proposes a modelling framework to consider both spatial–temporal constraints and a means to calibrate the model from observable data, based on an adaptation of an activity-based passenger model called the household activity pattern problem. Conceptual comparisons with a state-of-the-art freight forecasting methodology are made using an example. Application of the model is illustrated through formulating and implementing a Sequential Selective Vehicle Routing Problem associated with drayage truck activities at the San Pedro Bay Ports in Southern California. (Taylor & Francis)

10. Intelligent transport systems for road freight transport—an overview
Ilja Bäumler-Herbert Kotzab
Dynamics in Logistics, pp.279-290
This paper presents a state-of-the-art analysis of Intelligent Transport Systems (ITS) for road freight transport including an overview of telematics applications for road freight transport. Furthermore, an analysis on how different actors of a transport chain perceive the developments of ITS is given. The paper also presents selected examples of practical ITS usage. (Taylor & Francis)

11. Integrated intermodal transportation corridors for economically viable and safe global supply chain
Uddin, Waheed, Sherry, Patrick, Eksioglu, Burak, 2016
Report Numbers NCITEC 2012-27
Transportation infrastructure networks are essential to sustain our economy, society and quality of life. Freight transportation of consumer goods and commercial/industrial products is critical for sustainable and efficient supply chain. The primary objectives of this project are to identify major transportation corridors involving inland river ports, highway network and rail infrastructure; and to evaluate the revenue/funding aspects, economic viability, safety, and disaster resiliency of integrating selected segments of the candidate corridors. The scope of this project is limited to North American Free Trade Agreement (NAFTA) trading partner countries of the United States, Canada, and Mexico. The project investigated the aspects of multimodal freight related to congestion, intermodal integration, and impacts of fuel savings and carbon dioxide emissions. Key results of the study include: (1) This project developed geospatial maps, optimization models, benefit/cost results of proposed modal integration simulation studies, life cycle economic model results of economic and environmental impacts, and intermodal infrastructure bank proposal. (2) Theoretical consideration and associated field studies improved understanding of transportation professionals for tire/pavement interaction during braking and crash incidents. Guidelines are recommended for implementation to improve road safety. (3) Computer simulations of commodity flow through selected port(s) and freight corridor(s) with economic and sustainability analysis are used to show the importance of the intermodal integration approach for enhancing the economic competitiveness, safety, security and disaster resilience of freight transport. (4) The intermodal freight corridor case studies are used to develop a “best practice guide” for consideration by government transportation agencies, private transport operators, and other global
supply chain stakeholders. (5) The developed approach of freight corridor integration studies demonstrate the assessment of economic and other societal benefits, which include reduction of wastage of hours of travel time and traffic congestion, cost avoidance of fuel wastage on highway corridors, and decrease in transportation related emissions of carbon dioxide and other harmful pollutants. It is recommended that the developed approach of multimodal freight corridor studies be applied by transportation agencies to assess economic and other societal benefits, which include reduction in highway congestion and decrease in transportation related harmful emissions. (TRID)

12. Investigating public opinions towards emerging transportation technologies and service forms
Wang, Xiaokun (Cara), 2016
Technology advancement is bringing many changes to the transportation system. Some well-known examples are connected and autonomous vehicles and on-demand mobility services (including the ride hailing services such as Uber and on-demand home deliveries). In short term, these emerging technologies and services may enhance the efficiency of transportation system operation, improve traffic condition and residents’ quality of life. In long term, they will change people’s perception of travel time and traffic safety conditions, and reshape their behaviour. It has already been shown that the on-demand deliveries increase freight trips without reducing personal shopping trips. Policy makers are concerned that these new technologies and service forms may further reduce people’s perceived travel costs, inducing more travel activities and longer commuting distances, adding to the current congestion and urban sprawl conditions, and resulting in increased externalities. Some innovative demand management initiatives are thus being investigated, including new pricing schemes, new ride matching algorithms, and new facility planning and operation strategies. To get prepared for the changing trends, it is necessary to understand (1) how residents perceive these new technologies and service forms; (2) How they are ready to adapt to such a new transportation era in terms of technology/service form adoption and behavioural change; and (3) their reactions to potential demand management strategies. The goal of this proposed study is to analyse public opinions on the emerging transportation technologies and service forms in New York State (NYS) and assess the influence of travel demand management strategies through diligent data collection and analysis. In pursuit of the research goal, the proposed project will achieve the following objectives: (1) Acquire detailed information about public opinions towards emerging transportation technologies and service forms in NYS through a two-fold survey, and develop a comprehensive database; (2) Develop rigorous analysis framework that characterize public opinions and their expected behavioural responses, identify connections between residents’ socioeconomic characteristics and their responses; and quantify the effects of demand management strategies on respondent reactions; and (3) Based on the findings, simulate the future transportation system performance with the influence of emerging transportation technologies and service forms in NYS, with and without demand management initiatives, proposing optimal strategies that improve future transportation system operation efficiency. (TRID)

13. Managing the freight deliveries in Manhattan: opportunities for collaborative city logistics measures
Chowdhury, Md Shoaib
2016 International Conference on Transportation and Development, pp. 162-170Manhattan, the economic heart of New York City, is the most densely populated place in United States of America (USA) with diverse economic activities. It is also one of the most polluted and congested cities. Manhattan heavily relies on trucks for the delivery of goods, which contributes to congestions and in turn makes the delivery of goods and doing business costly. If Manhattan has to maintain sustained economic growth and ensure the quality of city life, efficient and cost economic freight delivery arrangements need to be made. Based on the review of literatures, it is identified that a freight consolidation and distribution strategy along with the utilization of cleaner motorized and non-motorized vehicles could be a potential solution to the problem as it would help increase the roadway capacity while potentially reducing the number of delivery vehicles on city streets. Furthermore, a vehicle may be used for a shared delivery of goods to multiple businesses/consumers. To further evaluate the strategy and to develop a comprehensive logistical and management solutions to the problem, it is recommended that the city administration leads the effort to collaborate with the private sector stakeholders including trucker's/carriers, businesses and consumers. (TRID)
14. Managing the impacts of freight in California
Giuliano, Genevieve
USDOT Program, 2017
One of the requirements outlined for a Fixing America’s Surface Transportation (FAST) Act-compliant
State Freight Management Plan is the need to consider the impact of significant congestion or delays
caused by the freight industry. Freight is a major industry in California. Growing freight demand
increases recurring congestion at freight bottlenecks, places where freight and passenger service
conflict with one another, and where there is not enough room for local pickup and delivery. Congested
freight hubs include international gateways such as ports, airports, border crossings, and major
domestic terminals and transfer points such as intermodal rail yards. Bottlenecks between freight hubs
are caused by converging traffic at highway intersections and railroad junctions, steep grades on
highways and rail lines, lane reductions on highways, and single-track portions of railroads, and locks
and constrained channels on waterways. The purpose of this project is to identify significant congestion
or delay caused by freight movements in the State of California, describe impacts of these delays on
other modes, and identify strategies to mitigate these effects. The main objective of this research is to
generate recommendations on the most effective strategies for reducing freight related congestion and
its impacts. These recommendations will be considered for inclusion in the California Freight Mobility
Plan (CFMP) to comply with FAST Act requirements. (TRID)

15. Marginal congestion costs in the case of multi-class traffic: A macroscopic assessment for the
Paris Region
Beziat Adrien, Koning Martin, Toilier Florence,
Transport Policy, 2017, Vol.60, pp.87-98
Although road congestion caused by freight activities is often pointed-out by researchers and public
deciders as a major issue, few studies model time losses at a macroscopic-regional level within a
“multi-class traffic” framework. This research proposes such empirical assessment for the Paris region,
using a simple method based on individuals' trip durations. The authors combine information on
passengers and commercial transport (to describe road demand) with a GIS describing the stock of
infrastructures (road supply) on that territory. According to econometric results, the travel times react
differently to the flow of similar and dissimilar vehicles: Cars and vans are more impacted than trucks
by the volume of “small” vehicles, whereas “large” vehicles are more affected than cars and vans by
the presence of other large vehicles. The authors' methodology thus highlights varying and reciprocal
congestion impacts, which is not common in the literature. They then propose various marginal
congestion costs, for various origin-destination pairs, various time periods and various types of
vehicles. In particular, they decompose external losses incurred to each category of vehicles by each
category of vehicles. These results constitute valuable materials for future appraisals of transport
policies in the Paris region. (TRID)

16. Multimodal freight transportation research roadmap
Rogers, William
RIP Project 41155
As outlined in the U.S. Department of Transportation (DOT)'s 30-year plan, Beyond Traffic, the nation's
ability to compete in global markets and to meet the needs and expectations of consumers and industry
depends on a robust multimodal freight transportation system and agile and efficient supply chains.
Rural communities, cities, and metropolitan areas rely on supply chains, and the supporting freight
transportation systems, to send and receive vast amount of supplies needed by local economies. For
example, freight-intensive-sectors (e.g., manufacturing, wholesale, retail, food, accommodation) – for
which the production and/or consumption of supplies are an essential part of their business – represent
45% of the establishments and 50% of the employment in the United States. Inefficient supply chains
will have a negative effect on all of them, hampering economic activity. Furthermore, the freight system
is under serious strain, with roads, railways, and airports becoming increasingly congested and
increasingly aging. Market and technological trends are impacting freight activity patterns in numerous
ways, both globally and locally. International trade is increasing, global manufacturing centres are
shifting, and trade routes are changing. Firms are driving down logistics costs through just-in-time
shipping. Online shopping is increasing demand for home delivery of consumer products, especially in
dense urban environments. Retailers, faced with new mobile computing consumer buying behaviour,
are experimenting with a wide range of new transportation options for last mile delivery. Intermodal
freight shipped in containers via ships, trains, and trucks is continuing to grow. Surging domestic
energy production is straining infrastructure in oil production regions. In the next 30 years, changes in freight demand, shipping, manufacturing, logistics, technology, and energy production are poised to transform the economics of transportation yet again. By 2045, freight volume will increase 45% from current levels. The increasing congestion in metropolitan areas is a major threat to the U.S. economy. About 80% of the freight transported in the U.S. has its origin or destination at one of the top 100 metropolitan areas, reflecting that the bulk of manufacturing is produced in metropolitan areas, and in turn, increases congestion and emissions in these areas. Taking into account the surge in Internet orders in the last several years, it is almost certain that deliveries to households now generate more freight trips than deliveries to commercial establishments. At the same time, a host of new technologies and operational practices are transforming freight transportation systems and supply chains. Smart City technologies, truck platooning, autonomous trucks, drones, 3D printing, delivery crowdsourcing, and others are already making their mark. As an example, 3D printing may lead to decentralization of manufacturing and to the development of on-demand manufacturing, resulting in unforeseen demands on road infrastructure because of the growth in small truck freight trip generation. There is a need to better understand the current and anticipated future freight trends to provide transportation agencies with the information they need to develop strategic plans. More specifically, research is needed to gain insight into how market and technological trends could impact transportation systems, safety, and the environment. Conducting research, with the collaboration of other stakeholders, that identifies, designs, pilot tests, and leads to the adoption of effective public sector freight initiatives, will help transportation agencies achieve their goals. The objective of this project is to develop a dynamic 5- to 10-year multimodal freight research roadmap. The roadmap should emphasize problem statements with a scope and budget appropriate for the National Cooperative Highway Research Program (NCHRP), but can include problem statements that are more suitable for other public, private, or academic research institutions or programs. The research roadmap should clearly define a portfolio of initiatives that will advance the knowledge and capabilities of transportation decision makers. The research roadmap should include, but not be limited to: (1) end-to-end emphasis (i.e., consider the research needs of all modes and stages of freight activity, from gateways, to corridors, to local deliveries); (2) identifying and assessing the impacts of social, technological, economic, environmental, and political trends on freight transportation systems and policies; (3) enhancing public sector decision-making capabilities (i.e., the research roadmap should lead to the development of new tools or methods and ways to gather necessary data for public agencies to make decisions that improve freight system performance); (4) expanding and deepening public sector knowledge (i.e., the research roadmap should contain projects that enhance the public sector’s understanding of the behaviour of the agents involved in freight, and the best ways to influence them to improve freight system performance); and (5) addressing institutional issues (i.e., analysing current and potential barriers to preventing improved freight transportation systems that could increase economic efficiency and productivity, foster sustainability, enhance liveability, quality of life, and environmental justice). The research roadmap should include: (1) a prioritized portfolio of problem statements, most of which should address the research gaps in a format and at a level of detail suitable for submission to NCHRP; (2) a detailed description and justification of how this portfolio addresses the five objective criteria; (3) an assessment of key gaps and needs that could be addressed through research and how this portfolio addresses these gaps; and (4) a dynamic communications concept (including format, platform, frequency, distribution channels, budget, and editorial and technical content) that could be widely distributed to keep practitioners informed of emerging issues affecting freight transportation. (TRID)

17. Networked control challenges in collaborative road freight transport
Kuo-YunLiang, Sebastian van de Hoefab, Håkan Terelius, Valerio Turria, Bart Besselink, Jonas Mårtensson, Karl H. Johansson
European Journal of Control, 2016, Vol.30, pp. 2-14
Freight transport is of major importance for the European economy and is growing thanks to increasing global trade. About three quarters of inland freight transport in the European Union is on roads. It has the potential to go through a dramatic change over the next decades thanks to the recent development of technologies such as wireless communication, cloud computing, sensor devices, and vehicle electronics. They enable a new integrated goods transport system based on optimized logistics, real-time traffic information, vehicular communications, collaborative driving, and autonomous vehicles. In this paper, we discuss challenges in creating a more efficient and sustainable goods road transportation system and how some of them can be tackled with a networked control approach. In particular, we discuss a method to improve the efficiency of the transportation system by minimizing the
number of empty transports needed to fulfil the assignments on a given road network. Assignments with overlapping route segments might lead to further improvements, as the formation of vehicle platoons yields reduced fuel consumption. For realistic scenarios, it is shown that such collaboration opportunities arise already with relatively few vehicles. The fuel-efficient formation and control of platoons is also discussed. Some of the presented methods have been tested on real vehicles in traffic. The paper shows experimental results on automatic formation of vehicle platoons on a Swedish highway. The influence of traffic density on the merge manoeuvre is illustrated. The results indicate that platoon coordination could be improved by support from appropriate traffic monitoring technologies.

(Science direct)

18. Overcoming barriers to the off-peak movement of freight in urban areas
Taylor, S, Giang, C, Kogios, L
ARRB Conference, 27th, 2016, Melbourne, Victoria, Australia, 2016
This paper presents the findings and outcomes on Austroads project: Overcoming Barriers to the Off-Peak Movement of Freight in Urban Areas project. The project investigated the hypothesis that off-peak (or out of hours) deliveries in urban areas have potential to reduce congestion, and assist freight and logistics operations. The objectives of the project are to provide comprehensive insight into: (1) what drives current supply chain operations and time of day freight movement in urban areas, (2) barriers to changing freight movement to off-peak hours (e.g. night time) and, (3) potential ways to overcome these barriers. The project was conducted in three phases: (1) literature review of current knowledge, experience and case studies promoting off-peak freight movement in Australia and overseas, (2) examining different supply chains and their practices in Australia and New Zealand, and (3) identifying supply chains and organisations interested in participating in off-peak delivery trials. Discussions with more than 60 people across 40 organisations ranging from international freight experts, Australian retailers and jurisdictions were held during the course of the project. The investigation revealed many successful examples of off-peak freight movement across the world that is relatable to Australia including the UK, Europe and USA. Stakeholder consultation with retailers and local jurisdictions also identified obstacles which are limiting the uptake of off-peak delivery in Australia. The paper recommends a number of steps which can be taken to both prepare and encourage change in urban freight deliveries. These include working together in a partnership approach, having discussions around the use of new technology to assist in off-peak deliveries, and demonstrating benefits of pilot trials.

(TRID)

19. Planning of resource replenishment location for service trucks under network congestion and routing constraints
Hajibabai, Leila, Ouyang, Yanfeng
Journal of the Transportation Research Board, 2016, No. 2567
It is often very challenging to plan expedient and cost-effective operations for service trucks under network design constraints, particularly on congested urban roadways. Hence, it is beneficial to account simultaneously for decisions on truck facility location design and network expansion to mitigate the additional congestion caused by trucks and facilitate their routing. This study developed an integrated mathematical model for facility location design under network routing and congestion constraints. The model determines the optimal number and location of replenishment facilities, minimizes truck routing costs on the basis of proposed network design, assigns traffic in the network (for both general roadway users and service trucks), and selects candidate links for possible roadway capacity expansion. The model aims to minimize the total costs for new facility construction, truck routing, transportation infrastructure expansion, and transportation delay. A genetic algorithm framework was developed that incorporates a continuous approximation model for truck routing cost estimation and a traffic assignment algorithm. The numerical results show that the integrated solution technique can solve the problem effectively. (TRID)

20. Potential for ITS/ICT solutions in urban freight management
Jacek Oskarbski, Daniel Kaszubowski
Transportation Research Procedia, 2016, Vol.16, pp.433-448
The article presents a study on applying ITS solutions in planning and management of urban freight transport in Gdynia. The traffic management system Tristar which is under implementation and its related systems show a potential to assist in development of freight transport measures. Recommendations for urban freight policy development supplementing Gdynia’s Sustainable Urban
Mobility Plan were used as a basis for identification where ITS/ITC could be implemented. The first stage may involve modelling and analysis of freight vehicle traffic with new multilevel transport model for Gdynia. Other possible measures include, among others provision of dynamic information for vehicle routing and priorities for trucks on selected sections of road network. However, problems with access to reliable data describing delivery vehicle traffic were identified in this early stage as no practical rules for their collection had been developed. Additional problems appear in acquiring urban supply chain characteristics that require collaboration with the private sector. Such studies have not as yet been conducted in Poland. The identified factors indicate the need to precisely specify expected results and the areas of ITS application in Gdynia to prepare for their. Dynamic routing and scheduling with real time information appeared to be the most promising solution applying ITS, with temporary priorities for HGV providing services to the sea port in Gdynia in peak traffic and directing lorries implementation to free parking slots. Experience gained in these applications will be useful in developing other, complex solutions, e.g. in organising distribution in the city centre. (Science direct)

21. Proposal for an evaluation grid for analysing local public urban freight policies: strengths, weaknesses and opportunities for French cities
Raphaëlle Ducret, Diana Diziaïn, Thomas Plantier
Transportation Research Procedia, 2016, Vol.12, pp.105-118
This article proposes an evaluation grid for analysing local public policies relating to freight transport in French cities. It is designed to provide local authorities and freight operators with guidelines for improving the urban freight management. The analysis is carried out on two levels: first a general analysis of the French context; then, a comparative analysis of three cities (Lyon, Angers and Toulouse). Eight criteria appeared as being essential for qualifying a local public urban freight policy. They cover the determining factors of the public freight policy. This method allows a comparison between regions, as well as an assessment of progress over time.(Science direct)

22. Requirements from vehicle routing software: perspectives from literature, developers and the freight industry
Rincon-Garcia, Nicolas, Waterson, Ben J, Cherrett, Tom J
Routing and scheduling software is part of the information and technology systems available to support the transport industry, and uses complex algorithms along with geographical representations of the road network to allow better planning of daily collection and delivery schedules. This paper reviews the evolution of routing and scheduling software, the algorithms used along with reported barriers to wider take-up and potential industry-driven improvements that could be made. A survey of transport companies in the U.K. was conducted in order to validate and prioritise the software capabilities that require the most development according to the new challenges that the industry is facing. Responses suggested that companies required improved route optimisation to tackle congestion based on time-dependent data and models, and greater accuracy in the representation of the road network. Not considering congestion leads to the underestimation of travel times and the production of inaccurate schedules. Literature shows that operational research techniques are available to solve problems that represent real-world conditions, but research into the relative merits of using time-dependent models needs to be undertaken. Data might be improved by cooperation between government and private sector. (TRID)

23. Study the impacts of freight consolidation and truck sharing on freight mobility
Liu, Tieming, Zhao, Chaoyue, 2017
The trucking industry has become an indispensable part of the economy. However, the trucking industry in the United States (U.S.) is very fragmented. It is difficult for small carriers to get enough shipping demand to fill the truckload for every trip, especially the returning trip. It is estimated around 20% of trucks on roads are traveling empty. Traveling empty trucks increases the freight costs, and contributes to traffic congestion and air pollution. Recently developed online freight-matching marketplaces can help small carriers find shippers to fill the truckload quickly. Such online freight-matching market places are rising to prominence with a network of small carriers. As the size of the network grows, large carriers also start to use this option to handle unmet demand or unused capacities. However, online freight consolidation is highly complex due to the many different types and
sizes of freight and trucks. It is very difficult and time-consuming for carriers to search shippers’ demand information online to identify freight consolidation options. As such, there is a need to provide consolidation solutions to the carriers. The goal of this project is to show the impacts of online freight consolidation on freight mobility, congestion and emission reduction, and thus draw the attention of transportation authorities and logistics companies. This project will lead more resources and experts to study online freight matching problems to further improve freight efficiency and reduce traffic congestion and emissions. (TRID)

24. **System dynamics investigation of freight flows, economic development and network performance**
   Stroombergen, A, Stuart, G, Barsanti, T
   The purpose of this research was to investigate if and how systems dynamic (SD) modelling could be used for understanding traffic flows at an inter-regional (state highway) level, in the context of improving understanding of the relationship between economic activity, the demand for freight, and the performance of the rail and road network. We used the Auckland – Hamilton – Tauranga (AHT) triangle as a pilot case study. The research involved the design and construction of three models; two simple Bayesian vector autoregressive model to forecast economic activity and freight flows within the AHT region, and a high level SD model for simulating freight flows along the main roads in the region. The key strength, and hence the main reason for selecting an SD model for this latter task, is that time is explicit. This means the SD model can simulate processes such as traffic flows, encompassing delays, congestion and capacity constraints. The SD model can be used to ask ‘what if’ questions around future freight growth and infrastructure planning. Examples include road improvements along the Waikato Expressway and the Kaimai Range, greater use of larger (HPMV) trucks, changes in driver working hours and road–rail substitution. (TRID)

25. **The constraints of vehicle range and congestion for the use of electric vehicles for urban freight in France**
   Rizet Christophe, Cruz Cecilia, Vromant Martine
   Transportation Research Procedia, 2016, Vol.12, pp.500-507
   Electric vehicle is a solution to reduce pollutant emissions from road urban freight. This paper assesses the potential CO₂ reduction by transferring urban freight from diesel to electric vehicles while simultaneously looking at the two main technical constraints: electric vehicle range and the impact on congestion linked to change diesel heavy duty vehicles (with a load up to 25 tons) to much smaller electric vehicles. The data used has been computed from a survey (ECHO) that describes in details a very large sample of French shipments. Two scenarios were set up, which differ mainly by the type of available electric vehicle: In scenario E1, the electric vehicle has a payload of 2 tons, versus 6 tons in scenario E2. The vehicle range is not very binding for urban deliveries in our scenario, except in the Paris Urban area. The CO₂ reduction is nearly the same in the two scenarios, but the congestion is much higher in scenario E1, showing that the payload is an important issue for the generalisation of electric vehicles in urban freight. (TRID)

26. **The effects of transportation infrastructure investments on freight mobility: a megaregion perspective**
   Walton, Michael, 2017
   Megaregions demonstrate strong economic linkages and support extensive internal freight movements amongst their constituent metropolitan areas. (Harrison, et al. 2011) As megaregions continue to grow, the number of freight movements is likely to increase, and new infrastructure or policies will be necessary to accommodate that growth. In 2014, traffic congestion cost urban areas of the United States $160 billion with trucks accounting for a disproportionately large share. (Schrank, et al. 2015) Additionally, the transportation sector causes over a quarter of the United States’ greenhouse gases, oxides of nitrogen, and volatile organic compounds. (United States Environmental Protection Agency 2017) (United States Environmental Protection Agency 2016) Improving the efficiency of freight flows within megaregions therefore has the potential to drastically reduce pollution and congestion. The proposed research will examine innovative strategies to increase the productivity of freight movements from the perspectives of technical, economic, and political feasibility. Specific strategies to be examined include truck-only lanes, autonomous trucking convoys, freight rail electrification, and truck–rail transfer hubs. While all of those strategies are active areas of research, they have not been widely
examined in the context of megaregions. The strong linkages within megaregions could create conditions for these strategies to work better than they otherwise would, but the lack of uniform governance throughout megaregions creates challenges for their implementation. As different technologies are developed, there will be significant changes in the efficiency of each freight mode. Additionally, investments in the power grid constantly change the emissions profile of electric vehicles. This research will incorporate predicted efficiency improvements and grid compositions to compare different alternatives. (TRID)

27. The smart freight project as a superior way to cope with congestion and environmental negative externalities in urban areas
Bubel, Dagmara, Szymczyk, Katarzyna
Congestion, car exhaust gases, permanent noise and risk of accidents are the most common and severe problems in conurbations, especially in their cores or commerce districts. Such problems basically result from the continuously increasing amount of private and business vehicles on streets. It is obvious that more cars moving on the streets indicate more environmental negative externalities; therefore, new solutions to combat them are not only needed, but absolutely necessary. The aim of this dissemination paper is to focus on the idea of the Smart Freight project which was introduced in the European Union (EU) a few years ago, but still has been neglected by many city representatives or cargo delivery companies. The project deals with all the problems that appear inside city centres due to cargo trucks services or lorry door-to-door delivery. The authors of this paper posit the hypothesis that for the time being, the Smart Freight project is the best solution against congestion and environmentally harmful externalities in urban areas. To support the hypothesis and show the effectiveness and benefits of the Smart Freight project implementation, the authors discuss all assumptions of the Smart Freight project and analyse statistics, figures and survey data collected in the cities where the Smart Freight project has been launched. (TRID)

28. Tracking truck flows with programmable mobile devices for drayage efficiency analysis
Lam, Shui, 2016, 40 p.
Inefficient use of drayage trucks results in negative externalities in the form of pollution and congestion. A clear awareness of the current state of drayage efficiency is especially important in Southern California since the cargo volume at the Ports of Los Angeles and Long Beach has just about recovered to its previous peak since the 2007-2008 financial crisis. A full measure of this awareness can only be obtained through detailed tracking of drayage activities. GPS tracking has been used for fleet and asset management, and can certainly be adopted for tracking truck movements. Data obtained through GPS tracking, however, can provide detailed information of where and when a truck has been, but not what a truck is doing at a particular location. Such information would require driver inputs. Tablet computers provide an ideal platform for the design of an electronic on-board recorder that supports both GPS tracking and touch screen input. In this report the authors will present their experience with the development of such a device, and findings from the data collected through its deployment. A thorough understanding of drayage inefficiencies and their causes, and the freight flow pattern in a given area will not only provide useful data for the truck industry to devise strategies for productivity improvement, but also help stakeholders in supply chain management, including the ports and terminal operators, to identify the sources of inefficiency in drayage, quantify the impacts of these inefficiencies and develop solutions. Such understanding would be especially important in the Southern California area where the largest port complex in the United States is located and where a large and growing population resides. (TRID)

29. Truck activity monitoring system for freight transportation analysis
Andre, Kyung (Kate) Hyun, Sarah Hernande, Kyungsoo, Yue (Ethan), Craig Rind, Stephen G. Ritchie
Transportation Research Record: Journal of the Transportation Research, Volume 2610, Understanding truck activity is an essential component of strategic freight planning and programming. However, recent studies have revealed a significant void in the availability of detailed truck activity data. Although some existing detectors are capable of providing truck counts by axle configuration, higher-resolution data that indicate truck body configuration, industry served, and commodity carried cannot be obtained from existing sensors. This paper presents the newly developed Truck Activity Monitoring System, which leverages existing in-pavement traffic sensors to provide truck activity data in California. Existing inductive loop detector sites were updated with inductive signature technology and
advanced truck classification models were implemented to provide detailed truck count data with more than 40 truck body configurations. The system has been deployed to more than 90 detector locations in California to provide coverage at state borders, regional cordons, and significant metropolitan truck corridors. An interactive geographic information system website provides users with advanced visual analytics and access to archived data across all deployed locations. The case studies presented in this paper demonstrate the potential of the data obtained from this system in analysing and understanding current and historical industry-specific truck activity. (TRB)

30. Truck route choice modelling using large streams of GPS Data
Pinjari Abdul, 2016
The overarching goal of this research is to utilize large streams of global position system (GPS) data of truck movements to analyse the travel routes (or paths) freight trucks choose to travel between different origins and destinations. To this end, the project will develop truck route choice models for understanding the factors influencing freight-truck route choice patterns in metropolitan regions of Florida. The large amount data to be used for this project offers an unprecedented opportunity to observe truck travel paths of a large number of trips between different origin and destination locations in Florida. Taking advantage of this, the project will analyse the diversity of observed truck travel paths between different origin and destination locations. Such an analysis will shed light into the factors, such as characteristics of the highway network structure, influencing the variability of truck travel paths between different origin and destination locations. Subsequently, the project will develop modelling tools to analyse and forecast the travel path choices of freight trucks under alternative scenarios. The models and findings from this project can potentially be used for designing short-term truck routing policies aimed at congestion mitigation, improving reliability, and for maintenance of good repair. Besides, it is essential to understand and to forecast truck travel route choice and the aggregate level network performance for medium- to long-term decisions such as the designation of truck routes, addition of new truck corridors, and by-pass routes. In addition, understanding individual truck route choice patterns can help in estimating link-level truck traffic volumes that have a bearing on highway pavement management decisions. (TRID)

31. Urban freight transport in city strategic planning
MajaKiba-Janiak
Research in Transportation Business & Management, 2017, Vol.24, pp.4-16
The issue of urban freight transport in city strategic planning is discussed in this paper. There are two main purposes of the paper - a theoretical one and empirical one. The author's concept of maturity levels of cities in planning and implementing activities in favour of urban freight transport is the theoretical objective, while the empirical objective deals with the analysis of selected European capital cities in terms of urban policy in creating long-term plans in the area of urban freight. In order to achieve these objectives the author has conducted a survey among selected European cities. As a result of the conducted survey, the description of the process maturity levels of studied cities with the use of a taxonomic measure in the field of planning and implementing urban freight transport actions has been proposed. The concept of process maturity of cities in the field of planning and carrying out actions in urban freight transport may be a practical tool for local authorities willing to self-improve and develop in this field. (Science direct)

32. Use of technology to measure and improve freight movements
The advance of technology has created several rich sources of data to analyse road network performance and freight patterns. New technology is also driving intelligent transport systems (ITS) designed to improve transport operations. This research used Auckland as a case study to explore how existing and real-time data sources could be used to manage network performance and improve journey predictability for urban freight using ITS solutions. Drawing on previous research and a wide range of international literature and case studies, the report presents an overview of the role of ITS and the innovative ways technology is being applied to measure congestion and manage infrastructure more effectively. Extensive industry stakeholder engagement revealed a high level of frustration and urgency to find solutions to improve network efficiency and an acknowledgement of the role of technology alongside infrastructure and regulatory measures to support efficient urban freight movement. This report proposes five case studies to demonstrate the application of technological
solutions to manage and improve network performance with regard to network efficiency, network optimisation and improved journey predictability for urban freight in Auckland. (TRID)

33. **Vehicle route reconstruction from GPS data: a map-matching algorithm harnessing open source software**
Camargo, P V, Hernandez, S V

The availability of large sensor-generated transportation datasets has increased rapidly in many parts of the world, but it has not yet been fully leveraged by transportation modellers in the USA, Australia and elsewhere. Further, the low quantity and quality of data available for freight transportation planning model development requires modellers to extract as much information as possible from every dataset. While GPS data from vehicles has the potential to provide a wealth of data for route choice behaviours, cross-validation of traditional vehicle classification counts, and vehicle movement animations, these areas have yet to be fully explored. In the case of freight modelling, the absence of sufficient data to support modelling makes it even more pressing to extract all possible information from datasets for freight-carrying vehicles. This means moving beyond the use of truck GPS data for simple travel time and speed measurements but rather developing methods to extract highly detailed truck activity data depicting route selection, trip chaining, and stop clusters, for instance. Before these detailed analyses for passenger or freight GPS data are possible, it is necessary to first reconstruct the vehicle routes based on their GPS data. This paper presents an algorithm for route reconstruction leveraging solely open source software. The paper also presents a successful application of the algorithm developed to the case of bus GPS data for a European city, as currently no truck GPS data is freely available for research purposes. The steps necessary for applying this algorithm to proprietary vehicle GPS data are also presented. The final result of this research is the source code developed for vehicle GPS map matching, available on an online repository. (TRID)