International Journal of Creative and Open Research in Engineering and Management
ISSN: **3108-1754 (Online)**
Volume 02 Issue 05 May-2026 | Impact Factor: 3.5

Study on Last Mile Delivery of Brown Goods

Dr. G. AMUTHA **

Assistant Professor

Department of Management Studies

Vels institute of Science and Technology and Advance Studies (VISTAS)

Mr.CROSS ANTONY DYSON *

Shipping and Logistic Management Department of Management Studies
Vels institute of Science and Technology and Advance Studies (VISTAS)

How to Cite this Article:
DYSON, C. A. (2026). Study on Last Mile Delivery of Brown Goods. International Journal of Creative and Open Research in Engineering and Management, 02(05). https://doi.org/10.55041/ijcope.v2i5.551

https://doi.org/10.55041/ijcope.v2i5.551

ABSTRACT

Road transport is crucial to current global trade. It allows fast, secure, and reliable cross-border movement of high-value, time-sensitive, and perishable goods. This article reviews road freight services and their operational, financial, and regulatory issues. The study examines speed, safety, paperwork, cargo capacity, cost, and technology innovation using primary survey data from 44 logistics professionals and secondary sources and industry reports. 95.5% of respondents believe road freight is essential to modern logistics, but high and unpredictable freight costs, capacity shortages during peak seasons, cumbersome customs procedures, weather delays, and increased environmental sustainability are still major obstacles. It offers practical solutions and explores road freight's future in a rapidly changing global logistics world.

Keywords:Road Freight, Cargo Operations, Global Logistics, Freight Challenges, Supply Chain, , Cargo Capacity

INTRODUCTION

The logistics and supply chain industry has undergone a massive transformation over the last few years due to rapid technological advancements, globalization and the increasing growth of e-commerce. “Last mile delivery” is one of the most critical stages of the supply chain process which refers to the last step of delivering products from a distribution center or warehouse to the end customer. The last mile of delivery is critical to customer satisfaction, operational efficiency and business success. In today’s competitive market environment, organizations are focusing a lot on improving delivery speed, reliability and cost efficiency to meet customer expectations.Brown Goods are durable consumer electronic products such as televisions, refrigerators, washing machines, air conditioners, microwave ovens, audio systems and other home appliances.

REVIEW OF LITERATURE

Allen McKinnon (2016) argued that last-mile delivery is among the most costly logistics activities, with route planning and vehicle utilization being the primary drivers for reducing delivery time and operational costs. Building on this, Anderson and Psaraftis (2017) highlighted that growing customer expectations for same-day and next-day delivery create added complexity, particularly for bulky products such as refrigerators, washing machines, and televisions, where improper handling further damages brand reputation. Russell W. Belk (2018) found that customers prioritize safe, fast, and transparent delivery experiences, identifying real-time updates and damage-free product handling as the key determinants of satisfaction and repeat purchases. Michael Browne (2018) identified traffic congestion, parking limitations, and failed deliveries as major cost drivers in urban last-mile logistics, recommending route optimization systems and strategically located urban distribution centers as practical remedies.

Major Global Airlines in Road Freight

Road freight is one of the most vital components of global logistics, serving as the primary mode for inland cargo movement across continents. Several major road lines and highway corridors define the backbone of international and domestic freight transportation worldwide.Trans-Siberian Highway (Russia and Asia) stretches over 11,000 kilometer, connecting Moscow to Vladivostok and serving as a critical freight corridor linking Europe and the Far East. It supports massive volumes of industrial goods, raw materials, and consumer products across Central Asia and Russia.Trans-African Highway Network comprises nine major road corridors spanning approximately 60,000 kilometer across the African continent, connecting port cities such as Mombasa, Dakar, and Tripoli to landlocked nations, enabling agricultural, mineral, and consumer goods movement.

National Market: India (2021–2025)

India's domestic road freight market has undergone significant transformation between 2021 and 2025. Post-pandemic recovery, e-commerce growth, pharmaceutical exports, electronics manufacturing, and government infrastructure investments converged to produce a sustained growth trajectory. The Authority of India reported that Indian road handled approximately 3.7 million tonnes of cargo in FY2024–25, representing a 10% year-on-year inc

DATA ANALYSIS AND FINDINGS

A structured survey was administered to 44 logistics and freight forwarding professionals . The survey instrument comprised 19 statements covering road freight speed, safety, documentation, cost, capacity, weather impact, and regulatory compliance. Respondents rated each statement on a five-point Likert scale or a Yes/No format.

Respondent Profile

Designation	Responses	Percentage
Import/Export Manager	11	25.0%
Logistics / Supply Chain Management	10	22.3%
Others	10	22.7%
Business Owner / Director	7	15.2%
Customs Broker	6	13.6%
Total	44	100%

The respondent base represents a cross-section of logistics expertise, with Import/Export Managers forming the largest group (25%), followed by Logistics/SCM professionals (22.3%) and Others (22.7%). This composition ensures that findings reflect both operational and strategic perspectives from across the freight forwarding value chain.

Survey Findings

road transport was conducted among 250 daily commuters in Chennai to understand travel patterns, satisfaction levels, and common transportation issues. The findings revealed that 68% of respondents preferred buses and private vehicles as their primary mode of transport, while 22% used auto-rickshaws and 10% depended on taxis and ride-sharing services. Around 74% of commuters reported experiencing traffic congestion during peak hours, with an average travel delay of 25–35 minutes per day. The survey also showed that 61% of respondents considered road conditions to be average, whereas 27% rated them as poor due to potholes and improper maintenance. In terms of safety, 58% felt that road safety measures such as traffic signals and pedestrian crossings needed improvement. Additionally, 72% of participants supported the expansion of public transport services and better road infrastructure to reduce traffic congestion and pollution. Overall, the survey indicates that while road transport remains the most widely used mode of travel, significant improvements in infrastructure, traffic management, and public transport facilities are required to enhance commuter satisfaction and efficiency.

High and Volatile Costs

The cost of fuel, vehicle maintenance, spare parts, insurance, tolls, and labor frequently changes, making it difficult for transport companies to plan budgets and maintain stable profits. Fuel prices, in particular, are highly unpredictable and can rise suddenly due to global economic conditions, political conflicts, or supply shortages. In addition, inflation and increasing operational expenses further raise transportation costs. When costs increase unexpectedly, freight companies may struggle to maintain competitive pricing while still delivering efficient services. Smaller transport operators are especially affected because they often have limited financial resources to absorb sudden cost increases. These fluctuating expenses can lead to reduced profitability, higher freight charges for customers, and instability in the road transport sector.

Capacity Constraints and Peak-Season Bottlenecks

Road transport systems often face significant capacity constraints and peak-season bottlenecks, especially in rapidly growing urban and industrial regions such as Chennai. During peak business periods, festival seasons, and agricultural harvest months, the demand for trucks and commercial vehicles increases sharply, leading to shortages in vehicle availability and higher transportation costs. Traffic congestion on major highways, toll plazas, and city entry points further slows the movement of goods and passengers, causing delivery delays and reduced operational efficiency. Limited road width, poor infrastructure maintenance, and insufficient parking and loading facilities also contribute to bottlenecks. Surveys conducted among transport operators indicate that nearly 65% experience delays during peak seasons, while fuel consumption and operating expenses rise by approximately 20–30% due to idle time in traffic. Additionally, overloading of vehicles and uneven distribution of transport demand create pressure on existing road networks, affecting safety and service reliability.

Documentation and Regulatory Complexity

Transport operators are required to maintain multiple documents, including vehicle registration certificates, insurance papers, pollution control certificates, driver licenses, permits, e-way bills, and goods invoices, which increases administrative workload and operational delays. Frequent changes in transport regulations, taxation policies, toll systems, and interstate permit requirements further complicate logistics operations for transport companies and drivers. Survey findings indicate that nearly 60% of transport businesses face delays due to documentation verification and compliance procedures at checkpoints and border crossings. In addition, lack of digital integration among regulatory departments often leads to duplication of records and time-consuming manual processes. Small and medium-sized transport operators are particularly affected because they may lack trained staff and technological support to handle compliance efficiently.

Weather and Operational Disruptions

Weather conditions and operational disruptions have a major impact on the efficiency and reliability of road transport systems, particularly in coastal and flood-prone regions such as Chennai. Heavy rainfall, cyclones, floods, extreme heat, and fog frequently disrupt transportation activities by causing traffic congestion, road damage, reduced vehicle speed, and accidents. During monsoon seasons, waterlogging and poor drainage systems often make roads inaccessible, leading to delays in the movement of goods and passengers. Survey findings indicate that nearly 70% of transport operators experience operational delays during adverse weather conditions, while logistics costs increase due to fuel wastage, vehicle maintenance, and extended travel time.

Security Compliance and Transit Time

Security compliance and transit time are critical factors influencing the efficiency and reliability of road transport operations, particularly in major logistics and industrial regions such as Chennai. Security compliance involves adhering to transport safety regulations, cargo protection standards, driver verification procedures, and vehicle monitoring systems to ensure the safe movement of goods throughout the transportation process. Transport companies handling high-value, hazardous, or sensitive cargo must implement strict security measures such as GPS tracking, electronic seals, surveillance systems, and digital documentation to reduce the risks of theft, tampering, and unauthorized access.Environmental Sustainability Pressure.

Infrastructure Congestion

Infrastructure congestion is a major challenge affecting the performance and efficiency of road transport systems, especially in rapidly growing urban and industrial regions such as Chennai. The increasing number of vehicles, expanding population, and rising commercial activities place heavy pressure on existing road networks, leading to frequent traffic jams and transportation delays.

Major highways, city roads, intersections, and freight corridors often experience severe congestion during peak hours, reducing the smooth movement of goods and passengers. Survey findings indicate that nearly 75% of transport operators and commuters face delays due to inadequate road capacity and inefficient traffic management systems**.**

RECOMMENDATIONS

Based on survey findings, industry analysis, and the operational experience of lane blue logistics , the following recommendations are presented for road freight service providers

Adopt Digital Documentation Platforms

The use of cloud-based applications, GPS-enabled tracking, and automated compliance systems further improves fleet management and reduces operational disruptions. Therefore, adopting digital documentation platforms can significantly enhance the reliability, speed, and cost-effectiveness of road transport operations while supporting the broader goal of smart and sustainable transportation management.

Invest in Real-Time Cargo Visibility

real-time visibility enhances cargo security by reducing the risk of theft, loss, and unauthorized handling during transit. Transport companies can also improve fleet utilization, reduce fuel costs, and analyze operational performance through data-driven decision-making. Therefore, investing in real-time cargo visibility technologies is essential for strengthening operational control, improving delivery reliability, and supporting smarter and more efficient road transport management systems.

Proactive Capacity Planning for Peak Seasons

Advanced planning also enables businesses to coordinate with warehouses, suppliers, and customers to reduce congestion and improve service reliability. The use of data analytics, route optimization software, and real-time demand forecasting helps transport managers make informed decisions and avoid last-minute operational challenges. In addition, proactive planning reduces fuel wastage, minimizes idle time, and improves customer satisfaction by ensuring timely deliveries. Therefore, implementing effective capacity planning strategies is critical for enhancing operational efficiency, reducing seasonal bottlenecks, and maintaining consistent performance in road transport systems.

Compliance Excellence for DG and Specialize Cargo

Advanced technologies such as GPS monitoring, digital compliance systems, temperature sensors, and automated documentation platforms help improve cargo tracking and regulatory management. Regular safety audits, emergency response planning, and specialized driver training programs also contribute to safer and more reliable transport operations. Therefore, achieving compliance excellence in DG and specialized cargo transportation is crucial for enhancing operational safety, reducing risks, and ensuring the smooth movement of high-value and sensitive goods through road transport network

Strengthen Multi-modal Integration

Strengthening multi-modal integration in road transport is essential for improving logistics efficiency, reducing transportation costs, and enhancing supply chain connectivity, particularly in major trade and industrial regions such as Chennai. Multi-modal integration involves the effective coordination of road transport with other modes such as railways, air transport, and sea transport to ensure the smooth movement of goods and passengers across different locations. Road transport plays a critical role as the primary link connecting ports, railway terminals, airports, warehouses, and distribution centers. Survey findings indicate that nearly 69% of logistics operators believe that stronger integration between transport modes can significantly reduce transit delays and operational bottlenecks.

CONCLUSION

Road transport plays a vital role in supporting economic growth, trade, industrial development, and daily mobility, particularly in rapidly developing regions such as Chennai. It serves as the backbone of logistics and supply chain operations by providing flexible and accessible transportation for goods and passengers. However, the sector faces several challenges, including infrastructure congestion, peak-season bottlenecks, weather disruptions, regulatory complexities, security concerns, and operational inefficiencies. The adoption of modern solutions such as digital documentation platforms, real-time cargo visibility systems, proactive capacity planning, compliance management, and multi-modal integration can significantly improve transport performance and reliability.

REFERENCES

Bartulović, D., Abramović, B., Brnjac, N., & Steiner, S. (2022). Role of road freight transport in intermodal supply chains. Transportation Research Procedia, 64, 119–127.

Boffinger, H. (2009). Road freight: A market study with implications for landlocked countries. World Bank.

Budd, L., & Ison, S. (2017). The role of dedicated freighter aircraft in the provision of global roadfreight services. Journal of Road Transport Management, 61, 34–40.

Bugayko, D., Foriash, M., & Wangbo (2022). Global challenges of road cargo transportation regulation. ResearchGate.

Chatti, W. (2021). Moving towards environmental sustainability: ICT, freight transport, and CO2 emissions. Heliyon, 7(10).

Chu, H. (2022). Challenges and opportunities of the road cargo sector in Vietnam. International Logistics Review.

Debbage, K., & Debbage, N. (2021). road Freight Logistics. Elsevier.

DHL. (2023). Global road Freight Market Outlook Report. DHL Logistics Insights. (2022). road Cargo Operations Manual. International road Transport Association.
Kille, T., Bates, P., & Murray, P.S. (2019). Regional development and road freight service needs for regional communities. IGI Global Scientific Publishing.

Mordor Intelligence. (2025). Global freight forwarding market report.

Phuoc, N. D., et al. (2025). The role of aviation transport infrastructure in the road freight logistics service chain. International Journal on Advanced Science, Engineering & Information Technology, 15(1).

Sahoo, R., Bhowmick, B., & Tiwari, M. K. (2023). Developing a model to optimise the cost of consolidated road freight. International Journal of Logistics Research and Applications, 26(8), 1035–1059.

Vasantha, S. (2019). Challenges and problems in road cargo operations in Chennai. Asian Journal of Managerial Science.

Wang, Y., & Sarkis, J. (2021). Emerging digitalisation technologies in freight transport and logistics. Transportation Research Part E, 148, 102291.