

Construction Materials Transport Vehicle Utilisation Efficiency: A Case Study of Gqeberha

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Abstract

This study examines the efficiency of construction materials transport vehicle (CMTV) utilisation, with the aim of identifying the principal factors that undermine logistics performance in material delivery and proposing targeted interventions to enhance operational efficiency. The quantitative study entailed an online survey of general contractors and material suppliers, yielding 27 valid responses from an initial sample of 92, which equates to a 29.3% response rate. Findings reveal pervasive systemic inefficiencies in vehicle deployment, including frequent empty return trips, partial loads, delayed deliveries, and prolonged vehicle dwell times factors that contribute to elevated costs, reduced productivity, and increased carbon emissions. Supplier-led deliveries dominate current practices, often resulting in sub-optimal routing and coordination. Respondents highlighted the need for improved communication, scheduling, and coordination, alongside the adoption of real-time tracking, monitoring tools, and enhanced training for logistics personnel. Basic ICT tools such as mobile communication and GPS tracking are relatively well-adopted, while more advanced solutions such as data analytics and route optimisation systems show lower utilisation. The findings suggest that strengthening internal coordination, building staff capacity, and integrating digital logistics technologies within a comprehensive supply-chain framework are essential for sustained improvements in CMTV efficiency. Isolated interventions are unlikely to deliver meaningful gains without alignment across stakeholders.

Keywords: Construction, Efficiency, Materials, Transport, Utilisation, Vehicle

1 Introduction

Material transport is a critical component of construction project performance, directly influencing cost, productivity, and operational efficiency. Materials typically account for a substantial proportion of total project costs, and inefficiencies in logistics such as delayed deliveries, underutilised vehicles, and poor scheduling can significantly increase project expenditure and reduce productivity (Patel *et al.*, 2015). Sezer and Fredriksson (2021) in turn, contend that construction logistics offer useful solutions to improve both the productivity and sustainability of the industry. Furthermore, Guerlain *et al.* (2019) state that the transport of construction materials represents up to 30% of freight movements in cities and even more in terms of pollutant emissions.

Despite the recognised importance of construction logistics, limited empirical research has been conducted relative to CMTV utilisation efficiency within the South African context, and therefore there is a paucity of related literature. Within the global context, this contention is underscored by Naz *et al.* (2022) who state that although it has been determined that there is great potential to improve construction transport, little research has been conducted within this field. Their research determined that in terms of construction transport time efficiency, over 40% of the

time was used for non-value-adding activities (NVAAAs). Therefore, this study addresses this gap by evaluating CMTV utilisation practices in the local industry, the aim being to identify the principal factors that undermine CMTV utilisation and propose interventions to enhance CMTV utilisation. The summarised objectives being to determine: construction materials logistics practices; the experience of phenomena, and the extent to which potential interventions can reduce inefficiencies and improve construction materials logistics.

2 Construction Logistics and Vehicle Utilisation: Critical International Perspectives

2.1 Construction logistics and supply chain inefficiencies

Construction logistics plays a critical role in project cost, productivity, delivery reliability, and environmental performance. Transport inefficiencies such as empty return trips, partial loading, and poor scheduling are widely associated with congestion, cost overruns, and underutilised vehicle capacity (Ying *et al.*, 2018). Construction supply chains are inherently fragmented, involving temporary collaborations that weaken coordination and information flow (Ghanem *et al.*, 2018). As a result, logistics planning is often overlooked in early project stages, leading to reactive

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practices such as inaccurate scheduling, communication breakdowns, and inefficient deliveries. Although early integration is widely recommended, its implementation in decentralised construction environments remains limited, particularly in developing urban contexts such as Gqeberha.

2.2 Vehicle utilisation and operational inefficiencies

Vehicle utilisation efficiency refers to maximising load capacity while minimising empty running and idle time. Inefficiencies reflect poor asset utilisation and reduced operational performance (Rushton *et al.*, 2022). In practice, inefficiencies arise from empty return trips, partial loading, and operational constraints such as vehicle design limitations, material compatibility, and contamination risks. Fragmented ordering and low delivery volumes further contribute to underutilised capacity, while manual data practices limit effective monitoring and optimisation. Although consolidation strategies and coordinated delivery systems have demonstrated improvements in load efficiency (El Moussaoui *et al.*, 2021), their implementation is constrained by limited governance, weak coordination, and the operational realities of small and specialised suppliers in decentralised markets.

2.3 Cost, performance and environmental implications

Transport inefficiencies contribute directly to increased project costs and delivery delays, with high fixed vehicle costs resulting in disproportionate pricing for partial loads (Ying *et al.*, 2018). Poor coordination further reduces scheduling efficiency and increases unnecessary transport movements. In addition, construction transport contributes to environmental impacts, with studies indicating that improved logistics coordination can reduce emissions and enhance overall project performance. Research conducted by Naz *et al.* (2022) determined that there is major potential for improving construction transport time efficiency as over 40% of the time was used for non-value-adding activities (NVAAs). Guerlain *et al.* (2019) in turn refer to the major impact of the transport of construction materials in terms of pollutant emissions.

2.4 Synthesis and research gap

The literature highlights the importance of integrated planning and coordination in improving logistics efficiency; however, key gaps remain, including

limited empirical measurement of vehicle utilisation in developing urban contexts, insufficient understanding of operational constraints affecting dedicated-use vehicles, and the limited transferability of coordination models to decentralised markets. Most studies focus on well-regulated environments, whereas secondary cities such as Gqeberha, lack comparable institutional and technological conditions. This study addresses these gaps by empirically assessing vehicle utilisation and associated inefficiencies within a developing urban context.

3 Research Methodology

A quantitative survey approach was adopted to assess construction vehicle utilisation in Gqeberha due to the nature and extent of the data required. An initial sample of 92 medium and large general contractor and material supplier members of the East Cape Master Builders Association (ECMBA) were provided with the URL of the structured online questionnaire via the Executive Director of the ECMBA via e-mail. The related ECMBA members were surveyed as the ECMBA is the only employer building construction organisation represented in Gqeberha. Furthermore, due to the number of related members sampling was not required. The self-developed survey instrument, based upon the survey of the literature, was comprised of closed-ended and mostly five-point Likert-scale type questions addressing delivery coordination, load planning, operational constraints, and logistics performance. Due to the tight timeline of the study, the supervisor of the study validated the factors. A total of 27 valid responses were received, which equates to a 29.3% response rate. According to Soetanto (2002) a response rate of 14.6% is the accepted rate for lengthy and comprehensive questionnaires. Given that an online questionnaire was completed the data was automatically captured in a MS Excel data file. The data was analysed to compute descriptive statistics, including frequencies and mean scores (MSs), to rank key factors influencing CMTV utilisation.

4 Findings and Discussion

Table 1 indicates the frequency at which different material delivery arrangements are utilised on construction sites in Gqeberha in terms of percentage responses to a scale of never to always, and MSs ranging from 1.00 to 5.00. All three delivery arrangements recorded MSs > 3.00, which in general

Table 1: Frequency of material delivery arrangements to construction sites in Gqeberha

Arrangement	Response (%)						MS	Rank
	Unsure	Never	Rarely	Sometimes	Often	Always		
Supplier-owned vehicles	0.0	0.0	11.7	17.6	29.4	41.2	4.00	1
Mixed (combination of both)	0.0	5.8	5.8	29.4	17.6	41.2	3.82	2
Contractor-owner vehicles	5.3	0.0	10.5	36.8	26.3	21.1	3.61	3

indicates frequent, as opposed to infrequent use. However, in terms of MS ranges, all the MSs are $> 3.40 \leq 4.20$, which indicates the delivery arrangements occur sometimes to often / often. It is notable that supplier-owned vehicles is ranked first, which is the ideal arrangement.

Table 2 indicates the frequency at which selected logistics-related phenomena occur on construction sites in Gqeberha in terms of percentage responses to a scale of never to always, and MSs ranging from 1.00 to 5.00. It is notable that 4 / 5 (80.0%) phenomena recorded MSs > 3.00 , which in general, indicates frequent, as opposed to infrequent occurrence. However, in terms of MS ranges, the same four phenomena have MSs $> 3.40 \leq 4.20$, which indicates they occur sometimes to often / often - vehicles leaving site empty is ranked first, followed by delays due to late delivery of materials, long vehicle dwell times on site, and unplanned or unscheduled deliveries. These findings indicate vehicle inefficiency, inadequate materials management and planning, and site layout and organisation. Site congestion delaying deliveries recorded a MS of 2.95, indicating it occurs rarely to sometimes / sometimes as the MS is $> 2.60 \leq 3.40$. It is notable that first ranked 'vehicles leaving site empty' is highlighted by Ying *et al.* (2018).

Table 3 indicates the extent to which various interventions are required to improve construction vehicle utilisation on sites in Gqeberha in terms of

percentage responses to a scale of 1 (minor) to 5 (major), and MSs ranging from 1.00 to 5.00. All five interventions recorded MSs > 3.00 , indicating a major, as opposed to a minor need, for the interventions. Better scheduling and coordination is ranked first, followed by improved communication with suppliers, which indicates a near major to major / major extent, as the MSs are $> 4.20 \leq 5.00$. Real-time tracking and monitoring tools, training for logistics personnel, and shared or centralised delivery hubs have MSs $> 3.40 \leq 4.20$, which indicates there is a moderate to near major / near major need for these interventions. All five interventions will address the inherent fragmentation of construction supply chains, involving temporary collaborations that weaken coordination and information flow, as referred to by Ghanem *et al.* (2018).

Table 4 indicates the frequency of material delivery scheduling approaches in terms of percentage responses to a scale of never to always, and MSs ranging from 1.00 to 5.00. It is notable that 2 / 3 (66.7%) approaches recorded MSs > 3.00 , which in general, indicates frequent, as opposed to infrequent occurrence. However, in terms of MS ranges, only the MS of mixed scheduling (both) is $> 3.40 \leq 4.20$, which indicates it occur sometimes to often / often. The remaining 2 / 3 (66.7%) MSs are $> 2.60 \leq 3.40$, which indicates they occur rarely to sometimes / sometimes - fixed daily routes, and on-demand orders.

Table 2: Frequency of logistics-related phenomena on construction sites

Phenomenon	Response (%)						MS	Rank
	Unsure	Never	Rarely	Sometimes	Often	Always		
Vehicles leaving site empty	20.0	10.0	0.0	20.0	30.0	20.0	3.69	1
Delays due to late delivery of materials	5.0	5.0	25.0	25.0	40.0	0.0	3.58	2
Long vehicle dwell times on site	15.0	0.0	30.0	30.0	15.0	10.0	3.47	3
Unplanned or unscheduled deliveries	10.0	10.0	30.0	15.0	35.0	0.0	3.44	4
Site congestion delaying deliveries	5.0	15.0	45.0	15.0	5.00	15.0	2.95	5

Table 3: Extent of interventions required to improve construction vehicle utilisation

Intervention	Response (%)						MS	Rank
	Unsure	Minor Major						
		1	2	3	4	5		
Better scheduling and coordination	0.0	4.5	0.0	13.6	22.7	59.1	4.32	1
Improved communication with suppliers	0.0	0.0	9.1	9.1	22.7	59.1	4.26	2
Real-time tracking and monitoring tools	4.5	0.0	13.6	9.9	27.3	45.5	4.00	3
Training for logistics personnel	0.0	4.5	4.5	27.3	27.3	36.4	3.79	4
Shared or centralised delivery hubs	9.1	4.5	9.1	22.7	31.8	22.7	3.71	5

Table 4: Frequency of material delivery scheduling approaches

Approach	Response (%)						MS	Rank
	Unsure	Never	Rarely	Sometimes	Often	Always		
Mixed scheduling (both)	20.0	0.0	0.0	60.0	0.0	20.0	3.50	1
Fixed daily routes	0.0	0.0	25.0	50.0	25.0	0.0	3.25	2
On-demand orders	0.0	0.0	0.0	75.0	25.0	0.0	3.00	3

Table 5 indicates the frequency at which selected logistics-related phenomena occur within respondents' own organisations in terms of percentage responses to a scale of never to always, and MSs ranging from 1.00 to 5.00. Only two phenomena recorded MSs > 3.00, indicating frequent, as opposed to infrequent occurrence as in the case of the other six phenomena. Vehicles returning empty is ranked first, followed by individual delivery, indicating that these phenomena occur sometimes to often / often, as the MSs are > 3.40 ≤ 4.20. Order consolidation is ranked third, followed by tight schedules causing late deliveries, part loads, deliveries affected by poor communication, and long waiting or offloading times, which indicates these phenomena occur rarely to sometimes / sometimes, as the MSs are > 2.60 ≤ 3.40. Congestion on construction sites has a MS > 1.80 ≤ 2.60, which indicates it occurs never to rarely / rarely. The first two ranked phenomena, which occur frequently, as opposed to infrequently are highlighted by Ying *et al.* (2018) and Rushton *et al.* (2022).

Table 6 indicates the extent to which selected efficiency-oriented measures would improve construction vehicle utilisation on sites in Gqeberha in terms of percentage responses to a scale of 1 (minor) to 5 (major), and MSs ranging from 1.00 to 5.00. All six

measures recorded MSs > 3.00, indicating major, as opposed to minor potential for improvement. Accurate early orders is ranked first with a MS > 4.20 ≤ 5.00, indicating near major to major / major potential to improve vehicle utilisation. The measures ranked second to fourth, namely digital procurement and dispatch records, route optimisation software, and consolidation or shared depots have MSs > 3.40 ≤ 4.20, indicating moderate to near major / near major potential. Using return trips to transport materials and ICT-based coordination tools have MSs > 2.60 to ≤ 3.40, indicating near minor to moderate / moderate potential. Using return trips to transport materials is a key issue identified by Ying *et al.* (2018) and Rushton *et al.* (2022).

Table 7 indicates the extent of organisational awareness or use of selected logistics technologies on construction sites in Gqeberha in terms of percentage responses to a scale of 1 (minor) to 5 (major), and MSs ranging from 1.00 to 5.00. It is notable that 3 / 5 (60.0%) technologies recorded MSs > 3.00, indicating a major level of awareness or use, as opposed to a minor level. Mobile communication tools and GPS vehicle tracking have MSs > 3.40 ≤ 4.20, which indicates that awareness or use of these technologies is between a moderate to near major / near major extent. Data analytics for logistics

Table 5: Frequency at which selected logistics-related phenomena occur within respondents' organisations

Phenomenon	Response (%)						MS	Rank
	Unsure	Never	Rarely	Sometimes	Often	Always		
Vehicles returning empty	0.0	25.0	0.0	0.0	25.0	50.0	3.75	1
Individual delivery	0.0	0.0	25.0	25.0	25.0	25.0	3.50	2
Order consolidation	25.0	0.0	0.0	75.0	0.0	0.0	3.00	3
Tight schedules causing late deliveries	0.0	0.0	25.0	50.0	25.0	0.0	3.00	4
Part loads	0.0	0.0	25.0	50.0	25.0	0.0	3.00	5
Deliveries affected by poor communication	0.0	25.0	0.0	50.0	0.0	25.0	3.00	6
Long waiting / offloading times	0.0	0.0	40.0	40.0	20.0	0.0	2.80	7
Congestion on construction sites	0.0	25.0	0.0	75.0	0.0	0.00	2.50	8

Table 6: The extent to which selected efficiency-oriented measures would improve construction vehicle utilisation in Gqeberha

Measure	Response (%)						MS	Rank
	Unsure	Minor Major						
		1	2	3	4	5		
Accurate early orders	0.0	0.0	0.0	25.0	0.0	75.0	4.50	1
Digital procurement and dispatch records	0.0	0.0	0.0	33.3	66.7	0.0	4.00	2
Route optimisation software	0.0	0.0	0.0	33.3	33.3	33.3	4.00	3
Consolidation or shared depots	0.0	0.0	33.3	33.3	0.0	33.3	3.67	4
Using return trips to transport materials	33.3	0.0	0.0	33.3	0.0	33.3	3.33	5
ICT-based coordination tool	33.3	0.0	0.0	33.3	0.0	33.3	3.33	6

Table 7: Awareness or use of logistics technologies

Technology	Response (%)						MS	Rank
	Unsure	Minor Major						
		1	2	3	4	5		
Mobile communication tools	5.6	11.1	5.6	11.1	33.3	33.3	3.76	1
GPS vehicle tracking	10.5	21.1	5.3	10.5	10.5	42.1	3.53	2
Data analytics for logistics planning	5.6	33.3	0.0	16.7	16.7	27.8	3.06	3
Route optimisation systems	5.6	33.3	5.6	16.7	22.2	16.7	2.82	4
Delivery management software	5.6	33.3	11.1	16.7	22.2	11.1	2.65	5

planning, route optimisation systems, and delivery management software have MSs $> 2.60 \leq 3.40$, indicating that awareness or use is between a near minor to moderate / moderate extent.

Table 8 indicates the potential of logistics management technologies to reduce inefficiencies / issues on construction sites in Gqeberha in terms of percentage responses to a scale of 1 (minor) to 5 (major), and MSs ranging from 1.00 to 5.00. All five inefficiencies / issues recorded MSs > 3.00 , indicating major potential for reduction, as opposed to minor potential. Communication breakdowns, delivery delays and poor scheduling have MSs $> 3.40 \leq 4.20$, which indicates that logistics management technologies have between moderate to near major / near major potential to address these inefficiencies issues. Empty return trips, and site congestion have MSs $> 2.60 \leq 3.40$, which indicates that logistics management technologies have between near minor to moderate / moderate potential to address these inefficiencies / issues. The potential of logistics management technologies to reduce inefficiencies is highlighted by Ying *et al.* (2018), Rushton *et al.* (2022), and El Moussaoui *et al.* (2021).

Table 9 indicates the potential of technology and coordination strategies to enhance selected logistics outcomes on construction sites in Gqeberha in terms of percentage responses to a scale of 1 (minor) to 5 (major), and MSs ranging from 1.00 to 5.00. All five outcomes recorded MSs > 3.00 , indicating major, as opposed to minor, potential for enhancement. Furthermore, all five outcomes have MSs $> 3.40 \leq 4.20$, indicating moderate to near major / near major potential - delivery time reliability is ranked first, followed by reduction of site congestion and environmental performance (reduced emissions), cost efficiency in transport, and vehicle utilisation efficiency.

Table 10 indicates the extent to which selected logistics-related records and documentation are accurately recorded or used on construction sites in Gqeberha in terms of percentage responses to a scale of 1 (minor) to 5 (major), and MSs ranging from 1.00 to 5.00. All four records recorded MSs > 3.00 , indicating a major, as opposed to a minor, level of accuracy or use. MS Only 1 / 5 (20.0%) of MSs is > 4.20 to ≤ 5.00 , namely delivery documentation checked and signed off, indicating the accuracy and use is between near major to major / major. The remaining 4 / 5 (80.0%) of MSs are $> 3.40 \leq 4.20$, indicating the accuracy and use is between a moderate to near major / near major extent

Table 8: Potential of logistics management technologies to reduce inefficiencies

Inefficiency / Issue	Response (%)						MS	Rank
	Unsure	Minor Major						
		1	2	3	4	5		
Communication breakdowns	0.0	5.6	16.7	11.1	22.2	44.4	3.83	1
Delivery delays	0.0	15.8	10.5	21.1	10.5	42.1	3.65	2
Poor scheduling	5.6	16.7	5.6	11.1	22.2	38.9	3.53	3
Empty return trips	25.0	15.0	10.0	10.0	10.0	30.0	3.40	4
Site congestion	0.0	5.6	16.7	27.8	33.3	16.7	3.39	5

Table 9: Potential of technology and coordination strategies to enhance selected logistics outcomes on construction sites

Outcome / Metric	Response (%)						MS	Rank
	Unsure	Minor Major						
		1	2	3	4	5		
Delivery time reliability	0.0	10.5	5.3	5.3	31.6	47.4	4.00	1
Reduction of site congestion	5.6	0.0	11.1	22.2	22.2	38.9	3.94	2
Environmental performance (reduced emissions)	5.3	5.3	10.5	15.8	15.8	47.4	3.94	3
Cost efficiency in transport	0.0	10.5	10.5	0.0	36.8	42.1	3.89	4
Vehicle utilisation efficiency	5.0	10.0	5.0	15.0	30.0	35.0	3.79	5

Table 10: Accuracy and use of logistics-related records and documentation

Record / Documentation	Response (%)						MS	Rank
	Unsure	Minor Major						
		1	2	3	4	5		
Delivery documentation checked and signed off	0.0	0.0	10.5	5.3	26.3	57.9	4.32	1
Formal material requisition logs maintained	5.0	5.0	5.0	15.0	30.0	40.0	4.00	2
Order frequency and delivery records tracked	5.3	5.3	0.0	26.3	26.3	36.8	3.94	3
Digital logistics documentation	0.0	5.3	26.3	5.3	31.6	31.6	3.58	4

- formal material requisition logs maintained, followed by order frequency and delivery records tracked, and digital logistics documentation.

Table 11 indicates the extent to which six selected efficiency-oriented measures would improve CMTV utilisation on sites in Gqeberha in terms of percentage responses to a scale of 1 (minor) to 5 (major), and MSs ranging from 1.00 to 5.00. All six measures recorded MSs > 3.00, indicating major, as opposed to minor potential for improvement. Only 1 / 6 (16.7%) MSs is > 4.20 ≤ 5.00, indicating near major to major / major potential to enhance CMTV utilisation, namely accurate early orders. Thereafter, 3 / 6 (50.0%) of MSs are > 3.40 ≤ 4.20, indicating moderate to near major / near major potential, namely digital procurement and dispatch records, route optimisation software, and consolidation or shared depots. The remaining 2 / 6 (33.3%) MSs are > 2.60 to ≤ 3.40, indicating near minor to moderate / moderate potential, namely using return trips to transport materials, and ICT-based coordination tools. The potential of the measures to improve CMTV utilisation is underscored by the role of consolidation

strategies and coordinated delivery systems cited by El Moussaoui *et al.* (2021),

Table 12 presents respondents' ratings of staff capacity and internal organisational capabilities related to construction logistics and CMTV utilisation, in terms of percentage responses to a scale of 1 (very poor) to 5 (very good), and MSs ranging from 1.00 to 5.00. It is notable that all five capacities / capabilities have MSs > 3.00, indicating that the ratings are above average, as opposed to below average. It is notable that only 1 / 5 (20.0%) MSs is > 4.20 to ≤ 5.00, indicating a good to very / very good rating - availability of delivery procedures. . Thereafter, the remaining 4 / 5 (80.0%) MSs are > 3.40 to ≤ 4.20 indicating that the ratings are average to good / good - awareness of vehicle use efficiency (petrol / load), training for logistics or transport staff, internal coordination (sales, dispatch, & drivers), and driver training on loading and routing.

Table 13 indicates the extent to which logistics technologies are used by organisations to support performance enhancement and CMTV utilisation

Table 11: The extent to which selected efficiency-oriented measures would improve CMTV utilisation in Gqeberha

Measure	Response (%)						MS	Rank
	Unsure	Minor Major						
		1	2	3	4	5		
Accurate early orders	0.0	0.0	0.0	25.0	0.0	75.0	4.50	1
Digital procurement and dispatch records	0.0	0.0	0.0	33.3	66.7	0.0	4.00	2
Route optimisation software	0.0	0.0	0.0	33.3	33.3	33.3	4.00	3
Consolidation or shared depots	0.0	0.0	33.3	33.3	0.0	33.3	3.67	4
Using return trips to transport materials	33.3	0.0	0.0	33.3	0.0	33.3	3.33	5
ICT-based coordination tools	33.3	0.0	0.0	33.3	0.0	33.3	3.33	6

Table 12: Rating of staff capacity and internal organisation capabilities related to construction logistics and CMTV utilisation

Capacity / Capability	Response (%)						MS	Rank
	Unsure	Very poor Very good						
		1	2	3	4	5		
Availability of delivery procedures	0.0	0.0	0.0	0.0	66.7	33.3	4.33	1
Awareness of vehicle use efficiency (petrol / load)	0.0	0.0	0.0	0.0	100.0	0.0	4.00	2
Training for logistics or transport staff	0.0	0.0	0.0	33.3	33.3	33.3	4.00	3
Internal coordination (sales, dispatch, & drivers)	0.0	0.0	0.0	25.0	75.0	0.0	3.75	4
Driver training on loading and routing	0.0	0.0	33.3	0.0	33.3	33.3	3.67	5

Table 13: Extent to which logistics technologies are used by organisations to support performance enhancement and CMTV utilisation efficiency in Gqeberha

Technology	Response (%)						MS	Rank
	Unsure	Minor Major						
		1	2	3	4	5		
GPS vehicle tracking	0.0	0.0	0.0	0.0	33.3	66.7	4.67	1=
Mobile communication tools	0.0	0.0	0.0	0.0	33.3	66.7	4.67	1=
Route optimisation systems	0.0	0.0	33.3	0.0	33.3	33.3	3.67	3
Data analytics for logistics planning	0.0	0.0	25.0	25.0	25.0	25.0	3.50	4
Delivery management software	0.0	0.0	66.7	0.0	0.0	33.3	3.00	5

efficiency in Gqeberha in terms of percentage responses to a scale of 1 (minor) to 5 (major), and MSs ranging from 1.00 to 5.00. All five technologies recorded MSs > 3.00, indicating major, as opposed to minor use. The 2 / 5 (40.0%) very high MSs > 4.20 ≤ 5.00 are notable, indicating GPS vehicle tracking, and mobile communication tools are used between a near major to major / major extent. Thereafter, 2 / 5 (40.0%) MSs are > 3.40 to ≤ 4.20, indicating they are used between a moderate to near major / near major extent - route optimisation systems, and data analytics for logistics planning. Delivery management software is ranked fifth, indicating between near minor to moderate / moderate use as the MS is > 2.60 to ≤ 3.40.

Table 14 indicates the potential of advanced logistics technologies and ICT integration to enhance key logistics and performance outcomes within construction operations in Gqeberha in terms of percentage responses to a scale of 1 (minor) to 5 (major), and MSs ranging from 1.00 to 5.00. All five outcomes recorded MSs > 3.00, indicating major, as opposed to minor potential. It is notable that 3 / 5 (60.0%) of MSs are > 4.20 to ≤ 5.00, indicating near major to major / major potential - reduction of site congestion ranked first, is followed by environmental performance (reduced emissions), and vehicle utilisation efficiency. The remaining 2 / 5 (40.0%) MSs are > 3.40 to ≤ 4.20, indicating moderate to near major / near major potential - delivery time reliability, and cost efficiency in transport. The potential enhancement addresses the key issues identified by Ying *et al.* (2018), Rushton *et al.* (2022), and Naz *et al.* (2022)

Given that the study identified CMTV utilisation inefficiencies, including partial loading, empty return trips, and poor scheduling, largely resulting from limited coordination among project stakeholders it can be concluded that construction logistics is a critical performance driver, with fragmented practices leading to underutilised CMTV capacity and inefficient transport movements.

The study contributes scientific and context-specific empirical evidence from a South African urban setting, demonstrating that improved coordination, planning, and contractor supplier integration can significantly enhance CMTV utilisation without substantial capital investment. Furthermore, the findings provide practical guidance in terms of the current practices, including interventions, and potential interventions and outcomes in terms of enhancing CMTV utilisation efficiency, thereby contributing to the related body of knowledge.

6 Recommendations

Improving CMTV utilisation requires coordinated action across stakeholders. Contractors and suppliers should enhance delivery coordination, integrate suppliers early, and use basic logistics tools to reduce idle time and inefficiencies.

At industry level, best-practice guidelines, collaborative delivery planning, and targeted training are needed to improve logistics performance. From a policy perspective, construction logistics should be integrated into urban planning, with support for pilot

Table 14: The potential of advanced logistics technologies and ICT integration to enhance key logistics and performance outcomes within construction operations in Gqeberha

Outcome	Response (%)						MS	Rank
	Unsure	Minor Major						
		1	2	3	4	5		
Reduction of site congestion	0.0	0.0	0.0	0.0	33.3	66.7	4.67	1
Environmental performance (reduced emissions)	0.0	0.0	0.0	0.0	50.0	50.0	4.50	2
Vehicle utilisation efficiency	0.0	0.0	0.0	0.0	66.7	33.3	4.33	3
Delivery time reliability	0.0	0.0	0.0	33.3	33.3	33.3	4.00	4=
Cost efficiency in transport	0.0	0.0	33.3	0.0	33.3	33.3	4.00	4=

5 Conclusions

Limitations of the study include the single geographical location, and the sample size, therefore the findings cannot be deemed representative, but indicative.

initiatives such as consolidation hubs and coordinated deliveries.

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