IMPACT OF TRUCK PLATOONING ON LOGISTICS & TRANSPORTATION INDUSTRY

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Abstract:

Truck platooning is the connection of two or more trucks within Convoy using connectivity technology and an automated driving assistance system. Truck platoons have tremendous potential to make road traffic safer, cleaner, and more efficient in the future. Asia Pacific region is projected to be the second-largest market during the forecast period. Logistics managers can take advantage of the greatest benefits of platooning multiple companies. As more vehicles are available, more companies will have the opportunity to save money and make roads more efficient. Platooning can provide smarter solutions to the needs of fleet management and the future of an autonomous world. The main objective of the research is to help analyse how truck platooning can optimize these parameters for the Indian logistics and transportation industry. The main parameters identified after the research boiled down to four major ones: cost minimization, energy efficiency, ease of transportation and road safety. The effectiveness that can be affected with truck platooning statistics was then analysed with the parameters.

Keywords: Platooning, logistics, road safety, fuel saving

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1. INTRODUCTION

When two or more trucks are connected inside a convoy using automated driving assistance and connectivity technologies, this is known as truck platooning. When these vehiclea are linked to specific road segments, such highways, they automatically maintain a specific distance from one another. The track at the head of the train acts as the leader, and the vehicle behind it reacts to and adapts to changes in its movement. Little or no action from the driver is required. In the first instance, the driver is always in control, so he can also leave the platoon and drive independently. Truck platoons have tremendous potential to make road traffic safer, cleaner, and more efficient in the future. Hence, truck manufacturers are eager to bring these platoons to the roads of India, given the potential of the rising logistics and transportation industry in recent years. It provides a cleaner, safer, and more efficient solution optimizing the cost of the industry. Along with other developments in self-driving car technology, the widespread benefits of truck platooning to the transportation industry can revolutionize. It will provide opportunities to improve current operations, which are the driving force of the logistics business, and develop new businesses. Therefore, the global platoon market should grow shortly.

The Asia Pacific region is projected to be the second-largest market during the forecast period due to the huge demand for commercial vehicles in India. The truck platooning market has grown as the demand for commercial vehicles has increased. The safety and minimal

driving associated with easy transportation to reach the desired self-driving car will require the adoption of advanced techniques such as platooning. With the efficient development of road transport across India with highways and expressways, platooning can be implemented since almost 15 per cent of total logistics costs comprises transportation. With fuel consumption and timely delivery, these constraints can be eliminated by platooning.

In the case of fleet management and logistics services, platooning provides positive impacts such as cost minimization, energy efficiency, ease of transportation and road safety. These sought the major parameters of the study and their effect on the trucking industry. It also provides other benefits such as reduction in CO2 emissions and thus reducing the greenhouse effects. The implementation and further development of truck platooning demonstrate that it helps to make the entire transportation process efficient while saving energy and costs. Indeed, there are many more possibilities on the horizon. Self-employed logistics managers can take advantage of the greatest benefits of platooning multiple companies. As more vehicles are available in this system, more companies will have the opportunity to save money and make roads more efficient. And such collaboration can provide smarter solutions to the needs of fleet management and the future of an autonomous world.

For more effective transportation planning, it is essential to consider the benefits and drawbacks, as well as the characteristics, of truck platooning. Truck transportation planning. Three stages can be applied to the study of platooning transportation: operational, tactical, and strategic. Strategic thinking addresses the long-term implications of truck platooning characteristics decisions about transportation, such as the design of the selecting whether to make investments in the transportation network infrastructures and transportation. tactical platooning of trucks, decisions made in the middle of the transportation planning process, such as considering the material flow between the origin and the terminal design of the service network, destination nodes, and transhipment operational transportation planning in truck platooning means decisions made in the near term, including daily scheduling and routing.

This research related to truck platooning can be separated into three main areas of study; the current market status of the trucking industry, linking the major parameters involved in the trucking industry with platooning and optimizing the parameters for efficient logistics. Hence, the main goal of the report is to identify and recheck whether the major parameters required for the optimization of logistics and the trucking industry can be sufficed or improved by truck platooning. After that, a relationship between the parameters of consideration needed to be compared with each other and find the effectiveness in each case with respect to truck platooning. Accordingly, weightage was given to each of the respective parameters and its effect with each case. To provide the relationship, ANOVA (Analysis of Variance) was chosen as a statistical technique that helps to find out whether the differences between groups of data are statistically significant. And then by creating hypotheses, relationship was derived.

The data was compared with the acquired and tested data of truck platooning testing and simulations. According to the data, the lead truck's fuel usage was lowered by roughly 18%, while savings of 24% and 23% were made by the second and third trucks, respectively. The reiterated values after calculating the simultaneous values corresponding to the truck platooning simulations calculated suggest that there is a significant amount of change in the values of the mileage, speed, and accidents per year. This change will vastly improve the all the four parameters under study and can ensure that the logistics and transportation industry can be improved by truck platooning.

OBJECTIVES OF STUDY

The main purpose and study involve around linkage of platooning technology and the logistics industry. Hence, after a thorough study of the trucking industry and transportation networking, the main objectives revolve around the same.

1. Analysis of the status of the trucking industry with drawbacks
2. Identifying the parameters affecting logistics specifically
3. Linking the benefits of platooning with the parameters
4. Mapping and analysing the optimization of the parameters for the logistics and transportation industry

Accordingly, the main parameters identified after the research boiled down to four major ones: cost minimization, energy efficiency, ease of transportation and road safety. Hence, the main objective of the research is to identify the probable potential of these parameters and help analyse how truck platooning can optimize these parameters for the Indian logistics and transportation industry.

Considering these parameters, and given the effectiveness of truck platooning, the parameters are analysed with platooning and its effect about the cost optimization and overall change in the logistics and transportation industry.

2. REVIEW OF LITERATURE

The Indian trucking industry is the core of the logistics movement and the country's growth. Factors such as quality, cost, delivery, and flexibility make the environment more competitive. In India, efficient logistics management and online transportation services in the transportation market can help reduce operating costs, improve customer satisfaction, improve delivery performance, and boost the country's economy. The development of the logistics industry has given the transportation sector a global competitive advantage. In addition to creating millions of jobs, Ken Research states that "India's e-commerce logistics industry is expected to reach Rs 492.4 billion by 2025." Increased demand, foreign infrastructure investment, e-commerce growth and digitalization are just some of the forces driving the development of transportation and logistics services (Ken Research, 2021). In addition, foreign trade is increasing, and private online transportation service providers are growing. As a result, serving as many people as possible is driving our Indian economy. The growth of logistics companies and transportation markets in various cities is contributing to the growth of the logistics sector. This makes it more competitive than other countries. The logistics sector spends about 13% of India's GDP on transportation. This spending, like other developed countries, should be reduced to about 9-10%. In doing so, the country and its economy can benefit most from this sector (Punit Chotia, 2022)

India's e-commerce logistics industry is expected to grow soon due to increased demand from Tier 2 and below cities due to increased Internet penetration in these regions. In addition, changing shopping patterns, increasing demand for high-speed delivery services, and the use of AI, big data analytics, and blockchain technology to improve the customer experience will play a major role in the industry's future growth. The industry is expected to

record a positive 5-year CAGR of 23.6% in terms of revenue during the 2020-2025 forecast period (Ken Research, 2021).

Road transport accounts for about 27% of the EU's energy consumption 4332. In addition, indicates that vehicles represent 20% of the total carbon emissions, of which a quarter comes from heavy cargo vehicles (HDVs). Therefore, the environmental impacts during transportation need to be minimized urgently. In addition, fuel costs make up a significant portion of total transportation costs. Fuel costs account for nearly 30% of the life cycle costs of owning and operating a truck. Similarly, according to a recent report by the American Transportation Research Institute (ATRI), fuel is considered the second most important cost, with the highest being the cost of personnel. Given many HDVs and the growing demand for road freight, it can be expected that even small advances in energy efficiency can lead to significant cost reductions. And it is also beneficial to achieve the goal of environmental protection through the reduction of emissions. Therefore, it is very beneficial to improve fuel economy, and how to reduce fuel consumption whether travelling has become a popular topic in recent years (Linlin Zhang, 2020).

A study of 1,800 heavy trucks across Europe, conducted in, found that spontaneous manual platoons were established by motorists on 1.2% of all routes, simply has minimized the safe distance. However, such an unoptimized and uncoordinated approach only resulted in an overall fuel economy of 0.07%. So, a platoon tech solution is desirable. Initial research on truck platoons predicted savings in the range of 30-40%. The fuel reduction from 4.7 to 7.7% was achieved, bringing two trucks with identical loads to 70 km / h. But the fuel economy varies on a case-by-case basis, for example, a 7% fuel reduction can be confirmed for a 350 km trip at 80 km / h. Contrary to this, they achieved in their tests the ability to save from 12.1 to 19.8%, driving at a speed of 60.1 km/h. Theoretical savings for non-lead vehicles of up to 20% are also described in, but the authors identify platoon speed and distance between trucks as important factors (Nicolai Krüger, March, 2018).

Research involving heavy truck platoons can be divided into three main areas of study: fuel consumption in truck platoons, platoon formation maintenance, and truck dispatch. The first includes aerodynamic studies to verify the reduction in fuel consumption when vehicles are moving close together. The second area of research concerns control design, communication methods and interactions between the driver and the vehicle. Finally, the final study area provides coordinated strategies that consider the platoon's advantage to achieve energy-saving manoeuvrers and speed profiles. When the companion project ended in 2016, the development of the truck platoon system reached a new milestone, providing the opportunity for a literature review summarizing the main contributions made to date (André de Souza Mendes, 2017).

Vehicle dispatching aims to increase traffic flow and reduce fuel consumption. The advantages of the peloton and aerodynamic phenomena are clear and well understood. However, optimal distance and mathematical modelling of fuel/drag reduction as a function of distance are still being studied and may provide important information for controlling design and coordination strategies. Therefore, future research should focus on these topics considering the effects of lateral deflection, engine cooling efficiency, atmospheric conditions, differences in spoilers (other truck models) each other and multipath analysis with other passing vehicles (André de Souza Mendes, 2017).

The main risk factors with traditional trucks are reaction time and driver concentration. Therefore, traffic accidents occur mostly due to human error. The platoon increases traction and reduces vehicle spacing by using mechanical and electronic coupling. This ability allows multiple vehicles to brake or accelerates simultaneously. These cars can brake instantly, and these automatic brakes can react much faster than humans. Thus, platoons improve safety and reduce the possibility of collisions. Truck platoon with vehicles, trailer design, infrastructure, and more. plays a key role in the transportation industry's integrated approach to further reducing CO2 emissions. In a platoon, the trucks move while maintaining a closer distance from each other at smoother speeds with less acceleration and braking than conventional trucks on the road. This leads to reduced fuel consumption and improved energy efficiency. According to one report, the unit can reduce CO2 emissions by up to 16% from the rear vehicles and up to 8% from the leading vehicle. Fuel costs make up a large portion of the overall operating costs of fleet services. Because channelling plays an important role in reducing fuel consumption, it saves a lot of fleet management costs. In addition, in driverless truck platoons, self-driving trucks can be cost-effective for drivers. The truck platoon uses the roads more efficiently than any other conventional truck. All trucks run at a steady speed due to their proximity to each other, which improves traffic flow, reduces traffic congestion, and delivers goods quickly. In summary, the truck plating process has great potential to optimize fleet service and make transportation more efficient than ever. In addition, it helps reduce costs without sacrificing security. So, with a well-executed chain, the logistics industry will have a bright future in the coming years (Sandeep Singh, S. Moses Santhakumar, 2021).

Closed areas like logistics parks and harbour ports have effectively adopted autonomous driving technologies. Platooning of autonomous trucks would be a potential solution for automated freight transportation in an open and uncontrolled environment, especially given the rapid development of automated driving technology. In a platoon of driverless trucks, the vehicles follow one another closely and interact with one another wirelessly. And because there would be less space between the vehicles, this will be more advantageous for fuel economy (Linlin Zhang, 2020).

To evaluate the impact of heavy vehicles on the traffic stream characteristics, the various traffic parameters under platoon conditions were examined. There were also some notable differences between the platoon condition and the non-platoon condition in terms of the traffic characteristics. Our main finding is that platooning of heavy vehicles may be harmful to the operational traffic's quality, safety, and mobility. The data analysed from the field investigation showed that the heavy vehicles have a greater impact on traffic density, flow, and speed. This effect has finally led to an increase in travel time and delay, which has increased time headway and vehicle spacing. According to the platooning condition, the predicted traffic congestion index of 0.42 indicates severe traffic congestion (Sandeep Singh, S. Moses Santhakumar, 2021).

3. RESEARCH DESIGN

The research design is well crafted which aligns to meet the research objective. This section shows how to select related studies on related parameters of truck platoons. Since the purpose of this paper is to understand the aspects of truck platoons that were studied, it is

important to get a complete picture of the major issues in this area. The secondary sources used for this study are research journals; business magazines; business newspapers; research reports; published and unpublished studies, articles, and blogs as well as websites and search engines. The research may not be exhaustive, but it does well show what has been studied in terms of the parameters in truck platooning and is valuable for future research.

3.1 Data Collection

Considering the four main factors for evaluation, the data collection was developed mentioning all the factors of optimization. The data included all the necessary information regarding the frequency of usage of vehicles, refuelling time, mileage per kilometres, average speed, type of terrain, frequency of incidents, stoppage time, etc. A comprehensive data of all the respondents was collected as derived from the survey involving value added qualitative questions. The data was collected from different third-party vendors of logistics, packers and movers, transportation from across the country. For different load carrying capacity, a standardized truck of 20-foot container, which holds about 1,150 cubic feet was chosen. A 20-foot container's unloaded weight is 2,300 kg and can, in theory, be loaded to a maximum weight of 28 tons (25,400kg) irrespective of the company of the truck.

3.2 Locations of Study

The data for study was figured from different sources of transportation and logistics industry. This shows how to select related studies on related parameters of truck platoons. The research may not be exhaustive, but it does well show what has been studied in terms of the parameters in truck platooning. The pilot survey was conducted for 10 senior corporate respondents and the questionnaire was altered 3 times before being finalised. The sampling technique adopted for this study is purposive sampling. This size was calculated based on credit cards users across the country with an acceptable margin of error of 5%. A comprehensive data of all the respondents was collected as derived from a survey involving value added qualitative questions. The data included all the necessary information regarding the frequency of usage of vehicles, refuelling time, average speed, type of terrain, frequency of incidents and stoppage time.

3.3 Sampling Techniques

The sampling technique adopted for this study is purposive sampling. Also, the scale used for this study is Likert and Nominal scale. The survey demanded an optimum use of sample size. This size was calculated based on users across the country with an acceptable margin of error of 5% and a confidence level of 95%. Accordingly, the required or estimated sample size for this study is 103.

The source of primary data collected for this study is through the questionnaire. The pilot survey was conducted for 10 respondents and the questionnaire was altered 3 times and finalised. The secondary sources used for this study are research journals; business magazines; business newspapers; research reports; published and unpublished studies, articles, and blogs as well as websites and search engines. After a broad understanding and thorough literature review, the following research objectives were recognized and put forward under consideration for the research and survey.

3,4 Fieldwork Details

A relationship between the parameters taken into consideration in the questionnaire were studied. Accordingly, the parameters were segregated into dependent and independent variables and a correlation between the variables was recognized. ANOVA (Analysis of Variance) was chosen as a statistical technique that helps to find out whether the differences between groups of data are statistically significant. It works by analysing the levels of variance within the groups through samples taken from each of them. The statistical f-value generated by the factorial analysis of variables and compared with the f-critical value establishes a hypothesis of their relationship. According to the hypothesis, the statistical result is verified. Based on the acceptance of the hypothesis, cross-tabulation between various dimensions of the variables provides the analysis of the relationship between them. The results given below gives the output of Anova-Single Factor analysis of the variables with hypothesis followed by their cross-tabulation. The major elements of the survey proposed the following variables to analyse the relationship between their dimensions according to the varied study in the literature review.

The values are then cross tabulated with each of the parameters to find relation between them to optimize for further use. This data collected is then compared to permissible results of truck platooning to have a clear visibility of the areas of improvement.

3.5 Limitations of Study

The previous sections provide a literature overview on truck platooning from the perspective of fuel efficiency. Truck platooning has been a prominent subject of study for several decades. There are still a lot of unanswered questions, even if some theoretical and experimental findings have been made. First and foremost, it's crucial to talk about safe and comfortable passenger distances between vehicles while also taking fuel efficiency and safety into account. Since the spacing shouldn't be fixed on variable slopes to reduce fuel consumption, the reasonable distances in this case refer to the longitudinal spaces between vehicles when traveling on a flat road.

Real-world considerations lead to problems with feedback and communication delays that affect passenger comfort and safety. Furthermore, although ancillary ultrasonic rangefinder and other sensors are used by autonomous vehicles for range finding, operating at a close range requires tight control, which could result in an increased control effort and expensive communication between vehicles. Therefore, more research is required to determine the reasonable longitudinal spaces between vehicles in a platoon by balancing various aspects. Knowing how traffic will impact coordinating decisions is another intriguing area for future investigation. Most studies to date have been conducted in precise simulations or under almost ideal circumstances, and they have assumed that the external traffic did not affect how the trucks moved when they followed the speed profiles. However, as the speeds and opportunities for catching up may decrease, traffic plays a significant role in coordination decisions. While traffic is heavy, this will affect the potential fuel savings. Therefore, it is crucial to research when and how to decide on coordination in a dynamic network.

4. DATA ANALYSIS

After a thorough analysis and study of the statistics and hypothesis, certain peculiar relationships between each of the variables and their corresponding dimensions were studied. The data and findings helped imply certain conclusions, remarks and target points that can be used by logistics and related transportation entities to grow in a particular direction.

1. Relationship between the mileage, average speed, accidents/per year, and ease of transportation
   Hypothesis
   H0: Mileage/Fuel Consumption of the truck is independent of accidents and average speed of the truck
   H1: Mileage/Fuel Consumption of the truck is dependent of accidents and average speed of the truck

Summary

Groups	*Count*	*Sum*	*Average*	*Variance*
Mileage	104	671.8	6.45962	0.35719
Average Speed	104	4010	38.5577	34.3073
Accidents/year	104	208	2	0.50485
Ease of Transportation	104	208	2	0.50485

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	97317.8	3	32439.3	3637.28	5.6016E-296	2.62656
Within Groups	3674.44	412	8.91855			
Total	100992	415				

Table 1: Anova Single Factor Analysis

Since the tabled f-value is greater than the critical f-value (2.62), we reject the null hypothesis in this case. Therefore, mileage or fuel consumption of the truck is dependent of accidents and average speed of the truck. These dependent factors were then studied individually to relate with the effects of truck platooning. The table shows the cross tabulation of different parameters.

Crosstab		
Count		
	Accidents	Total

		1	2	3	
Mileage	5.5	0	9	8	17
	5.8	9	8	0	17
	6.5	0	8	9	17
	6.9	0	9	9	18
	7	17	18	0	35
Total		26	52	26	104

Table 2: Accidents and Mileage

Crosstab					
Count					
		Ease of Transportation			Total
		1	2	3	
Mileage	5.5	9	0	8	17
	5.8	0	17	0	17
	6.5	8	0	9	17
	6.9	9	0	9	18
	7	0	35	0	35
Total		26	52	26	104

Table 3: Mileage and Transportation

Crosstab					
Count					
		Accidents			Total
		1	2	3	
Speed	30	3	8	4	15
	35	7	16	7	30
	40	12	21	11	44
	50	4	7	4	15
Total		26	52	26	104

Table 4: Accidents and Speed

Crosstab					
Count					
		Ease of Transportation			Total
		1	2	3	

Speed	30	4	7	4	15
	35	8	15	7	30
	40	11	22	11	44
	50	3	8	4	15
Total		26	52	26	104

Table 5: Speed and Ease of Transportation

In the table, the values 1,2 and 3 refer to as 1: Worse, 2: Average, 3: Good. This data collected is then compared to permissible results of truck platooning to have a clear visibility of the areas of improvement. Although the establishment of platoons may cause participating cars to experience longer delays, they have little effect on the average traveller wait time, which mostly depends on the vehicle assignment radius. The overwhelming data indicates that, to a certain extent, the hold-on time of leading cars reduces system performance in terms of decreased system capacity and lengthened travel times. In conclusion, a platoon's fuel consumption reduction is influenced by a variety of factors. Despite the possibility of varying outcomes from tests performed under various circumstances, the general tendency might be summed up as follows:

1. As inter-vehicle spaces shrink, fuel efficiency will improve
2. Aerodynamic trailer layouts, such as trailer skirts and trailer boat tails, can save more fuel than conventional trailers
3. In a platoon, following vehicles typically save the most on fuel
4. Fuel consumption reduction will partially diminish as masses or loads grow
5. Speed of a platoon has no discernible impact on fuel savings.

The data collected and assimilated was compared to the effectiveness of the truck platooning effects. Given the parameters affected by truck platooning, results were derived from the parameters affected by truck platooning.

5. RESULTS

The data was compared with the acquired and tested data of truck platooning testing and simulations. According to the data, the lead truck's fuel usage was lowered by roughly 18%, while savings of 24% and 23% were made by the second and third trucks, respectively. Additionally, the next tractor might save about 16 percent on fuel, compared to an impressive 8 percent for the leading vehicle. With fuel savings ranging from 2.8% to 9.7% compared to 2.7% to 5.3 percent, the trailing vehicle may benefit more than the leading tractor. The same outcome was attained in a platoon of three vehicles, where the trailing vehicle enjoyed the best fuel economy possible. Additionally, the number of trucks and their loads has an impact on energy usage. The results of the experiments showed that the trail truck with a total weight of 28 tons reduced its fuel consumption by roughly 21%, while the trail truck with a mass of 40 tons was anticipated to save fuel by 17%.

Ease of Transportation	Average Mileage	Average Speed	Average Accidents/year
Moderate	6.6	38.8	1.5

Worst	6.3	38.7	3
Great	6.3	38.1	2
Grand Total	6.5	38.6	2

Table 6: Cross Tabulation

On the similar lines, considering the percentage of change brought by truck platooning, reiteration of above cross tabulation was performed. Likewise, 16% increase in the average mileage and 20% on average speed was calculated. The following table shows the same calculated statistics of the parameters.

Ease of Transportation	Average of Mileage	Average Speed	Average of Accidents/year
Moderate	7.66	46.50	1
Worst	7.34	46.38	2.5
Great	7.30	45.69	1.7
Grand Total	7.49	46.27	1.6

Table 7: Reiterated Values

The reiterated values after calculating the simultaneous values corresponding to the truck platooning simulations calculated suggest that there is a significant amount of change in the values of the mileage, speed, and accidents per year. This change will vastly improve the all the four parameters under study and can ensure that the logistics and transportation industry can be improved by truck platooning.

5.1 Major Findings

Logistics and related transportation entities can be used to grow in a particular direction by studying the data and findings of this study. Data and findings helped imply certain conclusions, remarks and target points that can be useful for today's industrial and commercial sector. After a thorough analysis and study of the statistics and hypothesis, certain peculiar relationships between each of the variables were studied. The lead truck's fuel usage was lowered by roughly 18%, while savings of 24% and 23% were made by the second and third trucks, respectively. The next tractor might save about 16 percent on fuel, compared to an impressive 8 percent for the leading vehicle. There is a significant amount of change in the values of the mileage, speed, and accidents per year that can be achieved by truck platooning. This will vastly improve the all the four parameters under study and can ensure that the logistics and transportation industry can be improved.

6. CONCLUSIONS AND RECOMMENDATIONS

The study implies that a significant number of respondents have eased on the transportation part of logistics. This will improve the performance of the overall industry by optimizing cost and time. The drivers' initial scepticism was significantly altered when they participated in the actual highways and roadways. The drivers' evaluation of certain driving circumstances pays way for their general sense of safety and confidence in the technology.

Truck platooning may enhance transportation operations' financial, environmental, and social sustainability performance. Making the most of platooning advantages calls for effective planning and optimization strategies to realize these potentials. To the best of our knowledge, the literature on truck platooning transportation planning has not considered or has not thoroughly explored the following topics.

1. Transportation network planning involving strategic truck platooning.
2. Platooning transportation planning in intricate networks with multiple tiers.
3. Transportation planning for trucks using stochastic parameters and uncertainty
4. Transportation planning that involves cooperative truck platooning between several businesses and equitable cost-benefit distribution.
5. Using truck platooning in particular supply chains (such the forestry and agricultural supply networks) to test the benefits of this technology (compared to normal trucks).

For more effective transportation planning, it is essential to consider the benefits and drawbacks, as well as the characteristics, of truck platooning. Three levels of transportation planning for truck platooning can be examined: strategic, tactical, and operational. The implications of truck platooning features on long-term transportation decisions, such as the design of the transportation network and the choice of whether to make investments in infrastructure and vehicles, are dealt with in strategic planning. Tactical truck platooning and transportation planning are about making mid-term decisions, like designing a service network and considering material movement between the origin, terminal, transhipment, and destination nodes. Operational transportation planning in the context of truck platooning refers to daily route and scheduling decisions that are made in the short term.

Repeating the mentioned cross tabulation was done while considering the percentage of change brought about by truck platooning. The average distance increased by 16 percent, and the average speed increased by 20 percent. The results that were repeated after the simultaneous values for the truck platooning simulations were calculated indicate that there has been a considerable change in the annual values for mileage, speed, and accidents. This adjustment will significantly enhance each of the four research characteristics and ensure that truck platooning may enhance the logistics and transportation sector.

Conclusion

The average distance increased by 16 percent, and the average speed increased by 20 percent. This adjustment will significantly enhance each of the four research characteristics. The results that were repeated after the simultaneous values for truck platooning simulations were calculated indicate that there has been a considerable change in the annual values for mileage, speed, and accidents. This would greatly boost the logistics and transportation industry by almost 10-15% considering the parameters under which the effect was analysed.

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