

Evaluation & Development of Road Traffic Accident prediction model by Using Artificial Neural Network

Mrs. Neha Kasar^{1*}, Dr. R.R. Sorate²

¹ PG Student, Department of Civil Engineering, TSSM'S Padmabhooshan Vasantdada Patil Institute Technology, Pune

² Professor, Department of Civil Engineering, TSSM'S Padmabhooshan Vasantdada Patil Institute Technology, Pune India

Abstract - People's lifestyles have improved as a result of the rapid development in urbanisation. However, these developments have placed a burden on roadways by expanding vehicle ownership, causing traffic problems to worsen at an alarming rate. The primary cause of road traffic accidents could be an increase in the rate of traffic volume.

In rapidly developing metropolitan agglomerations, road traffic accidents are a big concern. There is a substantial body of research literature that sheds light on the scope of the problem and the remedies that are required. Road traffic accidents are the third leading cause of unnatural death among all deaths. Transportation engineers and academics have attempted to construct safe roads that adhere to suitable design standards, yet traffic accidents are inescapable. If an accident occurs, the reasons that caused it must be identified, and suitable corrective measures must be established and implemented as soon as possible. The goal of this study is to gain a better knowledge of the problem of road traffic accidents on the Mumbai Pune Expressway (MPEW) and the factors that may contribute to the high accident rates. Using Artificial Neural Networks, this research will construct an accident prediction model to anticipate the amount of accidents along the MPEW (ANN)

Keywords - Artificial Neural Network, Road traffic Accidents, Planning, Management, Prediction, Deep learning Algorithm, Highway, Expressway, MPEW

-----X-----

1. INTRODUCTION

Significant effort and money have been expended in recent years to improve road and highway safety. A continuing problem for transportation engineers is to build and operate the transportation system in such a way that it serves a variety of social goals such as shortening travel time and increasing safety. There has been an increase in due to an exceptional surge in road transportation and automotive traffic in India as a result of and the economy's and consumers' consumption habits have grown at an exponential rate, resulting in dangerous conditions. Circumstances on our Indian roads, including highways and expressways The number of people killed or injured in traffic accidents on these roads is increasing year after year. The path Accidents, deaths, and injuries are global events, but the issue is more severe in mixed communities.

The traffic situation on Indian multi-lane motorways; the true situation is likely to be far worse due to underreporting of incidents to make the road worse

Furthermore, there is a culture of poor car upkeep, poor driving practice, and a lack of enforcing the law, and the casual attitude of road users Road safety has become a major concern for the general population, and highway safety in particular.

Professionals in particular, because road accidents are a major cause of death; Furthermore, the economic losses as a result of property damage or lost working days as a result of injuries the annual cost of fatalities is estimated to exceed billions of dollars. Road safety is both a health and a safety concern and development issue of significance given its magnitude and gravity, as well as the as a result, negative effects on the economy, public

health, and general well-being individuals, particularly those with modest means

1.1 Road Accident Trend in India

There have been numerous types of vehicles on the road in India due to the development of road networks, such as cars, buses, motorcycles, trucks, vans, and others that have been used as a base to move from one place to another. According to the statistics from the Road Transportation Department website in 2019, as shown in Figure, the registered public vehicles in India are increasing every year, indicating that road safety is an important aspect because it involves the majority of the people in this country who are primarily transported by road.

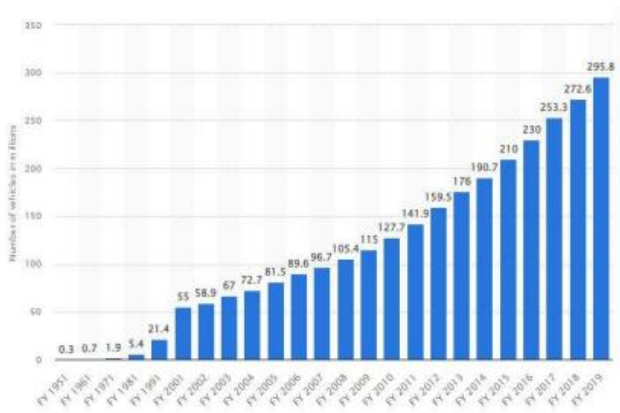


Figure 1: Total cumulative of registered public vehicles in India upto year 2019 (MoRTH website)

It is quite concerned based on the development of the complete situation about motor vehicles for that period. This is due to the fact that, as the diversity of motor vehicles on the road has increased, so has the number of accidents that have happened in India. This scenario must be investigated, and study must be conducted to determine the root reasons of the accident. It is also critical to ensure that India's present transportation infrastructure is in perfect working order in serving all types of vehicle users in this country.

1.2 Safety on the Road

The availability of transportation is directly and strongly tied to the economic development of any country, and the objective of transportation systems is to facilitate the efficient and safe movement of freight and passengers from one location to another. The increasing number of automobiles on the road had produced a serious social problem in the form of traffic accidents, which resulted in the loss of lives and property. According to several accident studies, road accidents are not caused by natural causes, but rather

by negligence and lack of road safety rules. Environmental factors, such as fog in the winter, also have a significant part in the causes of road accidents. As a result, road/highway safety is a modern-day necessity.

1.3 Initiatives to Improve Highway Safety

The Highway Police, Maharashtra State project "Highway MrityunjayDoot" was launched on March 1, 2021.

Following a thorough investigation into the causes of mortality in road accidents, it was discovered that the lack of rapid Medical Aid was the biggest source of worry.

In many cases, the injured were not properly evacuated and transported, which compounded the injuries and medical condition. Employees from nearby Malls, Petrol Pumps, Local Dhabas or Hotels, and neighboring villages establish groups of up to 4-5 persons as part of this project. These groups are known as "MrityunjayDevdoot" (Angels of God) and are trained in First Aid (including CPR, precautionary procedures for lifting and transporting injured people, and so on) with the assistance of Government/Semi-Government or Social Organizations. The Maharashtra State Highway Police has developed the "Highway MrityunjayDoot" Project to avoid any such scenarios and to enable timely and effective evacuation of people injured in accidents within the "Golden Hour," which is critical.

1.4 Artificial Intelligence Techniques

Statistics and accident prediction models are commonly employed in highway safety research. For example, they may be utilised for establishing correlations between collisions and explanatory factors like traffic flow, kind of control, and highway geometrical features, among others. It has been found that neural network models may be used successfully in a variety of transportation study domains, including traffic safety studies, with outstanding results.. networked brains. Traditional statistical models can't match the versatility, accuracy, generalisation, and forecasting capabilities of ANNs. When it comes to predicting traffic accidents, ANN outperforms all other AI algorithms since it is capable of representing non-linear functions without the use of statistical simulations.

2. LITERATURE SURVEY

Create an artificial neural network (ANN) model to predict the success of building projects in Syria. Journal of King Saud University - Engineering Sciences, 2 May 2021, Rana Maya, Bassam Hassan, and Ammar Hassan

With this paper, members of the construction project team will learn about the aspects they must constantly monitor to ensure that the project meets its deadline and expectations. The study's goal was to create an ANN model that could predict the success of building projects based on the aforementioned variables.

Artificial neural network research and applications in pavement engineering: A state-of-the-art review Science Direct, 23 March 2021, Xu Yang a, Jinchao Guan a, Ling Ding c, Zhanping You

In order to analyse one-dimensional, two-dimensional, and time-series data, these studies utilised MLPNN, CNN, and RNN architectures (multi-layer perceptron neural networks). CNN-based pavement health inspection and monitoring has received the greatest scholarly attention because of its potential to replace human labour. Data collecting, parameter optimization, model transferability, and low-cost data annotation are some of the primary problems that ANN meets in pavement material design, cost analysis, and fault detection.

The propagation of interruptions in multi-level public transportation networks can be quantified and controlled. International Journal of Transportation Science and Technology, edited by Menno Yap, Oded Cats, Johanna TörnquistKrasemann, and Niels van Oort, will be published by Elsevier on February 21st, 2021.

Here, we provide an approach to assessing the impact of rail network interruptions on the city's tram and bus systems. Models for optimising train scheduling and simulating dynamic public transit assignment are coupled in this framework in an iterative process. By iteratively constructing train schedules, passengers' flow re-distribution and delays may be taken into account. By conducting research, we've developed a framework that can be used to improve public transportation contingency plans at the strategic and tactical levels in response to short- and medium term disruptions, taking into account the impact on passengers of train network disruptions on the urban network. This technique allows for the retrospective quantification of interruption costs, including spillover effects.

AkmalMukhitdinov*, KamoliddinZiyaev, Janserik Omarov, and Shokhsanamismoilova "Methodology of constructing driving cycles by the synthesis" Web of Conferences 264, 01033 (2021)

Methods for building driving cycles, variables impacting performance and driving modes, and the car's fuel consumption are examined in this article. Standard driving cycles for urban settings are developed by synthesising several city-driving modes for passenger cars.

This approach of synthesising driving modes for vehicles has been shown to allow for distinct identification of vehicle driving cycles while also taking into account the individual conditions of their operation.

Inquiry into a molecular dynamics-based model for car-following Eighth January 2021: YanfengJia ; Dayi Qu; Lewe Han; Lu Lin; and Jiale Hong

Using a time-space diagram, we compare the molecular model to the classical optimum velocity model to examine the rule of evolution for traffic flow stoppage. Molecular car-following models better replicate micro-level behaviour, according to the study's findings.

Because of this, it's possible to build a more accurate model of the driver's behaviour as he or she follows another vehicle.

Huaikun Xiang, Jiafeng Zhu, Guoyuan Liang and Yingjun Shen "Prediction of Dangerous Driving Behavior Based on Vehicle Motion State and Passenger Feeling Using Cloud Model and Elman Neural Network", : Research Article, 29 April 2021

We propose a new method for predicting risky driving behaviours based on vehicle motion state estimates and passenger subjective sensation ratings, utilising a hybrid model comprised of a cloud model and an Elman neural network (CM-ENN). We've built a data collection system for driving motion states to test the recommended technique in China's Shenzhen metropolis. Tests show that the novel method outperforms traditional neural network-based approaches in terms of precision and robustness.

Eduard Pons, TomásGarcía-Calvo, Francesc Cos, Ricardo RestaEt.AI. "Integrating video tracking and GPS to quantify accelerations and

decelerations in elite soccer” Scientific Report 17 August 2021

During an official competition, a video tracking system (MEDIACOACH) and a GPS device were used to compare the number and distance travelled in various acceleration and deceleration stages. During the course of a season, data was gathered from a Spanish professional football team. Wimbu Pro recorded higher accelerations and decelerations than MEDIACOACH, but both systems recorded the same number of total distances travelled.

Robert I. M. Delves, Robert J. Aughey, “The Quantification of Acceleration Events in Elite Team Sport: a Systematic Review” Open Access2021

We measured the filtering methods utilised to compute acceleration and the minimal effort time for these occurrences in this review.... Accurate evaluation of athlete acceleration and deceleration datasets has been hampered by the variance in GPS/GNSS device reporting on horizontal dilution of accuracy and satellite number information.

Acceleration and deceleration loads may be influenced by technology-related differences across tracking manufacturers and devices, according to our research. As a result, applied team sport research must devise and implement an accelerated filtering method and reporting structure that are both consistent and possibly sport-specific.

Cost Forecasting of Public Construction Projects Using Multilayer Perceptron Artificial Neural Networks: A Case Study, Alcineide Pessoa, Gean Sousa, Research Article, and DECEMBER - 2021

An artificial intelligence-based computer model capable of predicting the execution costs of construction projects for Brazilian educational public buildings is being studied and presented. In order to train and test the neural network, the Ministry of Education's web portal was utilised to get the database. To optimise the gradient descent approach, a multilayer perceptron back propagation algorithm was applied. Using Pearson correlation coefficients and the mean absolute percentage errors, the findings were analysed.

Artificial Neural Networks, Fuzzy Inference System, and Regression Analysis were used to determine the efficacy of traffic accident models for projects. International Research Journal of Engineering and Technology (IRJET), ShabniyaVeliyampatt, Oct 2021

This research aims to compare the cost estimation models produced using various methods to determine their efficacy in producing realistic and accurate forecasts of building projects. The various Non-Traditional Methods employed in the study are Regression analysis, Artificial Neural Networks and Fuzzy Inference System. The result of the survey and literature review shows that many factors are affecting construction out of which 15 significant factors were identified by conducting t-test using SPSS Software. Data from 116 real executed construction projects in Kerala were collected for the most significant factors to build up models. The Models using ANN and FIS was done in Matlab whereas regression Analysis was carried out in SPSS Software

Predicting the Most Appropriate Post-Contract Cost Controlling Techniques in Construction Projects Using Artificial Neural Networks AwuzieBankole, TemitopeOmotayo, Research Gate, 28 July 2020

It has been suggested that ANNs can be used to forecast the decision-making process of construction professionals when selecting PCCTs in different stages of construction project delivery by evaluating survey data. How the questionnaire data may be used for ANN analysis is demonstrated by the standardised scaling of operationalized variables for pseudo-probability.

Predicting the Rework Cost Impact of Communication Factors Using Artificial Neural Networks, Roman Trach, Yuliia Trach, Research Article, 20 July 2021

This study intends to fill up the knowledge gap that currently exists in the field. We wanted to use artificial neural networks (ANNs) to analyse and anticipate the influence of factors like communication on project rework costs. Twelve communication-influencing variables were discovered and tested throughout the data gathering phase. 18 construction projects were examined to determine the average amount of rework required. The hidden layer of our network had a sigmoid transfer function, whereas the output layer had a linear transfer function. To reduce the amount of rework and energy and resource consumption in building projects, project management can utilise the suggested model as an integrated decision support tool.

Neural network-based structural element optimization in high-earthquake regions, V.

Arana, M. Sanchez and P. Vidal IOP Conference Series: Materials Science and Engineering 2021

A six-story building is being used as a test case for the use of artificial neural networks (ANNs) in this research. In order to train the algorithm, 30 reinforced concrete buildings with a system of structural walls were manually created using the ETABS application. MATLAB was used to create and train the neural networks. An extra studied building was used for validation, where the actual savings were estimated and existing rules were confirmed.

Existing Single Family Home Elevation Projects: A Predictive Statistical Cost Estimation Model Arash Taghinezhad, Carol J. Friedland, Research Article, 07 June 2021

Project efficacy is determined using a benefit-cost analysis (BCA) that compares expected averted flood loss to project expenditures. However, it is occasionally necessary to make decisions concerning mitigation measures based only on generic construction features, even when conventional construction cost estimates are quite detailed. The average floor area of an existing single-family home, the number of stories, and the foundation type are used in this paper to estimate the costs associated with re-elevation using data modelling and mining methods like multiple regression, random forest, generalised additive model (GAM), model evaluation and selection with cross-validation methods.

Information and Communication Technology Implementation Factors in Building Life Cycle Costs Peter Mésáro (Peter Mésáro), Tomáš Mandicák, Marcela Spišáková, Research Article, 25 March 2021

Here, we're talking about everything that goes into creating a new home, from land acquisition and development through completion and decommissioning. Even during the maintenance phase, budgetary restrictions, environmental circumstances, a lack of communication, and the availability of qualified workers have an impact on costs and timeliness. These characteristics can also have a substantial impact on the efficiency and cost-effectiveness of the design management and construction phase of the process. This means that the design and construction phases are closely intertwined.

Using artificial neural networks to model bricklaying productivity Orsolya Bokor, Laura Florez-Perez, Giovanni Pesce, 2021 European Conference on Computing in Construction 2021

To achieve these productivity rates, it is necessary to understand the link between numerous factors and productivity. Project managers can benefit from the use of artificial neural networks (ANNs) in modelling the complex interconnections that are typical of building operations and in estimating productivity. A bricklaying productivity ANN model's network settings are delineated in this study.

Machine learning approaches for estimation and prediction in building projects: a systematic review Sanaz Tayefeh Hashemi, Omid Mahdi Ebadati, Harleen Kaur, Springer Article 15 September 2020

Analytical, statistical and analogue models are grouped into three categories, and their features are examined. As a result, articles have been extensively examined in terms of their application area, method used, techniques utilised, journals published in, and the year of publication.. etc. Predicting construction costs and other associated projects using analytics and machine learning algorithms is a key finding of this research, which will help researchers discover the best practises for actual building projects.

Application of Artificial Intelligence for the Estimation of Concrete and Reinforcement Consumption in the Construction of Integral Bridges Zeljka Beljka, Milos Knezevic, Snezana Rutes and Nenad Ivanisevic, Research Article, 8th June 2020

The application of artificial intelligence for the assessment of concrete and reinforcement consumption and the selection of the best models for estimation; the estimation model was constructed by employing artificial neural networks. As measured by a mean absolute percentage error (MAPE), the best artificial neural network model had an accuracy of 8.56 percent for concrete consumption and 17.31 percent for reinforcement consumption.

A thorough study of machine learning approaches for cost estimate and prediction in building projects Springer Article, Sanaz Tayefeh Hashemi and Omid Mahdi Ebadati, 6 September 2020

The application field, method used, techniques employed, journals published in, and the year of publication of papers have all been extensively examined. Predicting construction costs and other associated projects using analytics and machine learning algorithms is a key finding of this research,

which will help researchers discover the best practises for actual building projects.

Using Pareto Analysis and the Analytical Hierarchy Process to Evaluate Critical Success Factors (CSFs) in the Selection of Building Contractors Murat Gunduz, Khalid F. Al-Salahi, Khalid K. Naji, and Khalid F. Al-Salahi, *Journal of Engineering Research*, 25th June 2020

CSFs (critical success factors) for selecting construction contractors in Qatar to assist investors develop their homes more effectively and efficiently are the goal of this article. To begin, a comprehensive analysis of prior studies was conducted to identify the twenty most common CSFs used in the construction of dwellings. Afterwards, 280 investors were surveyed to see out how important CSFs were to them. CSFs that are important to investors while developing houses were analysed using Pareto analysis and the Analytic Hierarchy Process (AHP). Building contractor selection may be improved by researching the investor's behaviour in terms of frequency, cost and time in order to identify the most important Critical Success Factors (CSFs).

A Review on Cost Prediction Analysis of Construction Project Using ANN Model G. C. Sarode, Shubham E. Chandgude, *International Journal of Innovative Research in Science, Engineering and Technology (IJIRSET)*, April 2020

Cost estimating is an experience-based process that requires assessments of unknown conditions and intricate interactions between cost-influencing elements.. factors.. factors.. ANNs are analogy-based processes that are best suited to the forecasting of costs.. They can generalise solutions for future applications because of ANNs' capacity to learn from examples (previous projects) (future projects). Everyone, especially in the construction industry, is concerned about the cost of their project. Any project must have an accurate cost estimate in order to motivate a choice on whether or not to proceed with it.

State-of-the-Art Review of Artificial Intelligence and Parametric Construction Cost Estimate Modeling ASCE 2020 Haytham H. Elmousalam

The cost drivers have been divided into two groups based on historical research: qualitative and quantitative methods, which are the subjects of this study. This study also discusses computational intelligence (CI) approaches and ensemble methods for developing credible cost prediction models. There are limits and suggestions in this study's hybridization of

many modelling methodologies, as well as potential advances in the building of cost models. Fuzzy logic (FL) models, neural networks, regression models, case-based reasoning, and hybrid models are all investigated in this study.

Using Artificial Neural Networks in Construction Projects to Improve the Earned Value Management Technique's Results AmirhosseinBalali, AlirezaValipour, *Research Article*, 21 October 2020

In order to better anticipate project cost indices, this research aims to reduce the drawbacks of the Earned Value Management (EVM) technique by employing an Artificial Neural Network (ANN) and multiple regression. This study focused on 50 different road development projects in Iran's Fars Province. Cost performance indices were forecasted using an ANN model, which allowed for a more accurate comparison between anticipated and actual costs by taking into account elements that impact project success. MATLAB was used to examine the ANN model's input data. In addition to the ANN, a multiple regression model was employed to verify the results.

For cost estimate of engineering services, an artificial neural network technique was used. This Evers & Hans Voordijk, *International Journal of Construction Management*, 29 Nov 2019. Erik Matel, FaridaddinVahdatikhaki, SiavashHosseinyalamdary, *This Evers & Hans Voordijk, International Journal of Construction Management*, 29 Nov 2019.

Accurate project estimates are critical for businesses. Because there is so little information available about the scope and details of the project, traditional methods of cost estimation tend to be slow and inaccurate. Machine Learning (ML)-based technologies like Artificial Neural Networks (ANNs), may now be utilised for more accurate cost prediction even in the face of limited information during the bidding process because of the increased computing power available in today's world. While ANNs have been widely investigated by contractors, there has been little study on the development and deployment of ML-based techniques for engineering consulting firms. Because the products and services provided by consultants are distinct from those provided by contractors.

Artificial neural networks may be used to estimate the cost of road development.

KsenijaTijanac The Springer Publishing Company, 8 August 2019

Cost analysis at an early stage may be enhanced by applying neural networks, which can give more accurate results and reduce estimation errors. The Republic of Croatia has a tendency to overspend on road construction projects. In order to avoid mistakes and raise the possibilities of success in future road projects, the contractor's prior work on comparable projects is a crucial factor. Artificial neural networks may be used to predict construction costs at various phases of the project life cycle using data from previous projects.

Evaluation of Constructions using Artificial Neural Network (ANN), Sandhya W T, International Journal for Modern Trends in Science and Technology, 09-November-2019

The purpose of this research is to estimate the costs through the use of an Artificial Neural Network (ANN) (ANN). Finally, a reasonable assessment of the model's accuracy is provided. Microsoft Excel Solver and MATLAB software were used to create a neural network model analysis. Papers on the building of artificial neural networks (ANNs) are the focus of these efforts. Research papers, articles, and studies on this topic are discussed in this document. Artificial neural networks (ANNs) have the potential to transform the way building costs are estimated in the future..

Construction Cost Estimation of Brazilian Highways Using Artificial Neural Networks Laís B. Barros, Marília Marcy and Michele T. M. Carvalho, International Journal of Structural and Civil Engineering Research Vol. 7, No. 3, August 2018

Artificial Neural Networks (ANNs) can be used to generate a more accurate method for estimating building highway projects. The back propagation approach was used to train and evaluate several network designs with 10, 15, and 20 neurons. Data from fourteen Brazilian highway projects was gathered and examined as a result of this. After a lot of trial and error, eleven criteria were identified that had the greatest impact on the final building cost. Cost estimates had an average accuracy of 99 percent in the best-case scenario. Public agencies may employ this preliminary study's findings if the tool is shown to be feasible for use on Brazilian projects in the future..

Estimation Model for I-Girder Bridge Superstructure Using Multiple Linear Regression and Artificial Neural Network, InasWinalytra,

AriefSetiawan Budi Nugroho, Applied Mechanics and Materials2018

The Daerah Istimewa Yogyakarta I-girder Bridge's detailed engineering design yielded a cost estimation model based on thirteen data points (DIY). I-girder Bridge superstructure costs were influenced by a number of variables. It is important to consider factors such as bridge span and breadth, sidewalk size, and kind of railing when determining the cost of a construction. Multiple linear regression (MLR) and artificial neural network (ANN) are used to generate the best estimation model using these variables. The study revealed that the length and breadth of the bridge were the most significant determinants of price.

An artificial neural network (ANN) model proposal for cost minimization and cost estimation based on building dimensions for reinforced concrete duplex villa in preliminary design, Latif Onur UĞUR, 2017

When it comes to building reinforced concrete duplex houses, this study aims to illustrate how design parameters and unit prices fluctuate over time. An efficient design can be created in this manner. It's also a goal to create an estimating model for costs based on a small number of design characteristics. The early design process will save time and money by using a model with a low error rate.

Construction cost prediction using neural networks Smita K. Magdum and Amol C. Adamuthe, ICTACT Journal on soft computing, October 2017,

Using neural networks and multilayer perceptrons, we want to build a model for estimating construction costs. We create NN and MLP models with varying numbers of hidden nodes and layers. In this study, four synthetic neural networks and twelve multilayer perceptron models are put side by side for comparison and contrast. MLP and NN outperform statistical regression when it comes to predicting outcomes. On training datasets, MLP outperforms NN; but, on testing datasets, it fails.

In Extreme Cold Regions, an Artificial Neural Network for Cross Laminated Timber Energy Consumption and Cost Assessment Office Building Research Article, 30 December 2017 by Qi Dong, Kai Xing, and Hongrui Zhang

Predicting the energy consumption and costs of CLT office buildings in cold climates at an early stage of

design using an artificial neural network (ANN) is the goal of this article. The values of eleven input factors for input variables containing building form and construction variables were determined using local building standards and surveys. To train ANNs using simulation data, researchers employed LHS, a Latin hypercube sampling (LHS) strategy for selecting training datasets.

Md. Ebrahim Shaik, Md. Milon Islam, Quazi Sazzad Hossain (2021) "A review on neural network techniques for the prediction of road traffic accident severity"

Forecasting the severity of traffic accidents is an important step in the intelligent transportation and traffic management system because it allows drivers at higher risk of catastrophic accidents to be identified and avoided colliding. The multilayer perceptron neural network (MPNN) is by far the most popular, fundamental, and widely utilised form of neural network (NN) for forecasting road accidents.

Aanal Desai, Dr. L. B. Zala, Amit A. Amin (2021) "Comparison of crash prediction models using MLR and ANN" RT&A volume 16.

To compare the two models, a graph was created showing the difference between the predicted crashes and those that really occurred. The ANN was found to be more effective. It has an R2 score of 88.79 percent for the ANN model. There were several discrepancies between the ANN model and the MLR model. In terms of forecasting traffic accidents, the ANN model outperforms the Multiple Linear Regression model.

Nivea John, Archana S (2019) "Crash Prediction Modeling of Two Lane Undivided Highways Using Artificial Neural Network" International Journal of Scientific & Engineering Research, Volume 10

The study concluded that the ANN model's superiority is demonstrated by its low error value and r2 value. As a result, artificial neural networks can be used to forecast the number of accidents on two-lane undivided roadways. This also serves as a platform for connecting ANN to other planning models in order to achieve the best results in the field of transportation planning.

Ebrahim and Hossain Q. (2018) "An Artificial Neural Network model for road accident prediction: A case study of Khulna metropolitan city" 4th International Conference on Civil Engineering for Sustainable Development (ISBN-978-984-34-3502-6).

According to the report, the ANN technique is a more flexible and assumption-free methodology that can evaluate and compare all traffic accident features. The model's superiority is indicated by low mean squared error values. The findings showed that, based on appropriate data, forecasted traffic accidents are near enough to real traffic accidents to be reliable in predicting future traffic accidents in Khulna Metropolitan City.

Borja García de Soto, Markus Deublein, Andreas Bumbacher, Bryan T. Adey (2018) "Predicting road traffic accidents using artificial neural network models" Infrastructure Asset Management Volume 5.

The study concluded that the ANN model's performance varied based on the type of accident. When evaluating predictions utilizing data from 2010 to 2012, it was discovered that the ANN and BN models performed similarly for minor and severe injury events.

3. PROBLEM STATEMENT

"By studying different examinations like Highway survey and traffic analysis that the problem at city by pass Highway is due to insufficiency of Highway space for the vehicles to pass through the junction at different instants of time in a day which is effecting the free flow of traffic, and improper movement of traffic also results in occurrence of accident in different instants of time."

As previously said, the number of incidents is increasing year after year and has become a major source of safety concern. As a result, doing this research is vital in order to grasp the scale of the problem, as well as to understand what causes accidents and injuries and what steps can be taken to prevent them. Furthermore, an effective solution for ensuring the safety of road users must be offered.

4. AIM OF PROJECT

This study focuses on accident investigations along the Mumbai-Pune Expressway, which runs through the Pune District. The goal of this study is to identify the primary elements that influence the occurrence of accidents and to construct an accident prediction model utilizing Artificial Neural Networks (ANN)

5. OBJECTIVES

- To collect road accident data on MPEW.

- To analyze the accident trend and accident parameters on MPEW.
- To determine the critical accident variables for accident prediction purposes.
- Using Artificial Neural Network (ANN) software, create an Accident Prediction Model for MPEW.

6. RESEARCH METHODOLOGY

This study focuses on accident investigations along the Mumbai-Pune Expressway, which runs through the Pune District. The goal of this study is to identify the primary elements that influence the occurrence of accidents and to construct an accident prediction model utilizing Artificial Neural Networks (ANN)

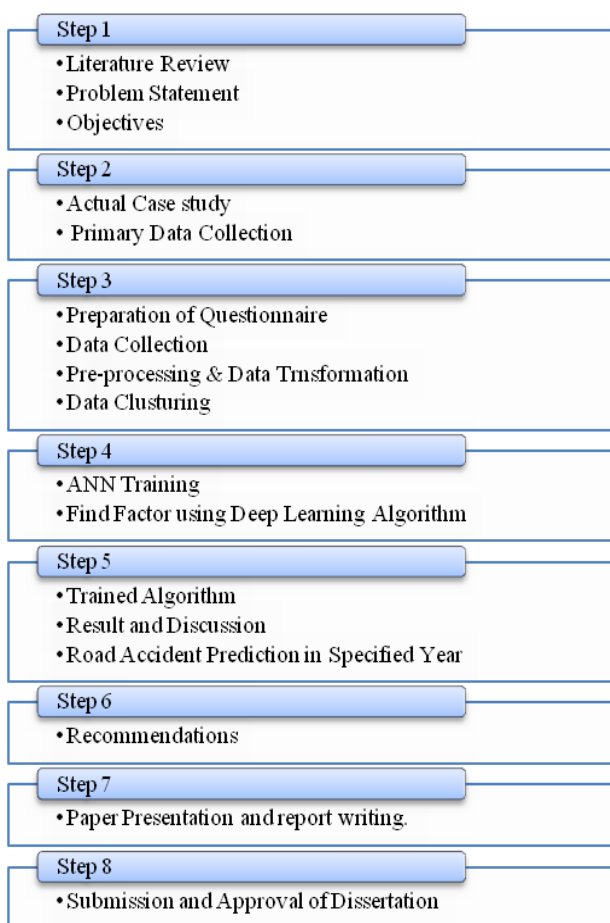


Figure 2: Methodology Flow

6.1 Development and application of ANN model

This image depicts the construction of a computer-generated neural network model for predicting traffic accidents. Data collection, decision-making, and data analysis or error-minimization are the fundamental activities of all neural networks, regardless of the kind of neural network used. These procedures ultimately have an impact on the trial's final results. In the relation

wn, the weights of all of the x_n inputs are multiplied by one another to form an artificial neuron. This is followed by iterating on the $w_n \cdot x_n$ results in order to limit the chance of a mistake.

7. DATA COLLECTION & EXPERIMENTATION

The Mumbai–Pune Expressway (MPEW) is India's first 6-lane wide concrete toll road. It connects Mumbai, Maharashtra's capital, and Pune, the state's capital, across a distance of 94.5 kilometers. Pune, Maharashtra's cultural and educational hub, is India's financial capital. In the year 200, it was fully operationalized.

There have been a lot of road accidents in MPEW because of human error and the high volume of traffic. The Highway Patrol has reported 872 collisions in the past three years. Out of which 232 were recorded as fatal accidents and 268 users were killed, 392 were seriously injured and 67 suffered minor injuries.

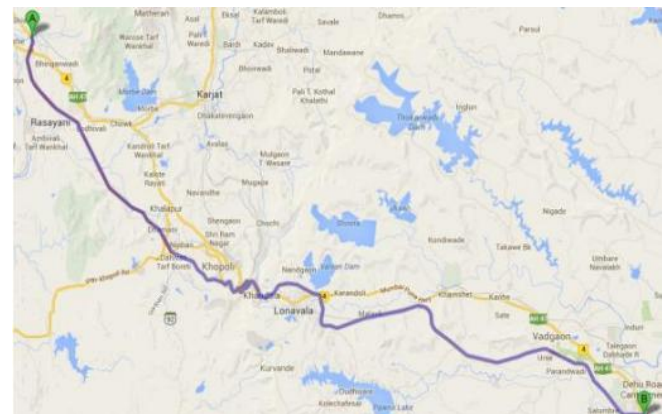


Figure 3: Map Showing Mumbai – Pune Expressway

The expressway travels from Kalamboli in Navi Mumbai to Kiwale in Pune. In the Sahyadri mountain ranges, it meanders through a series of tunnels and overpasses. The five interchanges are Kon (Shedung), Chowk, Khalapur, Kusgaon, and Talegaon. A central median divides the two carriageways, each of which has three concrete lanes and a tarmac or concrete shoulder on each side of the divider.

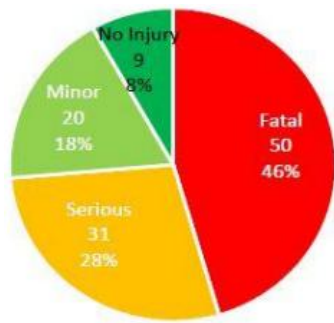


Figure 4: Distribution of accidents by highest injury

7.1 Distribution of accidents by Time of Occurrence

Three-hour time intervals were plotted against the accident instances included in the contributing factors research (Figure 5). Nearly three-quarters of all accidents and nearly half of fatal accidents occur between the hours of zero to five o'clock.

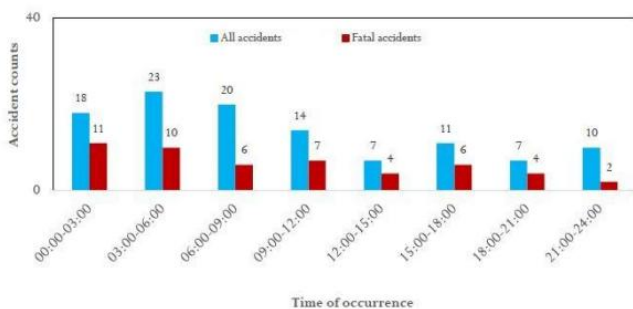


Figure 5: Distribution of accidents by time of occurrence in 3 hr time zone

Accidents that occur between the hours of 6:00 a.m. and 11:59 p.m. account for 31% of all accidents and 34% of fatal and severe ones. Between the hours of 00:00 and 09:00, 56 percent of all accidents occurred, including 54 percent of fatal ones.

Figure 5 depicts the breakdown of the total number of accidents (including fatalities) according to the kind of accident. Listed below are the 10 accident categories that are utilised to categorise these incidents.

- Collision with another vehicle that is moving, stopping, or standing still..
- Collision with a vehicle approaching or waiting.
- Collision with another car travelling in the same direction from the side..
- Collision with another oncoming vehicle.
- Collision with a vehicle that enters or crosses a road..
- A car collides with a pedestrian..
- Collision with a carriageway obstruction.
- Leaving the carriageway to the right.
- Leaving the carriageway to the left.

- A different type of mishap (such as truck jack-knifing, fires, and rollovers on the carriageway).

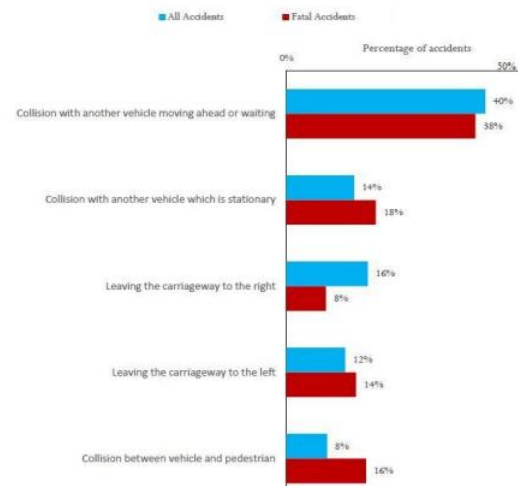


Figure 6: Percentage distribution of accidents by kinds of accident

4 percent of all accidents and 58 percent of fatal accidents are caused by collisions with another vehicle that is travelling ahead or waiting, and collisions with another vehicle that begins, stops, or is stationary at the same moment (Figure 6). The second most common form of collision is "run-off-road," which accounts for 28% of all collisions and 20% of deaths. Accidents between vehicles and pedestrians account for 7% of all fatalities and 14% of fatal collisions. Rear-end crashes, exiting the highway to the left or right, and pedestrian accidents are all examples of collisions with another vehicle that is driving forward, waiting, or halted. Alcohol is responsible for 90% of all accidents and 94% of fatal accidents.

7.2 Analysis of Contributing Factors

Most road traffic accidents and fatalities are caused by a combination of circumstances.

The injuries that resulted were thoroughly investigated and are detailed. Accidents and injuries are influenced by a variety of factors. The properties of contributing components are used to create a distribution.

The Venn diagram depicts (Human/Vehicle/Infrastructure) for road traffic accidents. The combination of human and vehicle components (56%) resulted in this diagram.

The influence of all variables (24 percent) on the occurrence of accidents and the subsequent injury

cause is largest, followed by human factors (14 percent).

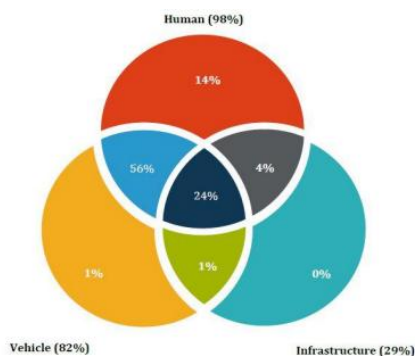


Figure 7: Venn diagram distribution of accidents by contributing factor type

Table 1: Contributing human influencing the accidents

HUMAN FACTORS (Influencing accidents and injuries)	All accidents	Fatal accidents
Driver - Sleep/Fatigue/Drowsiness	35%	26%
Speeding - Exceeding speed limit	32%	38%
Overtaking on left side of vehicle	15%	24%
Improper lane change/lane usage	15%	12%
Parked - vehicle off the road	10%	10%
Driving too slow for conditions	10%	12%
Pedestrian – Dangerous behavior on roadway	10%	20%
Parked – Vehicle on road (Full or partial)	7%	12%
Driver Inattention	3%	4%
Pedestrian Inattention	4%	6%
Speeding - Excessive speed for conditions	4%	4%
Following too closely	3%	4%
Turning suddenly or without indication	3%	2%
Illegal road usage	2%	4%
Vehicle slowed down/ stopped suddenly.	2%	%
Driver – Alcohol	1%	2%
Seatbelt not used	66%	64%

Human error, vehicle characteristics, and infrastructure/ environmental factors are the three key contributing factors in traditional accident analysis. It should be noted that when investigating an accident, it is important to try to identify all possible contributing variables (human, vehicle, and infrastructure) that may have contributed to the accident's occurrence, as any of these aspects might have an independent or combined effect. Despite human flaws, this type of study provides a broader viewpoint and can aid in the identification of vehicle and infrastructure-related solutions.

7.3 Accidents and injuries are influenced by human factors.

Table1.1 shows the total number of accidents and fatalities for each human contributor. Accidents and injuries might be caused by more than one factor, therefore the sum of percentage impacts will not match the number of human variables.

7.4 Accidents and Injuries Caused by Vehicle Factors

The following are the car variables that have been found to be responsible for causing accidents and injuries in the first place. One may see how many incidents occurred by looking at table 2. Each of the variables has an effect.

Table 2: List of contributing vehicle factor

VEHICLE FACTORS (Influencing accidents and injuries)	All Accident	Fatal Accident
Absence of Reflectors	4%	8%
Defective - Brakes	1%	2%
Vehicle-other	1%	2%
Passenger Compartment Intrusion - Underride/Override & Other	67%	72%
Seatbelts not available/usable	24%	20%
Knock-down of Pedestrian	11%	22%
Runover of Pedestrian	2%	4%
Unsecured Cargo	1%	2%
Ejection	16%	26%

7.5 Infrastructure Factors influencing Accidents and Injuries

Factors that may have contributed to the accident are outlined below. The percentage of accidents impacted by each component is shown in the table below.

Table 3: List of contributing Infrastructure factors

INFRASTRUCTURE FACTORS (Influencing Crashes and Injuries on the MPEW)	All accident	Fatal Accident
Inadequate warning about accident / parked vehicle	8%	12%
Shoulder – Narrow	3%	2%
Sharp Curvature	2%	2%
Gap-in-Median	2%	2%
Poor road marking/signage	1%	2%
Slippery road surface	1%	--
Animal/Object on roadway	1%	--
Poor object conspicuity	1%	--
Object impacts - roadside - manmade structures	12%	10%

Site images of Infrastructure factors causing accidents (Image source: JP research India, accident report (2020))



Unguarded bridge pier

Bridge wall



Curbstones & flowerpots

Narrow shoulder



Roadside parked vehicle with no shoulder

Concrete barrier

8. CONCLUSION

The following are the important results based on the above discussions on road traffic accidents for the Mumbai-Pune Expressway:

- 56% of all accidents and 54% of fatal accidents occur between the hours of 00:00 and 09:00.
- More over 90% of all accidents and 94% of all deaths are caused by collisions with another vehicle that is either moving ahead of, waiting, or halted (rear-end collisions).
- All road users involved in crashes and 98% of those with at least one death are either trucks or other vehicles, including pedestrians.
- Car occupants were outside the vehicle in 4.58 percent of pedestrian accidents while the vehicle was parked, broken down, or being pushed to the side of the road.
- Factors that cause accidents, together with their severity in percentages

9. ACKNOWLEDGMENT

We express our sincere thanks to Project Guide, Dr. R. R. Sorate, for his continuous support. We also thankful to our Head of Department of civil Dr. R.R. Sorate For support

REFERENCES

1. Develop an artificial neural network (ANN) model to predict construction projects performance in Syria Rana Maya, Bassam Hassan, Ammar Hassan, Journal of King Saud University – Engineering Sciences, 2 May 2021
2. Research and applications of artificial neural network in pavement engineering: A state-of-the-art review Xu Yang a, Jinchao Guan a, Ling Ding c, Zhanping You, Science Direct, 23 March 2021
3. Quantification and control of disruption propagation in multi-level public transport networks Menno Yap a, Oded Cats, Johanna TörnquistKrasemann, Niels van Oort, International Journal of Transportation Science and Technology, Elsevier 21st Feb 2021
4. AkmalMukhitdinov* , KamoliddinZiyaev, JanserikOmarov, and ShokhsanamIsmoilova “Methodology of constructing driving cycles by the synthesis” Web of Conferences 264, 01033 (2021)
5. Research on car-following model based on molecular dynamics YanfengJia , Dayi Qu, Lewei Han, Lu Lin and Jiale Hong, 8 January 2021
6. Huaikun Xiang, Jiafeng Zhu, Guoyuan Liang and YingjunShen “Prediction of Dangerous Driving Behavior Based on Vehicle Motion State and Passenger Feeling Using Cloud Model and Elman Neural Network”, : Research Article, 29 April 2021
7. Eduard Pons, TomásGarcía-Calvo, Francesc Cos, Ricardo RestaEt.Al. “Integrating video tracking and GPS to quantify accelerations and decelerations in elite soccer” Scientific Report 17 August 2021
8. Robert I. M. Delves, Robert J. Aughey, “The Quantification of Acceleration Events in Elite Team Sport: a Systematic Review” Open Access2021
9. Cost Forecasting of Public Construction Projects Using Multilayer Perceptron Artificial Neural Networks: A Case Study, Alcineide Pessoa, Gean Sousa, Research Article, and DECEMBER - 2021
10. Determination of Efficacy of Traffic accidents Models for Projects using Artificial

11. Neural Networks, Fuzzy Inference System and Regression Analysis ShabniyaVeliyampatt, International Research Journal of Engineering and Technology (IRJET), Oct 2021
12. An Artificial Neural Network Approach to Predicting Most Applicable Post-Contract Cost Controlling Techniques in Construction Projects TemitopeOmotayo, AwuzieBankole, Research Gate, 28 July 2020
13. Using ANN to Predict the Impact of Communication Factors on the Rework Cost in Construction Projects, Roman Trach, Yuliia Trach, Research Article, 20 July 2021
14. Optimization of structural elements in highly seismic areas using neural networks, V. Arana, M. Sanchez and P. Vidal2IOP Conference Series: Materials Science and Engineering2021
15. Predictive Statistical Cost Estimation Model for Existing Single Family Home Elevation Projects ArashTaghinezhad, Carol J. Friedland, Research Article, 07 June 2021
16. The Implementation Factors of Information and Communication Technology in the Life Cycle Costs of Buildings Peter Mésároš , TomášMandicák , Marcela Spišáková, Research Article, 25 March 2021
17. Using artificial neural networks to model bricklaying productivity OrsolyaBokor, Laura Florez-Perez, Giovanni Pesce, 2021 European Conference on Computing in Construction 2021
18. Estimation and prediction in construction projects: a systematic review on machine learning techniques Sanaz Tayefeh Hashemi, Omid Mahdi Ebadati, - Harleen Kaur, Springer Article 15 September 2020
19. Application of Artificial Intelligence for the Estimation of Concrete and Reinforcement Consumption in the Construction of Integral Bridges ZeljkaBeljkas, Milos Knezevic, SnezanaRutes and Nenad Ivanisevic, Research Article, 8th June 2020
20. Cost estimation and prediction in construction projects: a systematic review on machine learning techniques Sanaz Tayefeh Hashemi, - Omid Mahdi Ebadati, Springer Article, 6 September 2020
21. Evaluation of the Critical Success Factors (CSFs) in Selecting Building Contractors Using Pareto Analysis and the Analytical Hierarchy Process Khalid F. Al-Salahi, Khalid K. Naji and Murat Gunduz, Journal of Engg Research 25th June 2020
22. A Review on Cost Prediction Analysis of Construction Project Using ANN Model G. C. Sarode, Shubham E. Chandgude, International Journal of Innovative Research in Science, Engineering and Technology (IJIRSET), April 2020
23. Artificial Intelligence and Parametric Construction Cost Estimate Modeling: State-of-the-Art Review Haytham H. Elmousalam, ASCE 2020
24. Improving the Results of the Earned Value Management Technique Using Artificial Neural Networks in Construction Projects AmirhosseinBalali, AlirezaValipour, Research Article, 21 October 2020
25. An artificial neural network approach for cost estimation of engineering services, Erik Matel, FaridaddinVahdatikhaki, SiavashHosseinyalamdary, This Evers & Hans Voordijk, International Journal of Construction Management, 29 Nov 2019
26. Cost estimation in road construction using artificial neural network KsenijaTijanac Diana Car-Pusic, MarijaSperac, Springer, 8 August 2019
27. Evaluation of Constructions using Artificial Neural Network (ANN), Sandhya W T, International Journal for Modern Trends in Science and Technology, 09-November-2019
28. Construction Cost Estimation of Brazilian Highways Using Artificial Neural Networks Laís B. Barros, Marília Marcy and Michele T. M. Carvalho, International Journal of Structural and Civil Engineering Research Vol. 7, No. 3, August 2018
29. Estimation Model for I-Girder Bridge Superstructure Using Multiple Linear Regression and Artificial Neural Network, InasWinalytra, AriefSetiawan Budi Nugroho, Applied Mechanics and Materials2018
30. An artificial neural network (ANN) model proposal for cost minimization and cost estimation based on building dimensions for reinforced concrete duplex villa in preliminary design, Latif Onur UĞUR, 2017
31. Construction cost prediction using neural networks Smita K. Magdum and Amol C. Adamuthe, ICTACT Journal on soft computing, October 2017,
32. Artificial Neural Network for Assessment of Energy Consumption and Cost for Cross Laminated Timber Office Building in Severe Cold Regions Qi Dong, Kai Xing and

- Hongrui Zhang, Research Article, 30 December 2017
32. Md. Ebrahim Shaik, Md. Milon Islam, QuaziSazzad Hossain (2021) "A review on neural network techniques for the prediction of road traffic accident severity"
 33. Aanal Desai, Dr. L. B. Zala, Amit A. Amin (2021) "Comparison of crash prediction models using MLR and ANN" RT&A volume 16.
 34. Nivea John, Archana S (2019) "Crash Prediction Modeling of Two Lane Undivided Highways Using Artificial Neural Network" International Journal of Scientific & Engineering Research, Volume 10
 35. Ebrahim and Hossain Q. (2018) "An Artificial Neural Network model for road accident prediction: A case study of Khulna metropolotan city" 4th International Conference on Civil Engineering for Sustainable Development (ISBN-978-984-34-3502-6).
 36. Borja García de Soto, Markus Deublein, Andreas Bumbacher, Bryan T. Adey (2018) "Predicting road traffic accidents using artificial neural network models" Infrastructure Asset Management Volume 5.

Corresponding Author

Mrs. Neha Kasar*

PG Student, Department of Civil Engineering,
TSSM'S Padmabhooshan Vasantdada Patil Institute
Technology, Pune