

# A review of Design and Construction Parameters of Pavements

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**Abstract** – Design and Construction of highways deals with various aspects of geometric design and construction methodologies. As the need of sustainable infrastructure is rising it is important for future engineers to understand the scope of studying the basics with new twists. This paper presents crisp review of various literatures that have helped the society by giving away some very important information. This study shall help the students and researchers to choose the best criteria out of these to sustainably design and construct highways and other major roads.

**Key Words:** Pavement, Highway, Asphalt, Concrete

## INTRODUCTION

The first step lies in understanding the differentiation of various roads / pavements required at various locations. The pavements can be classified into the following types:

1. National Highways
2. State Highways
3. Major District Road
4. Other District Roads

It can be noted that as per the location, the pavement type is decided and then its design is being made. Various factors such as Geometric design, Crust type, Road width, etc. should be studied and considered before the actual process begins.

## Geometric Design

Kuldeep Kalita (2019) [1] has stated in one of his papers that the design input parameters such as vehicular operating speed, deceleration rate and driver's perception reaction time considered in the geometric design of highways exhibit considerable uncertainty in practical scenarios. Thus, he suggests applying probabilistic approach or reliability-based approach in geometric design of highways which can incorporate the factor of uncertainty of design input parameters.

Hameed Aswad Mohammed (2013) [2] had stated that increasing the shoulder width up to or greater than 2.25 m can provide additional safety. He had also presented that average single vehicle accident rate for highway curves is about four times the Average single vehicle accident rate for highway tangents. He also stated that small radius curves result in much shorter curve lengths and crashes may not turn out to be as severe as the first ones.

Vikas Golakoti (2015) [3] in his thesis included some of the geometric factors and data collection and analysis of geometric parameters. The general aim of his study was to find the role of the geometric factors of road on accident rate in the case of plain terrain and also find the extent to which these factors were responsible for the accidents in rural area.

## Type of Pavement Surface

Aman Rangari (2020) [4] had introduced in his research paper the use of Perforated Concrete as a new technology that can be used in pavement surface. He stated that permeable pavement consists of pervious concrete, permeable interlocking concrete paving units or grid type system over an open graded/ sub base layer (s) and porous asphalt. According to his research this type of technology has gained popularity in North America and has helped in managing storm water effectively.

Abu Hozaifa (2020) [5] had put forth the deflation in flexible pavement, disintegration and surface defect which maintains the pavement. The paper discusses various methods of design of flexible pavements, viz.,

- Group Index Method,
- California Bearing Ratio Method,
- California R Value or Stable Meter Method,
- Tri Axial Test Method,
- McLeod Method and
- Burmeister method.

The paper also discusses the failure criteria, critical locations in pavement.

## Sustainable Pavement Engineering

For any economy to achieve stability and overcome the environmental issues, sustainable and resilient pavement infrastructure will make it go a long way.

Jiaqi Chen (2021) [6] in his research paper stated that pavement infrastructure in the past 10 to 20 years has strongly supported the rapid development of the global social economy. Various new technologies, theories and methods related to pavement engineering have emerged. According to this paper, deterioration of pavements can be termed as multi – physics problem. The content of the paper includes asphalt binder performance and modeling, multi-scale mechanics, green and sustainable pavement, mixture performance and modeling of pavement materials.

Aimin Sha (2021) [7] had put forth a different aspect of Eco-Friendly pavements. He stated that the major compeer in pavement engineering is related to establishing green and sustainable infrastructures, i.e., reduction of environmental impacts, transportation efficiency. The paper presents various trends developed in recent times in field of research. The process of eco friendly construction of pavements mainly surrounds out two solutions, namely, materials modification and structure improvement. The paper also lists the setbacks of the existing technologies that can be listed as high cost, single functions, etc.

## Pavement Skid Resistance

T. F. Fwa (2021) [8] had stated that current practices used to prevent pavement skidding are inadequate. Thus leading to unsafe road operations. Due to some reasons the measurement and prediction of skid resistance property of a pavement or pavement mixture is a tedious process from theoretical and practical point of view.

The paper explains the capability of finite element simulation approach for wet skid resistance evaluation with good accuracy. Concept of Skid Resistance State has been given significance. Areas of practical applications of the concept, coupled with the simulation model has been introduced. The practical applications include driving safety analysis, road safety design and control, design of paving mixtures, safety maintenance and management of pavements, along with harmonization of skid resistance measurements and predictions.

Maria Pomoni (2022) [9] had stated in her article that pavement maintenance issues are triggered usually by pavement skid resistance. Numerous lab tests have been done to find a link between skid resistance and macrotexture. However, the results and findings cannot be extrapolated always as there are various multi – faceted parameters that influence the nature of skid resistance. The article aimed to identify important aspects of skid resistance

and its main textural components, macro and micro texture. The study was aimed to understand nature of skid resistance in mainly Mediterranean climate zones and to illustrate the cumulative traffic effect on resistance and macrotexture in the field. The study findings clearly show the necessary awareness of constraints in using only macrotexture data to develop models for predicting field skid resistance levels.

Er. Suhaib Firdous (2017) [10] had reviewed various methods for measuring the pavement friction and skid resistance measurement. According to his study and research analysis, pavement skid resistance can be recognized as the most important parameter in reducing traffic accident especially in wet conditions. Safety enhancement of roads require proper knowledge of friction coefficient and skid resistance. The paper has listed the following methods of skid resistance measurement:

1. Side Force Test
2. Locked Wheel Test
3. Fixed Slip Test
4. Variable Slip Test
5. Image Based Test
6. Laser Based Test
7. British Pendulum Test
8. Dynamic Friction Test
9. Sand Patch Test
10. Outflow Test

From his analysis it has been concluded that The British pendulum, dynamic friction, outflow test, sand patch test and circular texture meter are slow tests that need lane closure and traffic control during their measurement due to their low speed of measurement.

## Pavement Construction

Brett Ozolin and Stephen Muench (2007) [11] in their thesis have put forth information about various tools, materials and methods for rapid pavement construction. In a very brief report, they have enlisted Construction Analysis for Pavement Rehabilitation Strategies – CA4PRS, Current productivity estimation practices, some case studies, Development Plans, Rapid Concrete Panel Rehabilitation, Polymer Concrete, etc.

The article addresses the need to deliver cost – effective projects while minimizing traffic impacts in Washington State.

Arijit Dutta (2014) [11] described the life cycle cost analysis for roads. The report included various details about the parameters to be dealt with while designing the pavement economically. The report also consisted of consideration for several possible ways for routine maintenance action to reconstruction of road networks.

## CONCLUSIONS

It can be observed that many review, research and study-based papers and thesis have been created and published by engineers worldwide. Still there seems to be a lack of application of this wide range of information to the practical field. At the same time, it can be observed that, many of these articles focus on only one parameter neglecting the other. This review has tried to encapsulate the various review articles that can help in construction and designing process.

In order to achieve cost effective and sustainable development in the field of highway infrastructure one has to be aware of the latest trends. This review paper might come handy in doing so.

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