

Determination of the Influence of Pavement Friction on the Initial Velocity Using the Accident Reconstruction Engineering Principles

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Abstract: Several studies were conducted on the accidents of cars using the fundamental principles of physics and engineering including Newton's Laws of Motion and First Law of Thermodynamics. The objective of this study is to determine the influence of and pavement friction on the initial velocity. Regression analysis on the results of these variables was conducted. Excellent correlation coefficient was found for the relationship at $\alpha = 0.05$ significance level.

Keywords: Accident Reconstruction, First Law of Thermodynamics, Initial Velocity, Pavement Friction, Regression Analysis.

I. INTRODUCTION

Accident reconstructing engineering is the planning, surveying, measuring, investigating, analyzing, and report making process on the intricate engineering details of how accidents occurred. The analysis and conclusions are based on the extensive application of fundamental principles of physics and engineering including Newton's Laws of Motion [1] and First Law of Thermodynamics [2]. The first law of thermodynamics when applied to accidents states that the total energy before and after the accident will be the same. The input variables include roadway, vehicle, driver and environmental conditions. Accident reconstruction engineering studies can be utilized by the industry, city and state governments for modifying the structural facilities such as roads. The modifications may include obtaining improved friction factors, increased number of lanes and lane widths and better site distances. Vehicle manufacturers use the results of the studies for developing better designs of vehicles. Some of the recent vehicles may use event data recorder containing information on the speed of the vehicle before and at the time of the accident. Some manufacturers, such as GM and Ford, allow downloading the information from these boxes after an accident [3]. The results of the accident reconstruction studies are also used for producing better navigations aids to assist the drivers.

In this study the guidelines of Accreditation Commission for Traffic Accident Reconstruction (ACTAR) [4] are used. There are many research studies on the application of accident reconstruction engineering principles. One of the most important one is that of Hurt's [5]. Hurt found that motorcyclists needed to develop their capabilities on controlling skids and proper use of helmets significantly reduced head injuries. Hurt further found that out of all the turning movements, the left turners were involved in the accidents while turning in front of the oncoming motorcycles.

II. SCOPE OF THE STUDY

The study is limited to the accidents caused by negligent drivers of cars hitting the parked cars. All the accidents caused elastic deformations only. There are no significant plastic deformations.

III. METHODOLOGY

C2 was a parked car by the side of the road. The speed limit of the road is 15 mph. C1 was driven by a negligent driver. The friction coefficients of the shoulder and pavement were measured. C1 saw C2 too late and hit the brakes. C1 skidded and hit C2. C2 skidded on to the shoulder and stopped. In most of the cases C2 was damaged and its driver was injured. As the plaintiff, C1's driver sued the negligent driver of C1. In most of the cases C2 driver underestimated his or her speed at the time of the accident.

Parked vehicle Car 2

The following steps were followed.

1. Deceleration = Friction factor * acceleration due to gravity
2. Final velocity of C2 = 0
3. Initial velocity of C2 is shown in the following equation 1.

$$u = \sqrt{2 * a * s}$$

(1)

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Evaluation of Pavement Friction Characteristics John Jewett Henry,2000 This synthesis report will be of interest to pavement design construction management and research engineers highway safety officials and others concerned with pavement friction characteristics It describes the current state of the practice and discusses the methods used for evaluating wet pavement friction characteristics of new and restored pavements This synthesis reviews models used for measuring and evaluating friction and texture causes for friction changes over time and aggregate and mix design to provide adequate friction Also presented are construction and surface restoration practices for providing good pavement surface characteristics In addition considerations of noise and ride quality are discussed when compromise may be required

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Report No. FHWA-RD. United States. Federal Highway Administration. Offices of Research and Development,1978 **Engineered Cementitious Composites for Electrified Roadway in Megacities** Ali Aryo

Bawono,2022-01-03 This book describes the development of an innovative solution for electrified roadway pavements based on engineered cementitious composites which are exhibiting an extreme tensile strain capacity that is much higher than conventional concrete This enables the pavement to work without steel reinforcement and to embed a dynamic wireless power transfer technology for charging electric vehicles At first the book presents a modified performance driven design approach to improve the composites to achieve the optimum pavement design in terms of functional and structural performance It shows that the modified composites can be used to fulfil the safety and comfort factors without neglecting the characteristics of conventional ones Further 3D finite element and fluid dynamics models are used to analyse the pavement properties The validated models can predict the functional performance including skid resistance surface water drainage and noise In the remaining part of the thesis an environmentally friendly photocatalytic function for pavement made of engineered cementitious composites is investigated In turn a multi criteria design analysis is proposed to identify the optimum functional performance of the pavements All in all this book reports on a comprehensive approach to design analyse and optimize engineered cementitious composites for electrified road pavement application A special emphasis is given on applications in Singapore and other tropical megacities Vehicle Accident Analysis and Reconstruction Methods Matthew

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Zusammenfassung This book gathers the proceedings of the 10th International Conference on Maintenance and Rehabilitation of Pavements MAIREPAV10 held in Guimar es Portugal on July 24 26 2024 The conference series has been established to promote and discuss state of the art design maintenance rehabilitation and management of pavements The respective contributions share the latest insights from research and practice in the maintenance and rehabilitation of

pavements and discuss advanced materials technologies and solutions for achieving an even more sustainable and environmentally friendly infrastructure Green and Intelligent Technologies for Sustainable and Smart Asphalt Pavements Xueyan Liu, Kumar Anupam, Sandra Erkens, Lijun Sun, Jianming Ling, 2021-11-25 Green and Intelligent Technologies for Sustainable and Smart Asphalt Pavements contains 124 papers from 14 different countries which were presented at the 5th International Symposium on Frontiers of Road and Airport Engineering IFRAE 2021 Delft the Netherlands 12-14 July 2021. The contributions focus on research in the areas of Circular Sustainable and Smart Airport and Highway Pavement and collect the state of the art and state of practice areas of long life and circular materials for sustainable cost effective smart airport and highway pavement design and construction. The main areas covered by the book include Green and sustainable pavement materials, Recycling technology, Warm cold mix asphalt materials, Functional pavement design, Self healing pavement materials, Eco efficiency pavement materials, Pavement preservation, maintenance and rehabilitation, Smart pavement materials and structures, Safety technology for smart roads, Pavement monitoring and big data analysis, Role of transportation engineering in future pavements. Green and Intelligent Technologies for Sustainable and Smart Asphalt Pavements aims at researchers, practitioners and administrators interested in new materials and innovative technologies for achieving sustainable and renewable pavement materials and design methods and for those involved or working in the broader field of pavement engineering.

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