Evaluation Of Ground Tire Rubber In Asphalt Concrete

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KNOX BURNS

Criteria for Asphalt-rubber Concrete in Civil Airport Pavements CRC Press
The objective of the proposed research project is to determine the feasibility of utilization of laboratory blended ground tire rubber (GTR), terminally-blended GTR following Nevada Department of Transportation's (NDOT's) specifications, or other crumb-rubber-modified (CRM) products to meet the rheological and engineering properties of asphalt modified binders and mixtures. The test results will be compared to styrene butadiene styrene (SBS) modified binders used in Nevada. The specific objectives of the research project will include the following: (1) Determining initial recommendations for terminally-blended GTR mix design guidelines based on the literature review and basic laboratory test results; (2) Investigating the rheological characteristics of various crumb rubber types (e. g. -30, -40, and terminal blend) at high, intermediate, and low performance temperatures through the performance of American Association of State Highway and Transportation Officials (AASHTO) standards and any other NDOT's specification requirements; (3) Investigating the effects of various rubber modifiers on NDOT's mix design including the mix volumetric properties such as air voids, voids in mineral aggregate (VMA), and optimum asphalt binder ratio specifications from AASHTO and NDOT; (4) Determining the Hveem stability, moisture susceptibility, permanent deformation, dynamic modulus, flow number characteristics of various alternate modifiers with hydrated lime in terms of specifications from AASHTO and NDOT; and (5) Developing recommended specifications for Nevada DOT regarding the utilization of these materials.
NTP Research Report on Synthetic Turf/recycled Tire Crumb Rubber: Feasibility Study in Support of Non-inhalation in Vivo Exposures of Synthetic Turf/recycled Tire Crumb Rubber Woodhead Publishing
Investigation and Evaluation of Ground Tire Rubber in Hot Mix AsphaltEvaluation of ground tire rubber in asphalt concreteGuidelines for Use of Modifiers in Superpave MixturesLaboratory Evaluation of the Effects of Ground Tire Rubber (GTR) on the Rutting and Cracking Perfomance of Superpave MixesEvaluation of Ground and Reclaimed Tire Rubber in Bituminous Resurfacing MixturesEvaluation of Asphalt Mixtures Incorporating Terminal Blend GTR (ground Tire Rubber) BindersViability Assessment of the Use of Ground Tire Rubber in Asphalt PavementsUsing Ground Tire Rubber in Hot Mix Asphalt Pavements
Uses of Recycled Rubber Tires in Highways ASTM International
Documents the construction and performance of the research study which was initiated to address section 1038(d) of the 1991 Intermodal Surface Transportation Efficiency Act (ISTEA). The project selected to demonstrate the crumb rubber process was located on Platt Canyon (SH 75) from Bowles to C470 in the Denver metropolitan area. The project was a low volume roadway and quantities of crumb rubber introduced into the mix were minimal. This was to reduce risk in terms of premature failure and Colorado's limited experience with crumb rubber. Because of this limited experience, the "dry" process was selected. The project contained four different mix designs. A mix containing 1% [20 lb/ton (10 kg/Mg)] crumb rubber, a mix containing 1 lb/ton (0.5 kg/Mg), a mix containing 3 lb/ton (1.5 kg/Mg) and a mix which contained no rubber were placed on the project.
Public Roads Investigation and Evaluation of Ground Tire Rubber in Hot Mix AsphaltEvaluation of ground tire rubber in asphalt concreteGuidelines for Use of Modifiers in Superpave MixturesLaboratory Evaluation of the Effects of Ground Tire Rubber (GTR) on the Rutting and Cracking Perfomance of Superpave MixesEvaluation of Ground and Reclaimed Tire Rubber in Bituminous Resurfacing MixturesEvaluation of Asphalt Mixtures Incorporating Terminal Blend GTR (ground Tire Rubber) BindersViability Assessment of the Use of Ground Tire Rubber in Asphalt PavementsUsing Ground Tire Rubber in Hot Mix Asphalt PavementsDocuments the construction and performance of the research study which was initiated to address section 1038(d) of the 1991 Intermodal Surface Transportation Efficiency Act (ISTEA). The project selected to demonstrate the crumb rubber process was located on Platt Canyon (SH 75) from Bowles to C470 in the Denver metropolitan area. The project was a low volume roadway and quantities of crumb rubber introduced into the mix were minimal. This was to reduce risk in terms of premature failure and Colorado's limited experience with crumb rubber. Because of this limited experience, the "dry" process was selected. The project contained four different mix designs. A mix containing 1% [20 lb/ton (10 kg/Mg)] crumb rubber, a mix containing 1 lb/ton (0.5 kg/Mg), a mix containing 3 lb/ton (1.5 kg/Mg) and a mix which contained no rubber were placed on the project.Evaluation of Asphalt Rubber Stress-absorbing MembraneThis report describes the construction and evaluation of a stress-absorbing membrane (SAM) using a liquid asphalt binder containing ground tire rubber. Approximately 10 lane-km of SAM and 4 lane-km of control surface treatment for comparison were constructed in 1992. There was excessive loss of coarse aggregate under traffic on the SAM section, resulting in broken windshields. Although aggregate loss was significant, friction values were generally satisfactory. SAM was effective in keeping cracks of the underlying surface sealed. Because it appears difficult to determine and use the proper amount of binder to prevent aggregate loss and bleeding, the authors recommend that SAMs not be pursued further as a method of surface

treatment in Virginia.Occupational Exposure Assessment of Asphalt, Ground Tire Rubber, Blending, Mixing and Paving OperationsEvaluation of Rubber-modified Asphaltic ConcreteUses of Recycled Rubber Tires in Highways

This book comprises over 30 new and not previously published technical papers from the Association of Asphalt Paving Technologists on all phases of asphalt research and applications, including mixing, mixture elements, and testing. Includes an accompanying CD-ROM.

Department of Transportation and Related Agencies Appropriations for 1994: Transportation issues; Crumb Rubber Modified Asphalt DEStech Publications, Inc

The safe disposal and reuse of industrial and consumer rubber waste continues to pose a serious threat to environmental safety and health, despite the fact that the technology now exits for its effective recycling and reuse. Mountains of used tires confirm the belief that chemically crosslinked rubber is one of the most difficult materials to recyc

Rubber Recycling Frontiers Media SA

In light of requirements that rubber be mixed with any asphalt used in projects receiving federal aid beginning in 1994, and the general increase in the problem of what to do with waste material, 17 papers from a December 1992 symposium in Miami discuss some of the technical and economic considerati

Evaluation of Asphalt Rubber Stress-absorbing Membrane Routledge

About 285 million tires are discarded every year; less than 100 million are currently being recycled, with the rest being placed in landfills and other waste sites. A solution to reduce the littering of the environment is to use ground tire rubber in road construction. Currently, about 27 million tons of asphalt are used each year in road construction and maintenance of the country's 2 million miles of roads. If all of the waste tire rubber could be combined with asphalt in road construction, it would displace less than 6% of the total asphalt used each year, yet could save about 60 trillion Btus annually. Purpose of this project is to provide data needed to optimize the performance of rubber-asphalt concretes. The first phase is to develop asphalts and recycling agents tailored for compatibility with ground tire rubber. Chapter 2 presents results on Laboratory Testing and Evaluation: fractionate asphalt material, reblending for aromatic asphalts, verifying optimal curing parameters, aging of blends, and measuring ductilities of asphalt-rubber binders. Chapter 3 focuses on Evaluating Mixture Characteristics (modified binders). Chapter 4 covers Adhesion Test Development (water susceptibility is also covered). The final chapter focuses on the Performance/Economic Update and Commercialization Plan.

Evaluation of Waste Tire Devulcanization Technologies Academic Press

Climate change, energy production and consumption, and the need to improve the sustainability of all aspects of human activity are key inter-related issues for which solutions must be found and implemented quickly and efficiently. To be successfully implemented, solutions must recognize the rapidly changing socio-techno-political environment and multi-dimensional constraints presented by today’s interconnected world. As part of this global effort, considerations of climate change impacts, energy demands, and incorporation of sustainability concepts have increasing importance in the design, construction, and maintenance of highway and airport pavement systems. To prepare the human capacity to develop and implement these solutions, many educators, policy-makers and practitioners have stressed the paramount importance of formally incorporating sustainability concepts in the civil engineering curriculum to educate and train future civil engineers well-equipped to address our current and future sustainability challenges. This book will prove a valuable resource in the hands of researchers, educators and future engineering leaders, most of whom will be working in multidisciplinary environments to address a host of next-generation sustainable transportation infrastructure challenges. "This book proposes a broad detailed overview of the actual scientific knowledge about pavements linked to climate change, energy and sustainability at the international level in an original multidimensional/multi-effects way. By the end, the reader will be aware of the whole global issues to care about for various pavement technical features around the world, among which the implications of modelling including data collection, challenging resources saving and infrastructures services optimisation. This is a complete and varied work, rare in the domain." Dr. Agnes Jullien Research Director Director of Environmental, Development, Safety and Eco-Design Laboratory (EASE) Department of Development, Mobility and Environment Ifsttar Centre de Nantes Cedex- France “An excellent compilation of latest developments in the field of sustainable pavements. The chapter topics have been carefully chosen and are very well-organized with the intention of equipping the reader with the state-of-the-art knowledge on all aspects of pavement sustainability. Topics covered include pavement Life Cycle Analysis (LCA), pervious pavements, cool pavements, photocatalytic pavements, energy harvesting pavements, etc. which will all be of significant interest to students, researchers, and practitioners of pavement engineering. This book will no doubt serve as an excellent reference on the topic of sustainable pavements.” Dr. Wei-Hsing Huang Editor-in-Chief of International Journal of Pavement Research and Technology (IJPRT) and Professor of Civil Engineering National Central University Taiwan

Springer Nature

This report describes the construction and evaluation of a stress-absorbing membrane (SAM) using a liquid asphalt binder containing ground tire rubber. Approximately 10 lane-km of SAM and 4 lane-km of control surface treatment for comparison were constructed in 1992. There was excessive loss of coarse aggregate under traffic on the SAM section, resulting in broken windshields. Although aggregate loss was significant, friction values were generally satisfactory. SAM was effective in keeping cracks of the underlying surface sealed. Because it appears difficult to determine and use the proper amount of binder to prevent aggregate loss and bleeding, the authors recommend that SAMs not be pursued further as a method of surface treatment in Virginia.

Using Ground Tire Rubber in Hot Mix Asphalt Pavements Springer

This book presents selected articles from the 3rd International Conference on Architecture and Civil Engineering 2019, held in Kuala Lumpur, Malaysia. Written by leading researchers and industry professionals, the papers highlight recent advances and addresses current issues in the fields of civil engineering and architecture.

A Review of Crumb-rubber Modified Asphalt Concrete Technology Transportation Research Board

Bituminous materials are used to build durable roads that sustain diverse environmental conditions. However, due to their complexity and a global shortage of these materials, their design and technical development present several challenges. Advanced Testing and Characterisation of

Bituminous Materials focuses on fundamental and performance testing
Climate Change, Energy, Sustainability and Pavements CRC Press
The addition of a rubber-tire roller was required on two projects on maintenance schedules and on two construction projects in 1988. The rubber-tire roller was used as an addition to the conventional rollers on one-half of each project. The rubber-tire roller was required to have a minimum of 80 psi ground contact pressure (GCP). Used in the intermediate roller position, it applied three passes to the pavement. On one of the two projects, the addition of the rubber-tire improved pavement properties compared to those on the conventionally rolled section. On one project, the conventionally rolled section had better pavement properties, and on one project there was no differences. The results of this study an done conducted in 1987 indicate that the addition of a rubber-tire roller improved the pavement properties on more than half of the projects tested. Based on this rate of improvement, it is recommended that a rubber-tire roller operating in the intermediate roller position with a minimum GCP of 80 psi and applying three passes be required on all modified mixes; i.e., those in which the optimum asphalt content is based on a 75-blow Marshall compactive effort.
ICACE 2019 CRC Press
Roughly 242 million used tires are generated annually in the United States. Many of these tires end up being landfilled or stockpiled. The stockpiles are unsightly, unsanitary, and also collect water which creates the perfect breeding ground for mosquitoes, some of which carry disease. In an effort to reduce the number of used tire stockpiles the federal government mandated the use of recycled rubber in federally funded, state implemented department of transportation (DOT) projects. This mandate required the use of recycled rubber in 5% of the asphalt cement concrete (ACC) tonnage used in federally funded projects in 1994, increasing that amount by 5% each year until 20% was reached, and remaining at 20% thereafter. The mandate was removed as part of the appropriations process in 1994, after the projects in this research had been completed. This report covers five separate projects that were constructed by the Iowa Department Of Transportation (DOT) in 1991 and 1992. These projects had all had some form of rubber incorporated into their construction and were evaluated for 5 years. The conclusion of the study is that the pavements with tire rubber added performed essentially the same as conventional ACC pavement. An exception was the use of rubber chips in a surface lift. This performed better at crack control and worse with friction values than conventional ACC. The cost of the pavement with rubber additive was significantly higher. As a result, the benefits do not outweigh the costs of using this recycled rubber process in pavements in Iowa.
Laboratory Evaluation of the Effects of Ground Tire Rubber (GTR) on the Rutting and Cracking Perfomance of Superpave Mixes
A mixture design procedure is developed to allow the use of asphalt-rubber binders in concrete for flexible airport pavement. The asphalt-rubber is produced by reacting asphalt with ground, scrap tire rubber to produce the binder for the asphalt-rubber concrete. The report includes procedures for laboratory preparation of asphalt-rubber binders using an equipment setup that was found by researchers to produce laboratory binders with similar properties to field processes. The rubber-asphalt concrete mixture design procedure includes adjustments to the aggregate gradation to permit space for the rubber particles in the asphalt-rubber binder as well as suggested mixing and compaction temperatures, and compaction efforts. While the procedure has been used in the laboratory to successfully produce asphalt-rubber concrete mixtures, it should be evaluated in the field to ensure that consistent results can be achieved in a production environments.
Viability Assessment of the Use of Ground Tire Rubber in Asphalt Pavements
This synthesis on the use of recycled rubber tires in highways will be of interest to administrators and policy-makers; pavement, materials, geotechnical, environmental, and traffic operations engineers; and research engineers involved with highway design and construction issues. Information is provided on the uses of rubber tires in asphalt paving materials as well as other uses, such as on fills and embankments, for erosion control and on railroad grade crossings. Specifically, information is included which identifies the agencies using or implementing applications for recycled rubber tires and defines the design parameters, technical and construction limitations, performance, costs, benefits, environmental limitations, specifications, and availability. This synthesis of information defines the use of recycled rubber tires in highways and is based on a review of nearly 500 references and on information recorded from state highway agency responses to a 1991 survey of practice. Updates are included for as much of the state practice information possible through 1993. The use of scrap tires for highway applications is dynamic with regard to policy and technical issues. Therefore, the reader should keep in mind that the information presented reflects the best available data at a particular time. The synthesis also identifies current research in the topic area, critical research needs, and legislative issues that affect application and use of recycled rubber tires.
Evaluation of Rubber-modified Asphaltic Concrete
The Minnesota Department of Transportation is continually investigating ways to improve the cold temperature performance of its asphalt concrete pavements. One reported method is to modify the asphalt binder with ground reclaimed automobile and truck tire rubber. In 1984, a project on TH 7 (State Project 4703-17) was selected for the field trial of an asphalt-rubber cement dense graded concrete utilizing a product produced by Arizona Refining of Phoenix, Arizona. Construction of the asphalt-rubber cement dense graded asphalt concrete required some special effort and specialized equipment to maintain adequate mixing and placing temperatures. Evaluations included crack counting, resilient modulus, in place air voids, rutting, roughness, recovered penetration and cost considerations.
Transportation Research Record
Tire Waste and Recycling takes a methodical approach to the recycling of tires, providing a detailed understanding on how to manage, process, and turn waste tires into valuable materials and industrial applications. Sections cover fundamental aspects such as tire use, composition, trends, legislation, the current global situation, the possibilities for moving towards a circular economy, lifecycle options, treatment methods, and opportunities for re-use, recycling and recovery. Subsequent sections of the book focus on specific technologies that enable the utilization of waste tires in the development of high value materials and advanced applications. Finally, the future of tire recycling is considered. This is an essential resource for scientists, R&D professionals, engineers and manufacturers working in the tire, rubber, waste, recycling, automotive and aerospace industries. In academia, the book will be of interest to researchers and advanced scientists across rubber science,

polymer science, materials engineering, environmental science, chemistry and chemical engineering. Offers systematic coverage of tire recycling, covering composition, lifecycle, processing options, material developments and latest technologies Explains end-of-life-options in detail, considering approaches and methods for reduction, re-use, recycling and recovery Explores key application and product areas for recycled tire materials, from civil engineering, sports and leisure, to roads and transport, construction, automotive, and many more

2021 Retrospective: Structural Materials

This book presents an in-depth look at US infrastructure and its challenges in the 21st century. While infrastructure has received considerable attention in recent years, much of the discussion has concentrated on physical, economic, or noneconomic conditions. The Trump administration has heightened interest in the topic, promising infrastructure spending during his tenure, yet little demonstrable progress has been made. This book brings together a multi-disciplinary perspective—structural, technological, economic, financial, political, planning, and policy—that has been largely absent in discussions on the subject, to provide a clearer and broader understanding of the challenges facing US infrastructure. The book is divided into three parts: Part I looks at the challenges from a structural, technological, and sustainability perspective; Part II from an economic, productivity, and finance perspective; and Part III from an institutional, security, and political perspective. Written primarily for policy makers, managers, and administrators in public and private organizations, as well as individuals and academics with an interest in the future of US infrastructure, this book provides an in-depth analysis of the US infrastructure problem, its causes and consequences, and suggests timely, specific measures that may be taken at the state, local, and federal levels to improve and better secure our roads, transit, public buildings, economy, and technology.

An Evaluation of Dense Graded Asphalt-rubber Concrete in Minnesota

Asphalt binder modification is a common method of improving Hot-mix Asphalt (HMA) performance by enhancing mix properties and reducing or delaying three general HMA distress types: deformation (rutting and shoving), cracking (from repeated loads and low temperatures) and general deterioration (raveling and stripping). Since the early 1960’s, a common modified asphalt alternative has employed reclaimed rubber as an economical and environmental friendly method of recycling waste tires while improving asphalt physical and mechanical properties. Pavement network deterioration combined with increasing material costs makes polymer modification of asphalt binder desirable, with reclaimed rubber from waste tires being an attractive alternative which addresses performance, economics and environmental issues. The primary objective of this dissertation is to demonstrate the importance of proper processing of all types of modified bituminous binders, whether they be virgin (e.g. styrene-butadiene-styrene (SBS) or styrene-butadiene rubber (SBR)), post-consumer polymers (e.g. ground tire rubber (GTR)) or a combination (GTR plus SBS). To achieve this four secondary objectives were identified: 1) characterize GTR using thermo-gravimetric analysis (TGA), 2) improve processing of GTR modified binders, 3) improve testing and specifications of GTR modified binders and 4) evaluate mixes containing GTR modified binders. A simple efficient instrumental, TGA, method to analyze polymers in binary rubber compounds was developed to quantify the functional polymer content available in GTR. TGA analysis provides a better understanding of the general chemical characteristics of GTR used in modification of asphalt binders for production of asphalt paving mixtures. Results are presented from efforts to optimize GTR modified binder formulations with respect to how GTR loading, GTR particle size, processing temperature and asphalt cement source affect modified binder properties and ability to meet performance graded binder specifications. These results are the basis to establish recommended processing parameters for formulation and preparation of GTR modified asphalt binders. GTR modified binders were used in: dense graded asphalt (DGA), stone matrix asphalt (SMA) and open graded friction courses (OGFC) and compared to conventional asphalt cement and styrene-butadiene-styrene (SBS) modified asphalt binders. Mixture performance evaluation with respect to binder effectiveness as it relates to the three general HMA distress types.

US Infrastructure

The urgent need for infrastructure rehabilitation and maintenance has led to a rise in the levels of research into bituminous materials. Breakthroughs in sustainable and environmentally friendly bituminous materials are certain to have a significant impact on national economies and energy sustainability. This book will provide a comprehensive review on recent advances in research and technological developments in bituminous materials. Opening with an introductory chapter on asphalt materials and a section on the perspective of bituminous binder specifications, Part One covers the physiochemical characterisation and analysis of asphalt materials. Part Two reviews the range of distress (damage) mechanisms in asphalt materials, with chapters covering cracking, deformation, fatigue cracking and healing of asphalt mixtures, as well as moisture damage and the multiscale oxidative aging modelling approach for asphalt concrete. The final section of this book investigates alternative asphalt materials. Chapters within this section review such aspects as alternative binders for asphalt pavements such as bio binders and RAP, paving with asphalt emulsions and aggregate grading optimization. Provides an insight into advances and techniques for bituminous materials Comprehensively reviews the physicochemical characteristics of bituminous materials Investigate asphalt materials on the nano-scale, including how RAP/RAS materials can be recycled and how asphalt materials can self-heal and rejuvenator selection