

National Cooperative Highway Research Program

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Manual for Bridge Rating Through Load Testing

This NCHRP digest describes the research findings from NCHRP Project 12-28(13) A, "Bridge Rating Through Nondestructive Load Testing," conducted by A.G. Lichtenstein and Associates, Inc. The project developed and documented processes for performing load tests and using the test results to calculate bridge ratings. The research results are presented in the form of a manual, which provides guidelines for integrating the load testing of bridges with their load rating. The manual is supplemented with a technical report, which presents detailed data on two major technical areas—evaluating unintended composite action and establishing target proof load levels.

FOREWORD

This manual presents the results of a study on the use of nondestructive load testing to evaluate the carrying capacity of bridges. Recommended procedures for performing load tests and for using the results to calculate load ratings are included. The contents of this manual will be of immediate interest to bridge and structural engineers, bridge inspectors, traffic engineers, and others interested in bridge safety and the movement of traffic across bridges.


Nondestructive load testing of bridges has been used primarily as a research tool to provide better understanding of the way in which loads are carried by, and distributed through, the bridge structure. In some cases, load testing has been used to assist in the determination of bridge load-carrying capacity. From such tests, some structures have been found to possess greater load-carrying capacity than predicted by conventional analytical load rating procedures. Load-rating procedures that incorporate load test results have potential for demonstrating higher load capacity for many structures that would otherwise be determined to require load-posting based on conventional analysis alone.

NCHRP Project 12-28(13), "Nondestructive Load Testing for Bridge Evaluation and Rating," was initiated in 1987 with the objective of developing guidelines for nondestructive load testing of highway bridges to augment the analytical rating process. A 1990 follow-on project, NCHRP Project 12-28(13)A, "Bridge Rating Through Nondestructive Load Testing," developed and documented processes for performing load tests and using the test results to calculate bridge ratings. Project 12-28(13)A is the basis for this manual. The research was performed by A.G. Lichtenstein and Associates, Inc., of Paramus, New Jersey.

The research results are presented in the form of a manual that introduces the concept of nondestructive load testing (including the two major types of tests: diagnostic tests and proof tests), describes the appropriate selection of candidate bridges, provides detailed procedures for load testing, and describes how to use load test results to develop a load rating for a bridge. The manual also includes illustrative examples of both diagnostic-load-test and proof-load-test procedures. Finally, information on special topics, including evaluations for live load impact; fatigue life testing of steel bridges; and unintended composite action of bridges

Manual For Bridge Rating Through Load Testing

**Jaap Bakker, Dan M. Frangopol, Klaas
Breugel**



Manual For Bridge Rating Through Load Testing:

Manual for Bridge Rating Through Load Testing ,1998 *Manual for Bridge Through Load Testing ; Bridge Rating Through Nondestructive Load Testing* National Cooperative Highway Research Program,1998 **Structural Materials Technology** Sreenivas Alampalli,2000-02-29 The fourth Structural Materials Technology NDT Conference was held in Atlantic City New Jersey with over sixty speakers presenting on a wide variety of topics The goal of this conference was to inform engineers and researchers of the new nondestructive testing nondestructive evaluation NDT NDE technologies and techniques available for use in transportation construction The use of alternative materials is challenging NDT NDE professionals to develop new methods or modify existing techniques to address quality control quality assurance and long term monitoring of structures built or strengthened with these materials One such alternative is fiber reinforced polymer FRP products This conference included papers on this topic and a panel discussion that focused on the future of NDT NDE technologies for structures built or rehabilitated with FRP composites These proceedings contain the 62 papers that were presented at the conference arranged according to session number An author index is included Load Testing of Bridges Eva Lantsoght,2019-06-19 Load Testing of Bridges featuring contributions from almost fifty authors from around the world across two interrelated volumes deals with the practical aspects the scientific developments and the international views on the topic of load testing of bridges Volume 12 Load Testing of Bridges Current practice and Diagnostic Load Testing starts with a background to bridge load testing including the historical perspectives and evolutions and the current codes and guidelines that are governing in countries around the world The second part of the book deals with preparation execution and post processing of load tests on bridges The third part focuses on diagnostic load testing of bridges This work will be of interest to researchers and academics in the field of civil structural engineering practicing engineers and road authorities worldwide **Primer on Bridge Load Testing** ,2019 Load testing of bridges to assess bridge performance has been in practice since at least 1891 in Switzerland In times when engineering models were not as accurate and available as today a critical step in the construction of a bridge was to load test prior to opening or during the opening ceremony of the bridge Several bridges including ones in Serbia Switzerland and France collapsed during such load tests While advanced calculation methods are available to determine the ultimate capacity of existing structures load testing provides a useful alternative for such cases where current calculation methods for one reason or another cannot provide satisfactory answers to performance questions on existing bridges AASHTO s Manual for Bridge Evaluation and the 1998 Manual for Bridge Rating Through Load Testing have been generally used as a guidance to load testing This TRB E Circular TR Circular E C257 Primer on Bridge Load Testing provides significant updates to the existing documents to reflect the current state of the practice on bridge load testing It covers the preparation execution and analysis of load tests including diagnostic and proof tests If effectively used these methods can extend the useful life of existing bridges in a cost effective fashion **The Manual for Bridge**

Evaluation ,2010 Load Testing of Bridges: Two Volume Set Eva Lantsoght,2022-07-30 Load Testing of Bridges featuring contributions from almost fifty authors from around the world across two interrelated volumes deals with the practical aspects the scientific developments and the international views on the topic of load testing of bridges Volume 12 Load Testing of Bridges Current practice and Diagnostic Load Testing starts with a background to bridge load testing including the historical perspectives and evolutions and the current codes and guidelines that are governing in countries around the world The second part of the book deals with preparation execution and post processing of load tests on bridges The third part focuses on diagnostic load testing of bridges Volume 13 Load Testing of Bridges Proof Load Testing and the Future of Load Testing focuses first on proof load testing of bridges It discusses the specific aspects of proof load testing during the preparation execution and post processing of such a test Part 1 The second part covers the testing of buildings The third part discusses novel ideas regarding measurement techniques used for load testing Methods using non contact sensors such as photography and video based measurement techniques are discussed The fourth part discusses load testing in the framework of reliability based decision making and in the framework of a bridge management program The final part of the book summarizes the knowledge presented across the two volumes as well as the remaining open questions for research and provides practical recommendations for engineers carrying out load tests This work will be of interest to researchers and academics in the field of civil structural engineering practicing engineers and road authorities worldwide

Bridge Engineering Handbook, Second Edition Wai-Fah Chen,Lian Duan,2014-01-24 Over 140 experts 14 countries and 89 chapters are represented in the second edition of the Bridge Engineering Handbook This extensive collection highlights bridge engineering specimens from around the world contains detailed information on bridge engineering and thoroughly explains the concepts and practical applications surrounding the subject Published in five books Fundamentals Superstructure Design Substructure Design Seismic Design and Construction and Maintenance this new edition provides numerous worked out examples that give readers step by step design procedures includes contributions by leading experts from around the world in their respective areas of bridge engineering contains 26 completely new chapters and updates most other chapters It offers design concepts specifications and practice as well as the various types of bridges The text includes over 2 500 tables charts illustrations and photos The book covers new innovative and traditional methods and practices explores rehabilitation retrofit and maintenance and examines seismic design and building materials The fifth book Construction and Maintenance contains 19 chapters and covers the practical issues of bridge structures What s New in the Second Edition Includes nine new chapters Steel Bridge Fabrication Cable Supported Bridge Construction Accelerated Bridge Construction Bridge Management Using Pontis and Improved Concepts Bridge Maintenance Bridge Health Monitoring Nondestructive Evaluation Methods for Bridge Elements Life Cycle Performance Analysis and Optimization and Bridge Construction Methods Rewrites the Bridge Construction Inspection chapter and retitles it as Bridge Construction

Supervision and Inspection Expands and rewrites the Maintenance Inspection and Rating chapter into three chapters Bridge Inspection Steel Bridge Evaluation and Rating and Concrete Bridge Evaluation and Rating and the Strengthening and Rehabilitation chapter into two chapters Rehabilitation and Strengthening of Highway Bridge Superstructures and Rehabilitation and Strengthening of Orthotropic Steel Bridge Decks This text is an ideal reference for practicing bridge engineers and consultants design construction maintenance and can also be used as a reference for students in bridge engineering courses

Life Cycle Analysis and Assessment in Civil Engineering: Towards an Integrated Vision Robby Caspeele, Luc Taerwe, Dan Frangopol, 2018-10-31 This volume contains the papers presented at IALCCE2018 the Sixth International Symposium on Life Cycle Civil Engineering IALCCE2018 held in Ghent Belgium October 28 31 2018 It consists of a book of extended abstracts and a USB device with full papers including the Fazlur R Khan lecture 8 keynote lectures and 390 technical papers from all over the world Contributions relate to design inspection assessment maintenance or optimization in the framework of life cycle analysis of civil engineering structures and infrastructure systems Life cycle aspects that are developed and discussed range from structural safety and durability to sustainability serviceability robustness and resilience Applications relate to buildings bridges and viaducts highways and runways tunnels and underground structures off shore and marine structures dams and hydraulic structures prefabricated design infrastructure systems etc During the IALCCE2018 conference a particular focus is put on the cross fertilization between different sub areas of expertise and the development of an overall vision for life cycle analysis in civil engineering The aim of the editors is to provide a valuable source of cutting edge information for anyone interested in life cycle analysis and assessment in civil engineering including researchers practising engineers consultants contractors decision makers and representatives from local authorities

Cost-effective Practices for Off-system and Local Interest Bridges F. W. Klaiber, Terry J. Wipf, Francesco M. Russo, National Cooperative Highway Research Program, 2004 TRB s National Cooperative Highway Research Program NCHRP Synthesis 327 Cost Effective Practices for Off System and Local Interest Bridges examines off system bridge design construction maintenance financing rehabilitation and replacement For this report off system refers to those bridges typically owned and maintained by local agencies and by state agencies on rural and other low volume roads

Infrastructure Health in Civil Engineering (Two-Volume Set) Mohammed M. Ettouney, 2022-01-18 This two volume set discusses the importance of linking the decision making concept to damage identification and structural modeling It examines the process of addressing and maintaining structural health including measurements structural identification and damage identification and discusses the theoretical and practical issues involved for each aspect Emphasizing state of the art practice as well as future directions this text also features numerous practical case studies and covers the latest techniques in sensing and sensor utilization

Infrastructure Health in Civil Engineering Mohammed M. Ettouney, Sreenivas Alampalli, 2011-09-27 Continually increasing demands on infrastructures mean that maintenance and renewal require timely appropriate action

that maximizes benefits while minimizing cost To be as well informed as possible decision makers must have an optimal understanding of an infrastructure's condition what it is now and what it is expected to be in the future Wri *Dynamics of Bridges, Volume 5* Tom Proulx, 2025-08-07 This is the fifth volume of five from the 28th IMAC on Structural Dynamics and Renewable Energy 2010 brings together 19 chapters on the Dynamics of Bridges It presents early findings from experimental as well as computational investigations on the Dynamics of Bridges including studies on Modeling Environmental Effects on the Dynamic Characteristics of the Tamar Suspension Structural Health Monitoring of Bridges Structural Assessment of Damaged Bridges Using Ambient Vibration Testing and Development of a Tamar Bridge Finite Element Model

Diagnostic and Proof Load Tests on Bridges Fikret Necati Catbas, Eva Lantsoght, 2020-12-11 This eBook is a collection of articles from a Frontiers Research Topic Frontiers Research Topics are very popular trademarks of the Frontiers Journals Series they are collections of at least ten articles all centered on a particular subject With their unique mix of varied contributions from Original Research to Review Articles Frontiers Research Topics unify the most influential researchers the latest key findings and historical advances in a hot research area Find out more on how to host your own Frontiers Research Topic or contribute to one as an author by contacting the Frontiers Editorial Office frontiersin.org/about/contact **Bridge Maintenance, Safety, Management, Resilience and Sustainability** Fabio Biondini, Dan M. Frangopol, 2012-06-21 Bridge Maintenance Safety Management Resilience and Sustainability contains the lectures and papers presented at The Sixth International Conference on Bridge Maintenance Safety and Management IABMAS 2012 held in Stresa Lake Maggiore Italy 8-12 July 2012 This volume consists of a book of extended abstracts 800 pp Extensive collection of revised expert papers on recent advances in bridge maintenance safety management and life cycle performance representing a major contribution to the knowledge base of all areas of the field **Bridge Safety, Maintenance, Management, Life-Cycle, Resilience and Sustainability** Joan Ramon Casas, Dan M. Frangopol, Jose Turmo, 2022-06-27 Bridge Safety Maintenance Management Life Cycle Resilience and Sustainability contains lectures and papers presented at the Eleventh International Conference on Bridge Maintenance Safety and Management IABMAS 2022 Barcelona Spain 11-15 July 2022 This e-book contains the full papers of 322 contributions presented at IABMAS 2022 including the T.Y. Lin Lecture 4 Keynote Lectures and 317 technical papers from 36 countries all around the world The contributions deal with the state of the art as well as emerging concepts and innovative applications related to the main aspects of safety maintenance management life cycle resilience sustainability and technological innovations of bridges Major topics include advanced bridge design construction and maintenance approaches safety reliability and risk evaluation life cycle management life cycle resilience sustainability standardization analytical models bridge management systems service life prediction structural health monitoring non-destructive testing and field testing robustness and redundancy durability enhancement repair and rehabilitation fatigue and corrosion extreme loads needs of bridge owners whole life costing and investment for the future financial planning and application of

information and computer technology big data analysis and artificial intelligence for bridges among others This volume provides both an up to date overview of the field of bridge engineering and significant contributions to the process of making more rational decisions on bridge safety maintenance management life cycle resilience and sustainability of bridges for the purpose of enhancing the welfare of society The volume serves as a valuable reference to all concerned with and or involved in bridge structure and infrastructure systems including students researchers and practitioners from all areas of bridge engineering

Bridge Engineering Handbook, Five Volume Set Wai-Fah Chen,Lian Duan,2014-01-24 Over 140 experts 14 countries and 89 chapters are represented in the second edition of the Bridge Engineering Handbook This extensive collection provides detailed information on bridge engineering and thoroughly explains the concepts and practical applications surrounding the subject and also highlights bridges from around the world This second edition of the bestselling Bridge Engineering Handbook covers virtually all the information an engineer would need to know about any type of bridge from planning to construction to maintenance It contains more than 2 500 tables charts and illustrations in a practical ready to use format An abundance of worked out examples gives readers numerous practical step by step design procedures Special attention is given to rehabilitation retrofit and maintenance Coverage also includes seismic design and building materials Thoroughly revised and updated this second edition contains 26 new chapters

Structural Materials Technology Paul E. Hartbower,Philip J. Stolarski,2020-08-23 This book is a collection of papers presented in the NDT Conference held on February 20 23 1996 at San Diego California The conference provided an opportunity to share experience and provide additional input to the Federal Highway Administration

Life-Cycle of Engineering Systems: Emphasis on Sustainable Civil Infrastructure Jaap Bakker,Dan M. Frangopol,Klaas Breugel,2016-11-18 This volume contains the papers presented at IALCCE2016 the fifth International Symposium on Life Cycle Civil Engineering IALCCE2016 to be held in Delft The Netherlands October 16 19 2016 It consists of a book of extended abstracts and a DVD with full papers including the Fazlur R Khan lecture keynote lectures and technical papers from all over the world All major aspects of life cycle engineering are addressed with special focus on structural damage processes life cycle design inspection monitoring assessment maintenance and rehabilitation life cycle cost of structures and infrastructures life cycle performance of special structures and life cycle oriented computational tools The aim of the editors is to provide a valuable source for anyone interested in life cycle of civil infrastructure systems including students researchers and practitioners from all areas of engineering and industry

Bridge Safety United States. Congress. House. Committee on Science and Technology,2008

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