



Bridge Load Rating Through Proof Load Testing for Shear at Dapped Ends of Prestressed Concrete Girders

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Specialty section:

This article was submitted to
Bridge Engineering,
a section of the journal
Frontiers in Built Environment

Received: 13 December 2019

Accepted: 26 June 2020

Published: 22 July 2020

Citation:

Zhou YE and Guzdar MR (2020)
Bridge Load Rating Through Proof
Load Testing for Shear at Dapped
Ends of Prestressed Concrete
Girders. *Front. Built Environ.* 6:117.
doi: 10.3389/fbu.2020.00117

Load ratings of the 1967 built I-195 westbound bridge over Seekonk River in Rhode Island are governed by shear at the dapped ends of prestressed concrete (PSC) girders. Insufficient analytical load ratings, in combination with visible shear cracks at the dapped ends, prompted the need for a refined method of load rating through load testing. The proof load testing method was chosen over diagnostic testing for a higher level of reliability due to uncertainties involved in calculating shear capacities of the dapped ends. A proof load test was successfully completed with a maximum proof load of two test trucks of approximately 100,000 lbs each crossing the bridge side-by-side without any signs of distress or non-linear behavior observed. Vehicle loading dynamic impact was also assessed during the load test. Test measurements indicated full composite action between the bridge deck and the PSC drop-in girders, which was not accounted for in the analytical rating of the dapped ends. Test results suggested that the strut-and-tie and shear-friction analysis methods underestimate the shear resistance of the dapped ends by considering only the stirrup reinforcement and draped prestressing strands within the PSC girder. This paper provides detailed information on bridge proof load testing in general concept and procedure, comparisons with the diagnostic load testing method, field operation, examination of test measurements for linear elastic structural behavior, and determining bridge load ratings based on test results per *The Manual for Bridge Evaluation of AASHTO*.

Keywords: bridge, load rating, prestressed concrete, dapped end, proof load test

INTRODUCTION

The I-195 westbound (WB) bridge over Seekonk River in Providence, Rhode Island was built in 1967 and consists of 13 prestressed concrete (PSC) girder spans and five steel plate girder spans. The bridge carries five traffic lanes before an exit ramp and four traffic lanes plus a full-width right shoulder after the exit ramp. The superstructure of the PSC spans is of the cantilevered and drop-in girder construction and consists of six lines of girders equally spaced at a distance varying from 13 ft in the five lane section to 11.4 ft in the four lane section. The drop-in girders are the PSC Type IV AASHTO girders with dapped ends resting on elastomeric bearings at the end of the cantilevered girder sections.

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SJ Ball



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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 *Bridge*

Engineering Handbook Wai-Fah Chen, Lian Duan, 2014-01-24 The second edition of this bestselling 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 and an abundance of worked out examples give readers numerous step by step design procedures. Extensively updated and featuring several new chapters, this volume Construction and Maintenance covers construction inspection, bridge management systems, health monitoring, ratings, strengthening and rehabilitation, life cycle analysis and much more. 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. 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 1: 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

Advances on Testing and Experimentation in Civil Engineering Carlos Chastre, José Neves, Diogo Ribeiro, Maria Graça Neves, Paulina Faria, 2023-03-28 This book presents the most recent advances on testing and experimentation in civil engineering especially in the branches of materials structures and buildings complementing the authors publication Advances on Testing and Experimentation in Civil Engineering Geotechnics Transportation Hydraulics and Natural Resources It includes advances in physical modelling monitoring techniques data acquisition and analysis and provides an invaluable contribution to the installation of new civil engineering experimental facilities The first part of the book covers the latest advances in the testing and experimentation of key domains of materials such as bio cementation and self healing durability and recycled materials as well as the new environmental requirements related to the presence of hazardous substances in construction materials Furthermore laboratory and in situ tests together with equipment needed to estimate the behaviour and durability of construction materials are presented updating the most important technological advances The second part of the book highlights the relevance of testing and monitoring in structures including in situ tests related to static load tests dynamic tests and long term monitoring strategies as well as laboratory tests of adhesive joints Experimental tests on shake tables and blast resistant structures are also described Recent applications of drone technologies for the inspection and monitoring of civil structures are another important theme developed Finally in its third part the book presents new developments in the characterisation of building testing with the support of modelling to assess building pathology and new requirements acoustic comfort fire safety visual comfort and energy consumption

Field Inspection of In-service FRP Bridge Decks Niket M. Telang, National Cooperative Highway Research Program, 2006

Bridge Maintenance, Safety, Management, Digitalization and Sustainability Jens Sandager Jensen, Dan M. Frangopol, Jacob Wittrup Schmidt, 2024-07-12 Bridge Maintenance Safety Management Digitalization and Sustainability collects the lectures and technical papers presented at the 12th International Conference on Bridge Maintenance Safety and

Management IABMAS 2024 Copenhagen Denmark 24 28 June 2024 This Open Access book contains 480 contributions including the T Y Lin Lecture 9 Keynote Lectures and 470 technical papers from 44 countries The contributions are presented bring together academic and technological developments in Bridge Maintenance Safety Management Digitalization and Sustainability to solve new and old problems with innovative solutions 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 extensive data analysis and artificial intelligence for bridges among others Bridge Maintenance Safety Management Digitalization and Sustainability provides an up to date overview of the field of bridge engineering and significant contributions to making more rational decisions on bridge safety maintenance management life cycle resilience sustainability and bridge innovations to enhance society s welfare The Editors hope that this book will serve as a valuable reference to all concerned with bridge structure and infrastructure systems including engineers researchers academics and students from all areas of bridge engineering 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

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

The Manual for Bridge Evaluation, 2010

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

Dynamics of Bridges, Volume 5 Tom Proulx, 2025-08-07 This 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 **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 **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

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