

Guidelines for Design of Bridge Abutments and Retaining Walls

April, 2023



INDIAN ASSOCIATION OF STRUCTURAL ENGINEERS

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Foreword

Abutments and Retaining walls are important structures and frequently constructed as part of infrastructure projects. Their design criteria are covered mainly by IRC:78-2014 Code for Foundation and Substructure. However, there is no publication covering comprehensive guidelines for design of these structures which involves geotechnical engineering inputs apart from normal structural design. Practicing engineers are often at a loss to understand the behaviour and the entire range of design aspects.



The Indian Association of Structural Engineers (IAStructE) has been deliberating the subject for quite some time. It was realised that there is a need to provide the comprehensive Guidelines for Design of Retaining Walls and Bridge Abutments covering the types of such structures commonly used in highway and bridge sector and their design methods including a few illustrative worked examples. These guidelines may be used by structural engineers in performing the structural design works. It will help in better appreciations of the behaviour of such structures and in minimising design errors.

The initial draft of these Guidelines was entrusted to Mr. Rajiv Ahuja, Fellow and GC member of IAStructE and later a team of experts comprising Mr. Alok Bhowmick, Mr. Partha Banerjee and Mr. Amalendu Gope reviewed the initial draft and finalised the Guidelines.

I take this opportunity to thank all the contributors for sparing their valuable time in bringing out these important Guidelines. I am sure these Guidelines will be found useful by all stakeholders (Clients, Design Consultants, Independent Engineers, Proof Consultants, Contractors, Academicians) involved in the infrastructure sector.

Happy Reading !

A handwritten signature in blue ink, appearing to read 'Manoj Mittal', with a long horizontal stroke extending to the right.

Manoj Mittal
President, IAStructE

Message from Chairman, Publication Committee

Dear Colleagues,

It is my pleasure to write this message while presenting to you this important publication titled “Guidelines for Design of Bridge Abutments and Retaining Walls”. In India we have several codes of practices & standards prepared by various institutions including Indian Road Congress (IRC). However, we do not have a Code dedicated to retaining structures commonly used in infrastructure field. In view of this, Indian Association of Structural Engineers decided to prepare and publish such Guidelines exclusively dedicated to bridge abutments and retaining walls along with illustrative worked examples which would help young and practising designers in understanding their behaviour, geotechnical & structural design aspects and construction issues. Apart from covering various types of retaining structures and their design methodologies, Guidelines also cover possible reasons for failure of such structures and how these can be prevented. An expert panel consisting of Mr. Alok Bhowmick, Mr. Rajiv Ahuja, Mr. Partha Pratim Banerjee and Mr. Amalendu Gope, geotechnical engineer was formed for finalising the Guidelines. I am happy that expert panel has done a fabulous job in completing this document with worked examples in time. It has gone through several consultations & review process. The document was sent to Mr. Sandeep Pattiwar and Mr. Ravi Sundaram for their expert review and also circulated to all GC members of IAStructE for their comments and inputs. I sincerely thank all the people involved with the reviewing of this document and sending their comments for its improvement. I am sure these Guidelines will help all structural engineers involved in design & construction of such structures and I request them to send their feedback & suggestions for its improvement.

Best regards,



Rajiv Ahuja

Chairman -Publication Committee IAStructE



About this Guideline

These guidelines offer very valuable, most informative and practical tips to everyone involved in teaching, design and construction of abutments and retaining walls. There are currently no guidelines available, which deal with the design and detailing of earth retaining structures in entirety. In highway and bridge projects, a large number of abutments and retaining walls are constructed. In absence of proper guidelines, structural engineers depend on various IRC Codes and textbooks for complete understanding of the behaviour and design requirements for such structures. Coverage in these documents is only partial. These guidelines close the gap that existed between the theory and practical considerations in the treatment of earth retaining structures. For any structure, it is important for the practicing structural engineers to have a thorough understanding of the principles, the true interpretation of codal provisions and background of the issues involved which will ensure a safe structure and better compliance of the applicable codes. For young engineers particularly, the unfamiliarity with the structural behaviour and codal clauses poses huge problems in ensuring safe designs. This is the backdrop to the publication of these guidelines, titled "Guidelines for Design of Bridge Abutments and Retaining Walls" by the Indian Association of Structural Engineers (IAStructE). The association recognised this need and had set up a task group to prepare this document. The first draft of this document was prepared by Mr. Rajiv Ahuja and later an expert group was constituted comprising:

- Mr. Alok Bhowmick (MD, B&S Engineering Consultants Pvt. Ltd. and past President, IAStructE),
- Mr. Rajiv Ahuja (Independent Consultant and GC Member, IAStructE),
- Mr. Partha Pratim Banerjee (Technical Director, Ayesa)
- Mr. Amalendu Gope (Senior Geotechnical Engineer, Ayesa)

Mr. Jatin Singla (Structural Engineer, B&SECPL) and Mr. Partha Pratim Banerjee contributed for the preparation of illustrative worked examples.

This publication will assist practicing bridge and structural engineers in building confidence in the design of these structures, which offers tools for the design of economic and innovative retaining structures. The document is rich in theoretical explanations and draws on much experience of the authors. Worked examples further illustrate the application of the applicable codes and should promote better understanding. As members of the Expert Panel, we would like to thank all the authors, peer reviewers and members of the joint Task Force for working efficiently and effectively in producing these documents.

We trust these Guidelines and the Worked Examples will prove to be a valuable tool in better design of these structures and deserve every success.



Er. Alok Bhowmick

MD, B&S Engineering Consultants Pvt. Ltd. &
Past President - IAStructE



Er. Rajiv Ahuja

Independent Consultant &
GC Member, IAStructE



Er. Partha Pratim Banerjee

Technical Director, Ayesa India Pvt. Ltd. &
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Readers should note that all codes and standards published by the Indian Roads Congress are subject to revision from time to time and therefore this guideline is applicable and relevant to the latest publication of the code available at the time of publication of this document. Readers must ensure that they are in possession of the latest version of the code for practical application.

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