

A Case Study On Zoning And Construction Of Roller-Compacted-Concrete Gravity Dams

Qin Genquan¹, Chen Yangxian²

¹ Jiangxi Provincial Water Conservancy Planning Design and Research Institute, Nanchang 330029, China;

²College of Water Conservancy & Hydroelectric Engineering, Hohai University, Nanjing 210024, China

Abstract: In order to make full use of the concrete strength, reduce the amount of cementitious materials and simplify the temperature control measures, a roller compacted concrete (RCC) dam needs to be zoned reasonably in consideration of locations and working conditions. Taking the RCC gravity dam of Wuxikou hydropower project in Jiangxi province, this article specifies the zonation design, the problems encountered during construction stage and the corresponding measures. The results indicate that the zonation and the construction schemes of the RCC gravity dam can greatly reduce the amount of cementitious materials, improve the level of mechanization in construction, and thus accelerate the construction progress, reduce the project cost. It not only ensures the quality and safety of the project, but also achieves obvious economic benefits. It can be an important reference for zonation design and construction of similar projects.

1 Foreword

Roller compacted concrete dam (RCC) ^[1] refers to the dam made of dry concrete, with essentially no slump, which is spread in layers and then compacted by rollers. It is more economical and has shorter construction period, similar to earth & rock-fill dam, and makes full use of the strength and durability of concrete. According to incomplete statistics, the RCC gravity dams have been rapidly developed at home and abroad ^[1-10], more than 200 RCC dams have been built in over 20 countries around the world, which are distributed in the regions of tropical and subtropical climate. The first RCC dam is the Willow Creek Dam, 52m high, built in 1982 in the United States. The highest RCC gravity dam currently under construction is the Longtan Dam ^[4,5]. Its first-phase dam is 192m high, and the second-phase dam is up to 216.5 m. The amount of its roller compacted concrete is 7.5 million M³.

The design of the cross-section of the roller compacted concrete gravity dam is generally made with reference to that of the conventional concrete gravity dam. The dam cross-section should meet the requirements of the water-retaining function and ensure stability. Because of the high strength and better impermeability of the concrete, cross-section of gravity dam is mainly determined by the overall stability of the dam, so the cross-section is generally larger, and the strength and impermeability of inner part of the dam can not be fully utilized. Also, due to the different working conditions, various parts of the RCC dam have different strength, impermeability and frost resistance requirements. For all the above reasons, in order to save and make rational use of cementitious materials, reduce

costs, and optimize the performance of the dam, based on the requirement of the function of each part of the dam, we usually use different grades of concrete for different parts of the dam. That is to properly divide the dam into different zones according to their locations and working conditions. At present, the zoning of the concrete of RCC dam has gained attention from many scholars. Wang Bingjun^[6] discussed the Zoning of the concrete for the Left-bank RCC Dam of the Tongjiczi Hydropower Station. Li Diguang (2012) ^[7] analyzed the zoning and mix ratio of the concrete for the dam of Jinanqiao Hydropower Station. Chen Qiang ^[8] introduced the design of the Guandi Hydropower Station RCC dam's concrete mix proportion and concrete zoning. Zhao Chunju and Zhou Yihong ^[9] used the zoning of the concrete as the boundary condition for the construction of the Longkaikou RCC gravity dam. Nevertheless, the problems encountered in the construction of the different zones of the RCC dam and its effective solutions are rarely reported. Taking the WUXIKOU hydropower project in Jiangxi Province as an example, this paper focuses on the zoning of RCC gravity dam section, concrete mix proportion, construction problems and their solutions.

2 Case Study

2.1 Overview of the case

WUXIKOU Project ^[11,12] is an important part of the flood control system of the historic city - Jingdezhen,

Corresponding author: Qin Genquan(qingenquan@163.com)

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Case Study Of Roller Compacted Concrete:

Applications of Roller-compacted Concrete in Rehabilitation and Replacement of Hydraulic Structures James E. McDonald, Nancy F. Curtis, 1997 **RCC Dams - Roller Compacted Concrete Dams** Luis Berga, J. M. Buil, C. Jofré, S. Chonggang, 2018-04-27 A book of broad interest to professionals dam engineers and managers and to organizations responsible for dam development and management RCC Dams offers a topical account of the design and operation of roller compacted concrete dams describing the latest developments and innovative technologies in the field The book considers planning and design materials and construction as well as the operation and performance of RCC dams Concrete Pavement Design, Construction, and Performance Norbert J. Delatte, 2014-05-22 This second edition of Concrete Pavement Design Construction and Performance provides a solid foundation for pavement engineers seeking relevant and applicable design and construction instruction It relies on general principles instead of specific ones and incorporates illustrative case studies and prime design examples to highlight the material It presents a thorough understanding of materials selection mixture proportioning design and detailing drainage construction techniques and pavement performance It also offers insight into the theoretical framework underlying commonly used design procedures as well as the limits of the applicability of the procedures All chapters have been updated to reflect recent developments including some alternative and emerging design technologies that improve sustainability What's New in the Second Edition The second edition of this book contains a new chapter on sustainability and coverage of mechanistic empirical design and pervious concrete pavements RCC pavements are now given a new chapter The text also expands the industrial pavement design chapter Outlines alternatives for concrete pavement solutions Identifies desired performance and behavior parameters Establishes appropriate materials and desired concrete proportions Presents steps for translating the design into a durable facility The book highlights significant innovations such as one is two lift concrete pavements precast concrete pavement systems RCC pavement interlocking concrete pavers thin concrete pavement design and pervious concrete This text also addresses pavement management maintenance rehabilitation and overlays *Concrete Pavement Design, Construction, and Performance, Second Edition* Norbert J. Delatte, 2014-05-22 This second edition of Concrete Pavement Design Construction and Performance provides a solid foundation for pavement engineers seeking relevant and applicable design and construction instruction It relies on general principles instead of specific ones and incorporates illustrative case studies and prime design examples to highlight the material It presents a thorough understanding of materials selection mixture proportioning design and detailing drainage construction techniques and pavement performance It also offers insight into the theoretical framework underlying commonly used design procedures as well as the limits of the applicability of the procedures All chapters have been updated to reflect recent developments including some alternative and emerging design technologies that improve sustainability What's New in the Second Edition The second edition of this book contains a new chapter on sustainability and coverage of

mechanistic empirical design and pervious concrete pavements RCC pavements are now given a new chapter The text also expands the industrial pavement design chapter Outlines alternatives for concrete pavement solutions Identifies desired performance and behavior parameters Establishes appropriate materials and desired concrete proportions Presents steps for translating the design into a durable facility The book highlights significant innovations such as one is two lift concrete pavements precast concrete pavement systems RCC pavement interlocking concrete pavers thin concrete pavement design and pervious concrete This text also addresses pavement management maintenance rehabilitation and overlays Selected Water Resources Abstracts ,1991

Sustainable and Safe Dams Around the World / Un monde de barrages durables et sécuritaires Jean-Pierre Tournier,Tony Bennett,Johanne Bibeau,2019-08-08 These proceedings include digital media with the full conference papers 3600 pages Sustainable and Safe Dams Around the World contains the contributions presented at the 2019 Symposium of the International Commission on Large Dams ICOLD 2019 Ottawa Canada 9 14 June 2019 The main topics of the book include 1 Innovation recent advancements and techniques for investigations design construction operation and maintenance of water or tailings dams and spillways 2 Sustainable Development planning design construction operation decommissioning and closure management strategies for water resources or tailings dams e g climate change sedimentation environmental protection risk management 3 Hazards design mitigation and management of hazards to water or tailings dams appurtenant structures spillways and reservoirs e g floods seismic landslides 4 Extreme Conditions management for water or tailings dams e g permafrost and ice loading arid wet climates geo hazards 5 Tailings design construction operation and closure for tailings dams recent advancements and best practice Sustainable and Safe Dams Around the World will be invaluable to academics and professionals interested or involved in dams Un monde de barrages durables et sécuritaires contiennent les contributions pr sent es lors du symposium de 2019 de la Commission internationale des grands barrages CIGB 2019 Ottawa Canada 9 14 juin 2019 Les principaux sujets du livre incluent 1 Innovation Avanc es et techniques r centes pour l investigation la conception la construction l exploitation et l entretien de barrages hydrauliques de barrages de st riles et d vacuateurs de crues 2 D veloppement durable strat gies de gestion pour la planification la conception la construction l exploitation la mise hors service et la fermeture de barrages hydrauliques ou des barrages de st riles par exemple changement climatique s dimentation protection de l environnement gestion des risques 3 Risques mesures d att nuation et gestion des risques li s aux barrages hydrauliques et barrages de st riles aux ouvrages annexes aux vacuateurs de crues et aux r servoirs par exemple inondations tremblements de terre glissements de terrain 4 Environnement extr me gestion des barrages hydrauliques et barrages de st riles par exemple perg lisol et charge de glace climats secs humides g orisques 5 Barrages de st riles conception construction exploitation et fermeture des barrages de st riles avanc es r centes et meilleures pratiques Un monde de barrages durables et sécuritaires seront d une valeur inestimable pour les universitaires et les professionnels int ress s ou impliqu s dans les barrages Roller-Compacted Concrete Dams CIGB ICOLD,2020-12-22

ICOLD Bulletin 177 Roller Compacted Concrete Dams presents the state of the art on roller compacted concrete technology for dams incorporating the advances of the RCC technology for dams over the last 15 years since the previous Bulletin on the topic was released in 2003. Hence the present ICOLD Bulletin 177 supersedes ICOLD Bulletin 126 Roller compacted concrete dams State of the art and case histories published in 2003 and ICOLD Bulletin 75 Roller Compacted Concrete for Gravity Dams published in 1989. While roller compacted concrete technology could have still been considered a new technology in 2003, it is now true to say that construction by roller compaction has become the standard approach for large concrete gravity dams. This Bulletin addresses all aspects of the planning, design, construction and performance of RCC in dams. Mixture proportioning and quality control are discussed and a comprehensive listing of references is included. Many aspects of RCC in dams have become better understood since the publication of Bulletin No 126 and the present Bulletin contains less information on the particular approaches applied in different countries but includes more comprehensive information particularly in relation to design, mixture proportioning and construction. With greater understanding, it has further been possible to highlight more definitively the requirements of successful RCC dams as well as the pitfalls and difficulties that can be associated with RCC dam design and construction.

Le Bulletin CIGB 177 intitulé Barrages en B ton Compact au Rouleau présente les dernières avancées en matière de technologie du b ton compact au rouleau pour les barrages intégrant les progrès de la technologie BCR pour les barrages au cours des 15 dernières années depuis que le dernier bulletin sur le sujet a été publié en 2003. Par conséquent, le bulletin 177 remplace le bulletin 126 Barrages en b ton compact au rouleau Technique actuelle et exemples publié en 2003 et le bulletin 75 B ton compact au rouleau pour barrages poids Technique actuelle publié en 1989. Alors que la technologie du BCR pourrait encore être considérée comme une nouvelle technologie en 2003, il est maintenant vrai de dire que la construction par le compactage par rouleaux est devenue l'approche standard pour les grands barrages poids en b ton. Ce bulletin aborde tous les aspects de la planification, de la conception, de la construction et de la performance du BCR dans les barrages. Le dosage du mélange et le contrôle de la qualité sont discutés et une liste exhaustive des références est incluse. De nombreux aspects du BCR dans les barrages sont mieux compris depuis la publication du Bulletin no 126. Le présent bulletin contient moins d'informations sur les approches particulières appliquées dans différents pays mais comprend des informations plus complètes, notamment en ce qui concerne la conception, le dosage du mélange et la construction. Avec une plus grande compréhension, il a été possible de mettre en évidence les exigences des barrages en BCR réalisés ainsi que les pièges et les difficultés qui peuvent être associés à la conception et la construction du barrage en BCR.

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

Dams and Reservoirs, Societies and Environment in the 21st Century Luis Berga,J.M. Buil,E. Bofill,J.C. De Cea,J.A. Garcia Perez,G. Mañueco,J. Polimon,A. Soriano,J. Yagüe,2006-02-15 Water resources stored by dams and reservoirs play an essential role in water resource management hydropower and flood control Where there is an extensive network of dam infrastructures dams have made a major contribution to economic and social development providing considerable storage capacity per capita However dams and reservoirs may also have an important social and environmental impact and should be studied within the framework of integrated water resource management and sustainable development Dams and Reservoirs Societies and Environment in the 21st Century presents the latest research on the role played by dams and reservoirs in 21st century societies in developed emergent and developing countries It analyses the viability of dams and suggests alternative solutions from a holistic perspective considering the technical economic social and environmental aspects Other issues covered include the social acceptability of dams public involvement and dam awareness The book covers subjects ranging from dam engineering through the benefits and drawbacks of dams to their social and environmental impact and contains numerous case studies of the constructive contributions that reservoirs have made to water development and management The book is a valuable resource for professional and dam engineers water managers governmental organizations and commercial enterprises responsible for dam development and management

Hydraulic Structure,Equipment and Water Data Acquisition Systems - Volume III Jan Malan Jordaan,Alexander Bell,2009-11-25 Hydraulic Structure Equipment and Water Data Acquisition Systems is a component of Encyclopedia of Water Sciences Engineering and Technology Resources in the global Encyclopedia of Life Support Systems EOLSS which is an integrated compendium of twenty one Encyclopedias Hydraulic structures occupied a vital role in the development of civilization from the earliest recorded history up to the present and undoubtedly will do so in the future Humanity in ancient times settled mostly near perennial rivers nomadic people frequented oases and springs and to augment these natural ephemeral supplies established societies built primitive dams and dug wells This 4 volume set contains several chapters each of size 5000 30000 words with perspectives applications and extensive illustrations It carries state of the art knowledge in the fields of Hydraulic Structure Equipment and Water Data Acquisition Systems In these volumes the historical origins modern developments and future perspectives in the field of water supply engineering are discussed Various types of hydraulic structures their associated equipment and the various systems for collecting data are described These four volumes are aimed at the following five major target audiences University and College Students Educators Professional Practitioners Research

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