

## Relative density ( Density index )

$$D_r = \frac{e_{max} - e}{e_{max} - e_{min}} \quad \text{or}$$

$$D_r = \frac{1/\gamma_{dmin} - 1/\gamma_d}{1/\gamma_{dmin} - 1/\gamma_{dmax}}$$

$e$  = in-situ void ratio

$e_{max}$  = void ratio in loosest condition

$e_{min}$  = void ratio in densest condition

$\gamma_d$  = dry unit weight in the field

$\gamma_{d(max)}$  = dry unit weight in densest condition

$\gamma_{d(min)}$  = dry unit weight in loosest condition

## Shrinkage limit : S.L.

$$S.L. = \frac{(m_1 - m_2)}{m_2} - \frac{(V_1 - V_2)}{m_2} \rho_w \text{ in } \%$$

$m_1$  = initial mass in saturated state

$m_2$  = final mass in dry state

$V_1$  = initial volume in saturated state

$V_2$  = final volume in dry state

## Plasticity Index : P.I.

$$P.I. = L.L. - P.L.$$

L.L. = liquid limit

P.L. = plastic limit

## Liquidity Index : L.I.

$$L.I. = \frac{w - P.L.}{P.I.}$$

$w$  = in-situ moisture content

P.L. = plastic limit

P.I. = plasticity index

## Consistency Index : C.I.

$$C.I. = \frac{L.L. - w}{L.L. - P.I.}$$

## Soil Characteristic

brittle solid

plastic

liquid

## Liquidity Index

< 0

< 1

> 1

## Shrinkage Ratio : S.R.

$$S.R. = \frac{m_2}{V_2 \rho_w}$$

## Specific Gravity: $G_s$

$$G_s = \frac{1}{\frac{1}{SR} - \frac{SL}{100}}$$

## SOIL CLASSIFICATION

### U.S. Dept of Agriculture (USDA Method)

Gravel	Sand	Silt	Clay
> 2 mm	2 to 0.05mm	0.05 to 0.002mm	< 0.002 mm

### AASHTO Method

Gravel	Sand	Silt	Clay
76.2 to 2mm	2 to 0.075mm	0.075 to 0.002mm	< 0.002 mm

### Unified Soil Classification System

Gravel	Sand	Fines (Silt & Clay)
76.2 to 4.75 mm	4.75 to 0.075 mm	< 0.075 mm

# Geotechnical Engineering Formulas

**Dimitrios Sargiotis**



## **Geotechnical Engineering Formulas:**

**Geotechnical Engineering Calculations and Rules of Thumb** Ruwan Abey Rajapakse, 2015-11-18 Geotechnical Engineering Calculations and Rules of Thumb Second Edition offers geotechnical civil and structural engineers a concise easy to understand approach to selecting the right formula and solving even most difficult calculations in geotechnical engineering A quick look up guide this book places formulas and calculations at the reader's finger tips In this book theories are explained in a nutshell and then the calculation is presented and solved in an illustrated step by step fashion In its first part the book covers the fundamentals of Geotechnical Engineering Soil investigation condition and theoretical concepts In the second part it addresses Shallow Foundations including bearing capacity elastic settlement foundation reinforcement grillage design footings geogrids tie and grade beams and drainage This session ends with a chapter on selecting foundation types The next part covers Earth Retaining Structures and contains chapters on its basic concepts and types gabion walls and reinforced earth walls The following part covers Geotechnical Engineering Strategies providing coverage of softwares instrumentation excavations raft design rock mechanics dip angle and strike rock stabilization equipment soil anchors tunnel design seismology geosynthetics and slurry cutoff walls The final part is on Pile Foundations including content on design on sandy soils clay soils pin piles negative skin friction caissons and pile clusters In this new and updated edition the author has incorporated new software calculation tools current techniques for foundation design liquefaction information seismic studies laboratory soil tests geophysical techniques new concepts for foundation design and Dam designs All calculations have been updated to most current material characteristics available in the market Practicing Geotechnical Civil and Structural Engineers may find in this book an excellent companion to their day to day work benefiting from the clear and direct calculations examples and cases Civil Engineering students may find particular interest in the concise theory presented in the beginning of each chapter Calculations both in FPS and SI metric systems Convenient access to all needed calculations Access to concise theory that helps understand the calculations Case studies from around the world Includes new software calculation tools

**Civil Engineering Formulas and Equations for Students** PETER I. KATTAN, 2025-03-23 This is a little book for students who wish to have the essential formulas and equations of geotechnical engineering in a single easily accessible source In about 40 pages the 100 most essential civil engineering formulas are listed Unlike other large books on this topic there is no need to go through hundreds of pages and thousands of formulas for the student to get the basic equations The author has searched several books on engineering formulas and tables and selected only those equations which are essential to the student The civil engineering formulas and equations listed in this book are useful for students and researchers in various fields including geotechnical engineering soil mechanics and foundation analysis etc Only the most elementary and basic topics are covered including formulas for Unified Soil Classification System Rock Classification System Physical Properties of Soils Index Parameters for Soils Soil Indices Engineering Properties of Soils Shear Strength of

Cohesive Soils Shear Strength of Cohesionless Soils The Static Cone Penetration Test CPT California Bearing Ratio CBR Soil Permeability Expansive Soils Liquefaction of Soils Types of Footings Foundation Stability Analysis Eccentric Loading Allowable Bearing Pressures Settlement Analysis of Cohesive Soils Three Dimensional Settlement Analyses The Coefficient of Consolidation Settlement Analysis of Sands Standard Penetration Resistance Methods Piles Pile Testing and Pile Design Lateral Pressures on Retaining Walls This is the second book in this series and is dedicated to geotechnical engineering Other volumes will follow in other areas of civil engineering

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Ruwan Abey Rajapakse, 2011-04-08 Geotechnical Engineering Calculations and Rules of Thumb offers geotechnical civil and structural engineers a concise easy to understand approach the formulas and calculation methods used in of soil and geotechnical engineering A one stop guide to the foundation design pile foundation design earth retaining structures soil stabilization techniques and computer software this book places calculations for almost all aspects of geotechnical engineering at your finger tips In this book theories is explained in a nutshell and then the calculation is presented and solved in an illustrated step by step fashion All calculations are provided in both fps and SI units The manual includes topics such as shallow foundations deep foundations earth retaining structures rock mechanics and tunnelling In this book the author s done all the heavy number crunching for you so you get instant ready to apply data on activities such as hard ground tunnelling soft ground tunnelling reinforced earth retaining walls geotechnical aspects of wetland mitigation and geotechnical aspects of landfill design Easy to understand approach the formulas and calculations Covers calculations for foundation earthworks and or pavement subgrades Provides common codes for working with computer software All calculations are provided in both US and SI units

*ICE Manual of Geotechnical Engineering Volume 1* Hilary Skinner, D G Toll, Kelvin Higgins, Mike Brown, John Burland, 2023-11-17 ICE Manual of Geotechnical Engineering Second edition brings together an exceptional breadth of material to provide a definitive reference on geotechnical engineering solutions Written and edited by leading specialists each chapter provides contemporary guidance and best practice knowledge for civil and structural engineers in the field

Geotechnical Engineering for Transportation Infrastructure F. B. J. Barends, 1999

**Reliability and Statistics in Geotechnical Engineering** Gregory B. Baecher, John T. Christian, 2005-08-19 Risk and reliability analysis is an area of growing importance in geotechnical engineering where many variables have to be considered Statistics reliability modeling and engineering judgement are employed together to develop risk and decision analyses for civil engineering systems The resulting engineering models are used to make probabilistic predictions which are applied to geotechnical problems Reliability Statistics in Geotechnical Engineering comprehensively covers the subject of risk and reliability in both practical and research terms Includes extensive use of case studies Presents topics not covered elsewhere spatial variability and stochastic properties of geological materials No comparable texts available Practicing engineers will find this an essential resource as will graduates in geotechnical engineering programmes

Construction Engineering

Design Calculations and Rules of Thumb Ruwan Abey Rajapakse, 2016-09-02 Construction Engineering Calculations and Rules of Thumb begins with a brief but rigorous introduction to the mathematics behind the equations that is followed by self contained chapters concerning applications for all aspects of construction engineering Design examples with step by step solutions along with a generous amount of tables schematics and calculations are provided to facilitate more accurate solutions through all phases of a project from planning through construction and completion Includes easy to read and understand tables schematics and calculations Presents examples with step by step calculations in both US and SI metric units Provides users with an illustrated easy to understand approach to equations and calculation methods *Frontiers of Civil Engineering and Disaster Prevention and Control Volume 2* Yang Yang, Ali Rahman, 2023-01-16 Frontiers of Civil Engineering and Disaster Prevention and Control is a compilation of selected papers from The 3rd International Conference on Civil Architecture and Disaster Prevention and Control CADPC 2022 and focuses on the research of architecture and disaster prevention in civil engineering The proceedings features the most cutting edge research directions and achievements related to construction technology and prevention and control of disaster Subjects in this proceedings include Construction Technology Seismicity in Civil Engineering High Rise Building Construction Disaster Preparedness and Risk Reduction Smart Post Disaster Rescue These proceedings will promote development of civil engineering and risk reduction resource sharing flexibility and high efficiency Moreover promote scientific information interchange between scholars from the top universities research centers and high tech enterprises working all around the world *Practical Civil Engineering* P.K. Jayasree, K Balan, V Rani, 2021-05-04 The book provides primary information about civil engineering to both a civil and non civil engineering audience in areas such as construction management estate management and building Basic civil engineering topics like surveying building materials construction technology and management concrete technology steel structures soil mechanics and foundations water resources transportation and environment engineering are explained in detail Codal provisions of US UK and India are included to cater to a global audience Insights into techniques like modern surveying equipment and technologies sustainable construction materials and modern construction materials are also included Key features Provides a concise presentation of theory and practice for all technical in civil engineering Contains detailed theory with lucid illustrations Focuses on the management aspects of a civil engineer's job Addresses contemporary issues such as permitting globalization sustainability and emerging technologies Includes codal provisions of US UK and India The book is aimed at professionals and senior undergraduate students in civil engineering non specialist civil engineering audience *The Civil Engineering Handbook* W.F. Chen, J.Y. Richard Liew, 2002-08-29 Providing extensive coverage of all major areas of civil engineering the second edition of this award winning handbook features contributions from leading professionals and academicians and is packed with formulae data tables and definitions vignettes on topics of recent interest and additional sources of information It includes a wealth of material in areas such as coastal engineering

polymeric materials computer methods shear stresses in beams and pavement performance evaluation Its wide range of information makes it an essential resource for anyone working in civil structural or environmental engineering *Dictionary Geotechnical Engineering / Wörterbuch GeoTechnik* Herbert Bucksch,2013-03-09 Together the two volumes of the Dictionary of Geotechnical Engineering G E E G contain some 60 000 entries with common synonyms given in the target language where available Similarly additional explanations help to differentiate the headwords Apart from general terms used in geology the dictionary covers the more practical fields within geosciences the emphasis being placed on mining soil analysis reconnaissance geology geophysics geomorphology civil engineering hydrogeology hydraulic engineering geological engineering cartography soil deposits mineralogy oceanography and surveying

**Compendium of Civil Engineering Education Strategies** Hudson Jackson,Kassim Tarhini,2022-06-07 This book compiles proven strategies and information on civil engineering education and the skills necessary for successful practice of civil engineering such as critical thinking design thinking leadership and communication skills It also addresses other relevant topics including professional ethics global perspectives assessment recruitment retention and more It is designed so that each chapter can be used separately or in combination with other chapters to help enhance and foster student learning as well as development of skills required for engineering practice Features Includes overviews of successful academic approaches for each topic including implementation examples in every chapter Explains how assessment and the resulting data can be used for holistic evaluation and improvement of student learning Addresses the complexities of moral and professional ethics in engineering Highlights the importance of adopting a global perspective and the successful strategies that have been used or considered in educating resilient globally minded engineers Compendium of Civil Engineering Education Strategies Case Studies and Examples serves as a useful guide for engineering faculty practitioners and graduate students considering a career in academia Academic faculty and working professionals will find the content helpful as instructional and reference material in developing and assessing career skills It is also useful for intellectually curious students who want a deeper understanding and appreciation of the need for professional development and life long learning

**Offshore Technology in Civil Engineering** J. S. Templeton,2006-01-01 This book contains nine classic papers from the Offshore Technology Conference OTC which is the world s leading event for the development of offshore resources in the fields of drilling exploration production and environmental protection These papers provide innovation in vision for and lasting impact on design construction or installation of offshore infrastructure and have influence far beyond the offshore industry some becoming integral to the design process of onshore structures such as buildings and bridges The ASCE OTC Committee have chosen these classic documents to represent the outstanding papers from the early years of the OTC that withstand test of time They contain engineering methods that have proven their value through widespread use permeating codes standards guidelines and engineering software Topics include wave force evaluation ultimate strength and reverse capacity tubular joint material

and design pile foundations and pipeline installation      Physical Characteristics of Soils, Plasticity, Settlement Calculations, Interpretation of In-Situ Tests ,2013-10-22 Practical Problems in Soil Mechanics and Foundation Engineering 1 Physical Characteristics of Soils Plasticity Settlement Calculations Interpretation of In Situ Tests presents the analysis and calculation procedures for the solution of geotechnical problems The book contains example problems with detailed step by step solutions The text emphasizes the application of theoretical soil mechanics to geotechnical engineering Chapters provide example problems and solutions on the physical characteristics of soil water in the soil settlement calculations plasticity and shear strength plastic equilibrium and interpretation of in situ tests Civil engineers and civil engineering students will find the book highly useful      *Interaction Between Structural and Geotechnical Engineers* Rolf Katzenbach,Jens Turek,2003 This report has been prepared in the framework of the Co operation in Science and Technology COST Action C7 for Soil Structure Interaction in the Urban Civil Engineering Based on a survey in 13 European countries and with additional input from the COST C7 members the report focuses on several aspects effecting the interaction between structural and geotechnical engineers As the theoretical foundation for the interaction between both disciplines is laid during education the civil engineering education system of several European countries are described and evaluated      **MATLAB for Civil Engineers** Dimitrios Sargiotis,2025-05-21 This book is a comprehensive and rigorous guide to MATLAB for Civil Engineers bridging the critical gap between theoretical mathematics and practical engineering solutions With an approachable introduction for students and deep insights for experienced professionals it caters to a wide range of audiences across civil engineering disciplines environmental structural geotechnical and transportation engineering Structured to guide readers progressively the book begins with foundational MATLAB operations such as syntax and matrix manipulation then advances into sophisticated engineering applications including optimization numerical methods and data visualization It covers essential MATLAB functionalities offering detailed instruction on computation visualization and programming all within the context of solving real world engineering challenges What sets this book apart is its hands on approach Readers are immersed in practical learning through real world case studies examples and step by step exercises designed to reinforce key concepts The text provides both academic and professional readers with the tools they need to model analyze and optimize engineering systems using MATLAB ensuring they are equipped to handle both routine and complex engineering challenges with confidence By the end readers will not only master MATLAB s powerful tools but will also understand how to apply them directly to critical civil engineering problems positioning themselves to innovate and lead in a field where computational proficiency is increasingly essential      **Geotechnical Engineering Education and Training** I Antonescu,I Manoliu,N Radulescu,2020-09-10 This volume contains papers and reports from the Conference held in Romania June 2000 The book covers many topics for example place role and content of geotechnical engineering in civil environmental and earthquake engineering      **10th International Conference on FRP Composites in Civil Engineering** Alper Ilki,Medine Ispir,Pinar

Inci,2021-11-26 This volume highlights the latest advances innovations and applications in the field of FRP composites and structures as presented by leading international researchers and engineers at the 10th International Conference on Fibre Reinforced Polymer FRP Composites in Civil Engineering CICE held in Istanbul Turkey on December 8 10 2021 It covers a diverse range of topics such as All FRP structures Bond and interfacial stresses Concrete filled FRP tubular members Concrete structures reinforced or pre stressed with FRP Confinement Design issues guidelines Durability and long term performance Fire impact and blast loading FRP as internal reinforcement Hybrid structures of FRP and other materials Materials and products Seismic retrofit of structures Strengthening of concrete steel masonry and timber structures and Testing The contributions which were selected by means of a rigorous international peer review process present a wealth of exciting ideas that will open novel research directions and foster multidisciplinary collaboration among different specialists

**Green Building, Materials and Civil Engineering** Jimmy C.M. Kao,Wen-Pei Sung,Ran Chen,2014-10-21 This book contains select green building materials and civil engineering papers from the 4th International Conference on Green Building Materials and Civil Engineering GBMCE which was held in Hong Kong August 21 22 2014 This volume of proceedings aims to provide a platform for researchers engineers academics and industry professionals f **Fundamentals of Sustainability in Civil Engineering** Andrew Braham,Sadie Casillas,2020-12-20 This book provides a foundation to understand the development of sustainability in civil engineering and tools to address the three pillars of sustainability economics environment and society It includes case studies in the five major areas of civil engineering environmental structural geotechnical transportation and construction management This second edition is updated throughout and adds new chapters on construction engineering as well as an overview of the most common certification programs that revolve around environmental sustainability Features Updated throughout and adds two entirely new chapters Presents a review of the most common certification programs in sustainability Offers a blend of numerical and writing based problems as well as numerous application based examples that utilize concepts found on the Fundamentals of Engineering FE exam Includes several practical case studies Offers a solution manual for instructors Fundamentals of Sustainability in Civil Engineering is intended for upper level civil engineering sustainability courses A unique feature is that concepts found in the Fundamentals of Engineering FE exam were targeted to help senior level students refresh and prepare



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