

Life Cycle Analysis Of Brick And Mortar Products

This complete guide to the evaluation, selection, and use of sustainable materials in the landscape features strategies to minimize environmental and human health impacts of conventional site construction materials as well as green materials. Providing detailed current information on construction materials for sustainable sites, the book introduces tools, techniques, ideologies and resources for evaluating, sourcing, and specifying sustainable site materials. Chapters cover types of materials, both conventional and emerging green materials, environmental and human health impacts of the material, and detailed strategies to minimize these impacts. Case studies share cost and performance information and lessons learned.

Life Cycle Assessment (LCA) has developed in Australia over the past 16 years in a fragmented way with many different people and organizations contributing to the area at different times, and largely through informal or unpublished work. This publication will legitimize and document LCA research and methodology development to act as a record of what has happened and a basis for future development and application of the tool. The Centre for Design at RMIT has been a leading research center in Australia through its work on data collection, methodology development and contribution to knowledge through undertaking LCA studies for leading companies and government departments ranging from products, packaging, buildings, water management and waste management. This work, in addition to key work undertaken by other researchers, will be presented. The book will become a bridge between LCA implementation and life cycle management (LCM) and provide discussion on how LCA development will be in the future and how it integrates with available software tools.

Life cycle assessment enables the identification of a broad range of potential environmental impacts occurring across the entire life of a product, from its design through to its eventual disposal or reuse. The need for life cycle assessment to inform environmental design within the built environment is critical, due to the complex range of materials and processes required to construct and manage our buildings and infrastructure systems. After outlining the framework for life cycle assessment, this book uses a range of case studies to demonstrate the innovative input-output-based hybrid approach for compiling a life cycle inventory. This approach enables a comprehensive analysis of a broad range of resource requirements and environmental outputs so that the potential environmental impacts of a building or infrastructure system can be ascertained. These case studies cover a range of elements that are part of the built environment, including a residential building, a commercial office building and a wind turbine, as well as individual building components such as a residential-scale photovoltaic system. Comprehensively introducing and demonstrating the uses and benefits of life cycle assessment for built environment projects, this book will show you how to assess the environmental performance of your clients' projects, to compare design options across their entire life and to identify opportunities for improving environmental performance.

Note from the publisher: Now in its sixth edition, this bestselling reference focuses on the basic materials and methods used in building construction. Emphasizing common construction systems such as light wood frame, masonry bearing wall, steel frame, and reinforced concrete construction, the new edition includes new information on building materials properties; the latest on "pre-engineered" building components and sustainability issues; and reflects the latest building codes and standards. It also features an expanded series of case studies along with more axonometric detail drawings and revised photographs for a thoroughly illustrated approach.

The collection focuses on the advancements of characterization of minerals, metals, and materials and the applications of characterization results on the processing of these materials. Advanced characterization methods, techniques, and new instruments are emphasized. Areas of interest include, but are not limited to: Novel methods and techniques for characterizing materials across a spectrum of systems and processes., Characterization of mechanical, thermal, electrical, optical, dielectric, magnetic, physical, and other properties of materials., Characterization of structural, morphological, and topographical natures of materials at micro- and nano- scales., Characterization of extraction and processing including process development and analysis., Advances in instrument developments for microstructure analysis and performance evaluation of materials, such as computer tomography (CT), X-ray and neutron diffraction, electron microscopy (SEM, FIB, TEM), and spectroscopy (EDS, WDS, EBSD) techniques., 2D and 3D modelling for materials characterization. The book explores scientific processes to characterize materials using modern technologies, and focuses on the interrelationships and interdependence among processing, structure, properties, and performance of materials. .

This book showcases cutting-edge research papers from the 7th International Conference on Research into Design (ICoRD 2019) – the largest in India in this area – written by eminent researchers from across the world on design processes, technologies, methods and tools, and their impact on innovation, for supporting design for a connected world. The theme of ICoRD'19 has been "Design for a Connected World". While Design traditionally focused on developing products that worked on their own, an emerging trend is to have products with a smart layer that makes them context aware and responsive, individually and collectively, through collaboration with other physical and digital objects with which these are connected. The papers in this volume explore these themes, and their key focus is connectivity: how do products and their development change in a connected world? The volume will be of interest to researchers, professionals and entrepreneurs working in the areas on industrial design, manufacturing, consumer goods, and industrial management who are interested in the use of emerging technologies such as IOT, IIOT, Digital Twins, I4.0 etc. as well as new and emerging methods and tools to design new products, systems and services.

The Life of Structures: Physical Testing covers the proceedings of a seminar of the same name. The said seminar is focused on the actions on structures and the performance of existing populations of structures; the properties and performance of building materials; and the internal and external environments of buildings. The book covers topics such as the methodology for the prediction of the life of existing structures; reliability of service-proven structural systems; and some effects of micro-environment on materials. Also covered are subjects such as the assessment of structures through field measured dynamic response; physical properties of structures investigated by dynamic methods; and the stiffness damage test. The text is recommended for engineers who would like to know more about the strength and lifespan of structures, as well as the effectivity of the materials involved in their construction.

The transition towards renewable energy sources and "green" technologies for energy generation and storage is expected to mitigate the climate emergency in the coming years. However, in many cases, this progress has been hampered by our dependency on critical materials or other resources that are often processed at high environmental burdens. Yet, many studies have shown that environmental and energy issues are strictly interconnected and require a comprehensive understanding of resource management strategies and their implications. Life cycle assessment (LCA) is among the most inclusive analytical techniques to analyze sustainability benefits and trade-offs within complex systems and, in this Special Issue, it is applied to assess the mutual influences of environmental and energy dimensions. The selection of original articles, reviews, and case studies addressed covers some of the main driving applications for energy requirements and greenhouse gas emissions, including power generation, bioenergy, biorefinery, building, and transportation. An insightful perspective on the current topics and technologies, and emerging research needs, is provided. Alone or in combination with integrative methodologies, LCA can be of pivotal importance and constitute the scientific foundation on which a full system understanding can be reached.

This book focuses on the ways in which military installations and small cities can implement and integrate triple net planning and energy, water, and waste sustainability strategies into broad installation operational management, arrive at the best decision, create policy and communicate effectively to stakeholders. It explores current and emerging technologies, methods, and frameworks for energy conservation, efficiency, and renewable energy within the context of triple net zero implementation practice. Recognizing that the challenge extends beyond finding technological solutions to achieve triple net zero outcomes, the contributions also address the need for a systemic view in the planning phase, as well as adequate communication and policy measures and incentives.

This book results from a Special Issue published in *Energies*, entitled "Building Thermal Envelope". Its intent is to identify emerging research areas within the field of building thermal envelope solutions and contribute to the increased use of more energy-efficient solutions in new and refurbished buildings. Its contents are organized in the following sections: Building envelope materials and systems envisaging indoor comfort and energy efficiency; Building thermal and energy modelling and simulation; Lab test procedures and methods of field measurement to assess the performance of materials and building solutions; Smart materials and renewable energy in building envelope; Adaptive and intelligent building envelope; and Integrated building envelope technologies for high performance buildings and cities.

This book addresses the main challenges in implementing the concepts that aim to replace the regular fossil-fuels based energy pattern with the novel energy pattern relying on renewable energy. As the built environment is one major energy consumer, well known and exploited by each community member, the challenges addressing the built environment has to be solved with the consistent contribution of the community inhabitants and its administration. The transition phase, which already is under implementation, is represented by the Nearly Zero Energy Communities (nZEC). From the research topics towards the large scale implementation, the nZEC concept is analyzed in this book, starting with the specific issues of the sustainable built environment, beyond the Nearly Zero Energy Buildings towards a more integrated view on the community (Chapter 1) and followed by various implementation concepts for renewable heating & cooling (Chapter 2), for renewable electrical energy production at community level (Chapter 3) and for sustainable water use and reuse (Chapter 4). As the topic is still new, specific instruments supporting education and training (Chapter 5) are needed, aiming to provide the knowledge that can drive the communities in the near future and is expected to increase the acceptance towards renewable energy implemented at community level. The sub-chapters of this book are the proceedings of the 5th edition of the Conference for Sustainable Energy, during 19-21 October 2017, organized by the R&D Centre Renewable Energy Systems and Recycling, in the R&D Institute of the Transilvania University of Brasov. This event was organized under the patronage of the International Federation for the Science of Machines and Mechanisms (IFTOMM) - the Technical Committee Sustainable Energy Systems, of the European Sustainable Energy Alliance (ESEIA) and of the Romanian Academy of Technical Sciences.

The combined challenges of health, comfort, climate change and energy security cross the boundaries of traditional building disciplines. This authoritative collection, focusing mostly on energy and ventilation, provides the current and next generation of building engineering professionals with what they need to work closely with many disciplines to meet these challenges. A Handbook of Sustainable Building Engineering covers: how to design, engineer and monitor a building in a manner that minimises the emissions of greenhouse gases; how to adapt the environment, fabric and services of existing and new buildings to climate change; how to improve the environment in and around buildings to provide better health, comfort, security and productivity; and provides crucial expertise on monitoring the performance of buildings once they are occupied. The authors explain the principles behind built environment engineering, and offer practical guidance through international case studies.

A guide to building standards of residential architecture.

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) and a DVD (4057 pp) co

Alkali activated bricks offer an alternative to traditional clay fired bricks for use in construction in the developing world. Previous work in this lab focused on creating a robust mix formulation to create these bricks, but they faced high water absorption and were not optimized under pressure molding conditions. The motivation for the work on alkali-activated bricks is based on the claim that they have a lower environmental burden, but this claim has not yet been verified for this formulation. Thus, this thesis focused on the effects of controlled testing of formation pressure and particle size distribution on brick performance and understanding the relative environmental impacts of clay fired bricks and alkali activated bricks. It was found that water absorption and compressive strength have a strong dependence on forming pressure, with 3-day compressive strengths ranging from 7MPa to 27MPa and water absorption from 35% to as high as 60% as forming pressure increased from 5 to 35Mpa. Sieving of the ash used in the bricks to control for particle size distribution had a minimal effect on performance, but the similarity is attributed to the fact that packing density within the selected particle size ranges were similar. Further testing on controlled mixing of particle sizes is needed to see if better performance can be obtained. Life cycle assessment results verify the claim that the bricks perform better from an environmental perspective, but also show the dependence of that performance on variables such as lime content or kiln efficiency.

These books contain articles on R&D into the major aspects of durability and service life prediction of building materials and components, as well as theoretical aspects of methods and modelling of prediction, description of degradation environment by use GIS, as practical implementation of knowledge on durability in maintenance procedures and in standardisation and regulations.

This book contains the refereed proceedings of the 7th International Conference on Exploring Service Science (IESS), held in Bucharest, Romania, in May 2016. Service science constitutes an interdisciplinary approach to systematic innovation in service systems, integrating managerial, social, legal, and engineering aspects to address the theoretical and practical challenges of the service industry and its economy. The 45 full papers and 13 short papers accepted for IESS were selected from 119 submissions. The papers consider the topics service exploration theories and processes; modeling service requirements and management of business processes; value co-creation through knowledge management and user-centric services; service design methodologies and patterns; service innovation and strategy; IT-based service engineering; servitization in sustainable manufacturing; product-service systems; business software services and data-driven service design; web service design and service-oriented agents; IoT and mobile apps for public transport service management; e-health services and medical data interoperability; and service and IT-oriented learning and education systems.

This book provides a scientific framework for integrated solutions to complex energy problems. It adopts a holistic, systems-based approach to demonstrate the potential of an energy systems engineering approach to systematically quantify different options at various levels of complexity (technology, plant, energy supply chain, mega-system). Utilizing modeling, simulation and optimization-based frameworks, along with a number of real-life applications, it focuses on advanced energy systems including energy supply chains, integrated biorefineries, energy planning and scheduling approaches and urban energy systems. Featuring contributions from leading researchers in the field, this work is useful for academics, researchers, industry practitioners in energy systems engineering, and all those who are involved in model-based energy systems.

Life-Cycle and Sustainability of Civil Infrastructure Systems contains the lectures and papers presented at the Third International Symposium on Life-Cycle Civil Engineering (IALCCE 2012) held in one of Vienna's most famous venues, the Hofburg Palace, October 3rd-6th, 2012. This volume consists of a book of extended abstracts (516 pp) and a DVD-ROM

This work discusses the impact of the life of buildings on sustainable development methods. The study of the lifespan of the building is used to assess and manage the environmental impacts associated with all the stages of a product's life, from raw material extraction through to repair, maintenance and 'end of life' scenarios. While several papers have discussed the greenhouse gas emissions of buildings, less research has been done on how these are affected by the lifespan of the building. This book serves to highlight the pertinence of this factor and contributes to providing new ideas on efficiency within the life cycle assessment of a structure.

Historical stone arch bridges are still a major part of the infrastructure in many countries. Although this type of bridge has proven to be an efficient construction type, it often poses the problem of insufficient numerical models of the load bearing behavior. Therefore the book introduces methods to adapt life loads and introduces different types of numerical models of the load resistance respectively. The book continues with the introduction of specific damages and strengthening techniques. The book particularly focuses on the probabilistic safety assessment of historical arch bridges, for which often only limited material and structural data is available.

The adverse environmental impacts from inefficient building construction increase if measures to reduce energy and resource use, through stringent building policies and efficient technology, are not implemented in developed and developing countries. To illustrate a holistic approach to reducing buildings' energy and resources, the comparison of energy efficient and green buildings in terms of their technological aspects and their policy context in developed and developing countries, mainly in Europe, the USA and India, is presented together with a policy package recommendation for Nepal. A quality review of multiple literature sources, supported by various expert opinions, were the methods used for this in-depth analysis. It discusses that mandatory building standards, voluntary labels, information instruments and financial incentives are the most effective combination for the shift towards market transformation, that results in a higher share of energy efficient and green buildings. The lesson such as higher compliance with, and enforcement of, building energy standards can be seen in developed countries (e.g. Germany). Looking at a building's life cycle perspective, it is not sufficient to focus solely on operational energy reduction in higher energy efficient buildings as this is achieved by the increased use of energy intensive materials. Green requirements must be considered in updating building energy standards and labels, particularly for developed countries. Green building certification will also become more effective when the stringency of energy standards is higher and when the whole building life cycle assessment is considered. Due to the increasing scarcity of energy and resources, many developing countries are forced to face up to the need for holistic green buildings. Although baseline standards are not as high as in most developed countries and national financial support is low, the gradual move towards making the standards more stringent and incorporating the wider scope of resource saving are positive developments in developing countries (e.g. India). However, to achieve significant success, strategies must include the establishment of a suitable funding environment, a political commitment and a strong government vision for long term and sustainable building construction. The challenges faced by Nepal are even greater due to the fast pace of urban growth and the absence of energy and resource efficient buildings policies, highlighting the need for an effective policy package. Overall, this dissertation demonstrates how energy efficient and green buildings are interlinked. Green buildings reinforced with higher levels of energy efficiency and energy efficient buildings incorporating green requirements are stepping-stones for achieving greater building energy and resource efficiencies. And a suitable policy package fosters its development. *Nachteilige Umweltwirkungen eines ineffizienten Bausektors nehmen zu, wenn Maßnahmen zur Reduktion des Energie- und Ressourcenbedarfs in Form stringenter Gebäudepolitiken und effizienter Technologie in Industrieländer und Entwicklungsländer nicht umgesetzt werden. Um einen ganzheitlichen Ansatz zur Reduktion des Energie- und Ressourcenbedarfs von Gebäuden abzubilden, werden energieeffiziente und grüne Gebäude hinsichtlich technologischer Aspekte und ihres Politikontextes in Industrie- und Entwicklungsländern verglichen. Die Analysen beziehen sich hauptsächlich auf Europa, die USA und Indien und werden ergänzt um Empfehlungen für ein Maßnahmenpaket für Nepal. Ein Review unterschiedlicher Literaturquellen, unterstützt durch diverse Expertenmeinungen, stellt die methodische Grundlage für diese detaillierte Analyse dar. Es diskutiert dass Bauvorschriften und*

-standards, freiwillige Label, Informationsinstrumente und finanzielle Anreize bilden die effektivste Kombination für die Einleitung einer Markttransformation, die schließlich zu einem höheren Anteil energieeffizienter und grüner Gebäude führt. Gute Beispiele einer höheren Beachtung von Gebäudeenergiestandards und deren Weiterentwicklung existieren in verschiedenen Industrieländern wie Deutschland. Unter Berücksichtigung des Lebenszyklus von Gebäuden ist es nicht ausreichend, nur die Reduktion des Energieverbrauchs in der Nutzungsphase der Gebäude zu beachten, weil diese den Einsatz von Materialien mit hohem Energieverbrauch in der Herstellung bedeuten kann. Grüne Anforderungen müssen in der zukünftigen Entwicklung von Gebäudeenergiestandards und -labels berücksichtigt werden, insbesondere in Industrieländern. Die Zertifizierung grüner Gebäude wird auch effektiver werden, wenn Energiestandards verschärft werden und wenn vollständige Gebäude-Ökobilanzen berücksichtigt werden. Auf Grund steigender Knappheit von Energie und Ressourcen sind viele Entwicklungsländer gezwungen, sich der Notwendigkeit grüner Gebäude zu stellen. Obwohl das Niveau von Mindeststandards unterhalb dessen der meisten entwickelten Ländern liegt und die finanzielle Unterstützung gering ist, sind die schrittweise Verschärfung der Standards und die Einbeziehung der weiteren Perspektive der Ressourcenschonung positive Entwicklungen in Entwicklungsländern wie Indien. Um erfolgreich zu sein, müssen bestehende Strategien umfasst werden, an die Schaffung eines geeigneten Förderrahmens, die politische Bekenntnis und eine starke Regierungsvision für einen langfristigen und nachhaltigen Bausektor. Die Herausforderungen, mit denen Nepal konfrontiert wird, sind noch umfangreicher. Sie resultieren aus einem schnellen urbanen Wachstum und dem Fehlen von energie- und ressourceneffizienten Gebäudepolitiken. Die Erforderlichkeit eines effektiven Maßnahmenpakets für Nepal wird hierdurch unterstrichen. Insgesamt wird hierdurch der Zusammenhang zwischen energieeffizienten und grünen Gebäuden aufgezeigt. Die verstärkte Berücksichtigung von Energieeffizienz in grünen Gebäuden sowie von Nachhaltigkeitsanforderungen in energieeffizienten Gebäuden sind Sprungbretter für die verbesserte Energie- und Ressourceneffizienz von Gebäuden. Eine solche Entwicklung wird durch ein geeignetes Maßnahmenpaket unterstützt.

This book describes the latest advances, innovations, and applications in the field of building design, environmental engineering and sustainability as presented by leading international researchers, engineers, architects and urban planners at the 3rd International Sustainable Buildings Symposium (ISBS), held in Dubai, UAE from 15 to 17 March 2017. It covers highly diverse topics, including smart cities, sustainable building and construction design, sustainable urban planning, infrastructure development, structural resilience under natural hazards, water and waste management, energy efficiency, climate change impacts, life cycle assessment, environmental policies, and strengthening and rehabilitation of structures. The contributions amply demonstrate that sustainable building design is key to protecting and preserving natural resources, economic growth, cultural heritage and public health. The contributions were selected by means of a rigorous peer-review process and highlight many exciting ideas that will spur novel research directions and foster multidisciplinary collaboration among different specialists.

The construction industry is a vibrant and active industry. The building sector is responsible for creating, modifying and improving the living environment of humanity. This volume presents solutions that facilitate and promote the adoption of policies, methods and tools to accelerate the movement towards a global sustainable built environment.

When it comes to architecture, there has been a focus on sustainable buildings and human well-being in the built environment. Buildings should not only be environmentally friendly and sustainable, but dually focused on human health, wellness, and experience. This includes considerations into the quality of buildings, ranging from ventilation to thermal comfort, along with environment considerations such as energy usage and material selection. Specific architectural choices and design for buildings can either contribute to or negatively impact both society and the environment, leading research in the field of architecture to be focused on environmental and societal well-being in accordance with the built environment. The Research Anthology on Environmental and Societal Well-Being Considerations in Buildings and Architecture focuses on how the built environment is being constructed to purposefully enhance societal well-being while also maintaining green standards for environmental sustainability. On one side, this book focuses on the specific building choices that can be made for the purpose of human well-being and the occupants who will utilize the building. On the other side, this book also focuses on environmental sustainability from the standpoint of green buildings and environmental concerns. Together, these topics allow this book to have a holistic view of modern architectural choices and design. This book is essential for architects, IT professionals, engineers, contractors, environmentalists, interior designers, civil planners, regional government officials, construction companies, policymakers, practitioners, researchers, academicians, and students interested in architecture and how it can promote environmental and societal well-being.

This Special Issue contains selected papers from works presented at the 8th EASN–CEAS (European Aeronautics Science Network–Council of European Aerospace Societies) Workshop on Manufacturing for Growth and Innovation, which was held in Glasgow, UK, 4–7 September 2018. About 150 participants contributed to a high-level scientific gathering providing some of the latest research results on the topic, as well as some of the latest relevant technological advancements. Nine interesting articles, which cover a wide range of topics including characterization, analysis and design, as well as numerical simulation, are contained in this Special Issue.

So far in the twenty-first century, there have been many developments in our understanding of materials' behaviour and in their technology and use. This new edition has been expanded to cover recent developments such as the use of glass as a structural material. It also now examines the contribution that material selection makes to sustainable construction practice, considering the availability of raw materials, production, recycling and reuse, which all contribute to the life cycle assessment of structures. As well as being brought up-to-date with current usage and performance standards, each section now also contains an extra chapter on recycling. Covers the following materials: metals concrete ceramics (including bricks and masonry) polymers fibre composites bituminous materials timber glass. This new edition maintains our familiar and accessible format, starting with fundamental principles and continuing with a section on each of the major groups of materials. It gives you a clear and comprehensive perspective on the whole range of materials used in modern construction. A must have for Civil and Structural engineering students, and for students of architecture, surveying or construction on courses which require an understanding of materials.

This open access book presents the proceedings of the 3rd Indo-German Conference on Sustainability in Engineering held at Birla Institute of Technology and Science, Pilani, India, on September 16–17, 2019. Intended to foster the synergies between research and education, the conference is one of the joint activities of the BITS Pilani and TU Braunschweig conducted under the auspices of Indo-German Center for Sustainable Manufacturing, established in 2009. The book is divided into three sections: engineering, education and entrepreneurship, covering a range of topics, such as renewable energy forecasting, design & simulation, Industry 4.0, and soft & intelligent sensors for energy efficiency. It also includes case studies on lean and green manufacturing, and life

cycle analysis of ceramic products, as well as papers on teaching/learning methods based on the use of learning factories to improve students' problem-solving and personal skills. Moreover, the book discusses high-tech ideas to help the large number of unemployed engineering graduates looking for jobs become tech entrepreneurs. Given its broad scope, it will appeal to academics and industry professionals alike.

First Published in 2004. Routledge is an imprint of Taylor & Francis, an informa company.

This Special Issue covers a wide range of areas—including building orientation, service life, use of photocatalytically active structures and PV facades, implications of transportation system, building types (i.e., high rise, multilevel, commercial, residential), life cycle assessment, and structural engineering—that need to be considered in the environmental impact assessment of buildings, and the chapters include case studies across the globe. Consideration of these strategies would help reduce energy and material consumption, environmental emissions, and waste generation associated with all phases of a building's life cycle. Chapter 1 demonstrates that green star concrete exhibits the same structural properties as conventional concrete in Australia. Chapter 2 showed that the use of TiO₂ as a photocatalyst on the surface of construction materials with a suitable stable binding agent, such as aggregates, would enable building walls to absorb NO_x from air. This study found that TiO₂ has the potential to reduce ambient concentrations of NO_x from areas where this pollutant becomes concentrated under solar irradiation. Chapter 3 presents the life cycle assessment of architecturally integrated glass–glass photovoltaics in building facades to find the appropriate material composition for a multicolored PV façade offering improved environmental performance. Chapter 4 shows that urban office buildings lacking appropriate orientation experienced indoor overheating. Chapter 5 details four modeling approaches that were implemented to estimate buildings' response towards load shedding. Chapter 6 covers the life cycle GHG emissions of high-rise residential housing block to discover opportunities for environmental improvement. Chapter 7 discusses an LCA framework that took into account variation in the service life of buildings associated with the use of different types of materials. Chapter 8 presents a useful data mining algorithm to conduct life cycle asset management in residential developments built on transport systems.

This book is the result of a Special Issue published in Applied Sciences entitled "Low Binder Concrete and Mortars". The main aim of this work is to highlight practical approaches that facilitate the production of low binder content concrete and mortar with an acceptable level of technical performance (e.g., mechanical and durability) and environmental impacts (e.g., ecotoxicological and global warming). Its contents are organized in the following sections: Developing Zero-Cement Binder; Ecotoxicological and Chemical Characteristics of the Non-conventional Materials Used to Replace Cement and Natural Aggregates; Reduce the Environmental Impacts and Resources Use of Binders; Modify the Characteristics of the Cement-Based Materials; Low Binder Concrete On-Site Application; Sustainable Cement-Based Materials in Road Engineering.

Compressed stabilized earthen block (CSEB) masonry presents an environmentally and economically sustainable alternative to conventional residential construction materials such as clay brick masonry or concrete masonry (CMU). Earthen masonry is locally sourced and manufactured on site, thus minimizing costs associated with raw material extraction and transportation. Furthermore, CSEB requires very little use of electricity and water during both the manufacture and construction processes and it has excellent thermal resistivity while in use, allowing for additional cost and energy savings during most phases of its life cycle. Analyzing the life cycle trade-offs in a comparative study between CSEB and clay brick masonry supplements the existing recent research on earthen masonry and encourages a wider adoption of the technology around the world. In this study, a comparative Life Cycle Analysis (LCA) is conducted between an exterior residential wall constructed of CSEB and one of clay brick for a proposed single family dwelling on the Winnebago Native American Reservation in Nebraska, USA. The scope of this LCA is narrowed to the impacts associated with choosing one construction material over the other, and the system boundary includes the raw material extraction, manufacturing, and transportation phases of construction. Thermal conductivity is an important aspect of the energy efficiency of a building envelope during the use phase of a building's life cycle. As part of this study, an experimental program was conducted using a modified hotbox apparatus in order to obtain a thermal conductivity value for the CSEB blocks under investigation. After analysis, the thermal conductivity of the CSEB analyzed in this study is determined to be 0.361 W/(m·K) ± 20.0% compared to 1.024 W/(m·K) for clay brick. The three indicators for measuring the environmental or economic impacts of each material in this study are: 1) Energy, measured in kWh, 2) Global Warming Potential (GWP), measured in kg CO₂ eq., and 3) Cost, measured in US Dollars. The results of this Life Cycle analysis indicate that CSEB is the more economic and environmentally sustainable option, with the transportation phase of the life cycle of highest impact on cost.

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