1ST INTERNATIONAL ITINERANT POSTER EXHIBITION

Industrialized Construction

- May 11-13, 2022: ETS de Edificación, Universidad Politécnica de Madrid (**SPAIN**)
- May 18-20, 2022: Università Degli Studi di Catania (**ITALY**)
- May 23-27, 2022: Bialystok University of Technology (**POLAND**)
- May 30-June 1, 2022: Instituto Superior de Engenharia do Porto (**PORTUGAL**)
- TBA: Technical University of Ostrava (**CZECH REPUBLIC**)
- October 24-28, 2022: Instituto Federal de Pernambuco (**BRAZIL)**
- October 24-28, 2022: Instituto Federal de Alagoas (**BRAZIL)**

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A Brief Review at Industrial Construction

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Industrialization and the use of modular components in buildings is one of the best methods of mass production in the construction of housing and urban residential spaces. This method has always been used by humans for thousands of years in primitive housing; So that the age of industrialization in the building can be equated with the antiquity of architecture and the beginning of early construction by humans. This method has reached the best possible shape and quality with the advancement of science and technology in the present age and has caused many advances in mass production of buildings (Ghiasvand 2015). Increasing demand for housing due to population growth, migration to cities and finally the development of urbanization on the one hand and the lack of adequate supply of housing due to the inefficiency of traditional construction methods on the other hand, has made the use of building industrialization in different societies impossible (Hossein Alipour 2010). Today, the development of science and technology has led to the emergence of new technologies in the field of construction (Taqdiri 2013). In fact, for the production of quality, cheap and mass housing, other traditional methods of construction do not meet the current demand of society, so improving the quality of materials, design and implementation methods, speeding up the construction process, competition in technological progress, optimal use Labor force and the use of new manufacturing technologies are among the influential components in this industry (Zahraei 2015).

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A New Sustainable Pu-Gypsum Ceiling Tile for Building Industry

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Gypsum is part of the construction activity since its beginnings. Throughout history it has been updated and industrialised, and today it is a basic material in prefabrication. With this idea, and the challenge of the search for new sustainable materials, the Building Engineering Research Group (GIIE) of the University of Burgos (UBU), has led the LIFE-REPOLYUSE project (REcovery of POLYurethane for reUSE in eco-efficient materials). The project tackles the problem of managing plastic waste such as polyurethane through the use of innovative techniques for reducing and reusing it, integrating it into a new gypsum pre-fabricated tile for registrable ceilings, thus prolonging the useful life of the polyurethane waste.

The implemented technology has allowed to manufacture a new material with similar characteristics to the current commercial standards, improving some technical facets. In addition, the added value of the new product on an environmental level must be taken into account, each new ceiling tile contains 4.9% of recycled material (4.9% of recovered polyurethane waste).

The new material has undergone all the tests required by the sector's regulations to certify its technical viability, and has the CE mark. It also has the Product Environmental Self-Declaration (ADAP) or Eco-Label Type II, which guarantees its sustainable nature.

Compared with conventional tiles, the new gypsum-polyurethane tiles have the best reaction to fire classification according to the Eurocode (A1), maintain their acoustic absorption capacity, reduce their weight (28%) and reduce their thermal conductivity (24%). The last causes a reduction in annual heating and cooling demand of 0,23 kWh/m2 and 0,01 kWh/m2 respectively, improves energy efficiency, in the building as a whole in which they are integrated, by approximately 10% and increases comfort

providing a smaller temperature difference between the outside and inside temperatures of the space in which they are located.

The Life Cycle Assessment (LCA) comparing the LIFE-REPOLYUSE tile with a standard tile, according to the ISO 14.044:2006 Standard, determines that the new product consumes fewer raw materials in its production, saving 25% in water and 32% in gypsum. It also has important improvements in CO2 savings (14%) and less energy expenditure in its manufacturing process (14%) and in its useful life (22%). Besides, the following impact categories are reduced: 9% in the case of soil and water acidification, 9% in eutrophication, 12% in abiotic resource depletion (ADP-elements) and 14% in abiotic resource depletion (ADP-fossil fuels). The category of non-hazardous waste eliminated/disposed of is the category with the greatest difference between the two tiles, as the waste generated by the gypsum-polyurethane tile is reduced by 31%.

The new gypsum-polyurethane tiles have been placed in buildings of different typologies (one is new construction and the other two are refurbishments), with the aim of verifying their construction viability. Monitoring has been carried out at energy and comfort levels, comparing LIFE-REPOLYUSE tile spaces with traditional tile spaces.

The best performance of the product, the profitability of the production and the ecological properties, give the product a real opportunity to be an alternative construction material to the traditional ones.

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Analysis of the Improvement of Adobe Bricks with Addition of Cocos Nuciferas L. Fibers: Molding of the Blocks and Tests

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One of the human activities that has the greatest impact on the environment is construction, because the damage ranges from the extraction of raw materials to the high energy required to process them and the poor disposal of the resulting waste (MARINHO, 2014). One of the alternatives to mitigate these environmental problems is the use of raw soils as an alternative construction medium, with earth as the main raw material (FREIRE, 2003). Within the earthen building technique, there is the clay technique, which is characterized by the fact that it is a brick that is not fired and has some advantages, such as no energy required for production, low water consumption, no need for specialized labor, the raw material can be taken on the spot, which saves transportation costs, and excellent thermal comfort (CORRÊA et al, 2006). However, it also has some disadvantages, such as low mechanical strength. According to Neves (2005), the properties of the soil can be improved by adding other materials, a process called stabilization.

One of these materials are vegetable fibers that allow to reduce the cracks during the drying process of the clay and increase its resistance (BOUTH, 2005). Thus, the objective of this work was to analyze the residues of discarded Cocos nucifera L. and the possibility of their reuse for construction. Families with 0%, 10%, 20%, 30% and 40% fibers of Cocos nucifera L. were used for the tests and the production of the adobe bricks. The percentages converted to mass are 0%; 0.048%; 0.096%; 0.144% and 0.192%, respectively. The fibers were mixed with soil and water was added once the mass was found to be malleable. To produce 10 bricks per family, 72 kg of soil was used, using a 10x12x25 cm mold with manual filling. The 0% family had a large number of cracks and was the only family that showed cracks with greater thickness. In contrast, the families to which fibers were added showed a very significant decrease in cracks in the visible area. In the 10% family, cracks with a thickness of 0.15 mm predominated. In the 20% and 30% families, cracks with a thickness of 0.05 mm predominated. In the 40% family with the highest fiber content, more cracks were observed relative to the amount compared to the other families, indicating that fibers in large amounts can cause loss of cohesion. However, compared to the 0% family, the cracks of the 40% family are still negligible, because in the visual

analysis, the cracks of the 0% family are more likely to affect the physical properties of the clay due to their larger thickness. The family with the addition of fibers amounting to 0.096% (20%) showed greater cohesion. It can be concluded that this percentage has a positive effect on the contraction and expansion of the clay. However, in large quantities, the fibers can cause a loss of cohesion, as in the family with 40% and 0.0192%.

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Automation of the Generation of Structural Design Drawings with Support of Visual Programming Tools

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This work involves the automation of the reinforcement design process of the main structural elements of a reinforced concrete structure in Autodesk Revit platform. Numerical modeling of the structure was carried out in CYPECAD software. The geometric information of the numerical model can be exported using IFC format, while the reinforcement information can only be exported in table format. Thus, the BIM digital model on Autodesk Revit platform can only incorporate geometric information related to foundations, columns, beams, walls and slabs. Otherwise, the automation of the insertion of the reinforcement rebars required the development of a dedicated visual programming tool based on Dynamo software. The algorithm developed in Dynamo imports the reinforcement tables and performs the representation of the reinforcement rebars in the structural elements. This procedure allows a significant reduction in the execution time of the structural design drawings, as well as a notable reduction of the number of errors and omissions.

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BIM - Challenges in the Coordination of Building Projects

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Building construction in the world, and most particularly in Portugal, is still seen as a mainly traditional process with little precision and significant low levels of industrialization. The Architecture, Engineering and Construction (AEC) sector, unlike other industries, presents in most cases, significant levels of inefficiency and waste, partly due to poor information sharing and impaired communication between the various agents involved in the development of the different project phases.

Alternative project management tools and skills are efficient instruments able to contribute to the successful paradigm transition on this industry, providing adaptations to new needs arising from the growing complexity and diversity of projects. Coordinating entities must be able to control all incumbent processes, to certify the respective quality of execution. Using the technology currently available, multiple systems were created allowing integrated information sharing between the participants in the execution of projects. Besides ensuring the success of the projects, these systems enable cost optimization, time reduction and building quality improvement, which, in the end, translate into greater economic viability.

The solution, developed in the recent years, able to integrate the complexity of the AEC sector was Building Information Modelling (BIM), where, in terms of management, three main areas can be identified: Project process management, Information management and Asset management. Considering that the construction industry generally involves large investments with increasingly demanding levels

of complexity, errors and omissions in the development of projects represent significant losses and the implementation of the BIM methodology may be an important factor on their reduction or eventual elimination.

Ensuring an efficient BIM implementation on construction projects depends on the existence of a detailed process plan able to assist and manage the BIM project during its several phases defined by the project participants and in accordance with the accepted BIM standards. The BIM processes of a project, covered by ISO 19650, are related to the importance of its stakeholders, requirements, phases and uses during its life cycle. The process, defined for a given project, must allow its development and adapt to possible changes necessary for the correct delivery of the information it proposes to produce.

The implementation of the appropriate collaborative project management method is therefore necessary to increase the success of BIM implementation among the relevant stakeholders, namely the Owner, the designers, the construction companies and those responsible for facility management.

The current work presents an example of project coordination applying the BIM methodology. To this end, a model was used as a case study, encompassing the three areas of intervention: Architecture, Structure and MEP. It will be shown that project spatial coordination in a BIM environment enables the control of processes by all intervening parties on the several phases of the project considered: preliminary study, base project and execution project.

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Circular Economy System in an Industrialized Jam Production Plant

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The basis of any fruit and vegetable industrial processing is to create a production with as less of waste as possible. Therefore, processing plants are constantly trying to achieve the most efficient production without losing the value of the product.

In the case of jam production, huge amounts of waste might be generated, which can be easily reused or even sold. A circular economy system is a perfect solution for the moment. It is possible due to various types of industrial modernization introduced in a given processing plant, which can significantly reduce the cost of water or electricity. What is important, the circular economy system can be delivered to the plant as a part of industrialized construction. This is especially important in the case of cherry jam production, where cherries are having the biggest share in the Polish market.

The project of the processing plant was worked out by a selection of proper machines and equipment for processing cherry fruit with a capacity of 16t/day during a 90-days season. There was also developed modernization using renewable energy sources in the form of photovoltaic panels allowing to cover the total demand for electricity and a combustion unit to produce system heat while processing the solid waste in form of cherry stones. The building has also developed its water intake, reducing the cost of purchasing water from the water supply system and a recovery of juice section to produce food dye. Moreover, additional installations have been designed as the so-called green roof and an educational path to increase the sustainability of the building and educate the plant visitors.

Annually, the plant saves 3 600 EUR on the purchase of electricity necessary for the operation of the plant. By heating with cherry stones, the plant saved nearly 40 000 EUR per year. Drilling a deep well in the jam production plant made it possible to draw water and use it for washing and blanching the fruit. Seasonally, the jam production plant uses 31,680 m3 of water. After washing the fruit, 4320 m3 of sewage is generated, so it was decided to re-use it by using it like water in the toilet flush. This enabled savings of 2 000 EUR per season. The juice was used to produce a natural food dye. During the season, the plant produced 25,344 liters of cherry juice. After the water was evaporated from the juice, there was 4561.92 kg of raw material left for the production of food dye. The plant producing cherry jam gained PLN 15 000 EUR on the sale of dye. The idea of an educational path may allow for income during the off-season when the plant is not in operation.

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Digitalization in the Construction Industrialized Management

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In construction work, the planning and management processes are fundamental to guarantee its success, making it happen in the initially proposed time, within the planned budget and with the fewest deviations.

The objective aims to ensure that managers can monitor the construction work regarding the achievement of deadlines and budgets, to mitigate or reduce any deviations that may arise due to the occurrence of unforeseen events. This monitoring of the construction is crucial for the sustainability of the companies involved, so it must be done rigorously and with the help of dedicated software. If this software is made available on multiple devices, such as computers and smartphones, then we can guarantee that its users will have access to the project management data from anywhere and without difficulties.

The increase in productivity, costs and project time reduction are some of the main objectives of industrialization in the construction industry. The creation and use of these applications will contribute to industrialization, even if not directly, through digitization, automation and portability of the construction management processes. This contribution will consist in the provisioning of an end-to-end solution for its users, helping them in the process of managing the work in an easy and efficient way, reaching the deadlines and budgets initially planned.

The project under development consists of digitizing the processes of initial construction preparation and construction management, through the decomposition of complex and time-consuming processes into simpler ones. This digitalization involves providing the necessary tools for the planning and management of construction work. Thus, the user will be able to create and manage his team in the system and assign various positions to each one of them, as well as delegate tasks to each team member. In addition, you will also have the possibility to leave observations and feedback during the various activities. To ensure that each user can manage and view the information as they wish, the system will provide the functionality to create personalized reports and dashboards, ensuring this way that each user has the information available in their own way.

As a digital solution, it provides data, in real time, where all users can access and manage their tasks within the scope of their construction projects. Thus, with this provision of information, it will also be possible to have digital signatures, or the consent of authorized parties, allowing with this to ensure that the recipient has read and become aware of the documents or processes involved. However, for relevant documents it will also be possible to print them and/or send them by email to all interested entities.

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Electronic Crane for Visually Impaired People

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In light of the difficulties experienced by visually impaired people when it comes to walking alone through unfamiliar environments, a prototype of a sensory cane was developed in this work. This crane is capable of alerting users to the presence of obstacles on the way through vibration. In the prototype developed there are three motors that work independently, the first two ones have the objective of informing the user about the presence of obstacles and the third one has the objective of notifying about the presence of holes. In addition, the cane can connect to a mobile app, called the Synesthesia Vision app, via Bluetooth and has a button that is responsible for triggering functions in the app. The methodology used consisted of carrying out bibliographic research, developing and testing circuits, assembling the prototype of a sensory cane and carrying out tests of use of the cane in a controlled environment. The review step was carried out by reading scientific articles published on the internet and the other work steps were carried out in the laboratory. During the execution of the project, several circuits were schematized and tested, as well as several artifacts were created through 3D printers to compose the body of the cane. The assembly of the final prototype took place in the laboratory using prototyping boards based on microcontrollers widely available on the market, circuits developed exclusively for the project, distance sensors and vibracall motors. In respect of the health measures required by the pandemic, tests were not carried out with volunteers with visual impairments. However, tests were carried out with team members that proved the functioning and effectiveness of the prototype.

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Evolution of Carbonation Models in Spanish Structural Concrete Standards

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Concrete is one of the most used building materials nowadays because of its speed, economy and durability, but if it is not produced properly, it can deteriorate and no longer performs its function correctly. The pore network consists of a network of canaliculi and capillaries, not always communicating with each other and of varying sizes. The porosity of concrete makes it permeable to liquids and gases, which can allow aggressive elements to reach the steel. The main causes of the destruction of the passive layer of the steel are the decrease of the concrete alkalinity by reaction with acidic substances that can penetrate the concrete reaching the steel and breaking the passive layer.

The high alkalinity of the concrete, which promotes the formation of a film of passivating oxides on the steel, is principally caused by the portlandite formed during the hydration of the anhydrous cement composites and by the sodium and potassium hydroxides present. These substances bring the pH of the aqueous phase contained in the pores of the concrete between 12.6 and 14.

The decrease of alkalinity is due to principally to the reaction of the basic components of the concrete with the acidic components of the atmosphere, (CO2) and (SO2), forming carbonates, sulphates and water. The CO2 molecules penetrate the concrete through the capillary pores which are not saturated with water. This effect can be considered as a pathology, causing damage and reducing the durability and strength of a structure. Concrete deterioration manifests itself in the form of expansion, cracking and loss of coating. Once the concrete is cracked, fractured or spalled, carbon dioxide is allowed to enter, and the carbonation process intensifies. The most common way to determine the carbonate matrix is based on the application of a phenolphthalein ph indicator. This solution allows to recognize three ph zones, one with carbonation, another without carbonation and one between the first two.

The phenomenon of carbonation can be verified in a spontaneous way, but natural carbonation processes are generally very slow because of the low CO2 content of the atmosphere. Therefore, the slowness of the process has led some researchers to carry out accelerated studies.

Observing the evolution of Spanish legislation, we can see that the EHE-98 establishes a procedure for the designer to identify the conditions to which the structure will be subjected, and which may therefore affect its durability. The carbonation model is introduced, for the first time, in the EHE-08 legislation and is subsequently updated in the structural code. In both, there are formulas to determine the starting time of the carbonisation process and the propagation time, estimating the useful life of the reinforced concrete structure affected by this corrosion principle.

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Future-Bearing Technologies (TPF): Virtual Reality and GIS, in the Development of Systems for Risk Management Company and Engineering Services

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Applied research has been increasingly important in the Brazilian and World national scenario. The main objective of applied research is to generate knowledge for practical and immediate application. Failure to invest in applied research represents a loss of market space and innovation capacity, generating competitive disadvantages for all countries. Thinking about this scenario, a good alternative is to co-create and explore complementary skills between organizations, where we can mention the presence of the triple helix, according to Etzkowitz (1996): Government, Institutes of Science and Technology - ICTs/Universities and Companies and in the most current scenario, with the inclusion and participation of representatives of organized civil society, such as professional councils and unions. In addition to the possibility of making a big impact, cooperative work accelerates and delivers better results. This project, entitled “Development of professional skills for risk management and engineering services companies”, was the result of a partnership established between a government funding agency, Fundação de Amparo à Pesquisa e Tecnologia do Estado de Pernambuco (FACEPE), Instituto Federal Institute of Education, Science and Technology of Pernambuco (IFPE) and the International Institute Awakening Vocations, which established the three-month Technological Extension Program, from October to December 2021, with technological action directly in the company. The Project had as its principle the valorization of technical and higher education courses through transversal and practical actions that directly involved the application of technologies bearing the future, worked in the academy, together with the productive sector, more specific, in places where work at heights occurs. and confined spaces, as in civil construction. Its execution is justified for several reasons, among them: Training aligned with market demands; Improved training for employability; Partnerships between companies with teaching and research institutions and Training together with the productive sector; This strategy allowed, for example, that students who learn in the classroom, for example, contents of technical drawing on the computer, use of Arduino, development of sustainable materials for construction, use of audio visual resources, among other activities. In all, there were 10 students from the most diverse areas, such as: Buildings, Mechanical Engineering, Environmental Management, Occupational Safety and others, divided into 3 groups, seeking to develop the technological solution of the Project. Group 1 develop the creation of a platform that optimizes time and enhances control management processes and improving data collection in offline systems and simplifying repetitive steps for work at heights and confined spaces in works. Group 2 creation of a virtual reality game aimed at risk perception in confined spaces, in order to assist in training. Group 3 aimed at creating an application that optimizes the day to day of the civil firefighter within the works, so that it allows the generation of reports even offline, and also a greater monitoring and management control over the execution of activities. Finally, this project

used the Design Thinking approach to identify possible solutions to the challenges presented in each work plan and then the canvas model tool was used to model the project to be executed.

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GECON- Lightweight Geopolymer Concrete Building Material

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The poster will present the physical and mechanical properties of geopolymer concrete with lightweight artificial aggregate. These researches were carried out in the context of the GECON project funded by the Polish Ministry of Education and Science. Students are working on new, more environmentally friendly building materials.

A research experiment, where the influence of the FA-S mixture as part of the pozzolanic additive on the properties of geopolymers was carried out and the most favorable molar concentration of sodium hydroxide solution was determined.

Three variables values of the examined properties of geopolymer concrete were adopted: x_1- the content of pozzolanic additives (FA+FA-S): 200, 400, and 600 kg/m3, x2-amount of FA-S in a total of pozzolanic additives: 0, 50, 100%, x3 - molarity of activator NaOH: (8, 10, 12 mol/dm3). Based on the obtained results of geopolymer lightweight concrete: compressive strength after 28 days, water absorption, dry and saturated density, and thermal conductivity index were carried out. The structural tests used scanning electron microscopy analysis the beneficial effect of impregnating the artificial aggregate with NaOH solution were proved.

As a result of the test, the geopolymer bricks with lightweight aggregate were produced. It could be used for insulating materials and ceilings on the last floor.

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High-Reflective Precast Concrete Pavements as a Lever to Ease Climate Change Impacts

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Albedo or solar reflectivity is a thermal property defined as the ratio of reflected to incident solar energy at the earth's surface. Solar-reflective precast concrete pavements can ameliorate urban heat islands (UHI) and local climate change impacts. Therefore, they are becoming increasingly popular rather than asphalt-paved surfaces. The Summary for Policymakers of the report "Climate Change 2022: Impacts, Adaptation and Vulnerability", approved on 4th April 2022 during the Fifty-sixth Session of the Intergovernmental Panel on Climate Change (IPCC) and Fourteenth Session of Working Group III, assesses the vulnerability of cities and settlements to climate change. It highlights that adaptation efforts are uneven and that some 3.3-3.6 billion people are exposed to environments that are highly vulnerable to climate change. Integrated Development Planning is an approach suggested by the IPCC to manage the climate change impacts, which involves the municipality and its citizens in finding the best technical solutions to reach adequate long-term development. In this context, resilience encompasses a broad range of risk-mitigation strategies, such as the use of high albedo precast concrete, which pursues to respond to vulnerabilities in communities.

The methodology selected in this paper to assess the effect of the increase of albedo in precast concrete is based on a comparison between albedos of several types of precast concrete elements and

asphalt surfaces. The main finding of this study is the potential temperature reduction in the terrestrial surface, corresponding to the removal of 25–75 kgCO2/m2, by using high-reflective precast concrete.

For instance, considering the Spanish highway and freeway network, a yearly reduction of 13-27 million tons of the equivalent carbon dioxide emissions could be reached. Furthermore, concrete is a hundred percent recyclable, and its production requires local resources minimizing greenhouse gas emissions (GHG) emissions from transportation.

Summing up, the regional climate change mitigation will be enhanced by increasing the albedo of the Earth's surface by substituting asphalt pavers with high-reflective precast concrete pavements. Along the same line of reasoning, this study assesses the impact of increasing albedo by replacing asphalt pavements with high-albedo precast concrete pavements. The aim of this investigation is to: a) conduct albedo measurements on several precast concrete pavements, including concrete mix-designs that are not yet available on the market; b) compare the albedo data of some commonly used pavement materials, and c) evaluate the impact on mitigating the climate change resulting in a temperature drop in the pavement by using highly reflective materials. In conclusion, the albedo of the pavements can be increased by substituting asphalt with precast concrete. Accordingly, a positive influence on local climatic change mitigation was achieved.

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Industrialisation as an ally in the energy renovation of buildings

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Industrialization is considered when a construction has been produced under certain control circumstances and using a series of industrial means (qualified personnel, software, machinery, etc.) It has been determined that the greatest advantages of the industrialization of the construction process are obtained when they are implemented from the project phase, since it is at that moment when they can get more benefit from this process. Through industrialization, the training of personnel involved in the process is encouraged constructive, which translates into greater job security for the worker. Controlled and clean industrial environments enable the social inclusion of people with certain disabilities in certain positions that would be unthinkable in traditional construction.

Industrialization requires a greater definition of the project in the design phase, which translates into a reduction in uncertainties in the construction phase. The LEAN methodology allows a progressive increase in quality and an optimization of both human and material resources, as well as a more continuous control by all the agents involved in the work. Reduction and compliance with delivery times and costs: The traceability of the entire process allows deviations in time and cost to be eliminated. On the other hand, industrialization allows the production of some construction elements in the licensing phase. One of the main advantages is the elimination of overproduction. With a well-defined project and implementing industrial processes, waste is minimized, existing protocols and waste recycling processes in the industry. Substrate, atmospheric and acoustic contamination is reduced by reducing the presence on site only to the assembly phase. Water consumption is reduced.

Greater quality control improves energy demand, which translates in the long term into much lower energy consumption and the reduction of CO2 emissions. Industrialization allows us to establish a circular economy system through more sustainable projects where many of the resources used during construction can be reused.

As conclusions add that the industrialization of the process should start from the project phase, moment in which greater benefits are obtained in the project. In addition, the advantages of changing from traditional construction to industrialization are several: greater safety, greater sustainability, greater quality and, above all, the reduction of time in the execution of the work. Also, knowing the advantages of industrializing construction elements and processes is relatively simple, although the scope it has at all levels supposes a change of mentality in technicians, builders and promoters.

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Industrialized Construction in Ostrava

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Old industrial areas have potential and can be an inspiration for other artistic expressions. These spaces are mainly used newly as cultural - social and multifunctional centers. The currently perceived beauty of the industrial patina, imprinted on the buildings by architects and engineers of the 19th and 20th centuries, allows the rebirth of dilapidated factories, smelters, mills, breweries and warehouses. This work points to the current situation in Ostrava in the Czech Republic. The lower area of Vítkovice is a symbolic area of Ostrava, which determines the silhouette of the city. The most iconic buildings that underwent the conversion were the multifunctional Gong Hall, the Bolt Tower Café and Trojhalí Nová Karolina.

The Gong gas tank building from the 1920s has undergone several reconstructions during its existence, the most significant of which is the conversion into a multifunctional auditorium. This is the incorporation of a new building into the original steel structure of the gas tank. The original riveted perimeter structure and floor have been preserved here, which is contrastingly complemented by large glazed areas and exposed concrete structures, underlining the rawness of this industrial building.

The Blast Furnace No. 1 is located near the gas tank. The Bolt Tower café, which was established as a new superstructure, forms one of the three main landmarks of Ostrava, is a part of the blast furnace. The shape of the tower symbolizes the burning fire that burned in the past during the production of iron. Adjacent to the complex from the north side is the former Karolina coke plant, where Trojhalí is located. The buildings are connected underground with a new central space, which serves not only for exhibition purposes, but also as a multifunctional playground. The multifunctional double hall forms a covered square. In all the mentioned cases, traditional and modern building technologies and materials were used. The projects were designed by architect Josef Pleskot and his team, and the above-mentioned reconstruction of the Gong gas tank won the Construction of the Year 2013 award.

The former black coal mine in Landek, which serves as an industrial park in connection with a nature reserve, is the oldest evidence of the settlement of the Ostrava region. This is one of the methods of protection of monument care, specifically conservation. The mine is preserved in its original form, as if the miners had left yesterday. The Michal mine is approached in a similar spirit.

The latest addition to the conversion of industrial buildings is the Municipal Slaughterhouse complex by Robert Koniecze. The architect's vision was to get contemporary art into the city center. Fate was ruthless to the original building, and due to recent events, the building has fallen into disrepair. The new reconstruction design only works with the original perimeter walls.

In the past, Ostrava was an important industrial center. Today, therefore, we have a large number of industrial buildings, which over time lost their importance and it was necessary to deal with their future.

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Industrialized Constructions: Immersion in the maker universe

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The maker culture is known as an extension of the 'Do It Yourself ' philosophy, indicating that anyone, or companies, can build or create their own projects. This movement is possible thanks to the great technological and digital advance in which the world finds itself. The maker universe is in a slight approximation with industrialized constructions, since there is already a high demand for process automation.

One of the machines that are part of the use of this technological wave maker are 3D printers, developed in the 80s, have become more popular in recent years and have been revolutionary. 3D printers create three-dimensional shapes, with modeling formats in CAD(Computer Aided Design).

Bringing applicability to civil construction, it is a technology that few companies use, its use for constructions can be encouraged, since there are few examples in the world, such organizations were quite successful in their respective projects.

We can cite the following cases of industrialized construction using 3D printers: the 3D printer VULCAN, developed by the NGO New Storyand the startup ICON, which is capable of building a house with about 60m² in 12 to 24 hours, using cement; startup Apis Cor, which built a 3D printer capable of building a house in just 24 hours, the latter using concrete, both of North American origin. In China, houses were built with wall modules created by a 3D printer, the material used was a mixture of concrete and fiberglass, it would be possible to build up to 10 houses in less than 24 hours. While in Dubai, it was much further, instead of houses, buildings were built! The construction is around 250m² and took 17 days to print and two days to assemble.

In Brazil, this technology is also used, as is the case with InovaHouse3D, which started at the time with the creation of the 3Dprinter Alya100, considered the first cement 3D printer in Latin America, and 3DHomeConstruction, which completed the first house printed in 3D of Brazil in 2017.

The following advantages of using this technology can be listed: sustainability aimed at reducing costs and waste reduction, generating increased savings, more efficiency, fast delivery time, since it is an automated process, among others. However, like any acquisition for an organization, it also has its disadvantages, such as: the delicate purchase price, since it is not yet a common technology, professional qualification training for the use of technology, specific concrete and a building permit to carry out the projects, as there are still no specific regulations for use.

Taking into account all the successful examples cited and their experiences, it is concluded that the use of 3D printers for the construction sector is a new and very promising alternative path, and for those companies that wish to innovate and follow the advancement of the technological journey, is an investment of great relevance and cost-effectiveness, since by learning from the philosophy that governs the maker universe, organizations will be working themselves on the work that would be outsourced.

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Interior coating based on organic and mineral residues

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Based on historical background, adaptations of the most outstanding techniques have been made to carry out chemical and hydrothermal treatments for protein extraction for different sources derived from large-scale food processing today; of which the adherent properties based mainly on keratin, an organic compound present in animal plumage and fur in concentrations greater than 90%, are used. After knowing the large percentage of proteins contained in these wastes, a procedure has been designed with the purpose of converting them into viscous substances, totally opposed to the original solid state, with this the glue obtained is chromatically identified: beige the paste obtained from the feathers and black syrup obtained from the fur. have been elaborated with these main elements of the investigation four dosages (A, B, C and D), in which the amount and origin of the glue varies as well as the percentage of added pulverized residual mineral aggregates: marble dust (calcareous) and brick powder (ceramic) which are kneaded manually to uniformly integrate each material and form a homogeneous paste that is modeled in standardized molds to proceed to the calculation of its physical properties such as coefficient of absorption of environmental humidity, surface hardness and mechanical resistance. maximum compression and bending stresses.

After analyzing and contrasting the data in the laboratory, it was determined with satisfaction that by using the binding properties of animal protein origin (external structures rich in keratin) in combination with powdered mineral residues, it equals and far exceeds conventional materials used in the construction. Thus, its resistance can be considered for the design of coating mortars, load-bearing panels and blocks for interior divisions in environments whose relative humidity does not exceed 80%. With these scientific evidences, the new utilities attributed to animal and mineral residues are

demonstrated, clearly subtracting the environmental pollution produced by the construction and food industries.

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Learning Strategy for an Approach to Industrialized Construction

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Prefabricated construction, industrialization, and prefabrication differ completely from traditional construction. Designing and building in this field require specific requirements, based on knowledge of the material, both for the manufacture of the parts and for their execution and on-site installation. To this must be added the industrial manufacturing process, which, the more the designer knows about it, the better his work will result in a better product. Based on these basic concepts, a learning strategy has been designed so that the architecture student acquires the necessary skills to be able to design and build dry-joint buildings.

This strategy will be based on the analysis of three models, preferably executed in prefabricated construction, and built mostly with a specific material (wood, steel, concrete) each one of them, and that will be the starting point so that:

- the student investigates the possibilities of each material: its physical and mechanical characteristics and how these affect the selection criteria of the material to be used in the project.
- the student defines the different prefabricated pieces that make up the building (dimensions, modulation, serialization, weight, ease of transport, etc…), as well as their assembly process, and which will be used both in the structural system and in the enclosures and roofing.

All this will give rise to an architectural object, defined down to the last detail, following the steps of industrialized construction. Visits to specialized factories, as well as lectures given by professionals and associations in the sector, together with specific professional experiences shared with the students, will form part of the necessary information that completes the knowledge about industrialized construction, and that finally allows the student to start designing and constructing buildings in this field.

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Mechanical Properties in Specimens of Cement Mortars Reinforced with Polypropylene Fibers Subjected to Various Temperatures

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The evaluation of mechanical properties such as flexural and compressive strength in cement mortar specimens reinforced with polypropylene fibers in different proportions have provided information about their mechanical behavior when exposed to various temperature ranges.

In 2012 Cadvar, conducted research with various types of fibers that were included in cement mortars, with proportions from 0% to 2.0%, exposed to temperatures of 21°C, 100°C, 450°C and 650°C, where he concluded that the specimens exposed to temperature decrease their flexural strength by 88% at 650°C and 55% of the compressive strength at the same temperature.

In the research conducted by Irshidat, Al-Nuaimi and Rabie in which they studied the thermal and mechanical behavior of polypropylene microfibers when exposed to temperatures of 150°C, 200°C, 450°C and 600°C, they found an improvement in the residual compressive strength and thermal conductivity when the fusion point of the fibers was exceeded, results were obtained as an improvement in residual compressive strength and thermal conductivity when exceeding 200°C, also when the fusion point of the fibers is exceeded, they tend to melt, generating voids inside the mortar, affecting its mechanical strength.

Continuing with previous research, we are currently in the process of evaluating the properties of cement mortars made with cement type CEM II/B-L 32.5 R, recommended for the manufacture of plaster mortars, these mortars have been reinforced with polypropylene fibers in proportions of 2 kg/m3, 3 kg/m3 and 4 kg/m3, with a dosage of 1:3:0.6, these specimens are placed in a humid chamber for 28 days, then exposed to room temperature for 3 days, to achieve the natural evaporation of the contained humidity. They are then weighed and exposed to temperatures of 20°C, 50°C, 100°C, 200°C and 300°C, to be cooled in two regimes that are air and water, until reaching an average temperature of 17±2°C, obtaining a first conclusion about the weight of the specimens, being the group of specimens cooled in air regime in which there is more loss of mass, in relation to the group cooled in water, due to the dehydration of Ca(OH)2 there is a reduction in compressive strength, there is a significant reduction in flexural strength from 200°C, and a slight reduction in compression at the same temperature, therefore the behavior for temperatures of 400°C, 500°C and 600°C will be evaluated.

Based on several investigations made on the behavior of cement mortar specimens exposed to different temperatures and comparing their results with those we have obtained so far, we can conclude that there is a relationship between them, determining that when cement mortar specimens are exposed to high temperatures, their mechanical properties of flexural and compressive strength decrease in different percentages, depending on the percentage of polypropylene fiber used in the dosage. Continuing with this line of research, the adhesion behavior of cement mortars reinforced with polypropylene fibers in proportions of 2 kg/m3, 3 kg/m3 and 4 kg/m3 on ceramic materials, which are subjected to various temperatures and with different cooling regimes, will be evaluated.

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Mediterranean CLT Idea

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Mediterranean CLT Idea is a mixed use commercial and residential building within a development area in Valcorrente in the province of Catania, Italy. The building is mainly residential on three floors also comprising garages in the basement and commercial areas on the ground floor. The apartments are designed to host families with different needs and an expected number from two to five occupants. All residences can be visited by disabled people, while a housing on the first floor with a garage below is designed to be fully used by a disabled person. The building is made of simplex apartments except a duplex on the second and third floor, which can be adapted to accommodate up to five inhabitants from the initial three with simple changes in the internal partitions.

Sustainability has shaped the project, also thanks to a dry construction technology. The structure in CLT panels allows an efficient, clean and sustainable worksite. The panels are carefully controlled in dimension and shape in the design phase according to a precise model. The panels are assembled in the worksite, and dry mounted with metal elements (self-drilling screws, Hold-down, plates), without any kind of traditional binder and then saving time, water and energy; flooring, false ceilings, internal cladding and partitions are also dry mounted. The extensive use of timber provides energy advantages (it is a bad thermal conductor and the structure is easier to insulate) and performs well also in regards of acoustic and anti-seismic performance (due to the low specific weight and good flexural strength). Dry construction promotes easy maintenance of the building allowing the substitution of degraded parts and minor interventions on the building system without heavy demolitions. Mediterranean CLT Idea is developed according to a layout which optimizes the room exposure to maximize energy gain, for example by placing the kitchen to the north and the living room to the south. The solar radiation is

controlled by architectural elements (loggias and overhangs), while natural vertical and horizontal ventilation is maximized by the prevailing local winds. A green roof with solar panels contributes for more than 50% to the provision of domestic hot water, while a recycling system conveys rainwater to a tank in the basement. Outside of the building, in the courtyard, native vegetation and a water mirror help to mitigate the microclimate.

The use of traditional whitewashed plaster on the outside of the building heads to a concept of Mediterranean architecture, in harmony with the context, with light surfaces suited to the local climate emphasizing the pure volume of the building lightened by the thin steel cable railings.

The temperate design of the building, deprived of redundant extras, corroborates a traditional idea of Mediterranean frugality and ante litteram sustainability, in praise of the soberness and essentiality of living.

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Open Innovation and its Influence on the Civil Construction Industry

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Incentives and investment in applied research become essential, given the power to directly influence the sustainability and growth of nations. In this sense, we have open innovation, aligned with this sustainable process. Open innovation is understood as based on collaboration, in the search for new ideas, knowledge, technologies and resources with external actors, as presented by Etzkowitz and Leydesdorff (1996), in which we have the participation of: Government, Institutes of Science and Technology - ICTs/ Universities and Companies, in a triple helix configuration. In this sense, as part of open innovation strategies, processes, programs or projects can be created in partnership with researchers, students, startups, suppliers or consultants. The idea is to think together with external actors who will propose solutions. A key point in open innovation is that ownership can be shared with other partners in the research project. In this context, the power of open innovation is very great and, with the use of technological resources, it has expanded even further. Cooperative actions between companies, government and other actors can generate great results, especially if the regulatory environment keeps up with the updating needs. The innovation process brings numerous important connections, generating value to initiatives in the process of creation, seeking to connect institutions to work in partnership and unite efforts, connect knowledge to value generation, connect Science and Technology Institutes and Universities to companies, as well as, connecting social problems to effective solutions, connecting local problems to global solutions. Occupational Health and Safety starts to be inserted in this context of innovation, creating a specific ecosystem, aligned with several sciences and different sectors and economic activities, such as civil construction, which is one of the largest contractors of workers in Brazil. Data from the Ministry of Labor and Welfare shows that, in relation to the number of accidents at work, by registration situation and reason, according to the National Classification of Economic Activities (CNAE), in Brazil - 2018/2020, it was verified that in the construction civil society, had approximately 27,000 work accidents from 2018 to 2020. In this sense, open innovation is one of the primary tools with the direct objective of reducing accidents and their costs. Seeking to promote safe, healthy and productive work, the design of the Innovation Program aims to develop actions that create: Space for the Promotion of Innovation in OSH, Continuing Education, Market Assessment Methodology, Strategic Connections for projects, Attraction of research centers and companies and Development of SST products, processes or services linked to the registration of patents. The creation of this innovation ecosystem has the participation of: researchers, technicians, entities, entrepreneurs, students, professionals and startups, where they meet to exchange experiences. Among the creation of this innovation ecosystem, the implementation of an innovation policy, Innovation Laboratories and Innovation Hubs stand out. In Brazil, we highlight a Federal Governmental Institute of Science and

Technology, focusing on applied Research in Occupational Health and Safety in the creation of these innovation ecosystems.

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Prediction of the Activity Status of Construction Companies Using Machine Learning Techniques

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In this contribution we use multivariate data analysis to predict companies' activity status within the construction sector. Automatic classification methods have been calibrated based on a multivariate data set: the SABI database, which is quite exhaustive in terms of the financial data of Spanish and Portuguese companies, over a time series of several years. In order for the data set to be manageable, the study has been conducted using only companies from the construction sector within the accounting year of 2010 in the Community of Madrid.

We have used meaningful, well-known ratios that have a long-standing tradition within the field of financial statements. The financial ratios on which the proposed study has been based, which have been provided by the database, are the following: return on equity (ROE), return on capital employed (ROCE), return on total assets (ROA), profit margin, capital adequacy ratio, liquidity ratio, financial autonomy ratio, leverage, credit period, and collection period. These rates are usually used to predict the state of solvency and autonomy of companies individually, so that if they exceed certain thresholds, the company can be considered at financial risk.

Our study has shown whether it is better to classify the states of the companies using the ratios individually, or using a classifier based on the entire multivariate data set. To reach this answer, the degree of accuracy obtained has been compared using the thresholds established theoretically for each ratio as a reference, in contrast to calibrated statistical models using different machine learning techniques. Therefore, our trained classifiers improve the ability to predict the state of activity of companies not listed in the database.

In this work, we considered future applications that the statistical prediction models used may have and, consequently, different optimization possibilities have been analyzed in order to improve the success rate obtained, being able to fit a statistical model that meets the requirements in order to be used with high degree of success.

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Proposal of Used Waste from Agri-food to Green Concrete

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An extremely key factor in recent years is to create building materials based on ecology. Any research which is carried out is aimed at keeping or improving the parameters of a newly created product. The assumption is to create light and cheap material to produce with ecological values with simultaneous keeping attractive endurance values. The need to motivate society to use new solutions inspired me to write this work. Caring for our planet forces us to use technology to minimize toxic gases during the use of buildings, as well as to facilitate the recycling process because after demolition is subject to total decomposition and might be used in addition to the soil. To produce composites is unnecessary to use valuable products for the economy, but waste materials, for example, hemp shives which can evaluate into valuable building material. Restrictions of thermal insulations standards created for building may be fulfilled easier using fillers of good thermal conductivity coefficient. Additionally, it makes an

impression that the building breathes, the material is vapor-permeable and optimizes microclimate properly, which creates living conditions.

Hempcrete – concrete based on hemp is not much popular in the world. It has two main production streams, a poured mix with tamps and as blocks made in moulds. In this research, all parameters and description of observations about concrete with granules and hemp shives were described. Many concerns about material's durability result in resignation from huge interests, but if you explore the subject and summarize positive aspects, it may turn out that the material is very disregarded. This work consists of sequentially carried out research with composites of hemp granules and shives. The purpose of the work is to determine the optional composition of the mixture of the used plasticizer or bituminous emulsion. The scope of work includes a literature review taking into account all information about this technology, research methodology, development of the experiment, analysis, and conclusions.

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Remote Inspection of Reinforced Concrete Structures Using Artificial Intelligence

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Digitizing information from inspections of reinforced concrete structures is still, in many situations, a challenge for inspectors. Currently, new technological means of remote inspection are available, particularly the use of Unmanned Aerial Vehicles (UAVs) and advanced video systems. In addition, new techniques based on Artificial Intelligence (AI) have enabled the automatic and efficient identification of structural anomalies. This poster describes the development of an efficient methodology for identifying cracks in reinforced concrete structures using UAVs and image processing with the support of AI techniques. The methodology enables the detection and dimensional characterization of cracks, namely their development and opening, using a technique that uses Region Convolutional Neural Networks (R-CNN) and dedicated algorithms, both developed in Matlab®. The neural network was based on an extensive database, with about 86,000 images, and presented a reliability index close to 99%. The validation of the methodology was performed through field tests, under controlled conditions, involving the positioning of targets in structures with marked cracks and of previously known dimensions. A remote inspection of the exterior facade of a building on ISEP campus was also carried out, where it was possible to identify several cracks with dimensions that reached 0.3 mm. The digital information collected will serve as a basis for more efficient planning of infrastructure maintenance operations, including repair or strengthening works.

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Reutilization of Tires in the Construction of Retaining Walls and Cisterns in the Agreste of Pernambuco

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Along with the great industrial revolutions comes the production of solid waste, which - in the course of both the production process and the stage of its degradation - heavily affects the environment. At first, it is necessary to question human actions in order to reduce the environmental impact and, afterwards, the execution of these actions that effectively collaborate with waste management. From this point of view, with the availability of the solid waste in question (tire), two applications were

formulated in the area of civil construction, as one of the several possibilities for a new direction for what would become waste, besides the reduction of the disturbance generated to public health, as in the case of diseases caused by the Aedes Aegypti mosquito. Thus, it was idealized the construction of a retaining wall and the elaboration of a cistern project as another option to adequately dispose of the tires in the Agreste of Pernambuco, with the unserviceable tire being the element responsible for the soil containment in both structures.

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Requirement for Redundancy and Robustness in Building Structures

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After incidents on buildings caused by explosions due to gas, vehicle impact, bombing, etc, the prevention of the progressive collapse of the structure, which my follow some localised damage at the source of the incident, became one of the imperatives in structural engineering. For the fulfilment of the above-mentioned conditions there are several codes, European standards, such as the Eurocodes, and guidelines, which help the engineer in his work.

As regard to the precast concrete structures less design information is available than the cast in-situ buildings, but the structural integrity and redundancy, known as robustness, is a characteristic that deal with how the elements interact and perform. The main step in structural integrity in precast concrete structures is through tying systems in the transverse, longitudinal and vertical direction. The ties interconnect all individual elements, providing stability to the structure and forming redundant load paths. There are several methods to reduce the potential for accidental actions and/or to reduce the effect thereof, and these methods are complementary to different design approaches, defined by Eurocode EN 1991-1-7. The design approaches are:

- Indirect design approach/ tied force approach. The tying system assumes that through a structural system of ties, a precast structure will better prevent the spread of local damage, facilitating alternative load path and increase robustness, after accidental actions. The system includes both horizontal and vertical ties and must be effectively continuous around or across a building.
- Alternative load path approach. This method involves the removal of a critical element from the structure while ignoring all other damage that results from this removal. It is only applicable if the region of the locally damage is failure of a structural element in a limited area, to enable the remaining structure to find a new equilibrium.
- The extent of the primary local damage depends on the accidental action, but also on the type of building and the structural system. Specific load resistance method/ key element approach. The designer explicitly designs critical vertical load bearing building components to resist the accidental action.

About the analysis of notionally removal of a load bearing unit, it is necessary to verify that the remaining structure can redistribute the loads and that the local damage does not have disproportionate consequences. The most common mechanisms that can be used to provide alternative load path in skeletal multi-storey precast concrete structures are: bearing mechanisms: bridging of the damage area by catenary action of the ties reinforcement in the floor beams; cantilever action of the surrounding structure, for example in case of failure of a corner column: the horizontal tie reinforcement on top of the floor beam can function as cantilever reinforcement; suspension of the vertical elements to the intact upper structure above the damage area: this is realised by vertical ties from foundation to roof level in all columns and walls.

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Study and Development of Evaporative Cooler, by Spraying, Equipped with Innovative Atomizing Device and Classic and Linear Quadratic Gaussean Controllers (LQG)

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The aim of this research is to develop technologies in the field of mechanics and automation and to disseminate them through scientific articles and other technological events. Evaporative cooling is a natural process that consists in lowering the air temperature and increasing the relative humidity through simultaneous mechanisms of heat and mass transfer between air and water. Despite its simplicity and low cost of purchase and operation, the temperature reduction achieved in the evaporative cooler can be significant depending on the variation of relative humidity between the inlet and outlet of the cooler, which can be of great benefit in regions with hot and cold climates. Dry, as in the Brazilian semi-arid region. The proposed prototype presents some changes compared to commercial models, as it is equipped with an atomization device that breaks up the water droplets to form a thinner spray layer. This innovation is only possible because the prototype does not have a coil that comes into direct contact with the air during spraying. Another innovation is the introduction of automatic control systems aimed at making fewer mistakes and optimizing energy consumption. This work presents theoretical and practical approaches for the evaporative cooler. Here, the mathematical modeling of the new model of the evaporative cooler with water atomization using the atomizer component is carried out by the technique of identification of the experimental model, the identification black box, to compensate for both the variations of air temperature and humidity. Also, a control system with classical controllers and an optimal controller of linear quadratic Gaussian (LQG) type is designed. The responses of the systems and the energy consumption are also analyzed and compared when subjected to each controller. The work opens the way for studies on the use of the waste heat of the system and for the creation of hybrid systems.

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Study of Hand-Arm Vibrations Produced by the Use of Hammer Drills

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In the construction sector, activities are carried out on a daily basis in which tools and machines are handled that pose a risk to workers due to the transmission of vibrations. This energy is absorbed, producing various effects that influence health by causing deformations and tensions with a high probability of wear and tear that disturb the quality of work, concentration levels, organ fatigue or damage to cellular structures that lead to occupational injuries.

In order to study the consequences of the risk of vibration on workers, international standards classify vibrations into two types: whole-body vibrations and hand-arm vibrations. In order to assess the risk of exposure to vibrations, it is necessary to know their frequency, the acceleration with respect to the reference axes and the exposure time. The acceleration value can be obtained in two ways: firstly, by using the values provided by the equipment manufacturers or published in existing databases; secondly, an acceleration measurement can be made on the operator at his workstation by estimating the exposure time. The frequency indicates the number of times the object vibrates per second. In the hand-arm system, frequencies between 6.3 and 1250 Hz are transmitted by the use of tools with percussion, being low (between 1-20 Hz) or high frequencies (20-1250 Hz).

Prolonged use of the tool causes various disorders that can affect the blood circulation, nerves, bones, joints, muscles and connective tissues of the hand and forearm, which are referred to as Hand-Arm Vibration Syndrome (HAVS). Workers in industries with vibration exposures such as construction, agriculture, welding or forestry are often associated with HAV. This type of injury depends on several factors including mainly the intensity and duration of the vibration exposure, the type of work performed and the tool used.

This research will study the possible risks of hand-arm vibration when using electric-powered hammer drills. The study variables used are the hammer drill, the physiognomy of the worker using it, the type of material being worked on and the diameter of the drill bit used.

The results obtained allow us to compare the maximum acceleration values indicated by the manufacturer of the hammer drill with data obtained experimentally. Also, issue recommendations to reduce the risks to the forearms, arms and hands by contrasting the source and the means of propagation. At the same time, examine the necessary precautions to be taken by the worker and the employer in the construction industry.

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Sustainable Solutions in University Buildings

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By using ecological materials, such as lime-hemp composite (hempcrete), the construction industry reduces the emission of greenhouse gases emitted during the production of artificial materials such as sandwich panels or polystyrene used in the construction of buildings. By equipping a building with electricity and heat sources such as photovoltaic panels or a heat pump, energy self-sufficiency can be achieved, moreover, a well-chosen installation can pay for itself in a relatively short period and bring profits, so the benefits are not only environmental but also economic.

The energy-efficient University laboratory building described in the poster shows the demand for heating in the months of November-February, in the remaining months, the internal heat gains and gains from insolation exceed the heat losses in the building. The heat pump is the heat source in the building, and the hot water is the pellet boiler. The photovoltaic installation satisfies the energy needs for lighting, this investment pays back financially in a relatively short time and brings benefits. The use of rainwater to flush the toilet reduces the consumption of water resources from the water supply, and the home sewage treatment plant allows the use of treated water for irrigation of lawns.

The design calculations for the University building show that renewable energy sources can satisfy 100% of the energy demand for lighting and 100% of the electricity demand of the heat pump.

The use of lime-hemp composite as a wall-filling, compared to other technologies for the construction of partitions, such as sandwich panels, is a more expensive technology, but the advantage of hempcrete is a positive ecological aspect. In addition, walls made of hempcrete are non-flammable and have a very low thermal conductivity coefficient of approx. 0.2 kW/mK, which makes them a good heat insulator in the building.

Pro-ecological solutions, in addition to the environmental aspect, bring economic benefits, and their use contributes to environmental protection not only locally, but also globally.

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“The History is Just One that the Rivers Know How to Tell”: The Landfills of the Capibaribe River and their Environmental Impacts on Recife (1837-1950)

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This paper analyzes the social and environmental history of the Capibaribe River, observing the landscape and urban buildings as a historical source. Reading these records, as well as the historiography, allows us to conceive the landscape of Capibaribe as inherent to the development of the city of Recife/Pernambuco (Brazil). With the intensification of urbanization in the 19th century, the natural landscape was modified; therefore, we aim to demonstrate such changes.

The methods of Social and Environmental History imply thinking about the totality. We start from the river as an element that connects stories. Therefore, we use abundant bibliographic materials, as well as cartographic ones. We consulted and analyzed the collection of historical maps of the city of Recife that are part of the Pernambuco Topographic Laboratory.

From the 19th century onwards, the city of Recife was eminently marked by changes in its landscape. It was possible, through the opening of ports to friendly nations, in 1808, including Brazil in the international trade circuit, breaking the commercial monopoly with Portugal (MELO, 2007, p. 02). The development of the city originated in the port. With the economic performance in the 17th century, due to the production of sugar cane, the rivers and mangroves of Recife helped with the operation of preparation and implementation of urbanization (BEZERRA, 2014, p. 03). At the end of the 19th century, the implementation of urban constructions would continue, but they did not favor the poorest, who were expelled to make room for numerous landfills in areas close to the river, in order to modernize the city, which was then undergoing major transformations. The modification of the landscape, symbolized by the Capibaribe River and the mangroves, is clearly marked by the filling of the floodplains and mangroves to obtain an increase in land. They had to undergo soil alteration techniques resulting from engineering techniques that neglected future environmental and social damage. Such changes that were taking place developed the city, but in a disorderly way. In the course of urban development, Capibaribe begins to be used as a receptacle for excrement because there are no sewage systems. Industries were pioneers in promoting water pollution, since the implementation of sugar cane plants in the late 19th century (BEZERRA, 2014, p 05).

Reading the bibliography and cartographic material about Recife and Capibaribe allowed us to verify the impacts of urban buildings from the perspective of environmental history. This means affirming that, from Rio and its banks, one can access the urban and social history of the city of Recife. Finally, it was found that the landscape of Recife intensified exclusions in the name of what was considered progress and modernity.

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The Impact of Carbon-Based Gypsum Nanocomposites

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The world is currently facing a socio-ecological and political emergency. The rise in nearby conflicts, energy consumption, climate change, energy crisis and the COVID-19 pandemic have motivated the scientific community to seek for efficient alternatives that may offer the opportunity to build new homes that can meet our current challenges and needs. Furthermore, the strong economic revival experienced in 2021 resulted in an unprecedented rise in the prices of Gas, oil & coal (+290%, +50% and +47%, respectively), thus, exacerbating energy poverty worldwide. To face this, gypsum-based components ($CaSO4{\cdot}2H2O$) have shown great promise in this area. By itself, gypsum possesses many attractive qualities, such as, fire prevention, abundant availability, recyclability and low cost. However, it also has a very low resistance to water and exteriors. Although several studies have implemented the use of materials such as, carbon fibers, polymers, lime, wastes, slags and even clays, few of them have obtained an overperforming composite capable of satisfying current market needs. To our best knowledge, there are only a few studies focused on the impact that nanosystems, such as Graphene nanofibers (GNFs), can have in gypsum binders. This work presents a production strategy for gypsum-based tailored composites that include the benefits of GNF's. In order to do this, the appropriate water/gypsum ratio was determined, afterwards, specimens where prepared in triple 40x40x160 mm3 molds, adding up to 1% of GNF's to the mixture, and seven days later they were tested. All tests were performed in the building materials laboratory belonging to the Escuela Técnica Superior de Edificación (ETSEM) of the Technical University of Madrid (UPM). The final product presents a grayish coloration, with steady increases in thermal conductivity (λ) up to 68% when introducing low percentages of GNFs in the mixture (figure 1). In contrast, as concentration increases, a strong reduction in λ values by more than 41% was observed due to the effects of phonon scattering. Early findings

indicate that introducing nanoparticles in gypsum binders promotes the emergence of more realiable tailored building materials capable of meeting current market requirements, reducing energy consumption, acting as a carbon capturing structure, providing electromagnetic shields or even play a part in structural health or building monitoring.

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The Implementation of Industrialization in the Construction Sector as a Reality

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The construction market is characterized by a natural diversity that obeys the variety of individuals. It is, therefore, a heterogeneous market with constant changes over time, in which companies can choose to specialize in a single product or, on the contrary, propose different personalized products. A few years ago, it was not feasible to think about the incorporation of the construction sector in the industry, understanding as such the realization of serial products or chain production. Nowadays the trend is the opposite, construction comes hand in hand with industrialization, which is not only applied to materials or construction systems, but also to the entire building process.

This trend, already very advanced in the United States, is becoming important in Spain. The industrialized building allows personalization, constructive speed, efficiency and a significant increase in quality due to the strict controls to which the manufacturing processes in the industrial plant are subject. In this sense, Feigenbaum indicated in his work Total Quality Control the importance of the involvement of all the actors involved in a process to obtain quality, based on offering the best service and price for clients. In construction, this translates into an integration of the different phases that compose it (project phase and construction phase) that, in general, are not coordinated within the same quality system.

The industrialization also facilitates the organization, planning and programming of a constructive process. The organization, because the supplies, auxiliary resources and waste are reduced, resulting in the most orderly and safe work; the planning, because the measurements, the times, the labor inside the work, materials, rents, etc. are also reduced; and the programming, because it improves in the yields, the follow-up of work and even the economic control.

All this makes, therefore, that the industrialization of construction is the protagonist of an increase in quality, as it not only helps the integration of all phases and their control, but also participates in the development of new products and systems that suppose a continuous improvement in the building process.

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The Importance of Industrialization in University Teaching: Real Constructive Solutions and Current Needs

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Industrialized construction is a system that automatically elaborates the elements that make up the construction system of a building. In other words, mass production of each part of a whole, in order to guarantee performance and speed up processes, taking advantage of the great technological advances. The university instructs students to be able to understand these systems and work with them by making

architectural designs that propose industrialized solutions to real problems. Within the subject Building Construction Design-Prototypes of the Degree in Architecture of the Universidad San Pablo-CEU (Madrid), works are carried out with industrialized construction systems made of concrete, steel, and wood.

The work presented is a COVID Pavilion that must respond to initial basic medical care through a simple program of uses: entrance, waiting room, medical room, laboratory, office, warehouse, toilet, terrace... Its technical development responds to the basic concepts of constructive industrialization. Fifth-grade student, María Alonso Martínez, has developed a COVID Pavilion located in the university campus, near the parking area.

The main strategy is based on three volumes that are placed one next the other turning itself around the idea of a central patio/green area that is related to all the volumes in a visual way. In addition, each main material (mandatory use in this work) is placed in a different orientation, thus enhancing its main qualities. The use of concrete as a heavy and dense material is placed on the north façade (coldest side), while wood, which is lighter, is placed on the south façade. The medical room, storage and offices are located on the concrete area, where the openings are smaller. They have a north orientation but also views of the inner patio. The use of wood in the entrance and the waiting room allows people to feel comfortable due to its warmth. The facades of these two volumes are made up of VIROC panels (which give an appearance of heaviness in the concrete module) and translucent areas in contact with the wood. In the middle area, steel is used as a junction joint, which allows simple unions between the other two materials and even facilitates an extension of the pavilion (if necessary). This proposal works as an experimental pavilion.

The approach to constructive development through industrialization techniques is outstanding. Many aspects that are the hallmarks of these systems are exhaustively developed: the approach of the assembly processes, the modulation, the series, the characteristics of the materials, their properties and the justification for their use, the quantification of parts, the systems of anchoring and joining of elements… Finally, the technical development presented responds to the basic concepts of constructive industrialization based on the approach of a real and necessary architectural project.

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Waste Generated Industrialized Construction Vs On Site Construction

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The theme chosen is the difference between the waste generated by industrial construction work and the waste generated by on-site construction work. The main differences:

- In on-site construction works, 75% of the waste consists mainly of concrete remains and crushed material. The remaining 25% consists of a heterogeneous mixture of wastes
- In construction site works, these wastes are divided into eight easily distinguishable groups: Concrete and Clean Construction Waste, Brick, Tile, Ceramic, Metal, Wood, Glass, Plastic, Paper and Cardboard. This classification must be taken into account when disposing of waste in order to achieve proper waste management.
- Industrial companies generate a smaller amount of waste, and when it is generated, it is in the factory itself, so it is usually collected for later treatment (many companies in the sector manage to absorb almost 100% of internally generated waste).
- Since the materials are produced in an environment protected from adverse environmental conditions, their useful life is longer than in the case of on-site work.

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