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Binishells Construction Technology

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ABSTRACT: This paper aims to review Dante Bini's career, as well as his form-resistant Binishell and other pneumatic construction systems. The role of Mario Salvadori in Bini's international success works as the introduction to a broader discussion about the relationship between innovation in design and innovation in construction for shell and gridshell designers. The second part of the paper focuses, instead, on Bini's double profile—architect and builder—which led him to develop his inventions both architecturally and as commercial products.

Shells are lightweight, span long distances with minimum use of materials, provide thermal mass and are proved to have

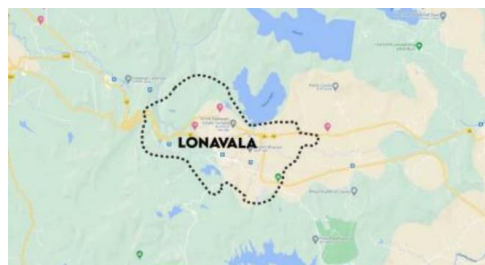
a very long design life. In an industry where sustainability has become paramount, and where architecture tends towards

dynamic and fluid forms, it is imperative for the engineer to reconsider shells during the design process. The paper illustrates the latest developments in construction techniques and material sciences adopted by the modern shell builders.

I. INTRODUCTION

In July 1964, Italian Architect Dante Bini (1932–) successfully constructed (in three hours) a 12 metre diameter, 6 metre high hemispherical reinforced concrete shell structure (Fig. 01) on the outskirts of Bologna. Bini had tested (for the first time) his unique system of inflated fabric formwork to lift and shape the concrete. Bini had been inspired by the concrete shell structures of Pier Luigi Nervi, but was simultaneously frustrated by the expense, time and material wastage associated with the timber formwork necessary to construct such forms. By using a low-pressure inflatable membrane (which Bini entitled pneumoform) to both lift and form the concrete, Bini managed to entirely obviate the need for timber formwork. The 1964 prototype subsequently became the Binishell, a patented technology licensed across the

SITE LOCATION : LONAVALA , PLOT NO – 123

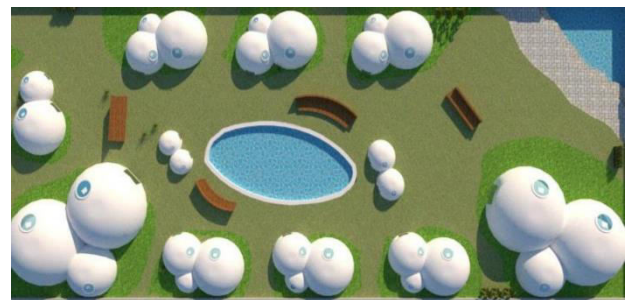
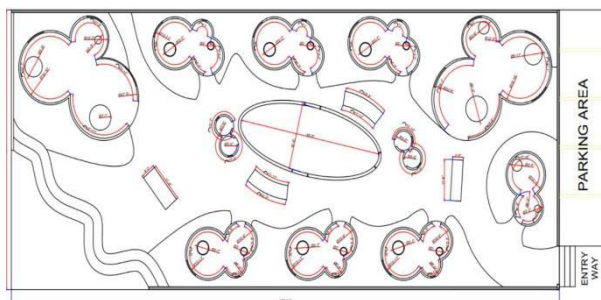


PLOT AREA – 20,000 SQ FT AREA
PROPERTY TYPE – COMMERCIAL
BUILDING TYPE – LAND
LOCALITY – LONAVALA
PRICE - 60 L
FACING – NORTH- EAST

Introducing a Dreamland in Lonavala For Tourism : A Magnificent Plot of 20,000 Square Feet, priced at 60 Lac Are you craving to build a home or invest in a picturesque land situated in the heart of Lonavala, Pune.

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8. Rejuvenate with the fresh air as you unwind in solitude, away from the chaos of the you're a food enthusiast or love exploring culinary delights, this plots proximity to popular restaurants adds to the charm.
9. Savor the finest flavors this little town has to offer without traveling far from the comfort of your new abode.
10. Rest assured, the plot is secure and offers a safe environment, allowing you to build your dream home with complete peace of mind.
11. Utilize the plot to its fullest potential by envisioning a stunning villa or a tranquil retreat that caters specifically to your needs and you seek a calm home away from the city or wish to surprise yourself with a great investment, this plot is a rare gem that guarantees both.
12. Located in the coveted town of Lonavala, it offers the perfect balance between tranquility and easy access to urban necessities.

PROPOSED PLAN AND 3D VIEWS



II. LITERATURE REVIEW

Andrea Menardo (2007) is an architect and Senior Lecturer in Architectural Design at the Faculty of Architecture, Building and Planning at The University of Melbourne (Australia). He is a co-director of the Advanced Digital Design + Fabrication (ADD+F) Research Hub and a founding member of the Bioinspiration Hallmark Research Initiative. Alberto has a PhD in architecture and building design and an MSc in architecture and construction. In 2007, he won the IASS HANGAI Prize, an international competition for research papers related to the field of shell and spatial structures for young researchers under 30. In 2023, he received the IASS Tsuboi Award for the most meritorious paper published in the Journal of the IASS in the preceding calendar year.

Alberto Pugnale (2023) from The University of Melbourne will join us to talk about the book he co-authored; Architecture beyond the Cupola- Inventions and Designs of Dante Bini 2023. The book provides the first comprehensive overview on Dante Bini's work and thoroughly explores Bini's pneumatic constructions and the form-resistant Binishell through the decades. In this talk Alberto will present the original archival material and the extensive representations of Bini's projects and constructions gathered in the book.

Matt Devine (1975) is a registered architect who has worked across a wide spectrum of architecture and heritage conservation in Sydney. He was part of the curatorial team for the State Library of NSW exhibition Imagine a City: 200 years of Public Architecture in NSW focusing on the 200 year history of the NSW Government Architect's Office. He works as a Senior Strategic Planner at the City of Sydney and teaches heritage conservation at the University of Sydney.

Mario Salvadori's Passion for Form-Resistant Structures Why Buildings Stand Up: The Strength of Architecture (1980) has become a paradigm, at least within the United States, of how to explain even the most complex notions of structures in simple terms for non-specialists. Such high-level popular science is also useful for students and professionals of architecture, and these are also among its many readers. The book, which does not include formulae, illustrates mechanical behavior and properties of materials as well as construction typologies and buildings that symbolise structural innovation by means of drawings and diagrams, the work of Saralinda Hooker and Christopher Ragus. As Salvadori says, he narrates his personal history of architecture, which he views through the evolution of structural systems or configurations, and the works of designers of greater and lesser renown.

Earlier, in 1963, Salvadori had tried to carry out this scientific and cultural work with co-author Robert Heller, in Structure in Architecture. This was destined for those “who love beautiful buildings and would like to know why they stand up”, but also for those “who dream of designing beautiful buildings and would like them to stand up”, and finally for those “who have designed beautiful buildings and would like to know why they stood up” (Salvadori 1963: Preface). Here too there are no mathematical formulae, and although the explanation of structural types does not yet succeed in distancing itself from a narration and graphic language that is characteristic of engineering, it manages to outline a historiographical trajectory that juxtaposes similar structural types of structures and traces an evolution in terms of statics and construction.

III. METHODOLOGY

Foundation

A reinforced concrete ring beam is built on the ground to act as a strip foundation (in the permanent case) and as a counterweight during the lifting procedure. A nylon reinforced neoprene membrane, cut in a spherical shape and concentrically folded on the ground, is fixed to the ring beam.

Reinforcement

The most time-consuming part of the process is the laying of the reinforcement bars. The pattern is a concentric arrangement of steel springs, fixed to the ring beam at diametrically opposed points. Traditional steel bars are inserted inside the springs, the bars fixed only to one side of the ring beam and allowed to slide in proximity to the pole, where they are overlapped with the diametrically opposite bars

Concreting

The whole concrete volume needed for the shell is poured flat on the ground, over the folded membrane and the steel rebar. Generally a thicker layer is deposited in the centre of the circle, progressively thinner towards the ring beam: this compensates for the gravity effect which drags the wet concrete down during the lifting procedure. Retarders and plasticizers are added to the mix to keep the concrete fluid for a few hours during the lifting.

Lifting procedure

A second, external, neoprene membrane is put on top of the fresh concrete. This serves three purposes:

1. It contains the fluid concrete during the lifting procedure;
2. It forms a slippery surface over which to run plate vibrators;
3. It forms an external waterproofing layer in the permanent scenario, if desired.



IV. ADVANTAGES OF IRON MAN HOUSE

- **State-of-the-Art Technology:** Stark's mansion is equipped with cutting-edge technology, including J.A.R.V.I.S. (Just A Rather Very Intelligent System), which assists him in various tasks.
- **Security:** The mansion features advanced security systems and is equipped with Iron Man suits, providing a high level of protection.
- **Luxury and Comfort:** It's a sprawling, luxurious estate with stunning architecture, extensive amenities, and a beautiful view of the Pacific Ocean.
- **Workshop and Lab:** Stark has a fully-equipped workshop and lab to create and work on his suits and inventions.
- **Remote Location:** The mansion's remote location offers privacy and seclusion.

V. DISADVANTAGES OF IRON MAN HOUSE

- The structure's design allows for efficient use of materials, reduced waste, and energy-efficient buildings.
- can provide a cost-effective solution for affordable housing projects
- due to curved shape and reinforced concrete, offers excellent resistance to natural disasters such as earthquakes, hurricanes, and tsunamis.
- It can be used for commercial structures, recreation centers, schools, healthcare facilities, and other public infrastructure.
- This can include automation of systems for energy management, climate control, and security.

VI. FUTURE SCOPE

- The structure's design allows for efficient use of materials, reduced waste, and energy-efficient buildings.
- can provide a cost-effective solution for affordable housing projects
- due to curved shape and reinforced concrete, offers excellent resistance to natural disasters such as earthquakes, hurricanes, and tsunamis.
- It can be used for commercial structures, recreation centers, schools, healthcare facilities, and other public infrastructure.
- This can include automation of systems for energy management, climate control, and security.



VII. CONCLUSIONS

Modern construction techniques have simplified and possibly resolved one of the historical downsides of reinforced concrete shells – labour-intensive construction. Until recently this has detracted from geometrical freedom, limiting the use of air forms to construct semi-spherical domes. It has been shown, though, how both Binishells and Dome Technology are currently adding architectural flair and environmental credentials to their portfolio and it is hoped that this will trigger a rediscovery of shells by both architects and engineers.

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