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## 9 Appendix


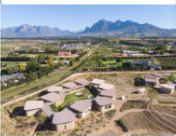

Architect	Project	Images & Diagrams	Year of Completion	Location	General Project Description	Emerging building technology			Mode of production		Developmental status		Value	List of References						
						Building material (I)	Construction process (II)	Structural system (III)	Low-tech (traditional or hand-based)	High-tech (industrialised)	Under-developed	Developed								
1	BuildCollective and S2arch	Ithuba Community College		2009	Ekurhuleni, Gauteng	A skills college where local participation takes place during the design and construction phases. A light-clay infill system was developed and used to construct the building. It is a platform for architecture and construction research, making use of local resources and community involvement to develop alternative building techniques.	Compacted straw and light clay as infill mixed with minimum amounts of cement.	Unskilled craftsmen actively involved by mixing the straw and clay on site manually and then inserting it into the steel frame on site.	An Adobe wall with straw-light-clay infill, load bearing wall.	Traditional hand-based methods of construction. Adobe wall infill it is done by hand and basic mixing machinery on site.	Unskilled labour and low tech equipment. The design and construction process does not require special equipment, making the processes low-tech in nature.	The adobe wall as a structural system functions as a load bearing wall that was constructed by	This structural system is underdeveloped as adobe walls have not been constructed many times in South Africa.	This material is developed since the specific mix of materials has been used in previous projects in the South African context.	Within the current built industry, the construction process of mixing materials on site and then using them in the construction process is a developed way of working.	The construction process was an opportunity for local people to come and learn new skills for design and construction technologies., making the project <b>socially responsible</b> . Unskilled labourers were taught how to build these structures, therefore uplifting the community's identity as well as their capabilities to contribute as working individuals.	The materials used are low cost since they can be sourced from surrounding natural landscapes and the equipment and time used to manufacture the materials and the structure is not too extensive., making it <b>economical</b> .	The project is <b>versatile</b> since this material and structure can become adapted to be used on a larger scale, enabling it to be versatile enough to be used in various regions. Since the materials are sourced from the landscape, it also means that any region in South Africa can use this building technology.	The materials are suited to the context's climatic conditions and makes use of appropriate passive heating and cooling systems with the materials used, making it <b>contextually responsive</b> to the area.	Figure 1: A photo of the community college in Ekurhuleni (Wagner, 2016)  Wagner, M. 2016. <i>Ithuba Community College</i> , Architecture in Development. Available from: <a href="https://a-l-d.org/project/207">https://a-l-d.org/project/207</a> [Accessed ON 25 March 2023]
2	Bottle2Build	School		2016	Gauteng	A project that creates buildings, especially classrooms, with empty, modular plastic water bottles as infill in a light steel frame and additional exterior material around the structure for waterproofing and thermal comfort.	Custom-made PET plastic bottles, BPA free and modular empty water bottles are made in the shape of interlocking bricks.	The construction process involves participants interacting with an element in the building and then taking part in the first phase of construction.	N/A Light Steel Framing System	The plastic is manufactured in an industrialised manner with many phases in order to achieve the shape and right material consistency - strong enough to be a building material.	The construction process is low-tech since the construction takes place using the labourers hands.	The construction process of constructing a light steel frame with infill materials inside is not a developed process	The production of plastic in South Africa is a develop process, since numerous products are made out of plastic. It is made in a well-established industry.	Local people are active participants in the construction process, making them educated on how the process works.	The project is <b>versatile</b> since the volume of material, construction process as well as structural system can be adapted to suit different circumstances for different projects.	It is <b>economical</b> because the bottles is a low-cost building material.	Figure 2: The school with empty plastic bottles as infill in the light steel frame and added exterior materials.  Watts, K. 2016. <i>Bottle to Build</i> , Kirsty Watts Foundation. Available from: <a href="https://www.kirstywattsfoundation.org.za/fundraising/bottle-to-build/">https://www.kirstywattsfoundation.org.za/fundraising/bottle-to-build/</a> [Accessed on 16 May 2023]  Vivier, T. 2017. <i>Bottle 2 Build created a brick shaped water bottle so that it can be used to build schools</i> , Good Things Guy. Available from: <a href="https://www.goodthingsguy.com/environment/bottle-2-build-brick-bottle/">https://www.goodthingsguy.com/environment/bottle-2-build-brick-bottle/</a> [Accessed on 16 May 2023]			
3	Carin Smuts Architects	GUGA S'THEBE Phase 2		2015	Langa, Western Cape	Theatre space of which falls part of a culture and heritage village. This building was predominantly made using recycled materials such as up-cycled wood and shipping containers. The building also makes use of indigenous technologies such as Adobe for insulative purposes	N/A Shipping containers N/A Up-cycled timber facade panels Adobe packed panels for insulative purposes	Simple construction methods where shipping containers were strategically placed in order to create space, simple construction method that community involvement was possible	Manufactured by hand on site used as a means of insulation situated behind the up-cycled timber facade panels	During construction local contractors, sub-contractors and artists are involved on the building site, materials and processes were manipulated by hand on site. Many local economic opportunities are created.	the use of "eco-materials" as a means for insulation	Manuacuring adobe by hand	Community involvement	Due to the use of locally available materials, upcycled materials and the implementation of simple construction methods, project costs were kept low. Building onto this, members of the community were employed during the construction process thus letting this project pose a rather substantial <b>social-economic impact</b> . The use of adobe is a well established form of making in South Africa letting the project become one that is <b>contextually responsive</b>	Figure 3 : Editors of Transsolar (2023)  Guga S'Thebe Theater: Transsolar: Klimaengineering, Transsolar. Available at: <a href="https://transsolar.com/projects/guga-sthebe-theater-cape-town">https://transsolar.com/projects/guga-sthebe-theater-cape-town</a> (Accessed: 18 May 2023).  ARVHA Femmes Architectes (2019) <i>Projet, Guga S'Thebe Arts, Culture and Heritage Village</i> . Available at: <a href="https://www.femmes-archi.org/projet/?c=1031">https://www.femmes-archi.org/projet/?c=1031</a> (Accessed: 15 May 2023).					

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4	cseventysix Architects	"Writers retreat" Residence		2019	Lanseria, Gauteng	A residence that is predominantly steel in its structure. The steel structure has been designed in such a way that the site that it sits on is preserved. The entire structure also has the capability of being disassembled	Locally sourced stone waste	The building was designed and constructed in such a manner that it could be disassembled if necessary – This complies with optimizing site sensitivity through circular design/ construction processes	N/A	Predominantly structural steel		Engineering and design strategies behind possible building disassembly and impermanence on a residential scale	Construction methods associated with structural steel	Floating off the ground, reducing site impact, all the building materials are responsibly sourced, having their full lifecycle considered -all steel used is recyclable and easily disassembled making the project <b>contextually responsive, as well as versatile</b> . The building functions organically having been shaped by passive design principles; ensuring maximum thermal efficiency throughout the year by means of natural ventilation flowing through Clerestory windows and by the natural convection of a nearby freshwater pond. Its reliance on Passive systems for thermal comfort further highlights the <b>projects contextual responsiveness and economic effectiveness</b> .	Figure 4: The Screenwriters Retreat (cseventysix Architects, 2020) cseventysix Architects (2020) Screenwriters retreat, c76 Accessed: 15 May 2023).
5	Choromanski Architects - Rod Choromanski and Dean Ramlat	uMkhumbane Museum		2017	Berea, Durban, KwaZulu-Natal	eThekweni Municipality's award-winning museum is the first new museum to be built in Durban in 100 years and also the first public cultural building constructed in the Cato Manor area.	N/A Concrete N/A Aluminum Facade Application	Due to its inherent strength, the "Firelight Satin" bricks achieved higher walls utilizing the method of diaphragms, thus avoiding the use of reinforced concrete beams		Bricks were laid by hand therefore following common building practice	Manufacturing processes associated with fabricating "Firelight Satin" bricks	The use of developed brick components that take on more of a structural role thus mitigating the need for an extensive re-inforced concrete intervention	The use of brick	The use of the "Firelight Satin" bricks proved to be in favour of <b>attainable economic factors</b> due to the fact that it mitigated additional costs usually needed for re-inforced concrete. While reducing costs associated with re-inforced concrete, the "Firelight Satin" bricks also managed to attain thermal and environmentally sustainable standards in the presence of less concrete, thus allowing the project to become <b>contextually responsive</b> .	Figure 6: uMkhumbane Museum(Editors at The Clay Brick Association of Southern Africa, 2020) Editors at The Clay Brick Association of Southern Africa (2020) Clay brick makes history at the uMkhumbane Museum, Clay brick makes history at the uMkhumbane Museum   Clay Brick Association of Southern Africa. Available at: <a href="https://www.claybrick.org.za/news/clay-brick-makes-history-uMkhumbane-museum">https://www.claybrick.org.za/news/clay-brick-makes-history-uMkhumbane-museum</a> (Accessed: 22 May 2023).
6	Earthworld Architects	KoSPAZA Pop-up restaurant		2021	Garsfontein Pretoria Gauteng	A complete plywood structural system – designed in detail and modelled 3-dimensionally in the architect's office – then sent to CNC (computer numerical control) Machines for cutting and manufacturing of site in components and then rapidly assembled on site.	N/A Plywood	Computer Aided Design and Prefabrication Complete 3D modelling of a project and all its components to be manufactured off-site for precision and efficiency			CAD methods are high-tech due to the use of intelligent software and systems used	This process can be seen as developed in South Africa due to architectural firms using 3D modeling software	The process of CAD and prefabrication is a new way of designing and constructing in South Africa and this adds value to the built environment through efficiency in time and costs – in return that is <b>economical</b> and by providing these prefabricated elements to people with little to no skills to construct the structures are <b>socially responsive</b>	Figure : KoSPAZA coffee shop (Earthworld Architects & Interiors, 2021) Earthworld Architects & Interiors (2021) Kospaza, Earthworld Architects & Interiors. Available at: <a href="https://www.earthworld.co.za/post/4060/kospaza2021/">https://www.earthworld.co.za/post/4060/kospaza2021/</a> (Accessed: 01 June 2023).	
								CNC production Plywood modules and elements are cut out by CNC machines			The use of CNC machines are high-tech due to the high industrialised components evident in the process	CNC machining of every component of a building is not common in South Africa and the whole process in under-developed using plywood for load bearing structural system is not commonly done and is underdeveloped			
								Plywood interlocking elements such as columns and rafters			plywood as a structural system with interlocking elements is high tech				






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7	Elliott, Paul	House Elliott		2021	Cape Town, Western Cape	Cork clad mass timber home influenced by the Japanese vernacular positioned on a relatively inaccessible site				Machined methods of Prefabrication associated with the manufacturing of Pre-fabricated CLT mass timber elements	The manufacturing of mass timber CLT is new to South Africa with the industry only consisting of 2 factories at present			This project was inspired by the Japanese vernacular and in turn it resulted in a sustainable home made from eco friendly materials. This project stands to highlight how vernacular systems of building can benefit todays architectural discourse. Further more, the use of cork clad panels as a facade finish doubles up as insulation. This material is also water proof and mold resistant. With somany capabilities this material mitigates the need for single function material applications thus resulting in an <b>economic</b> insilative cladding system.	Figure 7: House Elliott (Danie Nel for pro Landscaper + Architect 2021)  Pro Landscaper + Architect (2021) Zen: House elliott, issuu. Available at: <a href="https://issuu.com/outsideandinmag/docs/prolandscaper_nov_2021_issuu/s/13887468">https://issuu.com/outsideandinmag/docs/prolandscaper_nov_2021_issuu/s/13887468</a> (Accessed: 16 May 2023).
8	ELMO SWART ARCHITECTS	Wright House		2011	Ocean View, Durban, Kwazulu-Natal	Traditional thatched-roofed South African Villa Transformed with contemporary vernacular reinterpretation extension.	N/A corrugated steel sheeting N/A earth packed walls N/A Bamboo -wall and facade finishes N/A Gumpoles as non structural facade elements			Indigenous material implementation - e.g. thatch, gumpole, and bamboo	Prefabrication and parametric digital design of structural steel members used	The co-existence of vernacular building methods, in combination with modern "high tech" construction materials	The use of strucural steel	This project stands to show the possibilities that exist around design and construction methods that consider traditional means of space making as well as emerging means of space making. This project ultimately goes on to showcase the <b>versatility</b> behind using eco materials such as thatch, gumpoles and bamboo in the midst of structural steel construction.	Figure 8: Wright House (Editors of Dornob, 2019)  Editors of Dornob (2019) Organic South African villa transformed, Dornob. Available at: <a href="https://dornob.com/organic-villa-expansion-transforms-south-african-cottage/">https://dornob.com/organic-villa-expansion-transforms-south-african-cottage/</a> (Accessed: 16 May 2023).
9	Entity Architects & Blockhouses	Cradle Boutique Hotel		2018	Cradle of Humankind Muidersdrift North-West	6 Prefabricated pods used for vacation accommodation. Differ in size and layouts.	N/A Conventional steel,		"Pods" are manufactured and assembled off-site in a factory with the use of CAM and CAD. Placed on site with minor on-site construction.	CAD and CAM extremely high-tech due to the use of intelligent software	Premanufacturing and fabrication of whole buildings not done in South Africa commonly at this scale.			The <b>economical</b> value this premanufacturing adds to the building industry is due to the short construction periods. The products may seem to not be contextually and socially responsive due to the "generic" designs.	Figure 9: Cradle Boutique Hotel Pod (Blockhouses (2018) Projects   Blockhouse. Available at: <a href="https://blockhouse.co.za/projects-2/">https://blockhouse.co.za/projects-2/</a> (Accessed: 03 June 2023).  Blockhouses (2018a) Modular homes   Blockhouse. Available at: <a href="https://blockhouse.co.za/modular-homes/">https://blockhouse.co.za/modular-homes/</a> (Accessed: 03 June 2023).




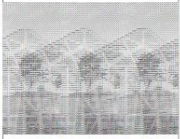





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13	Galland, Simon and LYT Architecture	Walmer Crèche		2021	Walmer, Gqeberha, Eastern Cape	Department worked together to construct this classroom structure in a rural community near the university. The structure was <b>built off-site</b> and then <b>dismantled and re-assembled</b> on the site in Gqeberha. <b>Recycled</b> building materials were used to make this classroom and careful consideration was given to what the <i>interface of the</i>	N/A Recycled timber material and	The crèche was constructed by students on campus and then dismantled and re-assembled on site again. The building process continued for 10 weeks.  Pre-fabrication.	N.A Timber framed structure	The university students built this structure, making them part of the construction process, where the whole structure was assembled off-site with conventional tools and techniques.		This process of assembling the structure in an academic environment is not a developed.  Dismantling a structure and then transporting it to site where the structure can be quickly assembled		The building is placed on plinths with the intention of removing the structure from the surroundings to create a safe and isolated environment where the children can become immersed in a learning experience, making it <b>contextually responsive</b> . The clerestory windows is another way in which the building is contextually responsive - it allows light and air into the building but restricts one's view at eye level, to create a safe environment where the students and teacher are able to focus on the programme.  This project is <b>economical</b> because recycled materials are used to construct the building as well as the labour of students who did the project as part of a university module.	Figure 12: The Walmer Crèche in Gqeberha (Berlanda, 2021)  Berlanda, T. 2021. <i>Walmer Crèche in Gqeberha, South Africa</i> by Simon Galland with LYT Architecture. <i>The Architectural Review</i> . Available from: <a href="https://www.architectural-review.com/places/south-africa/walmer-crèche-in-gqeberha-south-africa-by-simon-galland-with-lyt-architecture">https://www.architectural-review.com/places/south-africa/walmer-crèche-in-gqeberha-south-africa-by-simon-galland-with-lyt-architecture</a> [Accessed on 26 March 2023]  Available from: <a href="https://publications.mandela.ac.za/publications/media/Store/documents/Institutional/77/Mandela_University_Learning_Teaching_Publication-(DIGITAL2).pdf">https://publications.mandela.ac.za/publications/media/Store/documents/Institutional/77/Mandela_University_Learning_Teaching_Publication-(DIGITAL2).pdf</a> [Accessed on 26 March 2023]
14	GASS Architecture Studios	Green School South Africa		2021	Paarl Valley, Western Cape	This school designed with macro placement of spaces in mind. Separate buildings are linked together through landscape sections along with open courtyards. Many natural materials were sourced from the context, as well as indigenous design principles. Reclaimed materials were also used from the local region.	N/A Rammed earth walls (Soil, cement)	Creating a formwork with the desired curved shape, and then compacting layers of clay into the formwork to create the wall.		Rammed earth wall construction is low-tech since it uses straight-forward ways of excavating the soil and compressing it into formwork on site by construction workers.		The process is developed since rammed earth walls have been constructed several times in the country.	Social Values: The project promotes sustainable education and holistic development of students by providing an environmentally conscious learning environment that fosters creativity, critical thinking, and a sense of community.  Contextual Responsive Values: The design takes inspiration from the natural surroundings, incorporating local materials, passive design strategies, and biophilic elements to create a harmonious relationship between the built environment and the natural landscape, as water scarcity is a part  Economic Values: The project demonstrates a commitment to long-term cost savings through energy-efficient systems, water conservation measures, and the use of renewable materials. It also contributes to the local economy by supporting job creation and local sourcing of materials.	Figure 13: Green School within the Paarl topography (StirWorld, 2022)  ArchDaily (2022) <i>GASS Architecture Studios</i> . Available at: <a href="https://www.archdaily.com/978637/green-school-south-africa-gass-architecture-studios">https://www.archdaily.com/978637/green-school-south-africa-gass-architecture-studios</a> (Accessed: 1 April 2023).  StirWorld (2022) <i>Green School South Africa brings boulder-like clusters into organic coalescence</i> . Available at: <a href="https://www.stirworld.com/see-features/green-school-south-africa-brings-boulder-like-clusters-into-organic-coalescence">https://www.stirworld.com/see-features/green-school-south-africa-brings-boulder-like-clusters-into-organic-coalescence</a> (Accessed: 1 April 2023).  Legendary Thatching (2022) <i>Cape Thatch Reed Roofs Products</i> . Available at: <a href="https://legendarythatching.co.za/products.html">https://legendarythatching.co.za/products.html</a> (Accessed: 18 May 2023).	
15	GLH Architects	Witklipfontein Eco lodge Residential		2018	Vredefort, Freestate	Rammed earth walls, stone walls, steel framing system used to create a residence	N/A Rammed earth walls (Soil, cement) Compacted Earth Bricks (CEB) are made on site with soil from the surroundings and used in stead of common fired clay bricks.	Both building materials are sourced from the building site and constructed through on-site labour by hand. Different techniques but both are used in the form of compacted earth - sourced from the earth on site and construct either bricks or complete walls.	This composite structural system makes the implementation of a structural green roof possible	Earth from site compressed in press on site to form bricks.  Material sourced from site and compacted by hand tools. Unskilled labourers can construct this.	The integration of eco materials,, timber and steel construction in order to account for the weight of a structural green roof	The use of mud bricks constructed from the earth on site not widely used in South Africa  Using materials from site and compacted by hand a process that is developed although not used commonly.	Reuse materials from the site, making the end product <b>contextually responsive</b> and connected to the context through materiality.	Figure 14: Witklipfontein Eco Lodge (GLH Architects, 2018)  Abdel, H. 2020. <i>Witklipfontein Eco Lodge</i> / GLH architects, ArchDaily. Available at: <a href="https://www.archdaily.com/939202/witklipfontein-eco-lodge-ghl-architects">https://www.archdaily.com/939202/witklipfontein-eco-lodge-ghl-architects</a> (Accessed: 03 May 2023).	





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16 Heatherwick Studio	Zeitz Museum of Contemporary Art Africa (Zeitz MOCAA)		2017	Cape Town, Western Cape	Custom designed space, spread over nine floors, carved out of the monumental structure of the historic Grain Silo Complex.	N/A Concrete							Social Values: The museum provides a space for the local community and visitors to engage with contemporary art and participate in cultural events.  Contextual Responsive Values: The design of the museum is sensitive to its historical context, preserving the industrial heritage of the grain silo while transforming it into a modern and dynamic cultural destination. The architecture pays homage to the local context and integrates with the surrounding urban fabric.  Economic Values: The project contributes to the economic development of the area by attracting tourists and creating job opportunities. It revitalizes a previously underutilized building, generating revenue for the local economy and supporting the growth of the arts and culture sector.  Versatility: The museum provides flexible exhibition spaces that can accommodate a wide range of artworks and installations. The design allows for adaptable display configurations, enabling the curators to curate diverse exhibitions and accommodate changing artistic practices.	Figure 16: Zeitz MOCAA (UrbanNext, 2020)  UrbanNext (2020) Zeitz MOCAA: Carving a Void Sphere in the Silo. Available at: <a href="https://urbannext.net/zeitz-mocaa/">https://urbannext.net/zeitz-mocaa/</a> (Accessed: 28 March 2023).			
						N/A Pillowed glass panels											
							Subtractive method of diamond saw concrete-cutting techniques are implemented to carve an interior atrium out of the existing concrete tubes					This is a high-tech technique as it allow for precise and controlled carving process of selectively removing sections of the existing concrete structure to create galleries and a central atrium whilst still preserving the structural integrity of the existing tubes.					The use of subtractive diamond cutting is used for mining which is developed in SA
							The use of "pillowed" glazing to create curved glass walls, which required advanced glass manufacturing techniques by using computer-controlled machinery and precise temperature control to achieve accurate and consistent curvature					The combination of precise curvature, custom shaping, and advanced manufacturing techniques makes the pillowed glass panels a high-tech element					This is a developed method used in South Africa
							N/A reuse of existing structure										
17 Holzbau Hess	Yoga Studio		2018	Constantia, Western Cape	A yoga studio made from laminated timber columns and rafters - freeform timber structures moulded into curved structures.	N/A Laminated Pine columns and rafters							The construction process allows timber structures to become more organic while structural, making it versatile. Spatial qualities of structures are more creative and organic.	Figure 17: Yoga studio by Holzbau Hess (Holzbau Hess, 2018)  Holzbau Hess. (2018) Yoga studio - projects, Holzbau Hess. Available at: <a href="https://holzbauhess.com/projects/free-form-yoga-studio-constantia-cape-town#content">https://holzbauhess.com/projects/free-form-yoga-studio-constantia-cape-town#content</a> (Accessed: 05 May 2023).			
							Pine timber members glued together and moulded into curved forms. This process happens off site (prefabrication), constructed on site.				Members glued by hand and moulded into forms by clamps to designed shape.					Laminated timber rafters moulded into curved forms not common in S. A. this craft still needs to be developed.	
											N/A Portal frame like construction, only using timber as material.						
18 UJ's Faculty of Civil Engineering and the Built Environment, in partnership with the KwaZulu-Natal Department of Human Settlements and Afrisam	South Africa's first 3D printed low-cost house		2022	Johannesburg, Gauteng	South Africa has completed its first 3D printed low-cost construction home.  The 3D printing technique used can build a house in less than 24 hours.	N/A Concrete							Due to its efficiency, this means of construction resulted in residential infrastructure being produced at an unprecedented rate while using 32% less of the materials required for traditional construction methods. This could be a catalyst for procuring sustainable human settlements while strengthening the economy.	Figure 18: South Africa's first 3D-printed low-cost home (Reporters at News24, 2023)  Reporters at News24 (2023) Watch: Here's how South Africa's first 3D-printed low-cost home was constructed, News24. Available at: <a href="https://www.news24.com/news24/tech-and-trends/news/watch-heres-how-south-africas-first-3d-printed-low-cost-home-was-constructed-20230307">https://www.news24.com/news24/tech-and-trends/news/watch-heres-how-south-africas-first-3d-printed-low-cost-home-was-constructed-20230307</a> (Accessed: 16 May 2023).			
							3D printable concrete layed in layers one on top of another by a robotic industrial printing arm. Openings were accounted for as the printing process was in session				Automated robotic printing arm utilised on site to print the main concrete structure of the low cost home. Although a smaller labour force is needed for this project, the people involved need to be highly skilled practitioners.					Automated construction practices and BIM modeling techniques	
											N/A Load bearing walls						







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19 Jason Erlank Architects	Langbos Children's Centre Community centre School		2018	Gqeberha, Eastern Cape	Superadobe walls/roof create these dome structures without additional structural components.	Superadobe (Local soil mixed with a small amount of cement)	Bags mixed and filled by workers. Bags are then laid by hand and fixed with barbed wire. Then plastered and painted afterwards.	"Earth bags" act as structure itself. Compression of the weight of the bags makes it compact and sturdy.	Bags filled with sand and cement	Pan mixing of mixture, hand-filling the bags and lay it by hand by local workers. No expertise necessary	Material and mode of construction not developed in SA. Could be a new way of building structures with the earth	Material and mode of construction not developed in SA. Could be a new way of building structures with the earth	Teaches that one can build with the surroundings without expertise. The project makes use of the context and local craft. Sustainable solutions for construction in remote areas. Fast paced construction in remote areas, local skills and contextually responsive.	Figure 19: Construction phase of Langbos Childrens Centre (Chris Grava, 2018)  Abdel, H. (2020a) Langbos Children's Centre / Jason Erlank architects, ArchDaily. Available at: <a href="https://www.archdaily.com/942147/langbos-childrens-centre-jason-erlank-architects">https://www.archdaily.com/942147/langbos-childrens-centre-jason-erlank-architects</a> (Accessed: 06 May 2023).  Langbos children's shelter (2019) Jason Erlank. Available at: <a href="https://jasomerlank.co.za/portfolios/langbos-childrens-shelter/">https://jasomerlank.co.za/portfolios/langbos-childrens-shelter/</a> (Accessed: 06 May 2023).
20 Kimwelle, Kevin	Silindokuhle Creche		2017	Joe Slovo Township, Gqeberha, Eastern Cape	The building is made out of recycled materials by local builders that constructed a section of the building as a composite wall that contains glass and concrete within a timber frame. The architect works with the "Grossroot Community" concept that enables positive change from a community, to a region, to the local context all the way to an international level.	N/A Recycled glass bottles, timber and corrugated iron used in structure	N/A The construction process involved conventional techniques	Composite wall with glass wine bottles and concrete as infill.	The composite wall is constructed by hand by layering the glass bottles and concrete within the timber frame by hand.	Using glass bottles as part of a structural system is certainly underdeveloped in South Africa. Usually walls are constructed from conventional elements that do not let light and air through a recycled object.			The project is <b>economical</b> because of the recycled glass bottles that they make use of to build parts of the structure.  The composite wall with the glass bottle ensures natural light to enter the building for the educational programme, that lowers the need for electricity usage in the community.  The project is also <b>socially responsible</b> because the different class-income groups were connected due to the contribution and donation process "...connecting the most privileged members of the city with the most marginalised." (Chapman 2019)	Figure 20: The Silindokuhle Creche in Port Elizabeth (Chapman, 2019)  Chapman, S. 2019. <i>There is ingenuity in Africa: the architect who builds with trash</i> , The Guardian. Available from: <a href="https://www.theguardian.com/cities/2019/oct/22/ingenuity-south-africa-architect-kevin-kimwelle-builds-with-trash">https://www.theguardian.com/cities/2019/oct/22/ingenuity-south-africa-architect-kevin-kimwelle-builds-with-trash</a> (Accessed on 24 March 2023)
21 Krynauw, David & Khanye Architects	Kleine Rijkse Restaurant		2017	Hartebeespoort, Gauteng	A restaurant timber structure - columns and trusses with brick gable ends and infill. Galvanised steel roofing	N/A S.A Pine	Timber members made of rafters are cut out by CNC machines. Members are then routed and sanded down to smooth curved edges by hand.	N/A Timber columns and trusses as only structural system	Structural elements are cut out by a CNC machinerouted for rounder edges	CNC manufactured timber structural elements are underdeveloped			Cutting out members by CNC machine ensures precision with each individual member. The need to router and sand down the members to have the smoothed edges ensure the human touch is still evident in the building.	Figure 22: Kleine Rijkse Interior (Vicky Gerbelo, 2018)  Krynauw, D. (2017) Modular Mobile Home Pods: David Krynauw, David Krynauw Design. Available at: <a href="https://www.davidkrynauw.com/build">https://www.davidkrynauw.com/build</a> (Accessed: 07 May 2023).
22 Krynauw, David	MODULAR MOBILE HOME		2020	N/A - Mobile products sold on request	A prefabricated mobile living pod that is bought as a whole product and delivered to any site on request	N/A S.A Pine	Structural timber members are cut out by CNC machines. Members are then routed and sanded down to smooth curved edges by hand.	N/A Timber portal frame structural method	Structural elements are cut out by a CNC machinerouted for rounder edges	CNC manufactured timber structural elements are underdeveloped			The use of CNC techniques to prefabricate structural timber elements opens up a wide range of possibilities. In this project specifically one sees how careful design through the use of CNC techniques results in a mobile architectural typology	Figure 23: DAVID KRYNAUW'S LIVING PODS (Editors at Visi, 2020)  Krynauw, D. (2017) Modular Mobile Home Pods: David Krynauw, David Krynauw Design. Available at: <a href="https://www.davidkrynauw.com/build">https://www.davidkrynauw.com/build</a> (Accessed: 1 June 2023).

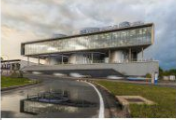



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23	Local Studio	Hillbrow Counselling Centre		2017	Johannesburg, Gauteng	project that provides mental health services to the Hillbrow community in Johannesburg, South Africa. The center is a compact, two-story building with an innovative design that incorporates recycled materials, natural ventilation, and sustainable strategies.	N/A Polycarbonate panel	whole building envelope is Advanced cutting techniques, CNC (Computer Numerical Control) routing for tailor made, is used to precisely shape the polycarbonate panels.	N/A Hybrid of implementing new cladding system over the existing concrete structure	advanced extrusion techniques, precise cutting methods of the prefabricated panels make this high-tech mode of production.	Although the method of CNC has become increasingly prevalent in SA it is still considered.	Economically, the project demonstrates cost-effectiveness by utilizing locally sourced and recycled materials, reducing construction expenses. The building's design also focuses on energy efficiency, utilizing natural ventilation to minimize the need for mechanical cooling systems and reducing operational costs in the long run. Engineered to be lightweight and leak-proof, withstand very high loads, and accommodate thermal expansion and contraction	Figure 24: Hillbrow Counseling Centre (ArchDaily, 2020)  ArchDaily (2020) Hillbrow Counselling Centre / Local Studio, ArchDaily. Available at: <a href="https://www.archdaily.com/940526/hillbrow-counselling-centre-local-studio">https://www.archdaily.com/940526/hillbrow-counselling-centre-local-studio</a> (Accessed: 11 May 2023).	
24	Local Studio	Limpopo Youth Hostel		2019	BELA-BELA, Limpopo	a project that reimagines the traditional hostel typology. The building's primary structure is a lightweight Hebel concrete block – the biggest load-bearing structure built using this material in South Africa  The Limpopo Youth Hostel project was commissioned by a Non-Profit Organization focused on advocacy training for youth.	Composite Lightweight Hebel concrete block (lightweight, autoclaved aerated concrete (AAC) block)	Composite timber (thermally modified and wax impregnation rhinewood cladding)	N/A manufacturing process of Hebel blocks involves advanced technologies such as autoclaving, where the blocks are cured under high pressure and temperature conditions to achieve their final strength and durability.	A high-tech mode of production, made from autoclaved aerated concrete, which is a lightweight concrete produced by mixing cement, sand, lime, and water with a small amount of aluminum powder The lightweight Design is due to the blocks undergoing an advanced manufacturing process  Thermally modified wood that is produced by heating the wood to high temperatures in a low-oxygen environment, undergoes wax impregnation where the wood is treated with a specially formulated wax solution.	Hebel is a well-established building material in South Africa, having been used for various construction projects  The use of thermally modified wood and wax impregnation techniques has been implemented in various construction projects, however the extent of its usage is still under-developed in SA.	The intrinsic value of this project lies in its focus on community development and social sustainability. By providing safe and affordable housing for young people, the project addresses issues of social inequality and creates opportunities for education and economic mobility. Additionally, the project's use of sustainable materials and innovative construction methods demonstrates a commitment to environmental sustainability and serves as a model for future development projects Locally sourced wax-treated pine that provides a natural, durable, and sustainable alternative to traditional timber cladding	Figure 24: Limpopo Youth Hostel (ArchDaily, 2020)  ArchDaily (2020) Limpopo Youth Hostel / Local Studio. Available at: <a href="https://www.archdaily.com/940354/limpopo-youth-hostel-local-studio">https://www.archdaily.com/940354/limpopo-youth-hostel-local-studio</a> (Accessed: 11 May 2023).	
25	Malan Forster Architecture & Interior Design	House Paarman Treehouse Residential		2017	Constantia, Western Cape	Treehouse built on corten steel columns with structural elements made out of timber. Facades that move also made out of timber	N/A Corten steel (columns)	Construction and design process combined where certain elements are prefabricated off-site, other made on site to be specific to conditions.	N/A Corten steel plates used as columns.	Timber elements of the building crafted (prefabricated) by hand by carpenters off-site.	Prefabrication of majority of a building's parts are not developed in South Africa	The design and construction process is socially responsive by using the skills of specialists to create a contextually responsive building in the landscape.	Figure 25: House Paarman Treehouse (Adam Letch, 2017)  Tapia, D. (2020) Tree House / malan vorster architecture interior design, ArchDaily. Available at: <a href="https://www.archdaily.com/973882/tree-house-malan-vorster-architecture-interior-design">https://www.archdaily.com/973882/tree-house-malan-vorster-architecture-interior-design</a> (Accessed: 08 May 2023).	





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26 Marais, Paul	House Gardiner		2014	Monaghan Farm, Johannesburg, Gauteng	<p>This design incorporates 500mm thick rammed earth walls, underground rain water tanks, a roof optimised for solar shading and rainwater harvesting and off grid living. The use of polymer stabilised foundations not only significantly reduced CO2 but also saved costs.</p>	Structural Rammed earth walls			soil was used directly from site and locals were trained and employed		Structural rammed earth walls as the only load bearing structure to hold the building is not		<p>Economical values: The polymer reinforced earth foundation required half of the steel of a reinforced concrete foundation, saving 46% of CO2 emissions</p> <p>contextually Responsive values: This offers a sustainable and cost-effective alternative to traditional construction materials, utilizing locally available resources and reducing the environmental impact of the building process. Versatile values: The polymer has, as its major component is bitumen emulsion, provided a waterproof layer. The polymer binder enhances the structural properties of the earth, making it suitable for load-bearing walls and other structural elements.</p> <p>Social values: Use local skills and provide job opportunities as well as skills training. Some local members were employed by the firm and continue to still be working for them.</p>	<p>Figure 26: House Gardiner (Simply Sustainable, 2023)</p> <p>Simply Sustainable (2023) 'House Gardiner – simply sustainable'. Available at: <a href="https://simplysustainable.co.za/projects/house-gardiner/">https://simplysustainable.co.za/projects/house-gardiner/</a> (Accessed: 4 June 2023).</p> <p>Marais, P., Littlewood, J. and Karani, G. (2015) 'The Use of Polymer Stabilised Earth Foundations for Rammed Earth Construction', Energy Procedia, 83, pp. 464–473. Available at: <a href="https://doi.org/10.1016/j.egypro.2015.12.166">https://doi.org/10.1016/j.egypro.2015.12.166</a>.</p>
						Polymer stabilised earth foundations				The mixing of the polymers required precision and were delivered	using polymer earth foundations is a very new technique and is			
						polymer stabilised rammed earth undersurface bed			compacted the earth layers was done by a		structural rammed earth floor beds is very new and not			
							The walls were rammed from soil from the site coloured with natural oxides and stabilised with hydrated lime		compacted the earth layers was done by a combination of hand and a	Ramming of the walls was also done with pneumatic rammers in layers no more than	The use of structural, load bearing rammed earth walls is still new to SA and is	the method of compacting soil as the construction technique is		
							foundations made of rammed earth that were stabilised with a bitumen polymer mixture. Mixing was done in a traditional cement mixer then laid in 1.5m trenches and compacted Initial compaction was done with a rammer with the final compaction done with a plate compactor			Traditional mixing techniques and rollers were used	The polymer solution to stabilize rammed earth is a new practice and not developed in SA	The method of compacting soil as the construction technique is developed		
							The earth floor slab construction technique required that all the services be placed underneath before it was compacted with rollers.		It does not involve highly specialized or cutting-edge technology, only rollers for compacting the layers of earth		Services are normally installed within the floor slab, however here they were required to be placed underneath as	The method of compacting soil as the construction technique is developed		
								Single story rammed earth walls: 500mm thickness and 4.2 meters in height with horizontal steel reinforcement		Reinforcing the rammed earth walls with bitumen covered steel reinforcing rods is considered to be high tech as this transforms the walls into being the structural element holding the building up	The use of structural, load bearing rammed earth walls is still new to SA and is still being studied.			
								The foundations are a combination of cement-stabilised earth with a polymer-stabilised layer above.		The cementstabilised earth was mixed by hand and the polymer stabilised earth with a rotary mixer before being placed and compacted by a rammer.	Polymer stabilised earth is a technology that was developed for road building and as such was designed to be applied at scale with the use of extensive plant. This was employed			
27 MMA Architects	Sandbag Houses Residential		2009	Mitchells Plain, Western Cape	Sandbag houses made out of Eco-beams as structure with sand filled bags as the infill and mass.	Sand filled bags			Bags filled by hand. No technology needed		Sand bags as construction material is a developed system, but informal, part of construction processes in SA.	<p>Use materials from the area makes it contextually responsive. Low cost connected to this material</p> <p>Use local skills and provide job opportunities as well as skills training</p>	<p>Figure 27: Construction of Sandbag house (MMA Architects, 2009)</p> <p>Fairs, M. (2018) Sand-bag houses by MMA architects, Dezeen. Available at: <a href="https://www.dezeen.com/2008/02/26/sand-bag-houses-by-mma-architects/">https://www.dezeen.com/2008/02/26/sand-bag-houses-by-mma-architects/</a> (Accessed: 09 May 2023).</p>	
						Bags filled with sand sourced from the area. Stacked on each other between structural elements.			Filling bags with sand by hand and placing it between structural elements. All done by unskilled labour		The use of sandbags for wall infill is developed			
								N/A Eco-beams						





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28	Moladi	Western Cape Education Centre		2018	Parrow, Western Cape	Concrete cast between reusable plastic formwork sheets. Plastered and painted the same as conventional way	N/A Common concrete mixture but without stone.	Setting up reusable plastic formwork rather than conventional timber/steel. These formwork systems are removed within 15 hours - a lot faster than conventional cast in-situ concrete.	N/A Concrete walls with reinforcing	Low tech. Formwork needs to be built and taken apart by hand		this mode of formwork is underdeveloped and can start a new movement in achieving faster construction	Fast paced construction. Time spared in construction duration- construction costs are lowered.	Figure 28: Western Cape Education Department (Moladi, 2018)  Oh, E. (2015) How the 'moladi' system is making affordable housing more accessible in South Africa, ArchDaily. Available at: <a href="https://www.archdaily.com/644369/how-the-moladi-system-is-making-affordable-housing-more-accessible-in-south-africa">https://www.archdaily.com/644369/how-the-moladi-system-is-making-affordable-housing-more-accessible-in-south-africa</a> (Accessed: 09 May 2023).
29	Moladi	Melkbos High School		2019	Melkbosstrand, Western Cape	Concrete cast between reusable plastic formwork sheets. Plastered and painted conventionally.	N/A Common concrete mixture but without stone.	Setting up reusable plastic formwork rather than conventional timber/steel. These formwork systems are removed within 15 hours - much faster than conventional cast in-situ concrete.	N/A Concrete walls with reinforcing	Low tech. Formwork needs to be built and taken apart by hand		this mode of formwork is underdeveloped and can start a new movement in achieving faster construction	Fast paced construction. Time spared in construction duration- construction costs are lowered.	Figure 29: Melkbos strand Highschool (Moladi, 2019)  Oh, E. (2015) How the 'moladi' system is making affordable housing more accessible in South Africa, ArchDaily. Available at: <a href="https://www.archdaily.com/644369/how-the-moladi-system-is-making-affordable-housing-more-accessible-in-south-africa">https://www.archdaily.com/644369/how-the-moladi-system-is-making-affordable-housing-more-accessible-in-south-africa</a> (Accessed: 09 May 2023).
30	NEO Architects	DOXA DEO CHAPEL		2022	Brooklyn, Pretoria, Gauteng	Pe-fabricated Chapel	N/A Internal Dry Walling N/A Light Weight Steel with Cavity Batts N/A Fibre Cement Board N/A Terraco cementitious render finishes	Fully light weight construction methods where majority of the materials used are pre-fabricated and delivered as modules to site	N/A Light Steel Framework structural system	The prefabrication and machining processes involved with manufacturing Internal Dry Walling, Light Weight Steel, Fibre Cement Board, and Terraco cementitious render finishes	Construction process where majority of the materials used to fabricate the building are pre-fabricated and delivered to site		The combination of the selected lightweight material palette achieved the required acoustic, maintenance, and thermal insulating properties required. Due to these methods of construction, the final product reached completion in 5 months. This form of prefab construction could pose substantial <b>economic benefits</b> in the near future if implemented at a greater scale.	Figure 30: Doxa deo chapel (NEO Architects, 2022)  Ohhorst Lightweight Building Solutions (2022) Ohhorst Lightweight Building Solutions on LinkedIn: Ohhorst LBS Latest Project: Doxa deo chapel, brooklyn campus, Ohhorst Lightweight Building Solutions on LinkedIn: Ohhorst LBS Latest Project: DOXA DEO CHAPEL, BROOKLYN CAMPUS. Available at: <a href="https://www.linkedin.com/posts/ohhorst-lightweight-building-solutions_ohhorst-lbs-latest-project-doxa-deo-chapel-activity-6966032608023449600-dg9ny7?k=public_profile_like_view&amp;originalSubdomain=id">https://www.linkedin.com/posts/ohhorst-lightweight-building-solutions_ohhorst-lbs-latest-project-doxa-deo-chapel-activity-6966032608023449600-dg9ny7?k=public_profile_like_view&amp;originalSubdomain=id</a> (Accessed: 16 May 2023).
31	Nieuw Architects	House Newlands		2023	Newlands, Cape Town, Western Cape	The architect decided to construct the building using AAC blocks, giving consideration to the different ways it could contribute to saving construction time, waste materials and amount of labourers needed on the project. The AAC blocks were modified on site, to appear more slender in the cavity wall.	Lightweight, composite Aertec AAC blocks (Autoclaved aerated concrete) - a foam concrete block that is precast and consists of water, sand, cement, aluminium powder, lime and gypsum. Aertec's CEM-SKIM 100 skimmining plaster directly applied to the wall at 5mm thickness, to reduce weight even further.	N/A Construction similar to conventional brick construction	N/A AAC bricks as structural system similar to conventional masonry structures	The bricks undergo a heating process called 'autoclaving'		The AAC blocks are relatively well-developed and have been implemented in various projects since its invention.	The construction period was shortened due to the lightness of the building materials, saving costs since labourers had to be hired for a shorter time. Another <b>economical</b> factor was the decreased amount of construction wastage that accumulated at the end of the project since the materials were modular, causing minimal excess. Although the AAC blocks are made to be modular units, the blocks can be cut along their length to appear more flattened, making it <b>versatile</b> in its application.	Figure 31: House Newlands in Cape Town (Aertec, 2023)  Aertec, 2023, House Newlands, Sans Souci Road, Aertec. Available from: <a href="https://www.aertec.co.za/news-articles/admin/NA/house-newlands-sans-souci-road/31">https://www.aertec.co.za/news-articles/admin/NA/house-newlands-sans-souci-road/31</a> [Accessed on 23 March 2023]



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32	Paragon Architects 105 Corlett Drive		2013	Johannesburg, Gauteng	A modern office building known for its distinctive design featuring a combination of glass and Arcelor Mittal Calman cladding, creating a visually captivating and innovative architectural expression.	N/A Arcelor Mittal Calman Cladding				innovative material properties, precision manufacturing processes, integration of digital tools,	Although made of steel, the method of construction in SA is considered to be under-developed		Collaboration and community integration by incorporating the community in the laying of the slate wall cladding brings a <b>social value</b> to this project. The design of the building takes into account the site's context, respecting site boundaries and creating a harmonious relationship with the surrounding environment, improving the <b>contextual responsiveness</b> of the area. <b>Economic Growth:</b> The construction and operation of the building contribute to the local economy by generating job opportunities and supporting related industries.	Figure 32: Corlett drive office (ArchDaily, 2014) ArchDaily (2014) 105 Corlett Drive / Paragon Architects. Available at: <a href="https://www.archdaily.com/552450/105-corlett-drive-paragon-architects">https://www.archdaily.com/552450/105-corlett-drive-paragon-architects</a> (Accessed: 16 May 2023).	
33	Philipp Exter Spout Coffee		2016	Pretoria, Gauteng	The cafe is made up of two repurposed shipping containers stacked on top of one another to create a two-story space. It's the first such recycled container space in the city, and the design touches throughout the small space help the bar to stand out	N/A a pair of recycled shipping containers stacked on top of each other							This project proves to be very <b>economical</b> since the shipping containers save costs on construction time. This project is <b>versatile</b> because this structure can be repeated and linked infinitely, meaning that it is versatile in size and usage.	Figure 33: Spout Coffee Shop (Scheffler, 2017) Scheffler, D. 2017. <i>Spout Coffee: A Modern Container Coffee Shop In Pretori</i> , Sprudge. Available from: <a href="https://sprudge.com/spout-coffee-company-pretoria-112751.html">https://sprudge.com/spout-coffee-company-pretoria-112751.html</a> (Accessed on 4 June 2023)	
34	Pietro Russo The Ecom Home		2010	Franschoek, Cape Town, Western Cape	The design is based on basic sustainable, green design principles. The ecom home offers a low-maintenance, modern, well-designed green housing alternative.	N/A SA Pine	precision manufacturing and streamline prefabrication, where the large wood components are fabricated off-site and then assembled on-site.			material is made through high tech industrial machinery	CLT is a developing material in South Africa		Contextual Responsive Values: The architectural design of the Ecom Home is responsive to its surroundings and local context. It integrates sustainable design principles and utilizes renewable materials. Ecological: incorporate passive design strategies to optimize energy efficiency and reduce its ecological footprint. The modular construction methods creates opportunity for customization and adaptability.	Figure 34: Ecom Home (ArchDaily, 2010) ArchDaily (2010) <i>The Ecom Home / Pietro Russo</i> . Available at: <a href="https://www.archdaily.com/82774/the-ecom-home-pietro-russo">https://www.archdaily.com/82774/the-ecom-home-pietro-russo</a> (Accessed: 27 March 2023).	
35	RAW Module 28 Day house Residential		2020	Sterkfontein, Krugersdorp, North-West	Steel modules designed and manufactured off site. Assembly on site on a slab that cured within 28 days that allows construction and finishing of buildings to be finished within 28 days.	N/A Steel framing system & Modular components	Premanufactured modules designed using CAD are assembled on site by hand			N/A Assembly low tech. still done on site by unskilled labourers	Computer Aided Design allows precise design and production of individual modules	Premanufacturing and the modular components	N/A On site assembly and construction	Fast paced construction where time is spared in construction duration- construction costs are lowered, making it <b>economical</b> .	Figure 35: 28 day house (Raw Module, 2020) RAW Module, 2022. <i>Process, Raw Module</i> . Available at: <a href="https://rawmodule.com/process/">https://rawmodule.com/process/</a> (Accessed: 12 May 2023).




Architect	Project	Images & Diagrams	Year of Completion	Location	General Project Description	Emerging building technology			Mode of production		Developmental status		Value	List of References		
						Building material (I)	Construction process (II)	Structural system (III)	Low-tech (traditional or hand-based)	High-tech (industrialised)	Under-developed	Developed				
36	Rich, Peter	Mapungubwe Interpretation Centre		2009	Mapungubwe National Park, Musina, Limpopo	Give a short description	Stabilised hand pressed soil tiles (minimal cement use)	Craftsmen following a catenary arch guide as they lay the brick layers until they meet at the vaults	Timbrei Vaults (catenary arch principle)	Hand-based (as opposed to Hydraform block equipment that is powered by)	Unskilled labour and and low tech equipment	The structural form-finding relies on techniques of graphic statics. A mix of commercially available CAD software (Rhinoscero), the application of graphic statics in coordinate geometry programs (Cabri or Geogebra)	Construction technique not commonly used in SA	Soil tiles and blocks are commonly used in SA (the challenge was)	<p>The construction process was an opportunity for local people to come and learn new skills for design and construction technologies., making the project <b>socially responsible</b>. Unskilled labourers were taught how to build these structures, therefore uplifting the community's identity as well as their capabilities to contribute as working individuals.</p> <p>The materials used are low cost since they can be sourced from surrounding natural landscapes and the equipment and time used to manufacture the materials and the structure is not too extensive., making it <b>economical</b>.</p> <p>This structural system and materials are adaptable since the material and structure can become adapted to be used on a larger scale, enabling it to be <b>versatile</b> enough to be used in various regions. Since the materials are sourced from the landscape, it also means that any region in South Africa can use this building technology.</p> <p>The materials are suited to the context's climatic conditions and makes use of appropriate passive heating and cooling systems with the materials used.</p>	<p>Figure 36: Headquarters under construction (Ramage, Ochsendorf, Rich, Bellamy &amp; Block, 2010: 19).</p> <p>Ramage, M.H., Ochsendorf, J., Rich, P., Bellamy, J.K. and Block, P., 2010. Design and construction of the Mapungubwe National Park interpretive centre, South Africa. ATDF JOURNAL, 7(1/2).</p>
37	Rothoblaas South Africa	Residence in Constantia		2022	Constantia, Western Cape	Residence built using masonry construction for "bunker" and rest of the residence built using CLT panels and rafters	Cross Laminated Timber (CLT)	Prefabrication (CNC) of building elements off site	Structural components of 2nd story made out of CLT	Material is made through high tech industrial machinery	The process of cutting elements to size through CNC machines highly technical	Using CLT as structural elements are under developed in South Africa Usually used as facade components	CLT is a developing material in South Africa	CNC machinery is a well developed practice in south africa and is developed	<p>Mass timber buildings allows projects in remote locations to be built and constructed due to off-site preice manufacturing. Faster construction times, lower costs in construction.</p>	<p>Figure 37: Residence under construction (Rothoblaas, 2022)</p> <p>O'Connor, M. (2023). ROTHOBLAS – Presentation for the University of Pretoria [online]. Pretoria South Africa: Unpublished. Available on request: RBZAPRESENTATIONUTUKS11.05.2023.pdf [Accessed: 20 May 2023]</p>
38	Snehetta and Local Studio	Desmond Tutu Archway		2017	Cape Town, Western Cape	Steam-bent Larch woven together to form this commemorative arch.	N/A Larch timber	Timber modules prefabricated by bending elements in factory with steam. Constructed (fixed) on site.	N/A Non structural (loadbearing) element	The use of steam used to bend the timber are done by hand		Underdeveloped way of manufacturing intricate timber elements.			<p>Creative and new way of forming timber into intricate forms - different from the conventional use of timber. Can be used as a precedent for other ways to use and introduce timber into buildings and designs.</p>	<p>Figure 38: Desmond Tutu Memorial (David Southwood, 2017)</p> <p>Lynch, P. (2018) Snehetta and local studio unveil wooden archway honoring Archbishop Desmond Tutu in South Africa. ArchDaily. Available at: <a href="https://www.archdaily.com/890412/snehetta-and-local-studio-unveil-wooden-archway-honoring-archbishop-desmond-tutu-in-south-africa?ad_medium=gallery">https://www.archdaily.com/890412/snehetta-and-local-studio-unveil-wooden-archway-honoring-archbishop-desmond-tutu-in-south-africa?ad_medium=gallery</a> (Accessed: 12 May 2023).</p>
39	StudioMas & Arup	The Ridge Deloitte Cape Town		2020	Cape Town, Western Cape	6-star Green Star Design awarded commercial building	Cross laminated timber (CLT)	n/a Medium sized prefabricated panels not machined (CNC)	N/A Non-load bearing cladding to RC slab and column structure	Structural engineered wood panels are made up of three or more layers of wood, each layer oriented perpendicular to the adjacent layer, and then pressed together and bonded with a special adhesive. Integration with services and openings are commonly pre-planned and cut using CNC routers.	Mass timber construction is relatively new to South Africa				<p>Rapid prefabrication, fast on-site assembly and design for disassembly. Machinable and allow for a high precision. Renewable material and atmospheric carbon dioxide is trapped (CO2 store).</p> <p>The CLT is local, renewable, and highly durable. It requires no additional finishes to the interior or exterior, no insulation (StudioMas: online)</p>	<p>Figure 39: Exterior view of CLT panels (StudioMas: online).</p> <p>The Ridge   StudioMAS ,no date. Available at: <a href="https://studiomas.co.za/the-ridge/#theridge">https://studiomas.co.za/the-ridge/#theridge</a> [Accessed: 19 April 2023].</p> <p>Mass Timber Technologies. 2022. Cross-laminated Timber &amp; Glue-laminated Timber, Design Guide, Edition 1, 2022, p. 51. Available at: <a href="https://www.masstimberech.co.za/designguide">https://www.masstimberech.co.za/designguide</a> [Accessed: 19 April 2023].</p>

Architect	Project	Images & Diagrams	Year of Completion	Location	General Project Description
40 Steyn Studio	The Bosjes Chapel		2016	Worcester, Western Cape	The new chapel, set within a vineyard in South Africa, is designed by South-African born Coetzee Steyn of London based Steyn Studio. Its serene sculptural form emulates the silhouette of surrounding mountain ranges, paying tribute to the historic Cape Dutch gables dotting the rural landscapes of the Western Cape. (ArchDaily, 2020)
41 Steyn Studio	'Die Spens' Bosjes		2021	Ceres, Western Cape	Indigenous methods of building were used as inspiration and indigenous plots form a big part of the landscape that surrounds the structure. The wooden trellis is placed underneath a retaining wall structure that also acts as a dome/roof garden.
42 SRLC Architects	Westcliff House			Westcliff, Johannesburg, Gauteng	Residence





Emerging building technology		Mode of production		Developmental status	
Building material (I)	Structural system (III)	Low-tech	High-tech	Under-developed	Developed
N/A Concrete	The concrete was poured in the form of shotcrete - projected at high velocity through a hose.		Due to the unusual form of the shell, each reinforcing bar (top and bottom) had to be individually cut and hand-bent to fit.	this method has become more developed and is on the rise as it achieves desired forms.	
	Undulating concrete shell self supporting		3D parametric CAD models used to calculate the required volumes of concrete and steel for the unique concrete form	The modelling process for technical qualities is still not developed in SA	
N/A Timber	A large quantity of wooden oak trellis that has been steam bent		The cutting and bending of the oak trellis includes the use of a laser cutter which would be high-tech	The construction process is under-developed due to the fact that oak is not usually cut and bent on that large scale.	
	A wooden oak trellis that has been bent and fixed in a 3D, sculpted manner that is meant to resemble the "matjehuis" from the Khoi San indigenous houses.		The structure is high-tech since it has been tested on a digital programme to test its compatibility with other materials as well as testing to see which form would work 3 dimensionally. Computer Aided Design (CAD)	The new way in which the structure is built with its free form is underdeveloped since it has not been executed on this level many times before.	N/A The indigenous concepts from which the oak trellis was derived is a developed structure.
N/A Bitumen					
N/A Glazing					
N/A Structural Steel					
N/A Zinc Panel Roof Cladding					
CLT Ceiling Panels			Prefabricated machining methods used to manufacture CLT panels		Use of CLT as ceiling panels
	N/A With specific reference to the main bedroom, its interesting form was achieved through a structural steel lattice of which was packed with insulative paneling and finished in a bitumen water proofing layer. From here Zinc Panel Roof Cladding was used as the final roof finish				Design processes associated with expressive form making using common material
		N/A Structural steel lattice made of hot rolled steel members of which were welded to one another to achieve an interesting form			


Value	List of References
<p>Contributing to the socio-economic of the surrounding area.</p> <p>Economical Value: The innovative use of concrete casting techniques allows for efficient construction processes and cost-effective solutions. These technologies streamline construction timelines and minimize material waste, optimizing the project's economic viability.</p> <p>Contextual Value: The chapel's design responds to its natural surroundings, taking cues from the landscape and embracing the contextual characteristics of the site. The use of emerging building technologies enables architects to push boundaries and create architectural forms that</p>	<p>Figure 40: Bosjes Chapel (ArchDaily, 2020)</p> <p>ArchDaily (2020) <i>Bosjes Chapel / Steyn Studio</i>. Available at: <a href="https://www.archdaily.com/867369/bosjes-chapel-steyn-studio">https://www.archdaily.com/867369/bosjes-chapel-steyn-studio</a> (Accessed: 17 May 2023).</p> <p>A.T. (2017) 'Bosjes Chapel - Architecture Today', 26 June. Available at: <a href="https://architecturetoday.co.uk/bosjes-chapel/">https://architecturetoday.co.uk/bosjes-chapel/</a>, <a href="https://architecturetoday.co.uk/bosjes-chapel/">https://architecturetoday.co.uk/bosjes-chapel/</a> (Accessed: 17 May 2023).</p>
<p>The oak trellis that can be bent and fixed in multiple ways makes the shape of what the structure could be <b>versatile</b>, enabling it to become adapted in different forms to both existing and new sites. The product can be applied structurally and allows opportunity for coverings to be applied or even vegetation to grow on it.</p>	<p>Figure 41: 'Die Spens' in Ceres (Ranjit, 2021)</p> <p>Ranjit, J. 2021. <i>Die Spens &amp; Winkel By Steyn Studio And Square One Landscape Architects</i>, Parametric Architecture. Available from: <a href="https://parametric-architecture.com/die-spens-winkel-steyn-studio-square-one-landscape-architects/">https://parametric-architecture.com/die-spens-winkel-steyn-studio-square-one-landscape-architects/</a> [Accessed on 24 March 2023]</p>
<p>Innovative use of materials in order to create intricate spatial experiences. The project stands to show how the innovative use of materials can result in the making of <b>versatile spaces</b>.</p>	<p>Figure 42: The residence done by SRLC Architects (Crewe-Brown, 2020)</p> <p>Crewe-Brown, M. 2020. <i>Westcliff Ridge Home</i>, Visi. Available from: <a href="https://visi.co.za/westcliff-ridge-home/">https://visi.co.za/westcliff-ridge-home/</a> [Accessed on 10 April 2023]</p>



Architect	Project	Images & Diagrams	Year of Completion	Location	General Project Description	Emerging building technology			Mode of production		Developmental status		Value	List of References		
						Building material (I)	Construction process (II)	Structural system (III)	Low-tech (traditional or hand-based)	High-tech (Industrialised)	Under-developed	Developed				
43 SRLC Architects	Darymple Pavilion			Westcliff, Johannesburg, Gauteng	A rentable Pavilion space in Westcliff, Johannesburg used for gatherings such as weddings and other celebrations	N/A Glazing			Lead wood was torched for protective purposes. The rough grain of the wood is still visible meaning that prefabrication and machining methods used to produce these structural elements were minimal		Use of Lead wood as a structural element in South Africa		This project displays the potential behind hybrid tectonics within South Africa. A rather modern building typology was achieved through the innovative use of indigenous building materials making the project <b>contextually responsive</b> which still pushing the bounds of architecture within South Africa.	Figure 43: The Darymple pavilion done by SRLC Architects (Divani, 2023)  Divani, M. 2023. <i>Darymple Pavilion</i> by Silvio Rech and Lesley Carstens Architects, Decoholic. Available from: <a href="https://decoholic.org/darymple-pavilion-by-silvio-rech-and-lesley-carstens-architects/">https://decoholic.org/darymple-pavilion-by-silvio-rech-and-lesley-carstens-architects/</a> [Accessed on 10 April 2023]		
						N/A Rammed earth										
						Lead Wood			Lead wood was torched for protective purposes. The rough grain of the wood is still visible meaning that prefabrication and machining methods used to produce these structural elements were minimal		Use of Lead wood as a structural element in South Africa					
						N/A Torched lead wood elements used as structural elements, fixed through nut-and-bolt articulation system										
								Lead wood used as main structural element	Lead wood was torched for protective purposes. The rough grain of the wood is still visible meaning that prefabrication and machining methods used to produce these structural elements were minimal		Use of Lead wood as a structural element in South Africa					
44 SVA International	Ocean Sciences Campus Extensions NMu		2022	Geberha, Eastern Cape	a large internal veranda space, articulated as a triple-volume, multi-layered foyer space which links the main circulation spine with the more private spaces within.	N/A Anodized aluminum sun-screen panels							This project has <b>social value</b> due to the integration of the dive tank element within the main facade adds a unique character presence to the building and provides a distinctive feature that can be enjoyed by the public.  <b>Environmental value</b> is contributed because the project includes several sustainable design features, such as the use of natural ventilation, rainwater harvesting, and an energy-efficient building envelope. These features help to reduce the building's environmental impact and promote sustainability.  The building's design and material choices adds <b>contextual value</b> because it takes into account the local context, such as the use of anodized aluminum sun-screen panels that are resistant to the harsh coastal environment and the incorporation of the dive tank element, which relates to the building's function and location near the ocean.	Figure 44: Ocean Sciences Campus extension NMu (ArchDaily, 2012)  ArchDaily (2022). <i>Ocean Sciences Campus Extensions NMu / SVA International</i> . Available at: <a href="https://www.archdaily.com/991550/ocean-sciences-campus-extensions-nmu-sva-international">https://www.archdaily.com/991550/ocean-sciences-campus-extensions-nmu-sva-international</a> [Accessed: 10 May 2023].		
							Parametric modeling software was used to develop the form and geometry, the panels were fabricated off-site using CNC (ArchDaily, 2023)			This is considered high-tech because of the advanced manufacturing process and properties	The construction method involved is not a developed process in SA					
							The curved and angled shapes the dive tank used advanced fabrication to achieve the desired cylindrical forms			3D modeling and digital fabrication techniques for customised and complex geometries is required to achieve the cylindrical form of the dive tank	Not yet a common practice in South Africa, but it is an emerging trend					
										N/A column and beam						
45 Tsai Design Studio	The Visserhoek School		2014	Malanshoogte, Cape Town, Western Cape	A recycled shipping container was adapted to become a classroom and is surrounded by additional elements and landscaping that is meant to contribute to the programme of the classroom.	N/A Corrugated iron material							This project is <b>versatile</b> because this structure can be repeated and linked infinitely, meaning that it is versatile in size and usage.  This lost-cost and time-saving construction process enables the project to be inserted on various sites similar to this one, contributing to community upliftment, making it <b>socially responsible</b> .  The container has been recycled, meaning that costs were saved on the construction materials, causing the project to be <b>economical</b> .	Figure 45: 'Visserhoek' School in Malanshoogte (Laylin, 2012)  Laylin, T. 2012. <i>The Vissershok School is a Colorful Shipping Container Classroom for Kids in South Africa</i> , Inhabitat. <a href="https://inhabitat.com/the-vissershok-school-is-a-colorful-shipping-container-classroom-for-kids-in-south-africa/">https://inhabitat.com/the-vissershok-school-is-a-colorful-shipping-container-classroom-for-kids-in-south-africa/</a>		
							N/A Conventional construction methods used		Shipping containers as structural system, where an existing steel container is modified to become a school classroom.	An existing container that has been altered. Some sides have been cut open to insert windows and a roof has been added to the top. The structure has been altered in a low-tech manner.	This structural system has been developed since its initial discovery. The process of reassembling the structure in other places is uncomplicated, thus making it easy to do, resulting in it becoming a developed building technology.					

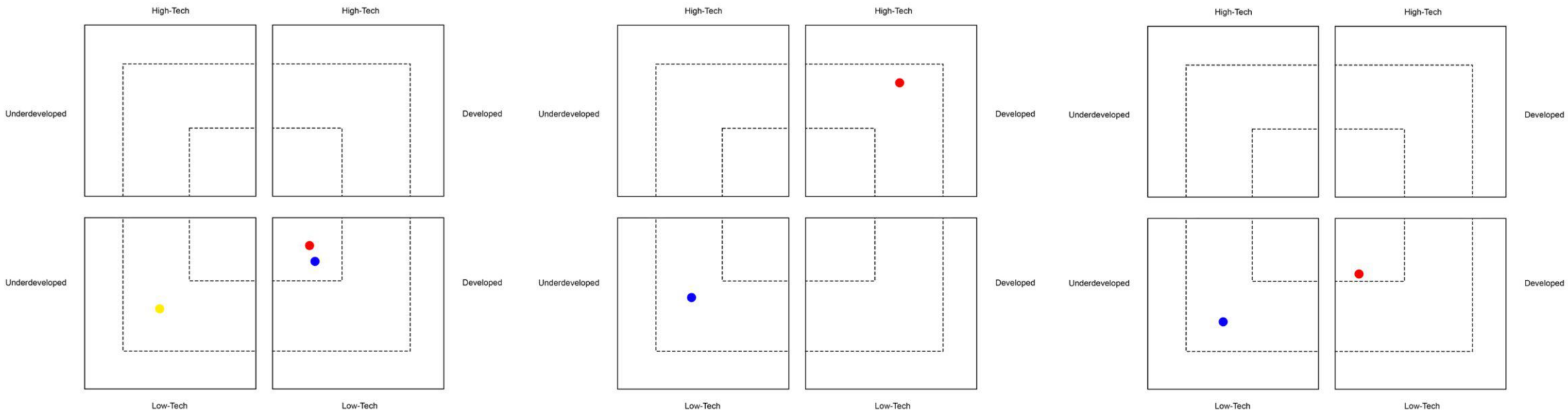


Architect	Project	Images & Diagrams	Year of Completion	Location	General Project Description	Emerging building technology			Mode of production		Developmental status		Value	List of References	
						Building material (I)	Construction process (II)	Structural system (III)	Low-tech (traditional or hand-based)	High-tech (industrialised)	Under-developed	Developed			
46	Urban Think Tank	Residence		2014	Khayelitsha, Cape Town, Western Cape	Architects worked with the community to improve their current home structures by working toward ways of maximising the quality and space. The existing structure is expanded in volume and assembly.	N/A Corrugated iron and timber for material	A design-and-build workshop for architects and local residents to collaborate with the final product being a community (experiments that are used)	Double volume residential structure with timber frame with corrugated iron cladding.	The workshop does not include the use of high-end machines or designs, the construction process is similar to normal shack construction, with the exception that it is built with an upper storey.	The double storey corrugated iron and timber structure is low-tech since it does not require any special joinery and is assembled by hand and low-tech equipment.	This way of working collaboratively is underdeveloped since the construction process usually does not include a workshop space where ideas can be tested between practitioners, builders and users.	This type of structure is currently underdeveloped since most of the current shack structures are single storey buildings and this new double stack idea has only recently been implemented.	The project is <b>contextually responsive</b> because the architects/builders are not removing the existing informants from their designs, but are rather using it to continue what is happening in the context and improving it.  The low cost materials that are used makes this project <b>economical</b> .  The people who inhabit the structure are a part of the construction process, not only to teach them the skill, but to save on labour costs. The use of this EBT makes the project <b>socially responsible</b> because the structures serve the community by meeting their needs within their social context, local people/the inhabitants are a part of the construction process.  Lastly, the project is <b>versatile</b> because the structure can be adapted in multiple ways depending on what the design requires. Although the size cannot become too large in size, it is able to contain more volume with a smaller footprint due to the fact that it is a double storey structure.	Figure 46: Residence done by Urban Think Tank in Khayelitsha (Frearso, 2014)  Frearso, A. 2014. <i>Urban-Think Tank develops housing prototype for South African slums</i> , Dezeen. Available from: <a href="https://www.dezeen.com/2014/03/07/empower-shack-urban-think-tank-housing-south-africa-slums/">https://www.dezeen.com/2014/03/07/empower-shack-urban-think-tank-housing-south-africa-slums/</a> [Accessed on 24 March 2023]
47	van Sittert, Bertus	Curtain House Residential		2021	Brooklyn, Pretoria, Gauteng	Brick, steel and concrete conventional residential house. Raked plaster facades with a new technique/application.	N/A Conventional brick and concrete materials	Stucco plaster scraped on facades with laser cut steel profile to create a 'tree bark' relief that turned out to look like the curtains hanging inside the house.	N/A Conventional (load bearing structural system) brick and concrete	Act of scraping and applying plaster is hand-based process	Profile used to scrape plaster is cut out using laser cutter that is high-tech	Traditional nature of applying plaster	The artisanal approach to applying plaster to buildings adds another layer of craft into the building. The specific design was chosen to mimic the trees that were on site. Shows how to create new ways of addressing the facades of conventional buildings in new ways.  Hybrid use of low and high tech. Combining past techniques with future processes	Figure 47: Curtain House (Bertus van Sittert, 2021)  S, M. (2021) Pretoria Institute of Architects: Winners of 2021 Architect Awards announced, Building & Decor. Available at: <a href="https://www.buildinganddecor.co.za/pretoria-institute-of-architects-winners-of-2021-architect-awards-announced/">https://www.buildinganddecor.co.za/pretoria-institute-of-architects-winners-of-2021-architect-awards-announced/</a> (Accessed: 02 May 2023).	
48	Veld Architects	Soil and Serenity		2022	Rhenosterspruit Conservancy, Centurion, Gauteng	A residence project where the rammed earth walls contain soil taken from the site to pay homage to the context.	N/A Soil used for the rammed earth walls	Rammed earth walls made on site by using the soil from the excavations, with plywood formwork and a pneumatic press.	N/A steel columns	It is low-tech due to the fact that simple methods are used to construct the	It is high-tech due to the fact that industrial machines are used to construct the walls.	Rammed earth walls are developed within the SA context since it	This project is <b>contextually responsive</b> because the soil that is sourced from the site pays homage to the context it is placed within.  It is also <b>economical</b> due to the low maintenance that is required for the rammed earth walls (GreenBuilder 2015).	Veld Architects, 2023, <i>Soil and Serenity</i> , Veld Architects. Available from: <a href="https://www.veldarchitects.co.za/projects/soil-and-serenity/">https://www.veldarchitects.co.za/projects/soil-and-serenity/</a> [Accessed on 27 March 2023]  Naditz, A. 2015. <i>Rammed Earth: Affordable, and Relatively Unknown</i> , Green Builder. Available from: <a href="https://www.greenbuildermedia.com/blog/one-of-the-most-affordable-eco-friendly-materials-is-relatively-unknown-but-it-has-the-advantages-of-2015-03-26/">https://www.greenbuildermedia.com/blog/one-of-the-most-affordable-eco-friendly-materials-is-relatively-unknown-but-it-has-the-advantages-of-2015-03-26/</a>	
49	Wall, S.	New Jerusalem Orphanage		2013	Midrand, Johannesburg, Gauteng	Multiple shipping containers were stacked and fixed to one another in order to create a children's home.	N/A Corrugated iron material	N/A Conventional construction methods used	Shipping containers as structural system, where an existing steel container is modified to become a room in a dwelling.	An existing container that has been altered. Some sides have been cut open to insert windows and a roof has been added to the top. The structure has been altered in a low-tech manner.		This structural system has been developed since its initial discovery. The process of repairing the structure in other places is uncomplicated, thus making it easy to do, resulting in it becoming a developed building technology.	The project proves to be very <b>economical</b> since the shipping containers "... are 25 percent cheaper than conventional brick and mortar homes." (Laylin, 2013)  This project is <b>versatile</b> because this structure can be repeated and linked infinitely, meaning that it is versatile in size and usage.	Figure 49: Shipping container home (Laylin, 2013)  Laylin, T. 2013. <i>New Jerusalem Orphanage is a Vibrant Shipping Container Home for South African Kids</i> , Inhabitat. Available from: <a href="https://inhabitat.com/new-jerusalem-orphanage-built-with-recycled-shipping-containers-makes-south-african-kids-feel-loved-again/">https://inhabitat.com/new-jerusalem-orphanage-built-with-recycled-shipping-containers-makes-south-african-kids-feel-loved-again/</a>	

Architect	Project	Images & Diagrams	Year of Completion	Location	General Project Description
50 WOLFF ARCHITECTS	Cheré Botha School		2017	Oakglen, Cape Town, Western Cape	A government school for children with special educational needs

Emerging building technology			Mode of production		Developmental status	
Building material (I)	Construction process (II)	Structural system (III)	Low-tech (traditional or hand-based)	High-tech (industrialised)	Under-developed	Developed
N/A Brick						
N/A Polycarbonate panels						
Glulam Structural timber				Each timber structural element is glued and placed under high machine compression for compaction to form elements		The glulam manufacturing process is developed in SA
	N/A A series of educational buildings that predominantly use the structural wood "A-frame typology". These A-frames are articulated using nut-and-bolt joinery systems, and are fixed to the finished floor level using a steel base plate in conjunction with a nut-and-bolt system					
		N/A Predominantly, A- frame glulam structural wood trusses are used to create large spans of space				

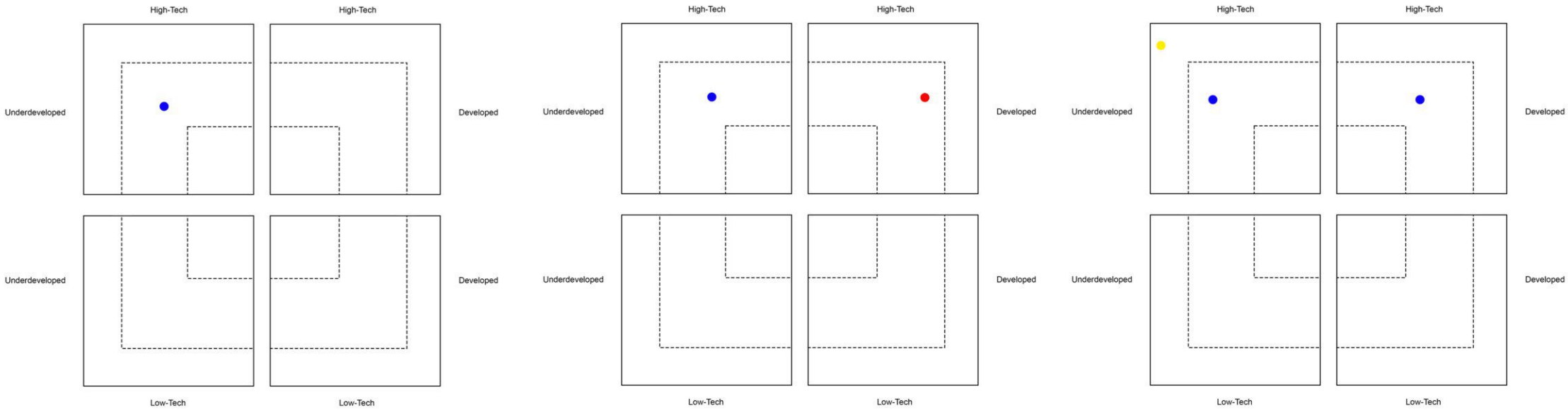
Value	List of References
This project stands to show how institutional spaces such as schools don't need to rely on the over-saturated use of brick and concrete. This project stands to highlight the potential of wood construction on a large scale thus presenting a level of <b>economic efficiency</b> for larger scale buildings within South Africa.	Figure 50 : Cheré Botha School (Editors at Wolff Architects, 2019) Editors at Wolff Architects (2019) Cheré Botha School, Wolff Architects. Available at: <a href="https://www.wolffarchitects.co.za/projects/all/special-needs-school/">https://www.wolffarchitects.co.za/projects/all/special-needs-school/</a> (Accessed: 16 May 2023).



1. BuildCollective  
- Ithuba Community College

2. Bottle2Build  
- School

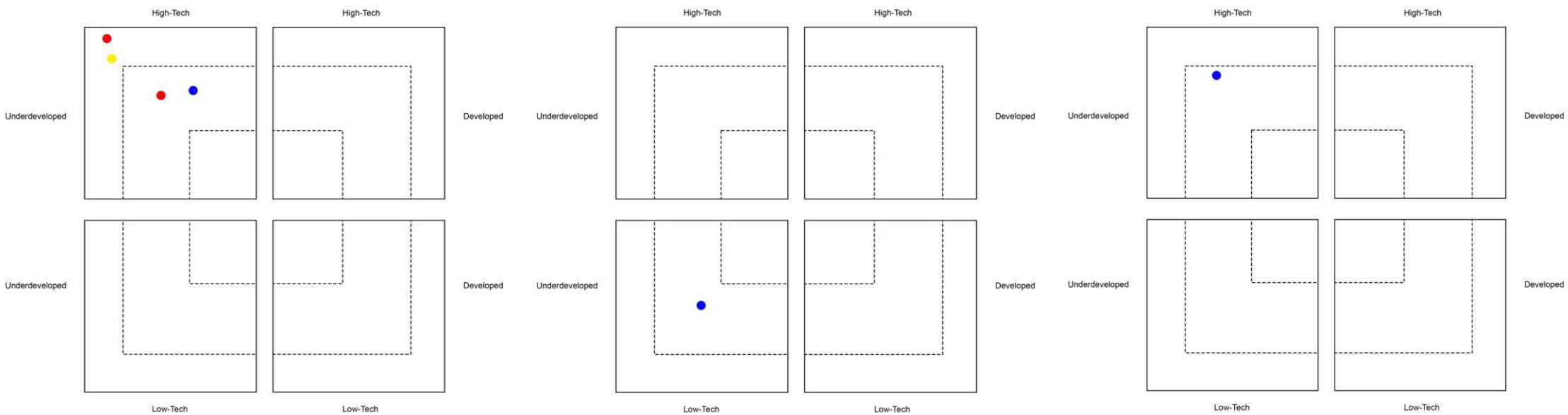
3. Carin Smuts Architects  
- Guga S'Thebe Phase 2



4. cseventysix architects  
- "Writer's Retreat" Residence

5. Rod Choromanski & Dean Ramlal of  
Choromanski Architects  
- uMkhumbane Museum

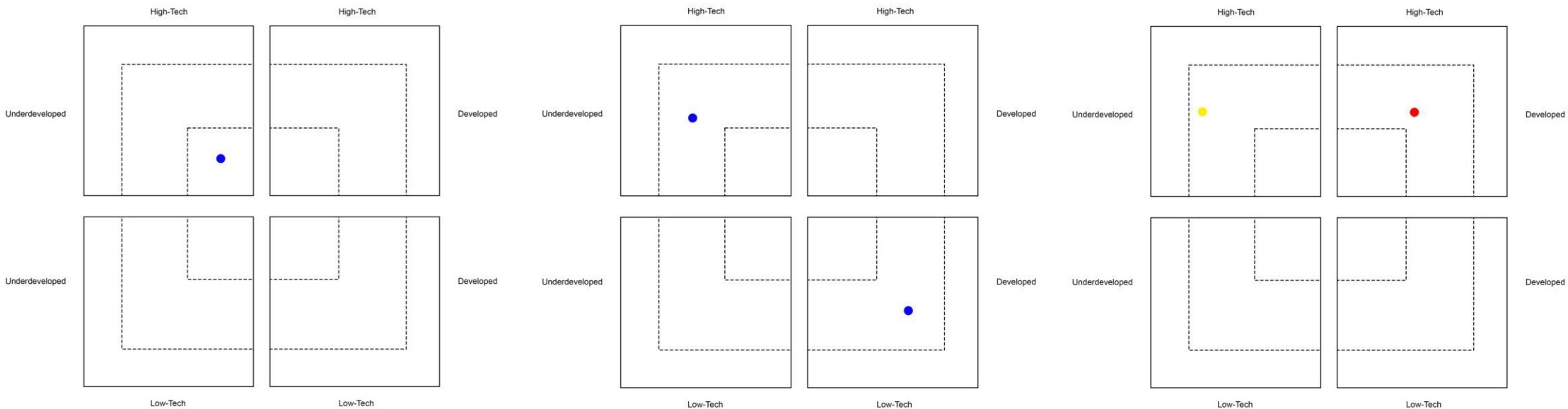
6. Earthworld Architects  
- Kospaza Restaurant



7. Elliot, Paul  
- House Elliot

8. Elmo Swart Architects  
- Wright House

9. Entity Architects and Blockhouses  
- Cradle Boutique Hotel

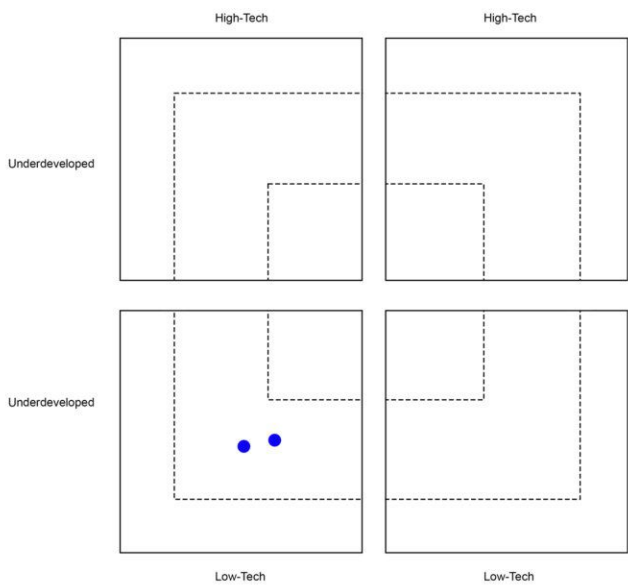


10. Elphick Proome Architects  
- Durban Christian Centre

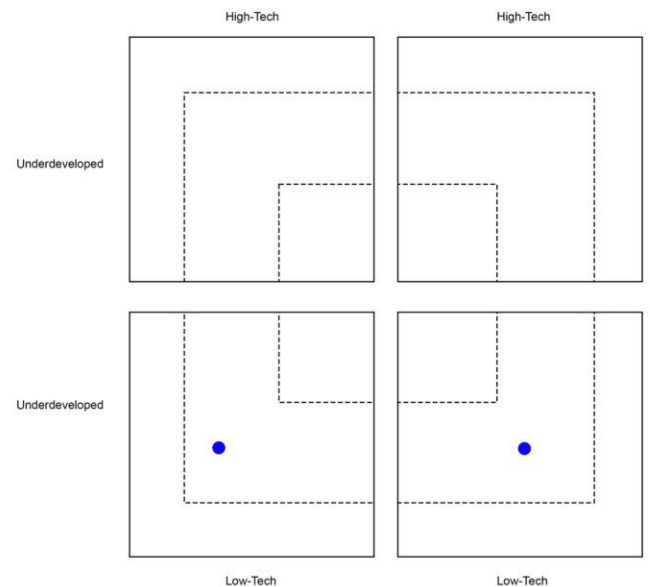
11. Field Architecture  
- Karoo Wilderness Centre

12. Frankie Pappas  
- House of the big arch

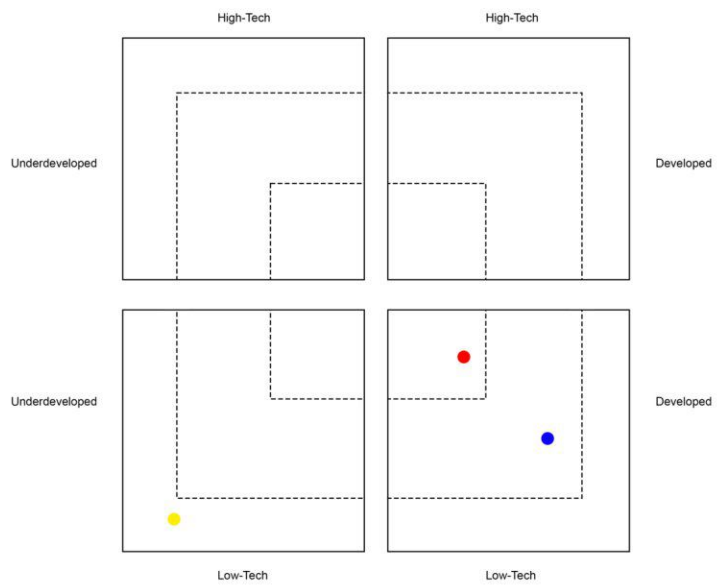




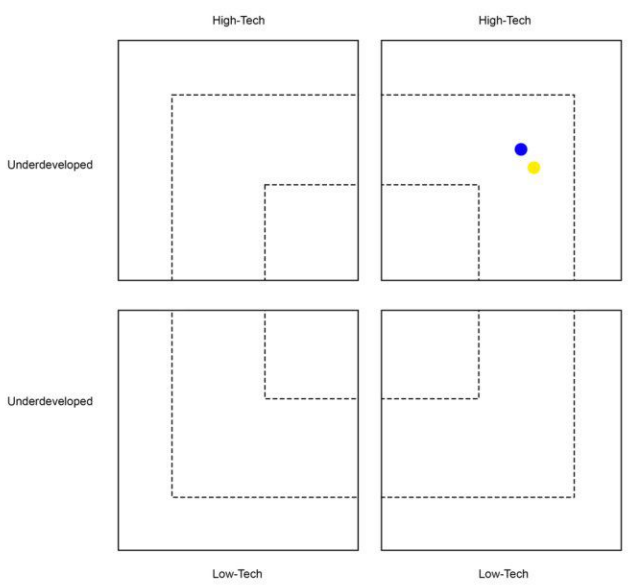
13. Galland, Simon and LYT Architecture  
- Walmer Crèche



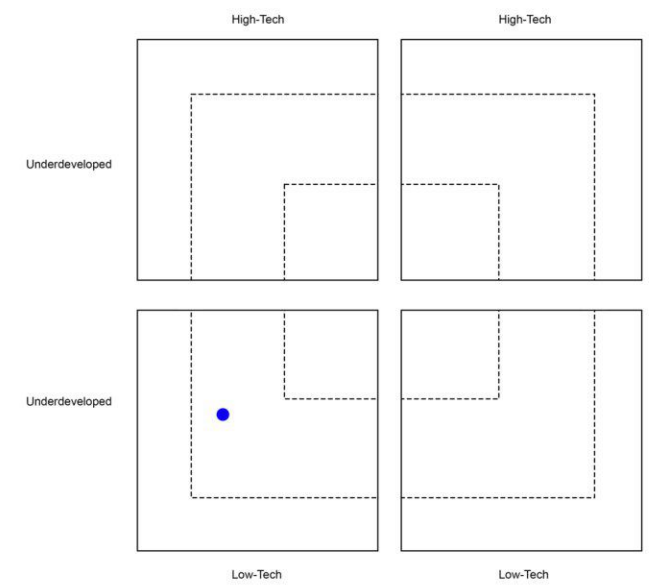
14. GASS Architecture Studios  
- Green School South Africa



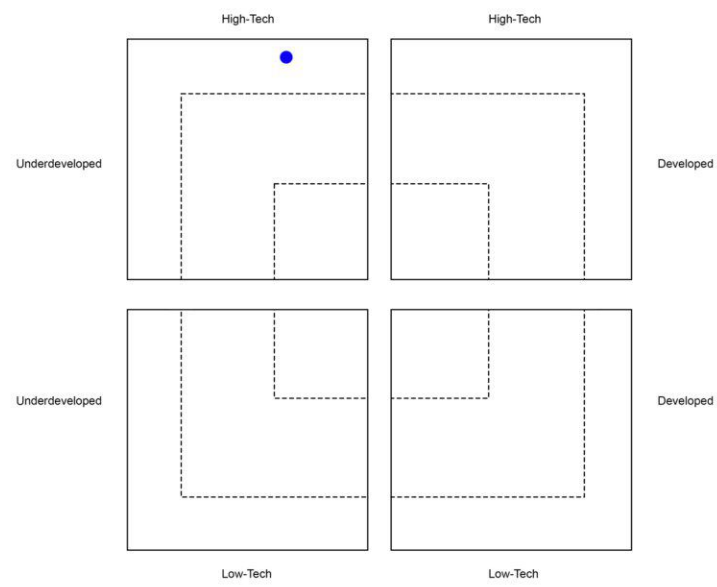
15. GLH Architects  
- Witklipfontein Eco Lodge Residential



16. Heatherwick Studio  
- Zeitz Museum of Contemporary Art Africa



17. Holzbau Hess  
- Yoga Studio



18. UJ'  
- South Africa's first 3D printed low-cost house