Directory

on

Emerging Housing Technologies



Building Materials & Technology Promotion Council
Ministry of Housing & Urban Poverty Alleviation
Government of India

Contents

Emerging Technology No. 1

Name of Technology: Industrialized 3-S System using Cellular Light Weight Concrete Slabs & Precast Columns

1.	Name of Organization/Company	M/s B. G. Shirke Construction Technology Pvt. Ltd.,
2.	Postal Address and Website	M/s B. G. Shirke Construction Technology Pvt. Ltd., 72-76 Mundhawa, Pune - 411036 Tel 020-26708130 / 26708100 Fax 020-26871612 / 26708130 E mail design@shirke.co.in / ypkajale@shirke.co.in Fax : 4257203 Email :pgsmysore@pgsetty.com Website : www.pgsetty.com
3.	Name, Designation and details of Contact Person (Telephone, Fax, E-mail) (Technical Person)	Shri Yogesh P. Kajale Vice President (Engineering Planning & Design) Pune - 411036 Tel 020-26708130 / 26708100 Fax 020-26871612 / 26708130 E mail design@shirke.co.in / ypkajale@shirke.co.in Website : www.pgsetty.com
4.	Name and details of Foreign Collaborator, if any	Own develop technology
5.	Name of the Technology/System	Industrialized 3-S System using Cellular Light Weight Concrete Slabs & Precast Columns
6.	Is it a patented system?	No Information.
7.	Brief Write- up on Technology / System	The industrialized total prefab construction technology is based on factory mass manufactured structural prefab Components conforming to provisions of relevant Indian Standards. The major precast elements are: • RCC hollow columns with notches • RCC solid beams (T/L/Square Shape) • Staircase • RCC precast slab • AAC precast slab • AAC precast block In the system, precast dense concrete hollow column shell of appropriate sizes are used in combination with precast dense concrete rectangular / 'T' shape / 'L' Shape beams with light weight reinforced autoclaved cellular concrete slabs for floors and roofs. The hollow columns are grouted with appropriate grade of in situ concrete. All the components and jointing of various structures are accomplished through on-site concerting along with secured embedded reinforcement of appropriate size, length and configuration to ensure monolithic continuous resilient, ductile and durable behavior. Autoclaved Aerated Concrete (AAC) slabs can be used as floor / roof slabs. Joints are filled with 1:5 Cement Mortar and separate screed concrete of minimum 40 mm thick, grade M20 is put in the entire area of slab before

		flooring / water proofing.
8.	If any evaluation/certification carried out.If yes, Give Details	**Against vertical load** Full Scale load test on assembly of RC precast assembly by Tor Steel Research Foundation in India, Bangalore found it safe. Structural Design evaluation for HIG – II Buildings at Powai by Shri H.P.Shah; Stanford University found that based on the design concept, design calculation and detailing; the structure is safe against vertical loads, seismic loads and the wind loads. Scrutiny of design for G+15 HIG type tenements by IIT Mumbai found it safe. **Against seismic and wind load** Test performed on full scale building to establish behaviour of various joints under all design loads including seismic Zone IV by CBRI. The experimental results on Full Scale Building Structure established the desired performance and behaviour of the system under all loading condition as above. When designed for use in Zone V, independent verification may be needed. **Durability** Anti corrosive treatment given to reinforcement used in AAC panels for durability, was evaluated by CBRI, Roorkee with satisfactory results. Concrete and cover requirement are as per durability clause of IS 456 : 2000, to ensure adequate durability.
9.	Advantages of the Technology vis- a-vis. conventional system	100 mm RCC Walls and Roof has thermal transmittance (U) value as 3.59 W/m2K) (as per IS 3792:1978).Since, it is more than the normal plastered brick wall (thermal transmittance (U) 2.13 W/m2K), it is advised that implementing agency shall ensure proper planning for heat insulation and air ventilation in the housing units through proper orientation, shedding etc. (see IS 3792:1978 for guidance). Average Sound reduction for 100 mm concrete is ≥ 45db (IS 1950:1962)
10.	Limitations of the Technology, if any	The project is taken as turnkey project by the agency M/s B.G.Shike & Co., Pune. No other agency is involved in this propriety system.
11.	Whether the manufacturing of components is on-site or factory made.	Factory made. CUM on-site
12.	In case of Factory made, whether Manufacturing Facility is established in India. (present status) If Yes, Location and Present Manufacturing Capacity.	For a new plant to be setup, a minimum project of 5000 dwelling units may be needed. In places, where plant is already set up, smaller project may also be viable.

	If No, what scale of project (No. of Dwelling Units) needed to establish the factory?	
13.	In case of on-site production, scale of The project (No. of Dwelling Units) Needed to establish the facility on site.	Economy Scale of economy depends upon the volume of work and achievable for the estimated time period of construction. The Minimum 5000 units.
14.	What is the economical lead distance In case factory made components?	Precasting yard / factory set up is required with facilities such as Casting Yard, Computerized batching plant, Moulds, Transportation facility, Stacking yard for materials & components, Lifting and loading facility, Laboratory to test raw material & finished products, Water tank of enough holding capacity as required for 2 – 3 days, Service road, etc. Utmost attention is required for process engineering before taking up any field work. Close co-ordination between design crew, field staff and quality crew is essential.
15.	Do you also execute the project, If yes, present capacity. If No, How it is proposed to be done.	YES we also execute the project of any capacity but Plants & Machineries for production of Components available in Pune and Delhi
16.	Are you ready to take up the execution of the project immediately on receipt of the work order?	Yes
17.	Do you provide complete design Solution? If Yes, whether structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893 If No, How do you propose to provide structural design?	Yes
18.	Do you provide construction supervision services / Project Management consultancy services If No, How it is proposed to be done	Yes
19.	Brief on the Training needs for Installing, Using and Maintenance along with readiness to execute the project using construction workforce with current skills in India.	Training is Required
20.	Note on Guarantees / Warrantees Provided to the user/customer.	Durability Since concrete is main constituent material, durability of the structure can be achieved by using proper ingredient, Grade of concrete & mix design as per IS456:2000. AAC P BLOCK :Density 451-550 Kg/m3 for internal wall, 551-650 Kg/m3 for external wall as per IS 2185 (Pt. 3) :1984 AAC PRECAST SLAB Grade1 of Density 551 –650 Kg/m3 of IS 6073:2006

21.	Attach a brief note on the Sustainability issues such as environmental friendliness, energy efficiency use of waste materials recyclability etc.	Proper lighting & ventilation, reduces the energy Consumption. Less water is consumed during construction.	
22.	Note on Upkeep / Maintenance facilities that will be available to the User / customer during guarantee / warranty period and after. Availability of annual maintenance contract.	As per tender document and own construction manual of B.G.Shirke.	
23.	Attach note on case studies of use of the Technology in the country/ other countries with date (month/year) of use/ installation.	Residential LIG and MIG housing project at Matulya Mills Ltd., Lower Parel, Mumbai Residential mass housing project of MSCADA, Powai, Mumbai Multistoried Residential Building at Chennai for True Value Homes Pvt. Ltd. Mass Housing Project at Delhi for DDA. S+30 multi storeyed building for National Peroxide Ltd, Wadala Concrete Reinforcement Block Several projects are being taken up / completed in Maharashtra & Delhi. Shall be of Fe 415 Grade or Fe 500 Grade as per IS 1786:2008 Grade 1 of Density 551 – 650 Kg/m3 of IS 6073:2006 Density 451-550 Kg/m3 for internal wall, 551-650 Kg/ m3 for external wall as per IS 2185 (Pt. 3) :1984 Projects in major cities of India.	
24.	Analysis of Life Cycle Cost including Initial cost, cost of maintenance, and comparison with conventional system, if any	Cost is half, Maintenance & Life is equal, and more Benefits are equally good.	
25.	Speed of construction vis-à-vis Conventional system.	Conventional system minimum 3 months, whereas it Will take 30 days only.	
26.	Brief on Performance Characteristics & related Standards	1. Structural Stability	OK
		2. Durability	OK
		3. Behavior in Earthquake	Safe
		4. Fire Safety	Safe
		5. Rain	Safe
		6. Thermal performance	OK
		7. Acoustic performance	OK
		8. Behavior under high wind/cyclones	Safe
		9. Floods	Safe
		10. Under high moisture /	OK

		Humid conditions.	
27.	Is there Standard on technology formulated by Your Company	Yes against vertical load Full Scale load test on assembly of RC precast assembly by Tor Steel Research Foundation in India, Bangalore found it safe. Structural Design evaluation for HIG – II Buildings at Powai by Shri H.P.Shah; Stanford University found that based on the design concept, design calculation and detailing; the structure is safe against vertical loads, seismic loads and the wind loads. Scrutiny of design for G+15 HIG type tenements by IIT Mumbai found it safe. against seismic and wind load Test performed on full scale building to establish behaviour of various joints under all design loads including seismic Zone IV by CBRI. The experimental results on Full Scale Building Structure established the desired performance and behaviour of the system under all loading condition as above. When designed for use in Zone V, independent verification may be needed	
28.	Attach Photographs / Diagrams showing Components, Installation /assembly details, Finished Structure		
			
29.	Name & Contact details of Professionals / Architects / Engineers	Shri Yogesh P. Kajale Vice President (Engineering Planning & Design) M/s B. G. Shirke Construction Technology Pvt. Ltd., 72-76 Mundhawa,	

		Pune - 411036 Tel 020-26708130 / 26708100 Fax 020-26871612 / 26708130 E mail design@shirke.co.in / ypkajale@shirke.co.in

Emerging Technology No. 2

Name of Technology: Pre-stressed precast prefab technology using hollow core slab, beams, columns, solid walls, stairs, etc.

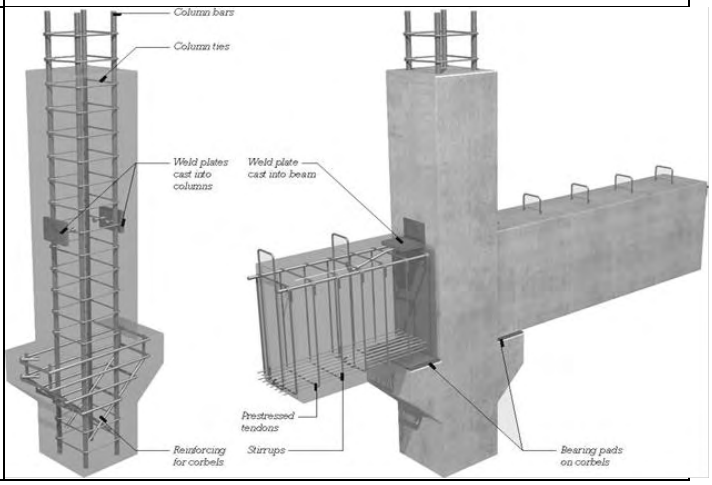
1.	Name of Organization/Company	**Simplex Prefab Infrastructure (India) Pvt. Ltd**. • The Late Shri Bhanji Monji Shah founded Simplex in Jabalpur, Madhya Pradesh in 1941 as a unit manufacturing Agricultural Implements, Steel Structure & Castings. • In the 1950's, with the decision of Government of India to construct India's first One Million Ton capacity Public Sector Steel Plant at Bhilai, Simplex moved to Bhilai to be closely associated with the building of the Steel Plant at Bhilai. • Simplex continued to be associated with the operation and expansion of and other SAIL Plants by way of manufacture and supply of critical spares including import substitution activities, components & equipment. • Simplex continued to be associated with the operation and expansion of and other SAIL Plants by way of manufacture and supply of critical spares including import substitution activities, components & equipment.
2.	Postal Address and Website	Simplex Prefab Infrastructure (India) Pvt. Ltd. 93, Balaji Bhavan, Nariman Point Mumbai 400 021 Tel. 022-22021932, 1730 267913 Fax 022-22866210 Mob 09870000296 E mail: vatsal@simplexgroup.co.in Web www.simplexgroup.co.in
3.	Name, Designation and details of Contact Person (Telephone, Fax, E-mail) (Technical Person)	Shri Vatsal Shah Project Executive Simplex Prefab Infrastructure (India) Pvt. Ltd. 93, Balaji Bhavan, Nariman Point Mumbai 400 021 Tel. 022-22021932, 1730 267913 Fax 022-22866210 Mob 09870000296 E mail: vatsal@simplexgroup.co.in Web www.simplexgroup.co.in
4.	Name and details of Foreign Collaborator, if any	**S**implex Prefab Infrastructure (India) Pvt. Ltd. is engaged in providing precast solutions to the construction industry in the Residential, Commercial & industrial sectors on turnkey basis. Its product includes pre stressed prefab hollow core slabs, pre stressed beams, columns, solid walls, partition walls. staircases, railway sleepers, highway elements, sound barriers and boundary walls for SEZ and Large plants. The company was incorporated in 2009 and is based in Mumbai, Maharashtra. Simplex Prefab Infrastructure (India) Pvt. Ltd. promoted jointly by Simplex Group of

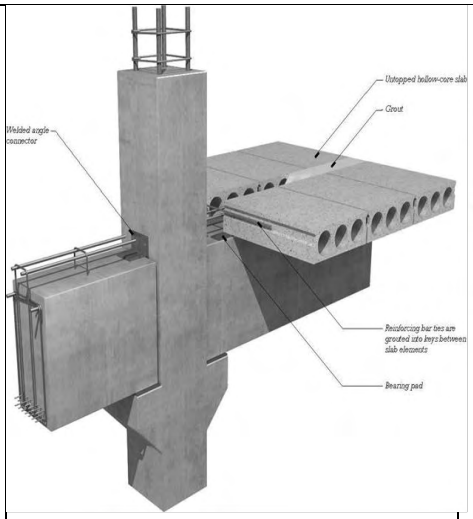
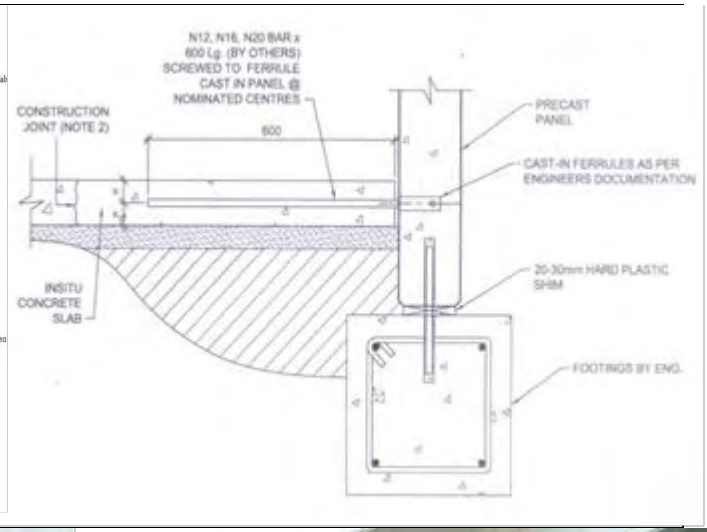
		Companies, Sarda Energy & Minerals Ltd and Betoni Mestarit (Finland).Web www.simplexgroup.co.in
5.	Name of the Technology/System	**Pre-stressed precast prefab technology using hollow core slab, beams, columns, solid walls, stairs, etc.**
6.	Is it a patented system?	Web www.simplexgroup.co.in
7.	Brief Write- up on Technology / System	Pre-stressed precast RCC technology using hollow core slabs, beams, columns, solid walls, s tairs etc. are designed and manufactured in factory, shipped and erected at site. Multi-storey precast concrete frames are constructed with columns and beams of different shapes and sizes, stair and elevator shafts and floor slabs. The joints between the floors elements are executed in such a way that concentrated loads are distributed over the whole floor. This system is widely used for multi storey buildings. The structural frame is commonly composed of rectangular columns of one or more storeys height. The beams are normally rectangular, L-shaped or inverted T-beams. They are single span or cantilever beams, simply supported and pin-connected to the columns. Hollow core floor slabs are by far the most common type of floor slabs in this type of structure. **Materials used:** Cement concrete, steel strands, reinforcing steel.
8.	If any evaluation/certification carried out. If yes, Give Details	Several laboratory tests carried out in different areas of the world as well as in Italy have put into evidence the high load resistance of the Advanced Building System panels. For example, compression tests with centred load carried out on a "nished single panel,cm 270 high, have shown that the same panel can sustain a maximum load of 1530 kN/m.
9.	Advantages of the Technology vis-a- vis. conventional system	**The Advantages** • Speedy & All Weather Construction • Assured Quality • Column-free Spaces • Green Building • Fire Resistant • Low Maintenance • Earthquake-proof • Less Labour Intensive • Leak Proof • Durable and Long Lasting • Design Versatility • Early Return on Investment • High Load Bearing Capacity • Excellent Thermal and Acoustic . **Salient Features:** • **Saving in Cost**: Precast Prefab buildings can be constructed in less than half the time it takes to construct using conventional construction. This results in huge financial

		savings. • **Material Savings**: Precast pre-stressed technology results in 40% reduction in slab weight. This reduces in building weight, material & foundation cost resulting in direct cost savings. • **Savings in Exterior Painting & Finishing**: All exterior surfaces can be provided with aggregate or other such colored finishes which require no additional painting over the life time of the building. Alternatively the walls are made with a very smooth mirror like finish saving in plastering costs. • **Increased Carpet Area:** Because of the high strength of the concrete structure small sized walls can be used in lieu of thicker ones. This results in the increased carper area for a similar construction of in-situ buildings. • **Energy Savings:** Hollow core slabs act as a natural insulator & thereby result in savings in air conditioning cost. Additionally, walls can have in-built foam insulation resulting in increased savings. • **Environmental Benefits**: Prefab concrete can have fly ash as a ingredient in the concrete mix. This results in higher strength concrete while at the same time utilizing an otherwise waste product. • **Long Life Cycles:** As buildings components are manufactured & cured in controlled conditions the resulting elements have better strength & durability. This results in buildings having much longer life cycles than conventional in-Situ construction • **Water Savings:** Water requirement for curing of elements is minimal as compared to in- situ con- struction. Also in the factory the water is recycled thereby saving this precious commodity.
10.	Limitations of the Technology, if any	The viability depends upon the quantum of work.
11.	Whether the manufacturing of components is on-site or factory made.	Factory made Precast Hollow-Core Slabs • Application : Precast pre-stressed hollow-core slabs are used predominantly for floor and roof deck components for various structures • Casting process : M60 equivalent grade concrete is cast over a steel bed along with pre-stressed wire strands, producing an incredibly strong product that tolerates high load capacities and can be used to cover long spans, from 6 meters to as high as 23 meters. The hollow core panels have continuous voids in them that help reduce the overall weight of the structure

12.	In case of Factory made, whether Manufacturing Facility is established in India. (present status) If Yes, Location and Present Manufacturing Capacity. If No, what scale of project (No. of Dwelling Units) needed to establish the factory?	Being a turnkey solution provider, one of the key elements is the ability to transfer the material in a timely fashion at the site. Extensive experience ensures both – a reliable & efficient delivery that enables a smooth flow of processes post delivery. The products are placed & delivered in the exact sequence that will be required for erection of the project. The precast elements arrive ready for installation and can be scheduled to be on site 'just-in-time' so they can be lifted directly and installed. This prevents unnecessary double handling, thus reducing time and energy.
13.	In case of on-site production, scale of the project (No. of Dwelling Units) needed to establish the facility on site.	**NO on-site production,** Being a turnkey solution provider, one of the key elements is the ability to transfer the material in a timely fashion at the site. Extensive experience ensures both – a reliable & efficient delivery that enables a smooth flow of processes post-delivery. The products are placed & delivered in the exact sequence that will be required for erection of the project. The precast elements arrive ready for installation and can be scheduled to be on site 'just-in-time' so they can be lifted directly and installed. This prevents unnecessary double handling, thus reducing time and energy.
14.	What is the economical lead distance in case factory made components?	1OOKM
15.	Do you also execute the project, If yes, present capacity. If No, How it is proposed to be done.	YES
16.	Are you ready to take up the execution of the project immediately on receipt of the work order.	YES
17.	Do you provide complete design solution? If Yes, whether structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893 If No, How do you propose to provide structural design.	YES **Manufacturing** Precast is produced in factories under strictly controlled conditions, which means excellent resource efficiency for materials, labour, energy and processes. Our in-house precast facility at Khopoli is home to all things manufacturing, when it comes to prefab & precast. **Unique Shape** – A Prefab Possibility Molds can be designed to produce unique, custom sized or shaped units/precast elements. Precast Concrete excels because of the flexibility and accuracy in the production process. ¬ Adapting Existing Structures with Prefab It is important to ensure that any new design structures or buildings that are constructed are in tune with their older counterparts. Vigilant designs in the precast factory and use of prototypes can ensure that the match is satisfactory and compatible
18.	Do you provide construction supervision services / Project Management consultancy services	YES **Manufacturing** Precast is produced in factories under strictly controlled conditions, which means excellent

	If No, How it is proposed to be done	resource efficiency for materials, labour, energy and processes. Our in-house precast facility at Khopoli is home to all things manufacturing, when it comes to prefab & precast. ¬ Unique Shape – A Prefab Possibility Molds can be designed to produce unique, custom sized or shaped units/precast elements. Precast Concrete excels because of the flexibility and accuracy in the production process. ¬ Adapting Existing Structures with Prefab It is important to ensure that any new design structures or buildings that are constructed are in tune with their older counterparts. Vigilant designs in the precast factory and use of prototypes can ensure that the match is satisfactory and compatible
19.	Brief on the Training needs for Installing, Using and Maintenance along with readiness to execute the project using construction workforce with current skills in India.	**Training required.** Precast construction requires minimal propping and bracing and reduces the need for scaffolding, to provide an immediate clear work area for following trades. Highly trained professionals using suitable gear & cranes lift the prefab panels. A special high quality grout material is used to achieve leak-proof joints along with a strong bond.
20.	Note on Guarantees / Warrantees provided to the user/customer.	**Quality Assurance** • The quality assurance program is an integral part of all processes. Each stage of manufacturing is closely monitored including quality control procedures, batching reports, production, placement, consolidation, casting, curing, stripping, testing, storage and handling of product. • Quality of maintenance of the building is the responsibility of the building owner.
21.	Attach a brief note on the Sustainability issues such as environmental friendliness, energy efficiency use of waste materials recyclability etc.	Long Life Cycles: As buildings components are manufactured & cured in controlled conditions the resulting elements have better strength & durability. This results in buildings having much longer life cycles than conventional in-Situ construction
22.	Note on Upkeep / Maintenance facilities that will be available to the user / customer during guarantee / warranty period and after. Availability of annual maintenance contract.	AS PER REQUREMENT
23.	Attach note on case studies of use of the Technology in the country/ other countries with date (month/year) of use/ installation.	No information
24.	Analysis of Life Cycle Cost including Initial cost, cost of maintenance, and comparison with conventional system, if any	Long Life Cycles: As buildings components are manufactured & cured in controlled conditions the resulting elements have better strength & durability. This results in buildings having much longer life cycles than conventional in-Situ construction
25.	Speed of construction vis-à-vis conventional system.	**Saving in Cost:** Precast Prefab buildings can be constructed in less than half the time it takes to

		construct using conventional construction. This results in huge financial savings. **Material Savings:** Precast pre-stressed technology results in 40% reduction in slab weight. This reduces in building weight, material & foundation cost resulting in direct cost savings. Savings in Exterior Painting & Finishing: All exterior surfaces can be provided with aggregate or other such colored finishes which require no additional painting over the life time of the building. Alternatively the walls are made with a very smooth mirror like finish saving in plastering costs. Increased Carpet Area: Because of the high strength of the concrete structure small sized walls can be used in lieu of thicker ones. This results in the increased carper area for a similar construction of in-situ buildings. **Energy Savings:** Hollow core slabs act as a natural insulator & thereby result in savings in air conditioning cost. Additionally, walls can have in-built foam insulation resulting in increased savings. **Environmental Benefits:** Prefab concrete can have fly ash as a ingredient in the concrete mix. This results in higher strength concrete while at the same	
26.	Brief on Performance Characteristics & related Standards	1. Structural Stability	OK
		2. Durability	OK
		3. Behavior in Earthquake	Safe
		4. Fire Safety	Safe
		5. Rain	Safe
		6. Thermal performance	OK
		7. Acoustic performance	OK
		8. Behavior under high wind/cyclones	Safe
		9. Floods	Safe
		10. Under high moisture /Humid conditions.	OK
		11. Any other, please specify)	No
27.	Is there Standard on technology formulated by Your Company		
28.	Attach Photographs / Diagrams showing Components, Installation /assembly details, Finished Structure		

29.	 
	 	
30.	Name & Contact details of Professionals / Architects / Engineers involved with this technology Attach a list, if it is exhaustive Give list of trained Artisans, if any	Shri Vatsal Shah Project Executive Simplex Prefab Infrastructure (India) Pvt. Ltd. 93, Balaji Bhavan, Nariman Point Mumbai 400 021 Tel. 022-22021932, 1730 267913 Fax 022-22866210 Mob 09870000296 E mail: vatsal@simplexgroup.co.in Web www.simplexgroup.co.in • **Factory Address:** Survey Number 48/A,4 Khopoli Pali Road, Village Khumbewadi, Gram Panchayat, Umbre Tal, Khalapur Dist. , Raigad-410203, 2km from Imagica Adlab Ph: +91 22 22021070 Fax: +91 22 22826680 Email : info@minmetint.com Contact : Mr. Prasan Shah .
31.	Provide additional information you may like to supplement.	**APPLICATIONS** • Residential Towers and Complexes

		• Apartments and Condominiums • Villas and Row Houses • Commercial Buildings • Factories and Warehouses • Car Park and Podiums • Schools • Hospitals • Educational and Cultural Buildings • Cold Storages

Emerging Technology No. 3

Name of Technology: Monolithic Concrete Construction System using Plastic - Aluminum Formwork

1.	Name of Organization/Company	Sintex Industries Ltd,
2.	Postal Address and Website	Shri S. B. Dangayach Managing Director Sintex Industries Ltd, Near Seven Garnala Kalol ,N Gujarat-382721 Phone: 02764-253500, 253800 Mobile: 09998822680 Fax:+91-02764 253800 Email : dangayach@sintex.co.in Web: www.sintex-plastic.com Prefab & Construction Division, A-38,2nd Floor,Main Mathura Road,New Delhi-110044
3.	Name, Designation and details of Contact Person (Telephone, Fax, E-mail) (Technical Person)	Shri S. B. Dangayach Managing Director Sintex Industries Ltd, Near Seven Garnala Kalol ,N Gujarat-382721 Phone: 02764-253500, 253800 Mobile: 09998822680 Fax:+91-02764 253800 Email : dangayach@sintex.co.in Web: www.sintex-plastic.com Prefab & Construction Division, A-38,2nd Floor,Main Mathura Road,New Delhi-110044
4.	Name and details of Foreign Collaborator, if any	No Information.
5.	Name of the Technology/System	Monolithic Concrete Construction System using Plastic - Aluminum Formwork
6.	Is it a patented system ?	No Information.
7.	Brief Write- up on Technology / System	In this system, in place of conventional RCC framed construction of columns and beams; all walls, floors, slabs, columns, beams, stairs, together with door and window openings are cast in place monolithically using appropriate grade of concrete in one operation on site by using specially designed, easy to handle (with minimum labour and without use of any equipment) modular formwork made up of Aluminium/Plastic/ Aluminium-Plastic Composite. Using the formwork system, rapid construction of multiple units of repetitive type can be achieved.
8.	If any evaluation/certification carried out. If yes, Give Details	The formwork made of Aluminium Extruded Section conforming to IS 733:1983 and PVC conforming to Grade PVC 67G ER01 of IS 10151:1982. It consists of different sections including starter of MS Angle, top frame of aluminium channels, wall panels, slab panels & truss.The Formworks are designed based on the structural requirements of building units. A quality control scheme is required to be followed for quality of raw materials used and formwork components manufactured. Under Performance Appraisal Certification Scheme, the Formwork System

		manufactured by M/s Sintex Industries, Ahmedabad, has been evaluated and certified by BMTPC (PAC No. 1006-A/2011). (refer BMTPC website for PACS Certification)
9.	Advantages of the Technology vis- a- vis. conventional system	THE TECHNOLOGY (4 houses (Shell) in 48 hours) Monolithic construction is a method where a structure is Monolithically built using a Homogeneous Material. We have successfully achieved an efficiency of 4 houses in 48 hours by importing the World Class Form Work technology. • Most of the key components like walls, columns, beams, floor slabs, staircases, balconies, openings, hoods, storage lofts, etc., are monolithically concreted in-situ. • No need of bricks, blocks and plastering. • Because of reduced dead load, superstructure and foundation cost are minimized without compromising on strength. • These structures are efficient against earth-quake due to its single rigid block nature. • Amenable to fast-track construction. • Excellent finished surface avoids expensive plastering and enhances a relatively water resistant surface. • All services like electrical, plumbing & Sanitary are embedded before concreting which avoids breaking & making of structures. • It demands least quality control on site-which is the greatest advantage for fast track construction. • Whenever there is a challenge of construction in least possible time with best quality.
10.	Limitations of the Technology, if any	Limitation Such as stairs, windows, etc. 1) A lead time of about 3 months is required for initiation of work, as the formwork are custom designed, manufactured and prototype approved before manufacturing required number of sets of formwork. 2) Capital cost to initiate construction is high and may require regular flow of funds. 3) Post construction alterations are difficult. 4) All the service lines are to be pre-planned in advance. Not much saving in construction in one storey structure
11.	Whether the manufacturing of components is on-site or factory made.	Construction system is used at site itself.
12.	In case of Factory made, whether Manufacturing Facility is established in India. (present status) If Yes, Location and Present	Minimum 100 repetitions are desirable. For very small project of less than 500 units, this system may not prove to be Economical.

	Manufacturing Capacity. If No, what scale of project (No. of Dwelling Units) needed to establish the factory?	
13.	In case of on-site production, scale of the project (No. of Dwelling Units) needed to establish the facility on site.	Economy Scale of economy depends upon the volume of work and maximum number of repetition of the formwork achievable for the estimated time period of construction. Minimum 100 repetition of the formwork is desirable. For small project of less than 500 units, this system may not prove to be economical. Construction of multiple units of repetitive type can be achieved.
14.	What is the economical lead distance in case factory made components?	Not Applicable for this Technology.
15.	Do you also execute the project, If yes, present capacity. If No, How it is proposed to be done.	YES Sintex execute the project of any capacity The Procuremet from manufacturers available in India and assemble at site.
16.	Are you ready to take up the execution of the project immediately on receipt of the work order.	Yes,
17.	Do you provide complete design solution? If Yes, whether structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893 If No, How do you propose to provide structural design	Yes, The structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893
18.	Do you provide construction supervision services / Project Management consultancy services If No, How it is proposed to be done	Yes
19.	Brief on the Training needs for Installing, Using and Maintenance along with readiness to execute the project using construction workforce with current skills in India.	Required
20.	Note on Guarantees / Warrantees provided to the user/customer.	Durability Since concrete is main constituent material, durability of the structure can be achieved by using proper ingredient, Grade of concrete & mix design as per IS456:2000. Thickness of the wall is generally 100 mm with the reinforcement placed in the middle. Therefore, adequate cover is likely to be maintained. The warrantees

		as per conventional system.
21.	Attach a brief note on the Sustainability issues such as environmental friendliness, energy efficiency use of waste materials recyclability etc.	Proper lighting & ventilation, reduces the energy Consumption. The industrial waste can be used the way we use for concrete.
22.	Note on Upkeep / Maintenance facilities that will be available to the user / customer during guarantee / warranty period and after. Availability of annual maintenance contract.	Being constructed using concrete, durability of the structure can be achieved by using proper ingredient, grade of concrete & mix design as per IS 456:2000. Thickness of the wall is generally 100 mm with the reinforcement placed in the middle. Therefore, adequate cover is likely to be maintained.so maintenance contract. May be taken as per tender.
23.	Attach note on case studies of use of the Technology in the country/ other countries with date (month/year) of use/ installation.	• 5008 No. of houses at Kanjhawala Narela, Delhi for DSIIDC. • 512 No. of houses in Bawana, Delhi for DSIIDC. • 3000 houses in Ahmedabad for Ahmedabad Municipal Corporation • More than 500 houses unit at lucknow (U.P)
24.	Analysis of Life Cycle Cost including Initial cost, cost of maintenance, and comparison with conventional system, if any	Cost is half, Maintenance & Life is equal, and more Benefits are 5times.
25.	Speed of construction vis-à-vis conventional system.	Conventional system minimum 3 months, whereas it Will take seven to ten days only.
26.	Brief on Performance Characteristics & related Standards	1. Structural Stability — OK 2. Durability — OK 3. Behaviour in Earthquake — Safe 4. Fire Safety — Safe 5. Rain — Safe 6. Thermal performance — OK 7. Acoustic performance — OK 8. Behaviour under high wind/cyclones — Safe 9. Floods — Safe 10. Under high moisture / humid conditions. — OK 11. Any other, please specify) — No
27.	Is there Standard on technology formulated by Your Company	Yes
28.	Attach Photographs / Diagrams showing Components, Installation /assembly details, Finished Structure	

29.		
30.	Name & Contact details of Professionals / Architects / Engineers involved with this technology Attach a list, if it is exhaustive Give list of trained Artisans, if any	Shri S. B. Dangayach Managing Director Sintex Industries Ltd, Near Seven Garnala Kalol ,N Gujarat-382721 Phone: 02764-253500, 253800 Mobile: 09998822680 Fax:+91-02764 253800 Email : dangayach@sintex.co.in

Emerging Technology No. 4

Name of Technology: Waffle Crete Building System Disaster-Resistant Construction. Faster. Greener. More Affordable.

1.	Name of Organization/Company	Butterfly Properties Ltd.
2.	Postal Address and Website	Head Office Butterfly Properties Ltd. 3rd Flr., Nakumatt Ukay Centre Ring Road, Westlands PO Box 46206 – 00100 Nairobi, Kenya. Phone: +254 775 743 494, +254 788 744 098 Email: info@bpl.co.ke - See more at: http://www.bpl.co.ke/contact-
3.	Name, Designation and details of Contact Person (Telephone, Fax, E-mail) (Technical Person)	Head Office Butterfly Properties Ltd. 3rd Flr., Nakumatt Ukay Centre Ring Road, Westlands PO Box 46206 – 00100 Nairobi, Kenya. Phone: +254 775 743 494, +254 788 744 098 Email: info@bpl.co.ke See more at: http://www.bpl.co.ke/contact-us#sthash.CklqZBUM.dpuf
4.	Name and details of Foreign Collaborator, if any	Waffle-Crete INTERNATIONAL — A Waffle-Crete Affiliated Company Partners for Africa
5.	Name of the Technology/System	***Waffle Crete Building System Disaster-Resistant Construction. Faster. Greener. More Affordable.***
6.	Is it a patented system ?	YES© Copyright Butterfly Properties Ltd. - 2015 Created by Netlink India *WAF FLE-C RETE* ® molds are cove red b y: U.S. PAT E N T N O . 5,667 ,192; CANADA PAT EN T N O. 1,109,653; JAPAN PATENT NO. 1,364,341. *WAFFLE-CRETE* ® is a registered trademark of WAFFLE-CRETE® International, Inc. of Hays, Kansas. "Reg. U.S. Pat. Off.", Reg. No. 1,116,050. Canadian Trade Mark Office Registration No. 241,383. Other foreign patents pending. *WAF FLE-C RETE* ® panels are recognized by the I.C .B.O. (International Conference of Building Officials). See I.C .B.O. Research Report Number PFC 3602See more
7.	Brief Write- up on Technology / System	Waffle-Crete is a fast, efficient and cost effective pre-cast concrete building system. Through the use of Waffle-Crete molds, one can benefit from many advantages. The versatile Waffle-Crete building system makes it uniquely possible to construct attractive, disaster-resistant, reinforced concrete buildings in a fraction of the time and with substantial reduction of raw materials of solid panels of the same strength. The dramatic reduction in raw materials also makes Waffle-Crete a far more sustainable and environmentally friendly option. Every detail of the patented Waffle-Crete system is designed to speed construction and reduce construction costs - without

		compromising structural strength. Concrete is placed directly in molds, vibrated and finished. With this unique system you can cast panels at a casting facility or directly on the jobsite. The panels can then be erected the next day in a fraction of the time of cast-in-place or traditional method. The Waffle-Crete system does not need any framework (columns and beams) for structural strength, because each panel is load bearing. Over the years, builders and developers from across the U.S., South America, the Caribbean, Asia, the Pacific Islands, and many other parts of the world have enjoyed Waffle-Crete's many benefits on variety of diverse projects. Examples of Waffle-Crete projects range from special applications such as cooling towers, artificial reefs and barrier walls, to low cost housing communities, to multi-story luxury hotels.
8.	If any evaluation/certification carried out. If yes, Give Details	• Seismic Test (by Inst. For Human Settlement, Jakarta, Indonesia). • Approved for Seismic Zone 3. • Structural Strength Test (by Testing Engineers, San Diego CA). • Panel strength in excess of design and local seismic loads. • Sound Transmission Loss Test (by Coffeen Fricke, Lenesa, KS). • Met ISO 140-3 standard (STC rating of 47). • Fire Endurance Test (by Consulting Engineers Group, Glenview, IL). • Met CAN4-S101 and ASTM E119 standards (2 hour interior rating). • Heat Loss Test (by Butler Mfg and Research, Grandview, MO). See report for results: • U.S. Structural Building Standard Tests (by ICBO Evaluation Services). Complied with 1997 Uniform Building Code & 2000 Int'l Residential Code, Welded. • Plate Shear Test (by Mohsen Saleh, Structural Engineer) • Design value of 5.00 kips with safety factor of 2.0 from failure load.
9.	Advantages of the Technology vis- a- vis. conventional system	Compared to traditional products, panels achieve far better results, at considerably reduced cost. The speedy construction represent additional savings.The building system gives full design flexibility as it offers a complete range of build-ing elements such as load-bearing walls, curtain walls, floors and stairs. The panels are easy to use in the construction of any type of structure, and can be shaped to any geometric requirement i.e. flat or curved by simple cutting the panels at site.

10.	Limitations of the Technology, if any	
11.	Whether the manufacturing of components is on-site or factory made.	Factory made cum on site development.
12.	In case of Factory made, whether Manufacturing Facility is established in India. (present status) If Yes, Location and Present Manufacturing Capacity. If No, what scale of project (No. of Dwelling Units) needed to establish the factory?	Yes
13.	In case of on-site production, scale of the project (No. of Dwelling Units) needed to establish the facility on site.	The viability depends upon the quantum of work. Generally requirements of 1 lakh sqm of panel per year for minimum period of three years make the plant viable.
14.	What is the economical lead distance in case factory made components?	At site it can be done
15.	Do you also execute the project, If yes, present capacity. If No, How it is proposed to be done.	YES
16.	Are you ready to take up the execution of the project immediately on receipt of the work order.	YES
17.	Do you provide complete design solution? If Yes, whether structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893 If No, How do you propose to provide structural design.	YES MATERIALS Material properties and criteria used in the design information contained herein are as follows: **A. Normal Weight Precast Concrete (145-150#/cubic foot)** **B. Reinforcing Steel** • Deformed Billet Steel Bars, ASTM A-615, Grade 60 fy = 60 ksi (412,992 KN/m2) or 40 ksi (275,328 KN/m2) • Welded wire fabric, ASTM A-185 fy = 60 ksi (412,992 KN/m2) or 40 ksi (275,328 KN/m2) **DESIGN** **A. Code** • Uniform Building Code, 1991 Edition • American Concrete Institute Building Code 318-89 **B. Spans** • The spans are in 2 and 4 foot intervals to best utilize the

		WAFFLE-CRETE ® form dimensions. • Lengths other than those shown may be obtained through the use of headers in the forms during fabrications. • Panels were designed in accordance with ultimate strength design methods for maximum allowable stresses. • All panels are designed for yield of reinforcing steel prior to concrete failure. **C. Loading** • Panel loading was calculated with dead load and superimposed loads. The dead load included only the panel weight. All superimposed weight, such as partitions, toppings, and live loads shall be considered superimposed loads. • Design loading was calculated in conformance with ACI 318-89 Ultimate strength load factors as follows: U = 1.4D + 1.7L D = dead load or L= live load U = .75 (1.4D + 1.7L + 1.7 W) W = wind load D. Deflections 1. Live load deflections were calculated by: 5WL4 Δ = 384 EI W = uniform live load L = span length E = modulus of elasticity I = effective moment of inertia • Deflections shown are elastic short duration only. Upper limit of span lengths do not consider deflection limits for varying applications. General deflection limits are L/240 for roofs and L/360 for floors. **E. Transportation and Erection** • Handling designs assumes “Swift Lift” anchors cast in the top edge of walls and top of floors. • Panels 16 feet and longer require two “Swift Lifts” for walls and four for floors to be located in top surface of panel in ribs 4 feet from each end.
18.	Do you provide construction supervision services / Project Management consultancy services If No, How it is proposed to be done	YES
19.	Brief on the Training needs for Installing, Using and Maintenance along with readiness to execute the project using construction workforce with current skills in India.	Training Required.
20.	Note on Guarantees / Warrantees provided to the user/customer.	• **The four core areas of focus are:** • Strategy • Performance

		• Compliance • Accountability • The implementation of clear strategy setting, planning and monitoring and adaptation to the changing business environment is a critical element of good governance. The importance of good planning is that it helps the organization clearly set the objectives, strategies and actions, timeframes and performance indicators, for a period and provides a means to monitor performance of the Organization.
21.	Attach a brief note on the Sustainability issues such as environmental friendliness, energy efficiency use of waste materials recyclability etc.	Precast system is always environmental friendly, energy efficiency use of waste materials like flyash can be used.
22.	Note on Upkeep / Maintenance facilities that will be available to the user / customer during guarantee / warranty period and after. Availability of annual maintenance contract.	Yes as per term and condition.
23.	Attach note on case studies of use of the Technology in the country/ other countries with date (month/year) of use/ installation.	Monarch Apartments Nairobi, Kenya Monarch Apartments is destined to become one of the most desirable housing complexes along the Thika Super Highway, comprising of high quality 2 and 3 bedroom apartments in a peaceful and central location. **Property Features:** • 60 units: 20 2bed/2bath (1 block) and 40 3bed/2bath (2 blocks). • Gated and secure walled compound. • Ample safe underground basement parking and visitors parking with cabro paving. • Beautifully landscaped gardens with a children's play area (over 6,000 square feet). • Backup water storage tanks and backup power for common areas. • Eco-friendly building and design. • Adjacent to a modern shopping mall. • Proximity to Nairobi, Thika and Airport. • New Horizons Industrial Park Size : Over 95,000 Square FeetWarehouses : 18 Ruiru, Kiambu Buttery Properties Ltd. is proud to announce 6 newly built WAREHOUSES located in a modern industrial park in RUIRU just o the THIKA HIGHWAY. Each godown is 5,300 sq. ft. This includes 2 storey offices. Excellent location with no traffic headache - served by the new Thika Highway (25 mins to NBO CBD), Eastern Bypass (30 mins to Airport/Mombasa Road), Northern Bypass (30 mins to Westlands). In a secure compound with borehole and 3 phase electricity. State of the art superior construction with added security. Nice, peaceful and safe surroundings - 24 hour security patrols. Ideal for distribution and light manufacturing tenants.
24.	Analysis of Life Cycle Cost including Initial cost, cost of maintenance, and comparison with conventional system, if any	The Waffle-Crete Advantage When compared to conventional brick & block construction, the Waffle-Crete precast concrete building system will Reduce material & labor costs Slash construction time Eliminate the need for skilled labor Very low life cycle cost (low

		ongoing maintenance) Waffle-Crete	
25.	Speed of construction vis-à-vis conventional system.	The system has been used in many countries worldwide. The construction experiences using the system show a marked reduction in construction time compared to traditional building methods. Panels are industrialized, and for this reason, assembly processes are optimized, labour is significantly reduced, and construction time decreased by roughly 60%.	
26.	Brief on Performance Characteristics & related Standards	1. Structural Stability	OK
		2. Durability	OK
		3. Behavior in Earthquake	Safe
		4. Fire Safety	Safe
		5. Rain	Safe
		6. Thermal performance	OK
		7. Acoustic performance	OK
		8. Behavior under high wind/cyclones	Safe
		9. Floods	Safe
		10. Under high moisture /Humid conditions.	OK
		11. Any other, please specify)	No
27.	Is there Standard on technology formulated by Your Company	YES. *WAF FLE-C RETE* ® molds are cove red b y: U.S. PAT E N T N O . 5,667 ,192; CANADA PAT EN T N O. 1,109,653; JAPAN PATENT NO. 1,364,341. *WAFFLE-CRETE* ® is a registered trademark of WAFFLE-CRETE® International, Inc. of Hays, Kansas. "Reg. U.S. Pat. Off.", Reg. No. 1,116,050. Canadian Trade Mark Office Registration No. 241,383. Other foreign patents pending. *WAF FLE-C RETE* ® panels are recognized by the I.C .B.O. (International Conference of Building Officials). See I.C .B.O. Research Report Number PFC 3602	

28.	Attach Photographs / Diagrams showing Components, Installation /assembly details, Finished Structure	
29.	Name & Contact details of Professionals / Architects / Engineers involved with this technology Attach a list, if it is exhaustive Give list of trained Artisans, if any	Head Office Butterfly Properties Ltd. 3rd Flr., Nakumatt Ukay Centre Ring Road, Westlands PO Box 46206 – 00100 Nairobi, Kenya. Phone: +254 775 743 494, +254 788 744 098 Email: info@bpl.co.ke
30.	Provide additional information you may like to supplement.	• Typical Applications • Housing and apartment buildings • Commercial buildings • Hotels • Schools and gymnasiums • Low cost housing communities • Churches • Hospitals • Multi-story luxury hotels • Airport traffic control towers • Public Works facilities • Waste water treatment facilities • Restroom facilities • Emergency Shelters • Railroad crossings • Parking blocks • Hazardous material storage -

Emerging Technology No. 5

Name of Technology: Waffle Crete Building System Disaster-Resistant Construction. Faster. Greener. More Affordable.

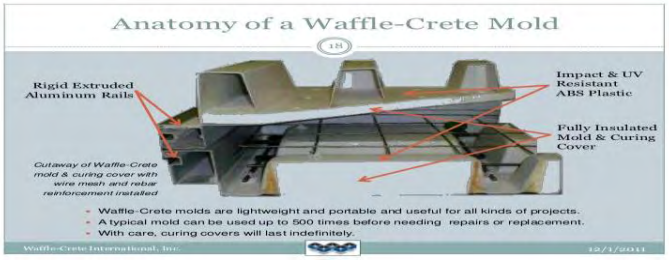
1.	Name of Organization/Company	**Waffle-Crete International, Inc.** Developers of a proven building system to perform rapid, affordable and durable construction in developing countries with unskilled labour. **Company Overview** Billions at the Bottom of the Pyramid live in substandard structures in large part because durable construction costs too much and takes too long. Compared to conventional systems, Waffle-Crete facilitates construction with half the materials in a fraction of the time without cutting durability. The company is now pursuing projects **in India and E. Africa with** the goal of achieving widespread adoption as a standard for affordable durable housing
2.	Postal Address and Website	Corporate Headquarters Gust LLC 158 West 29th Street, 11th Floor New York, NY 10001 USA info@gust.com -
3.	Name, Designation and details of Contact Person (Telephone, Fax, E-mail) (Technical Person)	Corporate Headquarters Gust LLC 158 West 29th Street, 11th Floor New York, NY 10001 USA info@gust.com
4.	Name and details of Foreign Collaborator, if any	Waffle-Crete INTERNATIONAL
5.	Name of the Technology/System	***Waffle Crete Building System*** ***Disaster-Resistant Construction. Faster. Greener. More Affordable.***
6.	Is it a patented system ?	YES© Copyright Butterfly Properties Ltd. - 2015 Created by Netlink India *WAF FLE-C RETE* ® molds are cove red b y: U.S. PAT E N T N O . 5,667 ,192; CANADA PAT EN T N O. 1,109,653; JAPAN PATENT NO. 1,364,341. *WAFFLE-CRETE* ® is a registered trademark of WAFFLE-CRETE® International, Inc. of Hays, Kansas. "Reg. U.S. Pat. Off.", Reg. No. 1,116,050. Canadian Trade Mark Office Registration No. 241,383. Other foreign patents pending. *WAF FLE-C RETE* ® pan els are recog n ized by the I.C .B.O. (In t ernat ional C onference of Building Offi cials). See I.C .B.O. Research Report Number PFC 3602See more
7.	Brief Write- up on Technology / System	Waffle-Crete is a fast, efficient and cost effective pre-cast concrete building system. Through the use of Waffle-Crete molds, one can benefit from many advantages. The versatile Waffle-Crete building system makes it uniquely possible to construct attractive, disaster-resistant, reinforced concrete buildings in a fraction of the time and

		with substantial reduction of raw materials of solid panels of the same strength. The dramatic reduction in raw materials also makes Waffle-Crete a far more sustainable and environmentally friendly option. Every detail of the patented Waffle-Crete system is designed to speed construction and reduce construction costs - without compromising structural strength. Concrete is placed directly in mouldsSSS, vibrated and finished. With this unique system you can cast panels at a casting facility or directly on the jobsite. The panels can then be erected the next day in a fraction of the time of cast-in-place or traditional method. The Waffle-Crete system does not need any framework (columns and beams) for structural strength, because each panel is load bearing. Over the years, builders and developers from across the U.S., South America, the Caribbean, Asia, the Pacific Islands, and many other parts of the world have enjoyed Waffle-Crete's many benefits on variety of diverse projects. Examples of Waffle-Crete projects range from special applications such as cooling towers, artificial reefs and barrier walls, to low cost housing communities, to multi-story luxury hotels.
8.	If any evaluation/certification carried out. If yes, Give Details	• Seismic Test (by Inst. For Human Settlement, Jakarta, Indonesia). • Approved for Seismic Zone 3. • Structural Strength Test (by Testing Engineers, San Diego CA). • Panel strength in excess of design and local seismic loads. • Sound Transmission Loss Test (by Coffeen Fricke, Lenesa, KS). • Met ISO 140-3 standard (STC rating of 47). • Fire Endurance Test (by Consulting Engineers Group, Glenview, IL). • Met CAN4-S101 and ASTM E119 standards (2 hour interior rating). • Heat Loss Test (by Butler Mfg and Research, Grandview, MO). See report for results: • U.S. Structural Building Standard Tests (by ICBO Evaluation Services). Complied with 1997 Uniform Building Code & 2000 Int'l Residential Code, Welded. • Plate Shear Test (by Mohsen Saleh, Structural Engineer) • Design value of 5.00 kips with safety factor of 2.0

		from failure load.
9.	Advantages of the Technology vis- a- vis. conventional system	Compared to traditional products, panels achieve far better results, at considerably reduced cost. The speedy construction represent additional savings.The building system gives full design flexibility as it offers a complete range of build-ing elements such as load-bearing walls, curtain walls, floors and stairs. The panels are easy to use in the construction of any type of structure, and can be shaped to any geometric requirement i.e. flat or curved by simple cutting the panels at site.
10.	Limitations of the Technology, if any	
11.	Whether the manufacturing of components is on-site or factory made.	Factory made cum on site development.
12.	In case of Factory made, whether Manufacturing Facility is established in India. (present status) If Yes, Location and Present Manufacturing Capacity. If No, what scale of project (No. of Dwelling Units) needed to establish the factory?	Yes
13.	In case of on-site production, scale of the project (No. of Dwelling Units) needed to establish the facility on site.	The viability depends upon the quantum of work. Generally requirements of 1 lakh sqm of panel per year for minimum period of three years make the plant viable.
14.	What is the economical lead distance in case factory made components?	At site it can be done
15.	Do you also execute the project, If yes, present capacity. If No, How it is proposed to be done.	YES
16.	Are you ready to take up the execution of the project immediately on receipt of the work order.	YES
17.	Do you provide complete design solution? If Yes, whether structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893 If No, How do you propose to provide structural design.	YES MATERIALS Material properties and criteria used in the design information contained herein are as follows: A. Normal Weight Precast Concrete (145-150#/cubic foot) B. Reinforcing Steel 1. Deformed Billet Steel Bars, ASTM A-615, Grade 60 fy = 60 ksi (412,992 KN/m2) or 40 ksi (275,328 KN/m2) 2. Welded wire fabric,

		ASTM A-185 fy = 60 ksi (412,992 KN/m2) or 40 ksi (275,328 KN/m2) DESIGN **A. Code** • Uniform Building Code, 1991 Edition • American Concrete Institute Building Code 318-89 **B. Spans** • The spans are in 2 and 4 foot intervals to best utilize the WAFFLE-CRETE ® form dimensions. Lengths other than those shown may be obtained through the use of headers in the forms during fabrications. • Panels were designed in accordance with ultimate strength design methods for maximum allowable stresses. • All panels are designed for yield of reinforcing steel prior to concrete failure. **C. Loading** • Panel loading was calculated with dead load and superimposed loads. The dead load included only the panel weight. All superimposed weight, such as partitions, toppings, and live loads shall be considered superimposed loads. • Design loading was calculated in conformance with ACI 318-89 Ultimate strength load factors as follows: U = 1.4D + 1.7L D = dead load or L= live load U = .75 (1.4D + 1.7L + 1.7 W) W = wind load D. Deflections 1. Live load deflections were calculated by: 5WL4 Δ = 384 EI W = uniform live load L = span length E = modulus of elasticity I = effective moment of inertia • Deflections shown are elastic short duration only. Upper limit of span lengths do not consider deflection limits for varying applications. General deflection limits are L/240 for roofs and L/360 for floors. **E. Transportation and Erection** • Handling designs assumes “Swift Lift” anchors cast in the top edge of walls and top of floors. • Panels 16 feet and longer require two “Swift Lifts” for walls and four for floors to be located in top surface of panel in ribs 4 feet from each end.
18.	Do you provide construction supervision services / Project Management consultancy services If No, How it is proposed to be done	YES

19.	Brief on the Training needs for Installing, Using and Maintenance along with readiness to execute the project using construction workforce with current skills in India.	Training Required.
20.	Note on Guarantees / Warrantees provided to the user/customer.	• **The four core areas of focus are:** • Strategy • Performance • Compliance • Accountability • The implementation of clear strategy setting, planning and monitoring and adaptation to the changing business environment is a critical element of good governance. The importance of good planning is that it helps the organization clearly set the objectives, strategies and actions, timeframes and performance indicators, for a period and provides a means to monitor performance of the Organization.
21.	Attach a brief note on the Sustainability issues such as environmental friendliness, energy efficiency use of waste materials recyclability etc.	Precast system is always environmental friendly, energy efficiency use of waste materials like flyash can be used.
22.	Note on Upkeep / Maintenance facilities that will be available to the user / customer during guarantee / warranty period and after. Availability of annual maintenance contract.	Yes as per term and condition.
23.	Attach note on case studies of use of the Technology in the country/ other countries with date (month/year) of use/ installation.	Monarch Apartments Nairobi, Kenya Monarch Apartments is destined to become one of the most desirable housing complexes along the Thika Super Highway, comprising of high quality 2 and 3 bedroom apartments in a peaceful and central location. **Property Features:** • 60 units: 20 2bed/2bath (1 block) and 40 3bed/2bath (2 blocks). • Gated and secure walled compound. • Ample safe underground basement parking and visitors parking with cabro paving. • Beautifully landscaped gardens with a children's play area (over 6,000 square feet). • Backup water storage tanks and backup power for common areas. • Eco-friendly building and design. • Adjacent to a modern shopping mall. • Proximity to Nairobi, Thika and Airport. • New Horizons Industrial Park Size : Over 95,000 Square FeetWarehouses : 18 Ruiru, Kiambu Buttery Properties Ltd. is proud to announce 6 newly built WAREHOUSES located in a modern industrial park in RUIRU just o the THIKA HIGHWAY. Each godown is 5,300 sq. ft. This includes 2 storey offices. Excellent location with no traffic headache - served by the new Thika Highway (25 mins to NBO CBD), Eastern Bypass (30 mins

		to Airport/Mombasa Road), Northern Bypass (30 mins to Westlands). In a secure compound with borehole and 3 phase electricity. State of the art superior construction with added security. Nice, peaceful and safe surroundings - 24 hour security patrols. Ideal for distribution and light manufacturing tenants.	
24.	Analysis of Life Cycle Cost including Initial cost, cost of maintenance, and comparison with conventional system, if any	The Waffle-Crete Advantage When compared to conventional brick & block construction, the Waffle-Crete precast concrete building system will Reduce material & labor costs Slash construction time Eliminate the need for skilled labor Very low life cycle cost (low ongoing maintenance) Waffle-Crete	
25.	Speed of construction vis-à-vis conventional system.	The system has been used in many countries worldwide. The construction experiences using the system show a marked reduction in construction time compared to traditional building methods. Panels are industrialized, and for this reason, assembly processes are optimized, labour is significantly reduced, and construction time decreased by roughly 60%.	
26.	Brief on Performance Characteristics & related Standards	1. Structural Stability	OK
		2. Durability	OK
		3. Behavior in Earthquake	Safe
		4. Fire Safety	Safe
		5. Rain	Safe
		6. Thermal performance	OK
		7. Acoustic performance	OK
		8. Behavior under high wind/cyclones	Safe
		9. Floods	Safe
		10. Under high moisture /Humid conditions.	OK
		11. Any other, please specify)	No
27.	Is there Standard on technology formulated by Your Company	YES. *WAF FLE-C RETE* ® molds are cove red b y: U.S. PAT E N T N O . 5,667 ,192; CANADA PAT EN T N O. 1,109,653; JAPAN PATENT NO. 1,364,341. *WAFFLE-CRETE* ® is a registered trademark of WAFFLE-CRETE® International, Inc. of Hays, Kansas. "Reg. U.S. Pat. Off.", Reg. No. 1,116,050. Canadian Trade Mark Office Registration No. 241,383. Other foreign patents pending. *WAF FLE-C RETE* ® pan els are recog n ized by the I.C .B.O. (In t ernat ional C onference of Building Offi cials). See I.C .B.O. Research Report Number PFC 3602	
28.	Attach Photographs / Diagrams showing Components, Installation /assembly details, Finished Structure		

29.		
30.	Name & Contact details of Professionals / Architects / Engineers involved with this technology Attach a list, if it is exhaustive Give list of trained Artisans, if any	**Jerry** moved from Boston to the Marshall Islands over 40 years ago. There he founded Pacific International, now the largest employer in the Marshalls with more than 2,000 employees focused mostly on construction projects across the pacific islands. Jerry became a Waffle-Crete customer in 1990 and by 1992 the company's largest shareholder. Jerry is widely regarded for the contributions of time and money he has made to his island community Corporate Headquarters Gust LLC Jerry Kramer 158 West 29th Street, 11th Floor New York, NY 10001 USA info@gust.com Phone: +254 775 743 494, +254 788 744 098 Email: info@bpl.co.ke
31.	Provide additional information you may like to supplement.	Gust is a global SaaS funding platform for the sourcing and management of early-stage investments. Gust enables skilled entrepreneurs to collaborate with the smartest investors and angel investor networks by virtually supporting all aspects of the investment relationship, from initial pitch to successful exit. The SaaS funding platform is endorsed by the world's leading business angel and venture capital associations, and powers over 1,000 investment organizations in 80+ countries. More than 200,000 startups have already used the funding platform to connect and collaborate with over 45,000 investors. The company was founded in 2004 under the name Angel soft and is privately held. Gust is based in New York, New York, with a European office in London, United Kingdom.

Emerging Technology No. 6

Name of Technology: Monolithic Concrete Construction System using Aluminum Formwork

1.	Name of Organization/Company	**PG SETTY CONSTRUCTION** Company handling, Traditional and modern architecture, RCC, structural steel and composite structures, moderately high rise structures, large span RCC and structural steel domes, Structural steel space frames, Heritage - structures restoration, Green-buildings
2.	Postal Address and Website	1056, Kavitha Vilas, M.G. Road, Chamarajpuram, Mysore-570005. Fax : 4257203 Email :pgsmysore@pgsetty.com Website : www.pgsetty.com
3.	Name, Designation and details of Contact Person (Telephone, Fax, E-mail) (Technical Person)	1056, Kavitha Vilas, M.G. Road, Chamarajpuram, Mysore-570005. Phone Number :08214257201/202, Fax : 4257203 Email :pgsmysore@pgsetty.com Website : www.pgsetty.com
4.	Name and details of Foreign Collaborator, if any	No
5.	Name of the Technology/System	Monolithic Concrete Construction System using Aluminum Formwork
6.	Is it a patented system ?	No
7.	Brief Write- up on Technology / System	In this system, in place of conventional RCC framed construction of columns and beams; all walls, floors, slabs, columns, beams, stairs, together with door and window openings are cast in place monolithically using appropriate grade of concrete in one operation on site by using specially designed, easy to handle (with minimum labour and without use of any equipment) modular formwork made up of Aluminium/Plastic/ Aluminium-Plastic Composite. Using the formwork system, rapid construction of multiple units of repetitive type can be achieved.
8.	If any evaluation/certification carried out. If yes, Give Details	The formwork made of Aluminum Extruded Section conforming to IS 733:1983 and PVC conforming to Grade PVC 67G ER01 of IS 10151:1982. It consists of different sections including starter of MS Angle, top frame of aluminum channels, wall panels, slab panels & truss. The Formworks are designed based on the structural requirements of building units. A quality control scheme is required to be followed for quality of raw materials used and formwork components manufactured. 100 mm RCC Walls and Roof has thermal transmittance (U) value as 3.59 W/m2K) (as per IS 3792:1978) Since, it is more than the normal plastered brick wall

		(thermal transmittance (U) 2.13 W/m2K), it is advised that implementing agency shall ensure proper planning for heat insulation and air ventilation in the housing units through proper orientation, shedding etc. (see IS 3792:1978 for guidance). Average Sound reduction for 100 mm concrete is ≥ 45db (IS 1950:1962)
9.	Advantages of the Technology vis- a- vis. conventional system	THE TECHNOLOGY (4 houses (Shell) in 48 hours) Monolithic construction is a method where a structure is Monolithically built using a Homogeneous Material. We have successfully achieved an efficiency of 4 houses in 48 hours by importing the World Class Form Work technology from USA. • Most of the key components like walls, columns, beams, floor slabs, staircases, balconies, openings, hoods, storage lofts, etc., are monolithically concreted in-situ. • No need of bricks, blocks and plastering. • Because of reduced dead load, superstructure and foundation cost are minimized without compromising on strength. • These structures are efficient against earth-quake due to its single rigid block nature. • Amenable to fast-track construction. • Excellent finished surface avoids expensive plastering and enhances a relatively water resistant surface. • All services like electrical, plumbing & Sanitary are embedded before concreting which avoids breaking & making of structures. • It demands least quality control on site-which is the greatest advantage for fast track construction. • Whenever there is a challenge of construction in least possible time with best quality.
10.	Limitations of the Technology, if any	Limitation Such as stairs, windows, etc. • The formwork are manually handled. There is no need for heavy equipment & cranes etc. • Finish is such that it requires no separate plaster.Minimum 100 dwelling units • A lead time of about 3 months is required for initiation of work, as the formwork are custom designed, manufactured and prototype approved before manufacturing required number of sets of formwork. • Capital cost to initiate construction is high and may require regular flow of funds. • Post construction alterations are difficult. • All the service lines are to be pre-planned in advance.

		• Not much saving in construction in one storey structure
11.	Whether the manufacturing of components is on-site or factory made.	Construction system is used at site itself.
12.	In case of Factory made, whether Manufacturing Facility is established in India. (present status) If Yes, Location and Present Manufacturing Capacity. If No, what scale of project (No. of Dwelling Units) needed to establish the factory?	Minimum 100 repetitions are desirable. For very small project of less than 500 units, this system may not prove to be Economical.
13.	In case of on-site production, scale of the project (No. of Dwelling Units) needed to establish the facility on site.	Economy Scale of economy depends upon the volume of work and maximum number of repetition of the formwork achievable for the estimated time period of construction. Minimum 100 repetition of the formwork is desirable. For small project of less than 500 units, this system may not prove to be economical. Construction of multiple units of repetitive type can be achieved. Limitation Such as stairs, windows, etc. • The formwork are manually handled. There is no need for heavy equipment & cranes etc. • Finish is such that it requires no separate plaster.Minimum 100 dwelling units
14.	What is the economical lead distance in case factory made components?	N.A
15.	Do you also execute the project, If yes, present capacity. If No, How it is proposed to be done.	YES we also execute the project of any capacity
16.	Are you ready to take up the execution of the project immediately on receipt of the work order.	Yes,
17.	Do you provide complete design solution? If Yes, whether structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893 If No, How do you propose to provide structural design	Yes, The structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893
18.	Do you provide construction supervision services / Project Management consultancy services If No, How it is proposed to be done	Yes

19.	Brief on the Training needs for Installing, Using and Maintenance along with readiness to execute the project using construction workforce with current skills in India.	Required	
20.	Note on Guarantees / Warrantees provided to the user/customer.	Durability Since concrete is main constituent material, durability of the structure can be achieved by using proper ingredient, Grade of concrete & mix design as per IS456:2000. Thickness of the wall is generally 100 mm with the reinforcement placed in the middle. Therefore, adequate cover is likely to be maintained. The warrantees as per conventional system.	
21.	Attach a brief note on the Sustainability issues such as environmental friendliness, energy efficiency use of waste materials recyclability etc.	Proper lighting & ventilation, reduces the energy Consumption. The industrial waste can be used the way we use for concrete.	
22.	Note on Upkeep / Maintenance facilities that will be available to the user / customer during guarantee / warranty period and after. Availability of annual maintenance contract.	Being constructed using concrete, durability of the structure can be achieved by using proper ingredient, grade of concrete & mix design as per IS 456:2000. Thickness of the wall is generally 100 mm with the reinforcement placed in the middle. Therefore, adequate cover is likely to be maintained.so maintenance contract. May be taken as per tender.	
23.	Attach note on case studies of use of the Technology in the country/ other countries with date (month/year) of use/ installation.	• Houses in Bangalore for Karnataka Slum Development Board. • Houses in Mysore for Karnataka Slum Development Board. • Houses in Bangalore for Bangalore Development Authority & several other projects in major cities of India.	
24.	Analysis of Life Cycle Cost including Initial cost, cost of maintenance, and comparison with conventional system, if any	Cost is half, Maintenance & Life is equal, and more Benefits are 5times.	
25.	Speed of construction vis-à-vis conventional system.	Conventional system minimum 3 months, whereas it Will take seven to ten days only.	
26.	Brief on Performance Characteristics & related Standards	1. Structural Stability	OK
		2. Durability	OK
		3. Behaviour in Earthquake	Safe
		4. Fire Safety	Safe
		5. Rain	Safe

		6. Thermal performance	OK
		7. Acoustic performance	OK
		8. Behaviour under high wind/cyclones	Safe
		9. Floods	Safe
		10. Under high moisture / humid conditions.	OK
		11. Any other, please specify)	No
27.	Is there Standard on technology formulated by Your Company	Yes	
28.	Attach Photographs / Diagrams showing Components, Installation /assembly details, Finished Structure		
29.			
30.	Name & Contact details of Professionals / Architects / Engineers involved with this technology Attach a list, if it is exhaustive Give list of trained Artisans, if any	Mr.M.G.Somashekar Managing Director 1056, Kavitha Vilas, M.G. Road, Chamarajpuram, Mysore-570005. Phone Number :08214257201/202, Fax : 4257203 Email :pgsmysore@pgsetty.com Website : www.pgsetty.com	
31.	Provide additional information you may like to supplement.	**PG SETTY CONSTRUCTION** handling, Traditional and modern architecture, RCC, structural steel and composite structures, moderately high rise structures, large span RCC and structural steel domes, Structural steel space frames, Heritage - structures restoration, Green-buildings	

Emerging Technology No. 7

Name of Technology: Waffle Crete Building System Disaster-Resistant Construction. Faster. Greener. More Affordable.

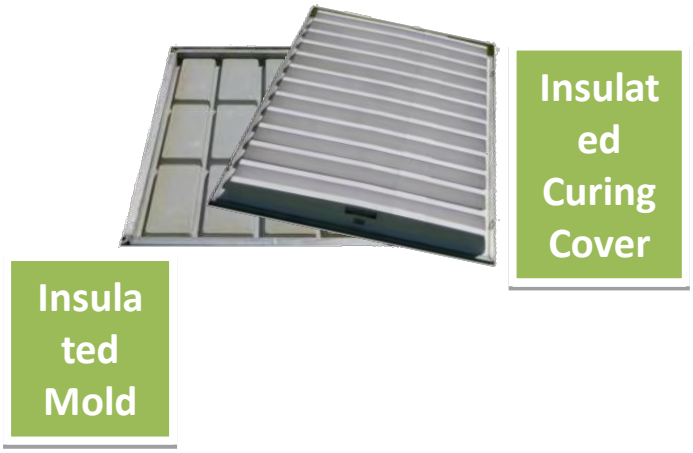
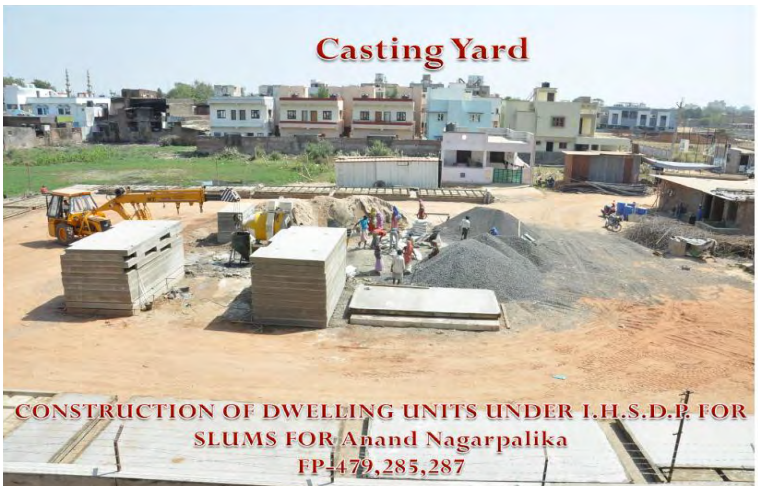
1.	Name of Organization/Company	SRPL Building System India
2.	Postal Address and Website	Shaival Reality Pvt. Ltd., A/B-1, Maharaj Palace, Near Vijay Char Rasta, Navrangpura, Ahmedabad – 380 009 Ph. 079 – 26407802 / 26404097 Email: shaivalgroup@gmail.com
3.	Name, Designation and details of Contact Person (Telephone, Fax, E-mail) (Technical Person)	Structural Consultant, PNL Consultants, 303, Gala Business Center, ST. Xaviers College Corner, Navrangpura, Ahmedabad – 380 009 Ph. No. 079- 26446318
4.	Name and details of Foreign Collaborator, if any	Waffle-Crete INTERNATIONAL — A Waffle-Crete Affiliated Company Partners for Africa
5.	Name of the Technology/System	***Waffle Crete Building System*** ***Disaster-Resistant Construction. Faster. Greener. More Affordable.***
6.	Is it a patented system?	YES© Copyright Butterfly Properties Ltd. - 2015 Created by Netlink India *WAF FLE-C RETE* ® molds are cove red b y: U.S. PAT E N T N O . 5,667 ,192; CANADA PAT EN T N O. 1,109,653; JAPAN PATENT NO. 1,364,341. *WAFFLE-CRETE* ® is a registered trademark of WAFFLE-CRETE® International, Inc. of Hays, Kansas. "Reg. U.S. Pat. Off.", Reg. No. 1,116,050. Canadian Trade Mark Office Registration No. 241,383. Other foreign patents pending. *WAF FLE-C RETE* ® pan els are recog n ized by the I.C .B.O. (In t ernat ional C onference of Building Offi cials). See I.C .B.O. Research Report Number PFC 3602See more
7.	Brief Write- up on Technology / System	Waffle-Crete is a fast, efficient and cost effective pre-cast concrete building system. Through the use of Waffle-Crete molds, one can benefit from many advantages. The versatile Waffle-Crete building system makes it uniquely possible to construct attractive, disaster-resistant, reinforced concrete buildings in a fraction of the time and with substantial reduction of raw materials of solid panels of the same strength. The dramatic reduction in raw materials also makes Waffle-Crete a far more sustainable and environmentally friendly option. Every detail of the patented Waffle-Crete system is designed to speed construction and reduce construction costs - without compromising structural strength. Concrete is placed directly in molds, vibrated and finished. With this unique system you can cast panels at a casting facility or directly on the jobsite. The panels can then be erected the next day in a fraction of the time of cast-in-place or traditional method. The Waffle-Crete system does not need any framework (columns and beams) for structural strength, because each panel is load bearing. Over the years, builders and developers from

		across the U.S., South America, the Caribbean, Asia, the Pacific Islands, and many other parts of the world have enjoyed Waffle-Crete's many benefits on variety of diverse projects. Examples of Waffle-Crete projects range from special applications such as cooling towers, artificial reefs and barrier walls, to low cost housing communities, to multi-story luxury hotels.
8.	If any evaluation/certification carried out. If yes, Give Details	Yes application is also in process in BMTPC FOR PACS
9.	Advantages of the Technology vis-a- vis. conventional system	Compared to traditional products, panels achieve far better results, at considerably reduced cost. The speedy construction represent additional savings.The building system gives full design flexibility as it offers a complete range of build-ing elements such as load-bearing walls, curtain walls, floors and stairs. The panels are easy to use in the construction of any type of structure, and can be shaped to any geometric requirement i.e. flat or curved by simple cutting the panels at site.
10.	Limitations of the Technology, if any	
11.	Whether the manufacturing of components is on-site or factory made.	• **Concrete panels can be cast right on the job site** - Eliminate the need for stationery plant and transportation • **Casting can be done on day one and erected on next day using Insulated curing covers** - Curing time is reduced by trapping the moisture generated from the concrete • **Simultaneous casting during foundation** - Casting can be done in casting yard while foundation is done, which reduces the time.
12.	In case of Factory made, whether Manufacturing Facility is established in India. (present status) If Yes, Location and Present Manufacturing Capacity. If No, what scale of project (No. of Dwelling Units) needed to establish the factory?	Yes
13.	In case of on-site production, scale of the project (No. of Dwelling Units) needed to establish the facility on site.	The viability depends upon the quantum of work. Generally requirements of 1 lakh sqm of panel per year for minimum period of three years make the plant viable.
14.	What is the economical lead distance in case factory made components?	At site it can be done
15.	Do you also execute the project, If yes, present capacity. If No, How it is proposed to be done.	YES
16.	Are you ready to take up the execution of the project	YES

	immediately on receipt of the work order.	
17.	Do you provide complete design solution? If Yes, whether structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893 If No, How do you propose to provide structural design.	YES MATERIALS Material properties and criteria used in the design information contained herein are as follows: A. Normal Weight Precast Concrete (145-150#/cubic foot) B. Reinforcing Steel 1. Deformed Billet Steel Bars, ASTM A-615, Grade 60 fy = 60 ksi (412,992 KN/m2) or 40 ksi (275,328 KN/m2) 2. Welded wire fabric, ASTM A-185 fy = 60 ksi (412,992 KN/m2) or 40 ksi (275,328 KN/m2) **DESIGN** **A. Code** • Uniform Building Code, 1991 Edition • American Concrete Institute Building Code 318-89 **B. Spans** • The spans are in 2 and 4 foot intervals to best utilize the WAFFLE-CRETE ® form dimensions. Lengths other than those shown may be obtained through the use of headers in the forms during fabrications. • Panels were designed in accordance with ultimate strength design methods for maximum allowable stresses. • All panels are designed for yield of reinforcing steel prior to concrete failure. **C. Loading** • Panel loading was calculated with dead load and superimposed loads. The dead load included only the panel weight. All superimposed weight, such as partitions, toppings, and live loads shall be considered superimposed loads. • Design loading was calculated in conformance with ACI 318-89 Ultimate strength load factors as follows: U = 1.4D + 1.7L D = dead load or L= live load U = .75 (1.4D + 1.7L + 1.7 W) W = wind load **D. Deflections** • Live load deflections were calculated by: $\Delta = \frac{5WL^4}{384\,EI}$ W = uniform live load L = span length E = modulus of elasticity I = effective moment of inertia • Deflections shown are elastic short duration only. Upper limit of span lengths do not consider deflection limits for varying applications. General deflection limits are L/240 for roofs and L/360 for floors. **E. Transportation and Erection** • Handling designs assumes “Swift Lift” anchors cast in the top edge of walls and top of floors. • Panels 16 feet and longer require two “Swift Lifts” for

		walls and four for floors to be located in top surface of panel in ribs 4 feet from each end.
18.	Do you provide construction supervision services / Project Management consultancy services If No, How it is proposed to be done	YES
19.	Brief on the Training needs for Installing, Using and Maintenance along with readiness to execute the project using construction workforce with current skills in India.	Training Required.
20.	Note on Guarantees / Warrantees provided to the user/customer.	• **The four core areas of focus are:** • Strategy • Performance • Compliance • Accountability • The implementation of clear strategy setting, planning and monitoring and adaptation to the changing business environment is a critical element of good governance. The importance of good planning is that it helps the organization clearly set the objectives, strategies and actions, timeframes and performance indicators, for a period and provides a means to monitor performance of the Organization.
21.	Attach a brief note on the Sustainability issues such as environmental friendliness, energy efficiency use of waste materials recyclability etc.	Precast system is always environmental friendly, energy efficiency use of waste materials like flyash can be used.
22.	Note on Upkeep / Maintenance facilities that will be available to the user / customer during guarantee / warranty period and after. Availability of annual maintenance contract.	Yes as per term and condition.
23.	Attach note on case studies of use of the Technology in the country/ other countries with date (month/year) of use/ installation.	Monarch Apartments Nairobi, Kenya Monarch Apartments is destined to become one of the most desirable housing complexes along the Thika Super Highway, comprising of high quality 2 and 3 bedroom apartments in a peaceful and central location. **Property Features:** • 60 units: 20 2bed/2bath (1 block) and 40 3bed/2bath (2 blocks). • Gated and secure walled compound. • Ample safe underground basement parking and visitors parking with cabro paving. • Beautifully landscaped gardens with a children's play area (over 6,000 square feet). • Backup water storage tanks and backup power for common areas. • Eco-friendly building and design.

		• Adjacent to a modern shopping mall. • Proximity to Nairobi, Thika and Airport. New Horizons Industrial Park Size : Over 95,000 Square FeetWarehouses : 18 Ruiru, Kiambu Buttery Properties Ltd. is proud to announce 6 newly built WAREHOUSES located in a modern industrial park in RUIRU just o the THIKA HIGHWAY. Each godown is 5,300 sq. ft. This includes 2 storey offices. Excellent location with no traffic headache - served by the new Thika Highway (25 mins to NBO CBD), Eastern Bypass (30 mins to Airport/Mombasa Road), Northern Bypass (30 mins to Westlands). In a secure compound with borehole and 3 phase electricity. State of the art superior construction with added security. Nice, peaceful and safe surroundings - 24 hour security patrols. Ideal for distribution and light manufacturing tenants.	
24.	Analysis of Life Cycle Cost including Initial cost, cost of maintenance, and comparison with conventional system, if any	The Waffle-Crete Advantage When compared to conventional brick & block construction, the Waffle-Crete precast concrete building system will Reduce material & labor costs Slash construction time Eliminate the need for skilled labor Very low life cycle cost (low ongoing maintenance) Waffle-Crete	
25.	Speed of construction vis-à-vis conventional system.	The system has been used in many countries worldwide. The construction experiences using the system show a marked reduction in construction time compared to traditional building methods. Panels are industrialized, and for this reason, assembly processes are optimized, labour is significantly reduced, and construction time decreased by roughly 60%.	
26.	Brief on Performance Characteristics & related Standards	1. Structural Stability	OK
		2. Durability	OK
		3. Behavior in Earthquake	Safe
		4. Fire Safety	Safe
		5. Rain	Safe
		6. Thermal performance	OK
		7. Acoustic performance	OK
		8. Behavior under high wind/cyclones	Safe
		9. Floods	Safe
		10. Under high moisture /Humid conditions.	OK
		11. Any other, please specify)	No
27.	Is there Standard on technology formulated by Your Company	YES. *WAF FLE-C RETE* ® molds are cove red b y: U.S. PAT E N T N O . 5,667 ,192; CANADA PAT EN T N O. 1,109,653; JAPAN PATENT NO. 1,364,341. *WAFFLE-CRETE* ® is a registered trademark of WAFFLE-CRETE® International, Inc. of Hays, Kansas. "Reg. U.S. Pat. Off.", Reg. No. 1,116,050. Canadian Trade Mark Office Registration No. 241,383. Other foreign patents pending. *WAF FLE-C RETE* ® pan els are recog n ized by the I.C .B.O. (In t ernat ional C onference of Building Offi cials). See I.C .B.O. Research Report Number PFC 3602	

28.	Attach Photographs / Diagrams showing Components, Installation /assembly details, Finished Structure	
29.		
30.	Name & Contact details of Professionals / Architects / Engineers involved with this technology Attach a list, if it is exhaustive Give list of trained Artisans, if any	Shaival Reality Pvt. Ltd., A/B-1, Maharaj Palace, Near Vijay Char Rasta, Navrangpura, Ahmedabad – 380 009 Ph. 079 – 26407802 / 26404097 Email: shaivalgroup@gmail.com
31.	Provide additional information you may like to supplement.	Typical Applications Housing and apartment buildings Commercial buildings Hotels Schools and gymnasiums Low cost housing communities Churches Hospitals Multi-story luxury hotels Airport traffic control towers Public Works facilities Waste water treatment facilities Restroom facilities Emergency Shelters Railroad crossings Parking blocks Hazardous material storage -

Emerging Technology No. 8

Name of Technology: construction technology with application of light gauge galvanized profiles to use in high-rise construction.

1.	Name of Organization/Company	**INSI JSC Headquarters** **Chelyabinsk**
2.	Postal Address and Website	**Contacts** **INSI JSC Headquarters** **Chelyabinsk** ***International Cooperation Department*** **Address: 2 Karla Libknekhta str.,** **office 500, Chelyabinsk, Chelyabinsk** **Region, Russia, zip code 454048** **Phone: +7351267-19-45** **E-mail: international@insi.ru** **INSI in Moscow** **INSI JSC** **Address: 33/13 Bolshaya Yakimanka str., bld. 2 (Oktyabrskaya metro station), Moscow,** **Moscow Region, Russia, zip code 119049**
3.	Name, Designation and details of Contact Person (Telephone, Fax, E-mail) (Technical Person)	Contacts **INSI JSC Headquarters** **Chelyabinsk** ***International Cooperation Department*** **Address:** 2 Karla Libknekhta str., office 500, Chelyabinsk, Chelyabinsk Region, Russia, zip code 454048 **Phone:** +7351267-19-45 **E-mail:** international@insi.ru INSI in Moscow **INSI JSC** **Address:** 33/13 Bolshaya Yakimanka str., bld. 2 (Oktyabrskaya metro station), Moscow, Moscow Region, Russia, zip code 119049
4.	Name and details of Foreign Collaborator, if any	*No Information*
5.	Name of the Technology/System	construction technology with application of light gauge galvanized profiles to use in high-rise construction.
6.	Is it a patented system?	YES
7.	Brief Write- up on Technology / System	**Framed buildings** Load bearing capacity of such buildings is ensured by metal light-gauge steel frame. Heat insulating, soundproof and windproof materials installed to the light gauge secondary steelwork create pleasant interior climate conditions. For a long time timber was number one construction material. However wood has a number of disadvantages: it is a combustible material, prone to wet rot and attack by insects or fungi. Many years of scientific research lead to emergence of the technology where galvanized profiles with special zigzag

		perforation are applied as secondary steelwork. Such profiles were later called "thermoprofiles" due to their unique thermal performance. **Perforation in the section webs extended the heat flow track. Bearing capacity of thermoprofile was reduced by 10%, while its thermal conductivity dropped by 80-90%. These figures are quite relative and depend on the profile type. Reduced steel thickness results in reduced heat losses (together with load-bearing capacity), approaching those of wood.** Thus the "cold bridge" problem found its solution **for building envelopes where metal elements were used. "INSI" construction technology** **Prefabricated construction technology has been widely applied in the USA, Canada, Sweden, Finland, Great Britain and Japan. In other European and Asian countries it started to be used not long ago, since middle 90-s of the 20th century.** **The technology is implemented in the following way. Construction of the bearing frame is followed by the framework for exterior panels, which is in its turn made of steel thermoprofiles 0.7-2.0 mm thick with bolt and screw connections. Then windproof film or fiber-reinforced gypsum plasterboard are fixed to the external side of the steelwork for wind protection. Mineral wool is fixed between the framework sections to ensure effective heat insulation. Vapourproof film is installed to the inner side of the insulation. Various options exist for internal cladding, including gypsum plasterboard, cement-shaving slabs, plywood and other modern materials.** **The external surface may be clad with profiled sheets, vinyl or metal siding, facade cassettes and panels with polymer coating.** This protective-decorative cladding is installed using rainscreen technology, which allows for a built-in airspace between the siding and the wall which provides an air space that prevents the build-up of water and moisture in the system. *"INSI" Construction Holding has been for almost 20 years producing façade and roofing materials, available for cost and time effective delivery to construction sites in Russia and CIS countries.*
8.	If any evaluation/certification carried out. If yes, Give Details	**yes** Certificate of conformity. Steel galvanized roll-formed thermoprofile for building structures. Certificate of conformity. Corrugated sheet. Certificate of conformity. Tile effect roofing sheets Constituent parts Drainback system. Certificate of conformity. Metal cold-formed facade cassettes and component items Certificate of conformity. Cold-formed profiles "Siding" , "Fasade Panel", "Constituent Parts", "Levelling System INSI" Technical certificate of Curtain wall facade system. Technical certificate Steel galvanized roll-formed profile. Certificate of conformity. Steel galvanized roll-formed profile for building structures.

9.	Advantages of the Technology vis- a- vis. conventional system	**The main advantage is time-saving construction. While it takes a year or longer to build a house of brick or concrete, a few months will be enough to assemble a light gauge steel structure.** Application of lightweight steel significantly reduces the weight of walls and floorings, thus making the whole building compare well with concrete and brick structures. Such buildings do not require solid deep foundations. Foundation posts or a solid slab can serve the purpose. Due to computer assisted design and prefabrication high accuracy of construction is achieved. Size tolerances of profiles do not exceed 1 mm lengthwise and hundredths of a millimeter in cross-section. As a result, the surface of walls, partitions and ceilings is flat, even and suitable to receive finishes. *All frame elements are factory-produced, labeled in compliance with assembly drawings, which helps to save time and avoid mistakes during assembly.* **Another strong point of prefabricated buildings with effective insulation is excellent energy performance. However, it can be achieved through high quality of all construction works only. Installation of service lines inside the outer walls allows to make the most of the interior space.** Open plan is another advantage of framed structures.
10.	Limitations of the Technology, if any	prefabricated parts comes to the site for assembly.
11.	Whether the manufacturing of components is on-site or factory made.	factory made
12.	In case of Factory made, whether Manufacturing Facility is established in India. (present status) If Yes, Location and Present Manufacturing Capacity. If No, what scale of project (No. of Dwelling Units) needed to establish the factory?	**NO**
13.	In case of on-site production, scale of the project (No. of Dwelling Units) needed to establish the facility on site.	100 UNITS
14.	What is the economical lead distance in case factory made components?	NO INFORMATION
15.	Do you also execute the project, If yes, present capacity. If No, How it is proposed to be done.	YES
16.	Are you ready to take up the execution of the project immediately on receipt of the	YES

	work order.	
17.	Do you provide complete design solution? If Yes, whether structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893 If No, How do you propose to provide structural design?	YES Corrugated Wall Sheets Installation Installation of corrugated roof sheeting Standing seam roof. Installation manual. Metal fencing sheets Facade cassette assembly manual General description of the construction system
18.	Do you provide construction supervision services / Project Management consultancy services If No, How it is proposed to be done	**Design of residential and industrial buildings** – design of any buildings using INSI Prefabricated House Building Concept. Our experts will develop a project of any residential, industrial or warehouse building that will meet all modern requirements regarding safety and convenience; **Façade design** — we offer façade design service for any building and provide the following cladding options to choose from: façade cassettes, façade panels, metal siding, fiber-cement boards, profiled sheets. For you to better imagine how the project will look like when brought to life, our engineers will convert drawings into a coloured 2D- image; **Design of roofs and mansard floors** — we offer design of roof framework (truss system) and roof fixing systems. Roof cladding includes several types of tile-effect sheets, profiled sheets or standing seam roofing; In addition, our clients are offered such services as preparation of sketch drawings, materials calculation for roofs and facades including complementing elements, as well as a façade cladding scheme; **Plasma cutting** — plasma cutting of up to 50 mm thick metal on the state-of-the-art equipment; **Metal painting** — colour-coating of rolled metal and metal sheets (aluminium, galvanized steel). We offer customized / bespoke metal coating at our powder paint line. Due to such painting technique the coating has higher resistance to chipping, scratching and fading; For information concerning **shipment and delivery of goods** you may contact our Logistics Department.
19.	Brief on the Training needs for Installing, Using and Maintenance along with readiness to execute the project using construction workforce with current skills in India.	Training Required. "INSI" Holding Company is one of the leading Russian producers of façade and roofing materials and prefabricated buildings. Its member-factories also manufacture autoclave gas-concrete blocks and construction fiber for reinforcement of concrete products and asphalt-concrete mixtures. "INSI" provides the whole range of construction services – from initial concept through design and construction to occupation, including

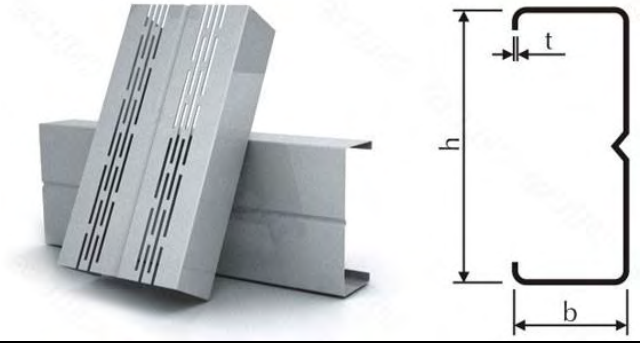
		comprehensive development.& training
20.	Note on Guarantees / Warrantees provided to the user/customer.	We rely on highly qualified personnel, design planning and supervision to meet the highest standards and time limits. Our services are tailored to meet our customers budget. with Guarantees
21.	Attach a brief note on the Sustainability issues such as environmental friendliness, energy efficiency use of waste materials recyclability etc.	"INSI" stands for QUALITY • A wide choice of roofs and facades produced of high-quality metal • A rich selection of color coatings, including rare exclusive colors • High quality of the produced goods "INSI" stands for CONVENIENCE • Integrated approach: from design to "turn-key" solutions for buildings and structures of any application. • Compact modern package that facilitates and speeds up shipping to any region. • Application of advanced materials only. No lifting equipment required. Bolt connections, no wet processes. Possibility of all-year-round construction. Construction in any part of Russia and CIS countries. On-time production and shipping. "INSI" stands for RELIABILITY • The company ha "INSI" stands for QUALITY • A wide choice of roofs and facades produced of high-quality metal • A rich selection of color coatings, including rare exclusive colors • High quality of the produced goods "INSI" stands for CONVENIENCE • Integrated approach: from design to "turn-key" solutions for buildings and structures of any application. • Compact modern package that facilitates and speeds up shipping to any region. • Application of advanced materials only. No lifting equipment required. Bolt connections, no wet processes. Possibility of all-year-round construction. Construction in any part of Russia and CIS countries. On-time production and shipping. "INSI" stands for RELIABILITY • The company has been for already 22 years on the market.

		• Hundreds of completed projects. • High expertise of our personnel. • All products and services have relevant certificates of quality .has been for already 22 years on the market. • Hundreds of completed projects. • High expertise of our personnel. • All products and services have relevant certificates of quality.	
22.	Note on Upkeep / Maintenance facilities that will be available to the user / customer during guarantee / warranty period and after. Availability of annual maintenance contract.	No Information available.	
23.	Attach note on case studies of use of the Technology in the country/ other countries with date (month/year) of use/ installation.	INSI JSC Headquarters Chelyabinsk International Cooperation Department Address: 2 Karla Libknekhta str., office 500, Chelyabinsk, Chelyabinsk Region, Russia, zip code 454048 Phone: +7351267-19-45 E-mail: international@insi.ru INSI in Moscow INSI JSC Address: 33/13 Bolshaya Yakimanka str., bld. 2 (Oktyabrskaya metro station), Moscow, Moscow Region, Russia, zip code 119049	
24.	Analysis of Life Cycle Cost including Initial cost, cost of maintenance, and comparison with conventional system, if any	No Information	
25.	Speed of construction vis-à-vis conventional system.	The system has been used in many countries worldwide. The construction experiences using the system show a marked reduction in construction time compared to traditional building methods. Panels are industrialized, and for this reason, assembly processes are optimized, labour is significantly reduced, and construction time decreased by roughly 50%.	
26.	Brief on Performance Characteristics & related Standards	1. Structural Stability	OK
		2. Durability	OK
		3. Behavior in Earthquake	Safe
		4. Fire Safety	Safe
		5. Rain	Safe
		6. Thermal performance	OK
		7. Acoustic performance	OK
		8. Behavior under high wind/cyclones	Safe
		9. Floods	Safe

		10. Under high moisture /Humid conditions.	OK
		11. Any other, please specify)	No
27.	Is there Standard on technology formulated by Your Company	Description of components of the system **1. Profiles and peculiarities of their maintenance** Bent galvanized profiles for building structures are produced in accordance with technical task TU 5285-001-42481025-01. Profiles are supplied to the construction field already cut according to the given dimensions of the project in accordance with constructional drawings, and also it is possible to cut the required dimensions directly at the construction field! JSC INSI produces thermoprofiles of two types TPS (pole) and TPP (rafter) of the following dimensions: TPP 110x1,0; TPP 145(150)x1,0; TPP 145(150)x1,5; TPP 170x1,0; TPP 170x1,5; TPP 195(200)x1,0; TPP 195(200)x1,5; TPP 220x1,0; TPP 220x1,5;TPS 145(150)x1,0; TPS 145(150)x1,5; TPS 195(200)x1,0; TPS 195(200)x1,5 PGS **2. Fixation** Thermoprofiles are fixed between each other on self-drilling screws 4,8 x 16, 4,2x16mm, 5,5x25mm and bolts. Fixing towards the concrete basements and walls is done by means of various fixing anchors. Method of fixation, quantity of fixing elements of thermal profiles are defined by design calculation. **3. Insulator** Glass wool and mineral wool are used as insulator of wall structures. URSA n-20 glass wool has the following characteristics: Density, kg/m2 18…26, thermal conductivity – 0.043 w/m Flammability group – Non-flammable, ISOVER thermal isolation Thermal conductivity with temperature 25°C w/mK, not more than 0.035 Flammability group – Non-flammable. **4. Vapor isolation** To create vapor proof barrier in the internal surface of thermal insulation for pitched and flat roofs, and while insulating external walls vapor proof film UTAFOL N is used. The film can be installed both horizontally and vertically from inside side of thermal isolation to carrying elements. Recommended area of overcloak is shown by the tape of black color situated on the edge of the film. The size of overcloak should be not less than 10 cm both vertically and horizontally. The film can be used by any side. UTAFOL N, UTAFOL AL The film is not flammable (flammability level B3 DIN 4102), vapor proof level 0.98g/m2/24 hours. Joints of the film are spliced by the scotch tape. **5. Under-roof films** To prevent internal construction of the object from moisture penetration from outside anti-condensate and diffusion film UTACON is used. At the same time it prevents condensate water	

		steam from discharging to the implemented thermal isolation.UTACON, UTAVEK 115, TYVEK. The film is not flammable (flammability B3 DIN 4102) vapor proof level 1000 g/m2/24h. The film is installed in horizontal position, directly on the rafters or another roof carrying construction in such a way, that the distance between the rafters in the point of the film does not exceed 1.2 m. Minimum gap between the film and insulator should be 4 cm. The coil with the film is made in such a way that when you uncoil it on the roof water-absorbing non-woven fabric was turned into internal area of the object. The edge of the film is coated by the stripe of the black color to identify recommended width of horizontal overcloak with the next part of the film.In all cases attachment of the film in the lower part of the roof and in the area of the apex should meet conditions necessary for mandatory air flows required for ventilation. **6. Wind protection for walls** In case of external insulation of vertical walls the water proof film named UTAVEK is used. The film is directly installed into the insulator. Joints of the film are spliced by the scotch tape. Ventilation gap is made between the film and external façade surface. UTAVEK (wind proof) has the level of 1.5 m, length – 50m and density of 80 g/m2. Flammability level B2 DIN 4102, vapor transmission 2000 g/m2/24h. Characteristics of constructions made on the basis of thermoprofile **1. Thermal transmission resistance** In thermoprofile construction high thermal conductivity of steel framework profiles is reduced due to perforation of the steel profile wall. It results in appearance of new thermal characteristics, the same that simple wooden constructions have. The statement upon the results of appraisal of heat-protective characteristics of heat insulation of the frame produced from INSI thermoprofiles was made by the Siberian State Automobile and Highway Academy, Omsk. Due to insulator, air proof nature and wind protection the construction possesses high characteristics of temperature and humidity conditions. Materials for identification of thermal and technical characteristics of external building envelopes fulfilled with INSI thermoprofiles are listed in the album called “Materials for designing external building envelopes with steel bent thermoprofiles produced by INSI”, script 66-00-MP, section 3 (pages 5-41). **2. Fire resistance** Panels with thermoprofile frames are produced from non-flammable materials; fire-resistant mineral or glass wool is used as an insulator, that is why the fire-resistance limit for the panel with thermoprofile frame comprises not less than I 90/RE 45.Calculation of thermoprofile constructions

		Calculation characteristics of profiles have been generated and confirmed during the tests in the Scientific and Research Center of Engineering and Construction Institute of the Siberian State Automobile and Highway Academy (ISI SIBADI), Omsk. Profiles characteristics have been received by calculation and confirmed by practical tests.Instructions for installation **1. Preparatory works** Before installation it is necessary to check presence of required installation material in the construction field and ensure uninterrupted supply during erection works It is required to check conditions of thermoprofiles before erection. Thermoprofiles should be absolutely straight, not bended or otherwise damaged. Before installation it is necessary to check accuracy of dimensions, straightness of foundation, and evenness of its top surface. Permitted deviation of the foundation top mark along the whole period should be not more than 10 mm, incline – not more than 1:1000mm. It is also necessary to check position of embedded parts and axles of the building. Before starting installation works, the assemblers should get acquainted with constructional drawings of the building. During installation it is necessary to follow design drawings. **2. Order of the frame installation** Usage of line-operated and battery-powered tools (screw-driving machine) equipped by torque moment regulator is recommended for works with thermoprofiles. Position of the lower guiding profile is marked on the basement. Before installing and fixing lower guiding profile the hydraulic isolation of the basement is placed. Usually, it is ruberoid (asphalt paper) spread in two layers. Installation of walls starts from the corner of the building. Wall posts are set on the lower guiding profile. The posts are installed in a vertical position and fixed by temporary backstays. Then several intermediary posts which ensure the straightness of the wall during installation of the posts are installed for the walls. Top guiding profiles are installed after installation of angle and intermediary posts. Temporary break-outs can be removed only after construction of baffles that ensure stiffness of the building, creation of trussed rafters and flooring panels. Installation of walls can be done by means of ready-made wall panels. Panels are assembled on a separate field and delivered for installation on the walls. During installation panels are set vertically, and the bottom of the panel is fixed towards the basement. Installation of panels from the corner of the building allows giving some stiffness to the installed panels by means of attaching angles of two panels and assembly of temporary backstays. Order of panel installation should be taken into account during their production. **3. Order of the trussed rafter installation**

		Position of trussed rafters is marked before installation. Constructional system requires combination of the axle of the trussed rafter with the axle of the wall post with allowed deviation plus/minus 10mm. If staying is done against the window or door opening, than the upper lintel is used for transition of lads from the rafters to the posts of window or door boxes. Trussed rafters are assembled on the separate field and delivered ready-made for installation on the walls. Supply of the rafters can be done by crane that possesses sufficient boom length. Trussed rafters are installed and fixed using designed fixing components. Erection of trussed rafters is better to start with the ones that have design diagonal connections between each other directed to the axle of the apex, if there are no such connections, they should be mounted by temporary backstays. Fixing of the following rafters shall be done by temporary break-outs attached to already settled rafters. Temporary break outs should not interfere with the further course of works. Disassembly of temporary breakouts should be done after installation of the lath. **4. Installation of the finishing, vapor proof, and insulator** Installation of the wind proof film for the walls, hydraulic proof film for the roof, erection of the lath, roof, external trimming of the walls with leveling system is reasonable after erection of the frame for the purposes of closing the contour of the building and ensuring further works inside the building without any dependence on the weather.Installation of insulator can be done indoors. The insulator is put into the framework made of thermoprofiles. To avoid amortization of the insulator the lintels should be foreseen in the construction of wall panels. Vapor proof film is erected after installation of insulator is finished. It is important that vapor proof film will keep its integrity. The film should be overcloaked for not less than 200 mm at the joint place of vapor proof film and upper flooring. In the bottom of the wall the film is left outstanding and entered into construction of the lower flooring in accordance of design of this unit. The joints of the film are spliced by scotch tape.
28.	Attach Photographs / Diagrams showing Components, Installation /assembly details, Finished Structure	
29.	Name & Contact details of Professionals / Architects / Engineers involved with this technology Attach a list, if it is exhaustive Give list of trained Artisans, if any	**INSI JSC Headquarters** **Chelyabinsk** ***International Cooperation Department*** **Address:** 2 Karla Libknekhta str., office 500, Chelyabinsk, Chelyabinsk Region, Russia, zip code 454048 **Phone:** +7351267-19-45 **E-mail:** international@insi.ru

		INSI in Moscow **INSI JSC** **Address:** 33/13 Bolshaya Yakimanka str., bld. 2 (Oktyabrskaya metro station), Moscow, Moscow Region, Russia, zip code 119049
30.	Provide additional information you may like to supplement.	Due to the great experience and availability to engage its own resources for the project implementation, the company is constructing a range of objects, very important for the region. The projects realised by INSISTROY during 2004 – 2007 include the following: • Warehouses of the company Cia International-Chelyabinsk Closed Joint Stock Company, 5000 square meters; • Warehouses of the Forpost-Chelyabinsk Co Ltd, 7500 square meters; • Manufacturing facilities of the C-Airlaid Co Ltd, Chelyabinsk City, 7500 square meters; • Production department of the RP Povolzhye Co Ltd, Talyatti City, 48 x 56 x 9 meters, two-storied; • Pressure Wave Smoothing Unit of the KhK RegionGasNefteStroi Co Ltd, Rostov City; • Auto Center Toyota-Center, Chelyabinsk City, 5000 square meters; • Production department of the Tradeservice Co Ltd, Balabanovo City, Moscow region, 36 x 116 x 6 meters; • City Market of the Gorodskoy rynok Co Ltd, Krasnokamensk City; • Ceramic Propant Plant, KARBO Keramiks Evroasia Co Ltd, Chelyabinsk region; • Manufacturing facilities of the Autoclaved Gas-Concrete Plant Closed Company, Emanzhelinsk City, Chelyabinsk region, 12000 square meters; • 2000-Head Cattle Farm, the Agrarnaya firma Vinogradov Co Ltd, Lipetsk region; • Agroindustrial complex for Spanish company CAMPOMOS, Tasna City, Moscow region, 30000 square meters; • Logistics Complex, the TANDER Closed Company, Sosnovsky district, Chelyabinsk region, 20000 square meters.

Emerging Technology No. 9

Name of Technology: Insulated Pre-Fabricated structural House

1.	Name of Organization/Company	AAA Engineers
2.	Postal Address and Website	323, Ashoka Main, Sec-35, Faridabad-121003
3.	Name, Designation and details of Contact Person (Telephone, Fax, E-mail) (Technical Person)	Anil Pathak, 09810194560 anildash@rediffmail.com
4.	Name and details of Foreign Collaborator, if any	No
5.	Name of the Technology/System	Insulated Pre-Fabricated structural House
6.	Is it a patented system ?	No
7.	Brief Write- up on Technology / System	Houses made up of MS Structure, walls of insulated sandwich panels with proper lighting & ventilation, roofs are suitable for gardening.
8.	If any evaluation/certification carried out. If yes, Give Details	no
9.	Advantages of the Technology vis- a-vis. conventional system	Can be made in a day. Can be moved to any place. Safe from earth quack, flood, heat wave, cold wave, External Sound, Rain & Wind storm.
10.	Limitations of the Technology, if any	No
11.	Whether the manufacturing of components is on-site or factory made.	Factory made
12.	In case of Factory made, whether Manufacturing Facility is established in India. (present status) If Yes, Location and Present Manufacturing Capacity. If No, what scale of project (No. of Dwelling Units) needed to establish the factory?	No, require 1000 dwelling units.
13.	In case of on-site production, scale of the project (No. of Dwelling Units) needed to establish the facility on site.	Minimum 100 dwelling units
14.	What is the economical lead distance in case factory made components?	For factory made components, the lead time will be 1month for 10units.

15.	Do you also execute the project, If yes, present capacity. If No, How it is proposed to be done.	No. Procure from manufacturers available in India and assemble at site.
16.	Are you ready to take up the execution of the project immediately on receipt of the work order?	Yes
17.	Do you provide complete design solution? If Yes, whether structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893 If No, How do you propose to provide structural design.	Yes
18.	Do you provide construction supervision services / Project Management consultancy services If No, How it is proposed to be done	Yes
19.	Brief on the Training needs for Installing, Using and Maintenance along with readiness to execute the project using construction workforce with current skills in India.	Not required
20.	Note on Guarantees / Warrantees provided to the user/customer.	WARRANTY : The equipment supplied by us are warranted against manufacturing defects for 12 months from the date of Installation or 13 months from date of supply, whichever is earlier .AAA Engineers responsibility will be limited to only repair of manufacturing defect.
21.	Attach a brief note on the Sustainability issues such as environmental friendliness, energy efficiency use of waste materials recyclability etc.	Proper lighting & ventilation, reduces the energy consumption. If walls made of PV glass, it can store the sufficient energy to be used in night. Roofs are suitable for gardening.
22.	Note on Upkeep / Maintenance	Spare components & application engineer will be

	facilities that will be available to the user / customer during guarantee / warranty period and after. Availability of annual maintenance contract.	available on call within 48Hrs.	
23.	Attach note on case studies of use of the Technology in the country/ other countries with date (month/year) of use/ installation.		
24.	Analysis of Life Cycle Cost including Initial cost, cost of maintenance, and comparison with conventional system, if any	Cost is half, Maintenance & Life is equal, and benefits are 5times.	
25.	Speed of construction vis-à-vis conventional system.	Conventional system minimum 3 months, whereas it will take one day only.	
26.	Brief on Performance Characteristics & related Standards	1. Structural Stability	OK
		2. Durability	OK
		3. Behaviour in Earthquake	Safe
		4. Fire Safety	Safe
		5. Rain	Safe
		6. Thermal performance	OK
		7. Acoustic performance	OK
		8. Behaviour under high wind/cyclones	Safe
		9. Floods	Safe
		10. Under high moisture / Humid conditions.	OK
		11. Any other, please specify)	No
27.	Is there Standard on technology formulated by Your Company	Yes	
28.	Attach Photographs / Diagrams showing Components, Installation /assembly details, Finished Structure		
29.	Name & Contact details of Professionals / Architects / Engineers	Anil Pathak 09810194560	

	involved with this technology Attach a list, if it is exhaustive Give list of trained Artisans, if any	
30.	Provide additional information you may like to supplement.	We can develop readymade RCC slabs for roof, Plastic Bricks for Road construction made from waste plastics.

Emerging Technology No. 10

Name of Technology: Glass Fibre Reinforced Gypsum (GFRG) Panel Building System

1.	Name of Organization/Company	FACT-RCF BUILDING PRODUCTS LTD FACT COCHIN DIVISION CAMPUS AMBALAMEDU-682303,KOCHI, KERALA,INDIA. email:frbl@factltd.com Fax:91484-2721971 Ph:0484-2722503,2722600 website:www.frbl.co.in 
2.	Postal Address and Website	FACT – RCF Building Products Ltd., FACT Cochin Division Campus, Ambalamedu , P.O. Kochi, Kerala – 682303 Fax No. 0484 – 2721971 Tel. No. 0484 – 2720499 Email. ceofrbl@gmail.com
3.	Name, Designation and details of Contact Person (Telephone, Fax, E-mail) (Technical Person)	Mr. C.P. Dinesh, Chief Executive Officer, FACT – RCF Building Products Ltd., FACT Cochin Division Campus, Ambalamedu , P.O. Kochi, Kerala – 682303 Fax No. 0484 – 2721971 Tel. No. 0484 – 2720499 Email. ceofrbl@gmail.com
4.	Name and details of Foreign Collaborator, if any	The panels manufactured at the above plants are based on the technology transferred through collaboration with GFRG Building System, Australia
5.	Name of the Technology/System	Glass Fibre Reinforced Gypsum (GFRG) Panel Building System
6.	Is it a patented system?	Yes
7.	Brief Write- up on Technology / System	Glass Fibre Reinforced Gypsum (GFRG) Panel known as Rapidwall is a building panel made-up of calcined gypsum plaster, reinforced with glass fibers. The panel was originally developed by GFRG Building System Australia and used since 1990 in Australia for mass scale building construction. Now, these panels are being produced in India and the technology is being used in India. The panel, manufactured to a thickness of 124mm under carefully controlled conditions to a length of 12m and height of 3m, contains cavities that may be unfilled, partially filled or fully filled with reinforced concrete as per structural requirement. Experimental studies and research in Australia, China and India have shown that GFRG panels, suitably filled with plain reinforced concrete possesses substantial strength to act not only as load bearing elements but also as shear wall, capable of resisting lateral loads due to earthquake and wind. GFRG panel can also be used advantageously as in-fills (non-load bearing) in combination with RCC framed columns and beams (conventional framed construction of multi-storey building) without any restriction on number of storeyes. Micro- beams and RCC screed (acting as T-beam) can be used as floor/ roof slab. The GFRG Panel is manufactured in semi-automatic plant using slurry of calcined gypsum plaster mixed with certain chemicals including water repellent emulsion and glass fibre

		rovings, cut, spread and imbedded uniformly into the slurry with the help of screen roller. The panels are dried at a temperature of 275oC before shifting to storage area or the cutting table. The wall panels can be cut as per dimensions & requirements of the building planned. It is an integrated composite building system using factory made prefab load bearing cage panels & monolithic cast-in situ RC in filled for walling & floor/roof slab, suitable for low rise to medium rise (single to 10 storeys) building.
8.	If any evaluation/certification carried out. If yes, Give Details	BMTPC under Performance Appraisal Certification Scheme has evaluated the Panel manufactured at RCF Mumbai and FRBL Cochin and issued PAC No. 1008-S/2011 and PAC No. 1009-S/2012 respectively. (Available from BMTPC website www.bmtpc.org). • IIT Chennai
9.	Advantages of the Technology vis- a- vis. conventional system	It makes use of industrial waste gypsum. Does not need any plastering. Uses much less cement, sand, steel and water than conventional building. It consumes much less embodied energy and less carbon footprint. Panels being only 124 mm thick, for the same carpet area, the built up area and the building footprint is much less than conventional buildings. This is particularly ad-vantageous in multi storey mass housing. Panels can be used not only as walls but also as floors, roofs and staircase. Using the system, the construction of a building can be very fast compared to the conventional building. One building of two storeyed (total 1981 sqft with four flats) was constructed in IIT Madras in one month. These panels are very light weight only 43 kg/m2. Even after filling some of the cavi- ties with concrete, the overall building weight is much less, contributing to significant reduction in design earthquake forces and savings in foundation and overall buildings cost especially in multi – storeyed buildings
10.	Limitations of the Technology, if any	• The shorter span of slab (floor / roof) should be restricted to 5 m. • Is ideal if the same floor / roof is replicated for all floors in multi storeyed structure.For any variations, structural designer needs to be consulted. • Curved walls or domes should be avoided. In case it is essential, use masonry / concrete for that particular area. • The electrical / plumbing drawing should be such that most of the pipes go through the cavities (in order to facilitate minimum cutting of panel)
11.	Whether the manufacturing of components is on-site or factory made.	Factory made
12.	In case of Factory made, whether	• Rashtriya Chemicals and Fertilizers Limited,

	Manufacturing Facility is established in India. (present status) If Yes, Location and Present Manufacturing Capacity. If No, what scale of project (No. of Dwelling Units) needed to establish the factory?	"Priyadarshini", Eastern Express Highway, Sion, Mumbai. • FACT – RCF Building Products Ltd., FACT Cochin Division Campus, Ambalamedu, Kochi (Kerala). The panels manufactured at the above plants are based on the technology transferred through collaboration with GFRG Building System, Australia. BMTPC under Performance Appraisal Certification Scheme has evaluated the Panel manufactured at RCF Mumbai and FRBL Cochin and issued PAC No. 1008-S/2011 and PAC No. 1009-S/2012 respectively. (Available for download from BMTPC website www.bmtpc.org).
13.	In case of on-site production, scale of the project (No. of Dwelling Units) needed to establish the facility on site.	N.A.
14.	What is the economical lead distance in case factory made components?	100 KM
15.	Do you also execute the project, If yes, present capacity. If No, How it is proposed to be done.	YES.
16.	Are you ready to take up the execution of the project immediately on receipt of the work order.	YES
17.	Do you provide complete design solution? If Yes, whether structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893 If No, How do you propose to provide structural design.	YES
18.	Do you provide construction supervision services / Project Management consultancy services If No, How it is proposed to be done	YES
19.	Brief on the Training needs for Installing, Using and Maintenance along with readiness to execute the project using construction workforce with current skills in India.	Training is Required.
20.	Note on Guarantees / Warrantees provided to the user/customer.	NO INFORMATION.
21.	Attach a brief note on the Sustainability issues such as environmental	It makes use of industrial waste gypsum. Does not need any plastering. Uses much less cement, sand, steel and

	friendliness, energy efficiency use of waste materials recyclability etc.	water than conventional building. It consumes much less embodied energy and less carbon footprint.	
22.	Note on Upkeep / Maintenance facilities that will be available to the user / customer during guarantee / warranty period and after. Availability of annual maintenance contract.	Manual available with FACT-RCF	
23.	Attach note on case studies of use of the Technology in the country/ other countries with date (month/year) of use/ installation.	Using the system, the construction of a building can be very fast compared to the conventional building. One building of two storeyed (total 1981 sqft with four flats) was constructed in IIT Madras in one month.	
24.	Analysis of Life Cycle Cost including Initial cost, cost of maintenance, and comparison with conventional system, if any	YET TO ESTABLISED	
25.	Speed of construction vis-à-vis conventional system.	Using the system, the construction of a building can be very fast compared to the conventional building. One building of two storeyed (total 1981 sqft with four flats) was constructed in IIT Madras in one month.	
26.	Brief on Performance Characteristics & related Standards	1. Structural Stability	OK
		2. Durability	OK
		3. Behavior in Earthquake	Safe
		4. Fire Safety	Safe
		5. Rain	Safe
		6. Thermal performance	OK
		7. Acoustic performance	OK
		8. Behavior under high wind/cyclones	Safe
		9. Floods	Safe
		10. Under high moisture / Humid conditions.	OK
		11. Any other, please specify)	No
27.	Is there Standard on technology formulated by Your Company	• Performance Appraisal Certification PACs No. 1008-S/2011 issued to M/s Rashtriya Chemicals and Fertilizers Limited, “Priyadarshini”, Sion, Mumbai. • Performance Appraisal Certification PACs No. 1009-S/2012 issued by FACT – RCF Building Products Ltd., FACT Cochin Division Campus, Ambalamedu, Kochi. • GFRG / Rapidwall Building Structural Design Manual, prepared by IIT Madras, published by BMTPC, New Delhi. • IS 3809:1979 – Fire Resistant Test of Structures	

28.	Attach Photographs / Diagrams showing Components, Installation /assembly details, Finished Structure	
29.	Name & Contact details of Professionals / Architects / Engineers involved with this technology Attach a list, if it is exhaustive Give list of trained Artisans, if any	Mr. C.P. Dinesh, Chief Executive Officer, FACT – RCF Building Products Ltd., FACT Cochin Division Campus, Ambalamedu , P.O. Kochi, Kerala – 682303 Fax No. 0484 – 2721971 Tel. No. 0484 – 2720499 Email. ceofrbl@gmail.com

Emerging Technology No. 11

Name of Technology: Schnell Wire System srl unipersonale Via Borghetto.

1.	Name of Organization/Company	**SCHNELL GROUP** SCHNELL GROUP is a multinational global leader in the field of automatic machines for the processing of steel for use in reinforced concrete construction. SCHNELL HOME is a manufacturer of machinery for the production of innovative building elements. The various machines, starting from wire in coils and polystyrene blocks, produce a sandwich panel consisting of a core of polystyrene and two welded mesh mats. Our mission is the development of machinery for the production of the panel system, giving the customers 360° service through both training on the use of the machines as well as the installation of the finished panels. Schnell Wire System srl unipersonale Via Borghetto, 2B - Zona Ind. San Liberio 61030 Montemaggiore al Metauro (PU) - Italia
2.	Postal Address and Website	**Schnell Wire System SRL Unipersonale** Via Borghetto, 2B - Zona Ind. San Liberio 61030 Montemaggiore al Metauro (PU) - Italia Tel. +39.0721.878711 Fax +39.0721.8787330 w w w.schnell.it schnellhome@schnell.it
3.	Name, Designation and details of Contact Person (Telephone, Fax, E-mail) (Technical Person)	Schnell Wire System srl unipersonale Via Borghetto, 2B - Zona Ind. San Liberio 61030 Montemaggiore al Metauro (PU) - Italia Tel. +39.0721.878711 Fax +39.0721.8787330 w w w.schnell.it schnellhome@schnell.it
4.	Name and details of Foreign Collaborator, if any	Schnell Wire System srl unipersonale Via Borghetto, 2B - Zona Ind. San Liberio 61030 Montemaggiore al Metauro (PU) - Italia Tel. +39.0721.878711 Fax +39.0721.8787330 w w w.schnell.it schnellhome@schnell.it
5.	Name of the Technology/System	SCHNELL HOME BRAND of SCHNELL WIRE SYSTEM
6.	Is it a patented system ?	YES
7.	Brief Write- up on Technology / System	ELEMENTS TO BUILD THE FUTURE Schnell Home machines produce a panel that consists of a polystyrene assembled together with welded wire mesh. A single facility can produce all the elements for building accommodate to customer needs and can vary the thickness, length and width of the polystyrene core as well as the diameter of the mesh connectors between the mats. The machines produce the following panel models: Single / Double / Evolution / Floor-Roof1 – **SINGLE PANEL** This panel consists of a sheet of polystyrene sandwiched between two mats of welded wire mesh. The polystyrene sheet can be shaped as required and the thickness can vary according to needs. The Single Panel can be used for

		the construction of single and multi-storey buildings according to the local building regulations. **CONCRETE APPLICATION** These are single panels that are integrated with traditional reinforced concrete structures as the external wall cladding, partition walls and floors. The advantages are the speed of application and the excellent insulation propty By varying the thickness of the panel it is possible to reach a classification of t construction of Category A - Passive House. - Increased energy savings; - Improved thermal comfort in all seasons; - No risk of mold on interior surfaces of the construction caused by condensation at thermal bridges; - Capacity of the building to retain heat during periods of shutdown of the heating system. - Increased usable floor space inside the building.
8.	If any evaluation/certification carried out. If yes, Give Details	**CERTIFICATIONS AND LABORATORY TESTS** SCHNELL HOME has carried out many different laboratory tests that certify the numerous qualities of the panels. 1. HURRICANE DEBRIS MISSILE IMPACT TEST - The Single Panels successfully passed the missile tests with estimated wind speeds around 320 km/h - 200 mph. 2. FIRE RESISTANCE TEST - PCS08 - EI 92 - E 120 (airtight - isolation) - PCD15 5+5 - EI 240 - E 240 (airtight-isolation) (source L API - CSI Milan) 3. ACOUSTIC ISOLATION TEST Double Panel: - PCD14 - Rw = 50 dB Single Panel: - PCS08 Traditional plaster and dr y wall finish - Rw = 55 dB - PCS16 Traditional plaster finish - Rw = 47 dB (Source Giordano Rimini Institute – CSI Milan) 4. FLOOR PANEL BENDING TEST - A Single Panel 400 cm x 400 cm was progressively loaded towards the breaking point which corresponds to a uniformly distributed nominal load well over 2000 kg/m2. The test was done by slowly filling a water tank measuring 300 cm x 300 cm and 200 cm high. 5. MECHANICAL RESISTANCE TEST: COMPRESSION AND SHEAR - The minimum value from the results of the testing for breakage under compression was 70 tons. This means that the Single Panel is able to support the loads from a six storey building. Single Panel with 3 cm of shotcrete per side = 20 MPa = 3000 PSI. 6. THERMAL TRANSMITTANCE TEST - The results of the laboratory tests carried out on the panels were: • PCS08 Up = 0,58 W/m2K = 0,102 Btu/hr ft2 °F • PCS16 Up = 0,30 W/m2K = 0,053 Btu/hr ft2 °F

		• PCD15_5+5 Up = 0,444 W/m2K = 0,078 Btu/hr ft2 °F • PCD15_8+8 Up = 0,35 W/m2K = 0,062 Btu/hr ft2 °F NOTE: EPS: expanded polystyrene PCS08: Single Panel - 8 cm thickness EPS PCS16: Single Panel - 16 cm thickness EPS PCD14 5+5: Double Panel – 5 cm EPS + 14 cm Concrete + 5 cm EPS PCD15 5+5: Double Panel – 5 cm EPS + 15 cm Concrete + 5 cm EPS PCD15 8+8: Double Panel – 8 cm EPS + 15 cm Concrete + 8 cm EPS
9.	Advantages of the Technology vis- a- vis. conventional system	Compared to traditional products, panels achieve far better results, at considerably reduced cost. The speedy construction represent additional savings.The building system gives full design flexibility as it offers a complete range of build-ing elements such as load-bearing walls, curtain walls, floors and stairs. The panels are easy to use in the construction of any type of structure, and can be shaped to any geometric requirement i.e. flat or curved by simple cutting the panels at site. ADVANTAGES FOR BUILDING AND FOR LIVING - Resistanceto Earthquakes - High Mechanical performance - Resistanceto Hurricanes - Light and Easy to handle - Resistance to Fire - Thermal insulation - Modular and Versatile - Quick and Easy to install - Sound insulation - Economically Priced
10.	Limitations of the Technology, if any	Economical for mass housing only.
11.	Whether the manufacturing of components is on-site or factory made.	INSTALLATION AND CONSTRUCTION PHA Schnell system means time saving, greater production capacity and reduced costs on every job. 1. INSTALLATION OF REBAR ANCHORS - Anchor bars are normally inserted before the pouring of the foundation. Alternatively it is possible to drill holes in the existing slab and then anchor the bars with an approved system. 2. INSTALLATION OF THE PANEL - Thanks to their lightweight, a single operator can easily lift and place the panels where required. This is another factor that contributes to the labor savings of the Schnell System compared to traditional techniques. 3. POST INSTALLATION - Immediately after the placement of the panels, the perfect linearity and verticality of the walls is checked and ensured. 4. PREPARATION FOR ELECTRICAL AND PLUMBING - A hot-air gun or torch is used to create channels in the polystyrene for the placement of switch boxes, electrical conduits, cables, pipes, etc. 5. INSTALLATION OF THE FLOOR PAN - Once the floor panels are placed, supported by the walls a from below, any necessar y additional steel reinforcement installed and the concrete is

		poured. 6. APPLICATION OF SHOTCRETE - Both sides of the walls of the Single Panel are sprayed with shot Crete and subsequently finished with plaster.
12.	In case of Factory made, whether Manufacturing Facility is established in India. (present status) If Yes, Location and Present Manufacturing Capacity. If No, what scale of project (No. of Dwelling Units) needed to establish the factory?	YES At Ahmedabad
13.	In case of on-site production, scale of the project (No. of Dwelling Units) needed to establish the facility on site.	The viability depends upon the quantum of work. Generally requirements of 1.5 lakh sqm of panel per year for minimum period of three years make the plant viable.
14.	What is the economical lead distance in case factory made components?	100KM (Approx).
15.	Do you also execute the project, If yes, present capacity. If No, How it is proposed to be done.	YES with the support of Entrepreneurs/Construction agency
16.	Are you ready to take up the execution of the project immediately on receipt of the work order.	No
17.	Do you provide complete design solution? If Yes, whether structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893 If No, How do you propose to provide structural design.	YES The structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893
18.	Do you provide construction supervision services / Project Management consultancy services If No, How it is proposed to be done	YES TOTAL CUSTOMER SERVICE FOR OUR CLIENTS! SCHNELL HOME after sales service offers assistance worldwide on all of the products: the technicians will install the machines at the customers location and fully train the operators. SCHNELL HOME engineers will also train the customers labor force on the installation and completion of the panels at the construction site. Subsequently technicians specialized in mechanics and electronics and well as site foremen and surveyors are always available to assist customers at their location after the purchase of SCHNELL HOME machinery. Full trust and customer satisfaction are the basis for SCHNELL HOME in any successful business relationship.
19.	Brief on the Training needs for Installing, Using and Maintenance along with readiness to execute the project using construction workforce with current skills in India.	SCHNELL HOME engineers will also train the customers labor force on the installation and completion of the panels at the construction site. Subsequently technicians specialized in mechanics and electronics and well as site foremen and surveyors are always available to assist customers at their location after the purchase of SCHNELL HOME machinery.

20.	Note on Guarantees / Warrantees provided to the user/customer.	YES TOTAL CUSTOMER SERVICE FOR OUR CLIENTS! SCHNELL HOME after sales service offers assistance worldwide on all of the products: the technicians will install the machines at the customers location and fully train the operators.	
21.	Attach a brief note on the Sustainability issues such as environmental friendliness, energy efficiency use of waste materials recyclability etc.	The insulating envelope provided by polystyrene core eliminates thermal bridges and ducts within the panel. This brings high level of energy efficiency. The system pro- vides significant improvements in indoor thermal comfort by greatly reducing en- ergy consumption and promoting strategies aimed at sustainable development	
22.	Note on Upkeep / Maintenance facilities that will be available to the user / customer during guarantee / warranty period and after. Availability of annual maintenance contract.	No information	
23.	Attach note on case studies of use of the Technology in the country/ other countries with date (month/year) of use/ installation.	Almost in fifteen country	
24.	Analysis of Life Cycle Cost including Initial cost, cost of maintenance, and comparison with conventional system, if any	Initial investment is high to established machine and equipment.	
25.	Speed of construction vis-à-vis conventional system.	The system has been used in many countries worldwide. The construction experiences using the system show a marked reduction in construction time compared to traditional building methods. Panels are industrialized, and for this reason, assembly processes are optimized, labour is significantly reduced, and construction time decreased by roughly 40%.	
26.	Brief on Performance Characteristics & related Standards	1. Structural Stability	OK
		2. Durability	OK
		3. Behavior in Earthquake	Safe
		4. Fire Safety	Safe
		5. Rain	Safe
		6. Thermal performance	OK
		7. Acoustic performance	OK
		8. Behavior under high wind/cyclones	Safe
		9. Floods	Safe
		10. Under high moisture /Humid conditions.	OK
		11. Any other, please specify)	No
27.	Is there Standard on technology formulated by Your Company	YES. **CONCRECAD SOFTWARE** The software runs in the AutoCAD environment and calculates the quantities of manpower and materials of structures with the possibility of importing those originally designed with other construction system or programs. It automatically calculates the required quantities of the various panel types. Also included are modules for cost estimation and production management. - AUTOCAD FILE IMPORTING - WALL PANEL INSERTION - ESTIMATING - PRODUCTION LIST - ASSEMBLY PLAN	

28.	Attach Photographs / Diagrams showing Components, Installation /assembly details, Finished Structure	
29.	Name & Contact details of Professionals / Architects / Engineers involved with this technology Attach a list, if it is exhaustive Give list of trained Artisans, if any	**Schnell Wire System srl unipersonale** Via Borghetto, 2B - Zona Ind. San Liberio 61030 Montemaggiore al Metauro (PU) - Italia Tel. +39.0721.878711 Fax +39.0721.8787330 w w w.schnell.it schnellhome@schnell.it
30.	Provide additional information you may like to supplement.	TOTAL CUSTOMER SERVICE FOR OUR CLIENTS! SCHNELL HOME after sales service offers assistance worldwide on all of the products: the technicians will install the machines at the customers location and fully train the operators. SCHNELL HOME engineers will also train the customers labor force on the installation and completion of the panels at the construction site. Subsequently technicians specialized in mechanics and electronics and well as site foremen and surveyors are always available to assist customers at their location after the purchase of SCHNELL HOME machinery. Full trust and customer satisfaction are the basis for SCHNELL HOME in any successful business relationship.

Emerging Technology No. 12

Name of Technology: Speed Floor System

1.	Name of Organization/Company	Jindal Steel & Power Limited, 1st Floor, Tower – B, Jindal Centre, Plot No. 2, Sector – 32, Gurgaon
2.	Postal Address and Website	Jindal Steel & Power Limited, 1st Floor, Tower – B, Jindal Centre, Plot No. 2, Sector – 32, Gurgaon Tel.: +91 124 6612000 Fax: +91 124 6612125 Email: ss.raju@jindalsteel.com
3.	Name, Designation and details of Contact Person (Telephone, Fax, E-mail) (Technical Person)	Mr. S.S. Raju, Group President (Construction), Jindal Steel & Power Limited, 1st Floor, Tower – B, Jindal Centre, Plot No. 2, Sector – 32, Gurgaon Tel.: +91 124 6612000 Fax: +91 124 6612125 Email: ss.raju@jindalsteel.com
4.	Name and details of Foreign Collaborator, if any	No Information
5.	Name of the Technology/System	Speed Floor System
6.	Is it a patented system?	Yes,
7.	Brief Write- up on Technology / System	The Speed floor system is a suspended concrete flooring system using a roll formed steel joist as an integral part of the final concrete and steel composite floor. It is essentially a hybrid concrete/steel tee-beam in one direction and an integrated continuous one-way slab in other direction. The joists of different depths are manufactured from pre- galvanized high tensile steel in a one pass roll former, where it is roll formed, punched, pressed and slotted in a fully computerized machine manufactured in New Zealand. The joist depth and the concrete thickness are varied depending on the span, imposed loads and other functional considerations. The Speed floor composite floor system is suitable for use in all types of construction. The Speed floor joists are designed and custom manufactured to suit Particular job conditions.
8.	If any evaluation/certification carried out. If yes, Give Details	This technology is being evaluated by BMTPC under PACS.please refer BMTPC website:www.bmtpc.org
9.	Advantages of the Technology vis- a- vis. conventional system	The Speed floor composite flooring system is suitable for use in all types of construction including: • Steel frames structures • RCC frame buildings • Poured insitu or precast concrete frames

		• Light gauge steel frames • Conventional Structural brick wall constructions etc The range of end uses include : • General individual Houses • Multi-storey residential blocks • Single and multi-storey retail developments • Mezzanine floors • Car parks and storage buildings • Multi-storey office complexes etc. ***Structural*** • High strength to weight ratio. Earthquake force generation is less due to light weight. Chance of progressive collapse are marginal due to highly ductile and load carrying nature of closely spaced studs/joists. ***Speed in Construction*** • Construction speed is very high. A typical four storeyed building can be constructed within one month. ***Saving in foundation*** • Structure being light, does not require heavy foundation. **Mobility** • Structural element can be transported any place including hilly places to remote places easily and structure can be erected fast. • Structure can be shifted from one location to other without wastage of materials. ***Environment friendly*** • Steel used can be recycled when required.
10.	Limitations of the Technology, if any	Initial high investment.
11.	Whether the manufacturing of components is on-site or factory made.	Factory made. (The sectional are manufactured using a Centrally Numerical Control (CNC) automatic four innacle Roll Forming machine having production speed of 450-900 m/h with very high precision)
12.	In case of Factory made, whether Manufacturing Facility is established in India. (present status) If Yes, Location and Present Manufacturing Capacity. If No, what scale of project (No. of Dwelling Units) needed to establish the factory?	YES
13.	In case of on-site production, scale of the project (No. of Dwelling Units) needed to establish the facility on site.	-
14.	What is the economical lead distance in	1000km

	case factory made components?	
15.	Do you also execute the project, If yes, present capacity. If No, How it is proposed to be done.	YES
16.	Are you ready to take up the execution of the project immediately on receipt of the work order?	YES
17.	Do you provide complete design solution? If Yes, whether structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893 If No, How do you propose to provide structural design.	The design of the speed floor system is based on NZS 3404 (Part 1 &2) 1997, AS/ NZS 4600, 1996 and the Australian Composite Standard AS 2327 (Part-I). The design load shall be taken as prevalent in IS 875 (Part 1 & 3):1987. Earthquake forces shall be taken in accordance with IS 1893 (Part-1):2002. The section properties and design parameters are calculated from the section geometry, supplementary full side tests and finite elements analysis. The joist is manufactured from G 350 Z 275 pre-galvanized steel conforming to AS 1397:2001. Size may be any one of the following i.e. 200mm, 250mm, 300mm, 350mm and 400mm, depending upon the design requirements. Concrete thickness may be 75mm or 90mm as required.
18.	Do you provide construction supervision services / Project Management consultancy services If No, How it is proposed to be done	YES
19.	Brief on the Training needs for Installing, Using and Maintenance along with readiness to execute the project using construction workforce with current skills in India.	TRAINING REQUIRED
20.	Note on Guarantees / Warrantees provided to the user/customer.	No information on Guarantees
21.	Attach a brief note on the Sustainability issues such as environmental friendliness, energy efficiency use of waste materials recyclability etc.	Steel used can be recycled when required.
22.	Note on Upkeep / Maintenance facilities that will be available to the user / customer during guarantee / warranty period and after. Availability of annual maintenance contract.	Speed floor is a composite floor system using both steel and concrete. The two materials must be treated and maintained separately. Steel: If the joists are in a clean and dry environment, they may not require any maintenance. If they are exposed, they shall require maintenance to ensure the expected performance is achieved. Guidelines given below should be followed for maintenance: a) Keep surfaces clean and free from continuous contact with moisture, dust and other debris. b) Periodically inspect the joists for any signs of corrosion. Remove any by- products of the

		corrosion by mechanical means and spot prime the exposed steel substrate with an approved steel primer. Repaint the area using an appropriate paint to manufacturer's recommendations. Concrete: During the service life of the Speedfloor system, if any cracks appear in the concrete floor, they should be filled using an epoxy injection system or equivalent, to completely close the crack and prevent moisture ingress. For detailed Installation process, manufacturer's Installation Manual shall be referred.	
23.	Attach note on case studies of use of the Technology in the country/ other countries with date (month/year) of use/ installation.	Jindal housing colony	
24.	Analysis of Life Cycle Cost including Initial cost, cost of maintenance, and comparison with conventional system, if any	High initial cost of investment.	
25.	Speed of construction vis-à-vis conventional system.	Speed of construction is higher to conventional system.	
26.	Brief on Performance Characteristics & related Standards	1. Structural Stability	OK
		2. Durability	OK
		3. Behavior in Earthquake	Safe
		4. Fire Safety	Safe
		5. Rain	Safe
		6. Thermal performance	OK
		7. Acoustic performance	OK
		8. Behavior under high wind/cyclones	Safe
		9. Floods	Safe
		10. Under high moisture / Humid conditions.	OK
		11. Any other, please specify)	No
27.	Is there Standard on technology formulated by Your Company	Installation process is as follows: Lightweight bundles of joists is lifted into position and then individual joists are placed by hand. Speedfloor joists are generally placed at 1250 mm c/c. Joists are held in place using the lockbars which slip into slotted holes. The lockbars is placed at 300mm apart to support plywood formwork. The propping is not required.Full sheets of 12.5mm plywood formwork is to be laid from above creating a working platform. Cam action of lockbars secures plywood. Mesh is placed on top section of joist thereby embedded in the concrete poured thereafter. After three days of concreting, lockbars and plywood are removed from the underside revealing a	

		clean surface ready for services or a fire rated suspended ceiling. IS 1893 (Part 1):2002 Criteria for Earthquake Resistant Design of Structures - Part 1 : General Provisions and Buildings
28.	Attach Photographs / Diagrams showing Components, Installation /assembly details, Finished Structure	
		
29.	Name & Contact details of Professionals / Architects / Engineers involved with this technology Attach a list, if it is exhaustive Give list of trained Artisans, if any	Mr. S.S. Raju, Group President (Construction), Jindal Steel & Power Limited, 1st Floor, Tower – B, Jindal Centre, Plot No. 2, Sector – 32, Gurgaon Tel.: +91 124 6612000 Fax: +91 124 6612125 Email: ss.raju@jindalsteel.com
30.	Provide additional information you may like to supplement.	Design The design of the speed floor system is based on NZS 3404 (Part 1 &2) 1997, AS/ NZS 4600, 1996 and the Australian Composite Standard AS 2327 (Part-I). The design load shall be taken as prevalent in IS 875 (Part 1 & 3):1987. Earthquake forces shall be taken in accordance with IS 1893 (Part-1):2002. The section properties and design parameters are calculated from the section geometry, supplementary full side tests and finite elements analysis. The Joist is manufactured from G 350 Z 275 pre-galvanized steel conforming toAS 1397:2001. Size may be any one of the following i.e. 200mm, 250mm, 300mm, 350mm and 400mm, depending upon the design requirements. Concrete thickness may be 75mm or 90mm as required. The joist weight vis-à-vis the depth are given below: *Depth* *Weight (kg/* 200 9.41 250 10.59

		300 11.76 350 12.94 400 14.12 The *top section* of the joist is embedded in concrete and has following functions: • It is the compression element of the non-composite joist during construction • It is a 'chair' for the welded mesh or the reinforcement which develops negative • moment capacity in the concrete slab over the joist • It locks in and supports the slab shuttering system (lock bar and plywood • forms) • It becomes a continuous shear connector for the composite system. The bottom section of the joist acts as a tension member both during the construction phase and when the joist is acting compositely with the slab. The *mid section* or web of the joists has the flanged service hole and the lock-bar hole punched into it. The flanging of the service hole provides stability to the web and services can pass through without requiring protection from the sharp edges of the punched material. The *bottom triangular* section of the joist acts as a tension member both during construction phase and when the joist is acting compositely with the slab. The lock bars support the temporary plywood formwork between the joists during construction. They shall be spaced approx. 300mm apart and engage in the slotted holes punched in the top section of the joist. They also maintain the exact spacing of the joists. The standard lockbars when installed will position the joists 1230mm, 930mm or 630mm apart. There are also special adjustable lockbars that will position the joists in increments of 50mm from 330mm to 1530mm. Other type of lockbars are provided for special situations such as cantilevers or lowered soffits. High density paper overlaid 12mm shuttering plywood conforming to IS 4990:2011 or equivalent is used as formwork to produce a good finish to the underside of the slab. The rigid plywood sheets are used in conjunction with the lockbars and when locked in place, provide lateral stability to the entire Speedfloor system during the construction phase. Welded reinforcement mesh made of 8mm dia bar (fy 415 N/m2) placed @ 200mm c/c in both directions, is laid and tied into place. No chairs are required as it is held off the plywood forms by the top section of the joist, which becomes embedded in the concrete. (i) Minimum grade of concrete shall be M25 as per IS 456:2000. It should preferably be

		batched at 60mm and super plasticized to 110mm slump to provide good placement and shrinkage characteristics. A curing compound should be used and an expanding agent may be introduced in consultation with the engineer to further control shrinkage during the curing period. (ii) The concrete should initially be placed evenly and continuously over the area to be formed. Special attention should be given to ensure the concrete is screened and finished to the specified thickness so that designed deflections are achieved in the Speedfloor joists and the supporting structures. (iii) In structures for carparking, an expanding agent is generally used to reduce the effect of shrinkage during initial cure and a curing compound is used to help control the curing process.

Emerging Technology No. 13

Name of Technology: Light Gauge Steel Framed Structures (LGSF)

1.	Name of Organization/Company	Jindal Steel & Power Limited, 1st Floor, Tower – B, Jindal Centre, Plot No. 2, Sector – 32, Gurgaon
2.	Postal Address and Website	Jindal Steel & Power Limited, 1st Floor, Tower – B, Jindal Centre, Plot No. 2, Sector – 32, Gurgaon Tel.: +91 124 6612000 Fax: +91 124 6612125 Email: ss.raju@jindalsteel.com
3.	Name, Designation and details of Contact Person (Telephone, Fax, E-mail) (Technical Person)	Mr. S.S. Raju, Group President (Construction), Jindal Steel & Power Limited, 1st Floor, Tower – B, Jindal Centre, Plot No. 2, Sector – 32, Gurgaon Tel.: +91 124 6612000 Fax: +91 124 6612125 Email: ss.raju@jindalsteel.com
4.	Name and details of Foreign Collaborator, if any	
5.	Name of the Technology/System	Light Gauge Steel Framed Structures (LGSF)
6.	Is it a patented system ?	
7.	Brief Write- up on Technology / System	Light Gauge Steel Framed Structures (LGSF) is based on factory made galvanized light gauge steel components, designed as per codal requirements, produced by cold forming method and assembled as panels at site forming structural steel framework of a building of varying sizes of wall and floor. The basic building elements of light gauge steel framing are cold formed sections which can be prefabricated on site using various methods of connection. The assembly is done using special types of screws and bolts. Cold formed sections are widely used in construction including residential floors, industrial buildings, commercial buildings, hotels and are gaining greater acceptance in the residential sector. LGSF is already well established in residential construction in North America, Australia and Japan and is gaining ground in India. LGSF is typically ideal for one to three storey high buildings, especially in residential homes, apartments and commercial buildings. Due to its flexibility fast construction and durability, this technology has great potential for counties like India. LGSF can be combined with composite steel / concrete deck resting on light steel framing stud walls. Apart from having potential for mass housing, modular buildings can

		be used for long term temporary or permanent structures such as schools and classroom, military and civil housing needs, post – disaster relief structures and industrial buildings. Advisable span for LGSF buildings should be 7.5 m.
8.	If any evaluation/certification carried out. If yes, Give Details	Wall panels are generally made by using heavy duty Cement Particle Board and Gypsum board. It can also be made using high density extended polystyrene core plastered from outside using wire mesh and chicken mesh. Galvolume sheet of appropriate thickness can also be used as cladding. This technology is being evaluated by BMTPC under PACS.
9.	Advantages of the Technology vis- a- vis. conventional system	LGSF is based on established system of light gauge steel structures and designed as per codal provisions with loading requirements as per Indian Standards. ***High Precision*** • Fully integrated computerised system with CNC machine provides very high ac-curacy upto 1 mm. ***Structural*** • High strength to weight ratio. Earthquake force generation is less due to lightweight. Chance of progressive collapse are marginal due to highly ductile and load carrying nature of closely spaced studs/joists. ***Speed in Construction*** • Construction speed is very high. A typical four storeyed building can be constructed within one month. ***Saving in foundation*** • Structure being light, does not require heavy foundation. ***Mobility*** • Structural element can be transported any place including hilly places to remote places easily and structure can be erected fast. • Structure can be shifted from one location to other without wastage of materials. ***Environment friendly*** • Steel used can be recycled when required.
10.	Limitations of the Technology, if any	Initial high investment.
11.	Whether the manufacturing of components is on-site or factory made.	Factory made. (The sectional are manufactured using a Centrally Numerical Control (CNC) automatic four Pinnacle Roll Forming machine having production speed of 450-900 m/h with very high precision)
12.	In case of Factory made, whether Manufacturing Facility is established in India. (present status)	YES

	If Yes, Location and Present Manufacturing Capacity. If No, what scale of project (No. of Dwelling Units) needed to establish the factory?	
13.	In case of on-site production, scale of the project (No. of Dwelling Units) needed to establish the facility on site.	No Information
14.	What is the economical lead distance in case factory made components?	1000km (Aprox.)
15.	Do you also execute the project, If yes, present capacity. If No, How it is proposed to be done.	YES
16.	Are you ready to take up the execution of the project immediately on receipt of the work order?	YES
17.	Do you provide complete design solution? If Yes, whether structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893 If No, How do you propose to provide structural design.	IS 2095 (Part 1) : 2011 Specification for Gypsum Plaster Boards - Part 1 Plain Gypsum Plaster Boards IS 14862 : 2000 Specification for Fibre Cement Flat Sheets ASTM – A653/ A 653 M -13 Specification for steel sheet, zinc coated (galvanized) on zinc – iron alloy coated by hot dip process. ASTM – A 792/792 M -13 Specification for steel sheet, 55% aluminium zinc alloy coated by hot dip process ASTM – A 875/875 M -13 Specification for steel sheet, zinc 5% aluminium alloy coated by hot dip process.
18.	Do you provide construction supervision services / Project Management consultancy services If No, How it is proposed to be done	YES
19.	Brief on the Training needs for Installing, Using and Maintenance along with readiness to execute the project using construction workforce with current skills in India.	TRAINING REQUIRED
20.	Note on Guarantees / Warrantees provided to the user/customer.	No information on Guarantees
21.	Attach a brief note on the Sustainability issues such as environmental friendliness, energy efficiency use of waste materials recyclability etc.	Steel used can be recycled when required.
22.	Note on Upkeep / Maintenance facilities that will be available to the user / customer during guarantee / warranty period and after. Availability of annual maintenance contract.	As per contract terms
23.	Attach note on case studies of use of the Technology in the country/ other countries with date (month/year) of use/ installation.	Jindal housing colony

24.	Analysis of Life Cycle Cost including Initial cost, cost of maintenance, and comparison with conventional system, if any	Initially high investment to produce prefabricated steel components.	
25.	Speed of construction vis-à-vis conventional system.	Speed of construction is higher to conventional system.	
26.	Brief on Performance Characteristics & related Standards	1. Structural Stability	OK
		2. Durability	OK
		3. Behavior in Earthquake	Safe
		4. Fire Safety	Safe
		5. Rain	Safe
		6. Thermal performance	OK
		7. Acoustic performance	OK
		8. Behavior under high wind/cyclones	Safe
		9. Floods	Safe
		10. Under high moisture / Humid conditions.	OK
		11. Any other, please specify)	No
27.	Is there Standard on technology formulated by Your Company	The LGSS is designed based on provision of the following standards: • Indian Standard IS 801: 1975 Code of Practices for use of cold formed and welded section and light gauge steel structural members in general building construction. • British Standard BS 5950 (Part 5):1998 – Structural use of steel in Building Part 5 – Code of Practice for design of cold formed thin gauge structure. • British Standard BS 5950 (Part 1): 2000 Structure use of steel work in Building Part • 1 with loading requirement as per IS 875 (Part 1) • Indian Standard IS 875 : 1987 Code of Practice for design loads • Part 1 - Dead Loads - Unit Weights of Building Material and Stored Materials • Part 2 - Imposed Loads • Part 3 - Wind Loads • IS 1893 (Part 1):2002 Criteria for Earthquake Resistant Design of Structures - Part 1 : General Provisions and Buildings	

28.	Attach Photographs / Diagrams showing Components, Installation /assembly details, Finished Structure	
		
29.	Name & Contact details of Professionals / Architects / Engineers involved with this technology Attach a list, if it is exhaustive Give list of trained Artisans, if any	Mr. S.S. Raju, Group President (Construction), Jindal Steel & Power Limited, 1st Floor, Tower – B, Jindal Centre, Plot No. 2, Sector – 32, Gurgaon Tel.: +91 124 6612000 Fax: +91 124 6612125 Email: ss.raju@jindalsteel.com
30.	Provide additional information you may like to supplement.	The sectional are manufactured using a Centrally Numerical Control (CNC) automatic four Pinnacle Roll Forming machine having production speed of 450-900 m/h with very high precision

Emerging Technology No. 14

Name of Technology: Building quasi "conventional" high-quality rcc houses, made of steel-reinforced, eps-alleviated concrete

1.	Name of Organization/Company	**M/s J.K. Structure Ltd.**
2.	Postal Address and Website	Shri Ashoke Aggrwal Group Executive Director M/s J.K. Structure Ltd. 42, Swan Street, Peters field, Hampshire, GU32 3AD, United Kingdom Tel. 044-20 79001570, 1730 267913 Fax 044-20 7900 3957 Mob 09820348924 E mail: ashoke.aggrwal@gmail.com Web www.JK-structures.com
3.	Name, Designation and details of Contact Person (Telephone, Fax, E-mail) (Technical Person)	Shri Ashoke Aggrwal Group Executive Director M/s J.K. Structure Ltd. 42, Swan Street, Peters field, Hampshire, GU32 3AD, United Kingdom Tel. 044-20 79001570, 1730 267913 Fax 044-20 7900 3957 Mob 09820348924 E mail: ashoke.aggrwal@gmail.com Web www.JK-structures.com
4.	Name and details of Foreign Collaborator, if any	Ritman Infra Ltd is introducing a panel construction technology. This technology has been used in the world for more than 3 decades. It is both inexpensive and of high standards. Light-weight and energy-efficient, this technology has many advantages. It is versatile as well safe. Its greatest advantage, however, is that it is a 'green' technology that causes no harm to the environment. As a result, it has been shortlisted by BMTPC under Ministry of Urban Poverty Alleviation, Govt of India, in its global tender for Alternate Building Technology. Ritman has also collaborated with Fullmark, based out of Singapore to bring high quality printer consumables to India. Ritman Fullmark Inks will cater to the Indian consumer's printing requirements across all categories of printers: inkjet, laser, dot matrix, line printers and thermal printers to name a few
5.	Name of the Technology/System	Building quasi "conventional" high-quality rcc houses, made of steel-reinforced, eps-alleviated concrete. Built all on-site, in a "non-conventional" high quality and time-labour-logistics and hence cost-effective way
6.	Is it a patented system?	YES (RIL partnered Silkflex, Malaysia, to bring in an eco-friendly and environmentally non-hazardous product to India.)
7.	Brief Write- up on Technology / System	The system is entirely a "on-site" construction process, not based on prefabricated, pre cast or preassembled elements and is a most spectacular, versatile and efficient construction system. The houses are entirely, including the roof, made up of structure panels assembled with Beams. Alleviated

		concrete, a special mix of concrete and expanded polystyrene beads, hence incorporating both the thermal and the sound insulation, is injected into a steel structure made of panels reinforced with beams (galvanized steel wire studs/ steel rods). The Concrete base and the foundations of the houses are prepared in a conventional manner. They can be made from regular, poured, heavy concrete, but more generally the use of alleviated concrete or at least of one more layer of alleviated concrete, will provide good thermal insulation and good comfort from the ground also. Prior to the pouring of the concrete of the base, the panels are tied to the soldered wire mesh and to the iron rods in the base and in the foundations and assembled in accordance with the design of the house. They are then, held together by special made galvanized s teel wire studs, which fit one into the other, horizontally and vertically, to form the complete skeleton of the construction, roof included. The assembled panels form a rigid, extremely robust, self-supporting steel skeleton, comprising the outside walls and all other bearing walls and partitions, the floors and ceilings, including the roof. Doors and walls are then simply “cut out”, using steel scissors or other steel cutters. Cut-offs is recovered and re-used. Templates of doors and windows are positioned. Instead of using framework, both sides of each panels are then simply covered with a galvanized wire mesh/fencing mesh/Chicken mesh, which is clipped to the panels, and will serve as a frame when the alleviated concrete injected. “Alleviated” or “light” concrete is then injected with a special concrete pump. This pump can operate from a distance of 60 meters and to a height of up to 60 meters (almost 20 floors). The alleviated concrete is a custom-made mixture of cement, fiber, sand and Expanded Polystyrene (EPS) beads (1 to 4 mm), resulting in a low-density concrete (50-700 kg/m3) and hence incorporating thermal and sound insulation. The injected walls are then finished / leveled / smoothened from both sides. The concrete-injected then forms a true and quasi-homogeneous composite with incomparably better properties than plain steel reinforced concrete; Offers excellent thermal and phonic insulation; has walls that breathe; is completely resistant to fire; Offer complete protection against earthquakes and hurricanes and; is immune to termites and other insects. Materials used: Expanded steel type of galvanized steel mesh panels, cast and expanded in continuous process from a 1.6 mm thick and 30 cm wide galvanized steel sheet coil and Alleviated concrete made up of cement; fiber; sand and expanded polystyrene beads(1-4 mm). Salient Features: Well insulated, earthquake/hurricane/tornado resistant, fire and termite resistant, built on site in less time, minimal manpower, equipment and logistics, high quality and durability, cost

		effective, sound, safe, healthy, energy efficient, environment friendly, architectural flexibility, higher strength of walls and roof, wires and pipes embedded in the walls, no forms, shuttering frames or casings.
8.	If any evaluation/certification carried out. If yes, Give Details	Several laboratory tests carried out in different areas of the world as well as in Italy have put into evidence the high load resistance of the Advanced Building System panels. For example, compression tests with centred load carried out on a "nished single panel, cm 270 high, have shown that the same panel can sustain a maximum load of 1530 kN/m.
9.	Advantages of the Technology vis- a- vis. conventional system	The JK STRUCTURE construction system is all-on-site construction method, with no prefabricated elements and hence no prefabrication unit and no transportation issues. It is fast and easy; it requires only small teams of easy and fast to train workers: 4 men, with no prior construction skills and trained on site in only a few days can build the raw house of a 100 m² construction in only a week, without major efforts or heavy construction equipment LIGHTNESS: The panels are lightweight and sufficiently sturdy even before they are finished with spritz-beton. Thus, they are extremely manageable, easy to handle and to assemble even in the most challenging operating conditions. VERSATILITY: Equipped with a full range of building elements such as load-bearing walls, curtain walls, doors and stairs, this system favours absolute design flexibility. Furthermore any kind of geometrical form, either plane or curve, is easily obtainable just by simply cutting the elements at the site. ENERGY-SAVING: New constructions are made energy-efficient by creating a tight building envelope. This is done by using structural insulated panels that are completely integrated: in a single phase it is possible to obtain excellent thermal insulation conforming to the strictest energy standards. The high-level insulation of SIP walls and roofs serves to lower heating and cooling energy consumption up to 60 percent making it more energy-efficient than traditional methods. RAPID INSTALLATION: There is a remarkable shortening of the time of realization for constructions carried out with the Advanced Building System in comparison to those carried out with the traditional systems. This is because SIPs are provided in pre-cut, labelled pieces that can instantly be installed. This optimizes the assembling sequences and reduces the dependence on site personnel to a minimum. INEXPENSIVE: This system is advantageous for the final users as well as the firms. Proper insulation and freedom from leakage serve to minimize the utility costs. Moreover, the SIPs are sturdy and easy to maintain, thus, reducing maintenance and replacement costs. As a result, this system offers true value for money obtaining better performances at

		reduced costs. ACOUSTIC INSULATION: Acoustic insulation materials (such as cork, cocoa fibre, plasterboard, rock wool) can be applied to the panels for complete soundproofing. These successfully optimize the insulation of the walls in accordance with the strictest acoustic legislation. FIRE-RESISTANT: The quality of the foam polystyrene used for our panels is of the self-extinguishing type. Moreover, the two concrete layers which coat the panel sides further prevent its combustion. This ensures complete fire-resistance. It has further been verified in tests carried out at different laboratories, in compliance with the minimum requirements of even the most demanding regulations. CYCLONE RESISTANT: Buildings realized with the R-Panel system have a capacity to withstand the passing of the most destroying cyclones, thus confirming the high resistance of R-Panel buildings to the complex strains and thrusts of the force generated by cyclones.
10.	Limitations of the Technology, if any	The viability depends upon the quantum of work.
11.	Whether the manufacturing of components is on-site or factory made.	Factory made
12.	In case of Factory made, whether Manufacturing Facility is established in India. (present status) If Yes, Location and Present Manufacturing Capacity. If No, what scale of project (No. of Dwelling Units) needed to establish the factory?	Yes JK STRUCTURE needs no complex construction equipment or materials, no complex transportation or logistics chain: One truck or container or railway-wagon delivers all the JK STRUCTURE proprietary elements needed for the construction of more than 15 houses of 100m² (1,500 m² of built-up area), without geographical limitations
13.	In case of on-site production, scale of the project (No. of Dwelling Units) needed to establish the facility on site.	JK STRUCTURE needs no complex construction equipment or materials, no complex transportation or logistics chain: One truck or container or railway-wagon delivers all the JK STRUCTURE proprietary elements needed for the construction of more than 15 houses of 100m² (1,500 m² of built-up area), without geographical limitations
14.	What is the economical lead distance in case factory made components?	NO
15.	Do you also execute the project, If yes, present capacity. If No, How it is proposed to be done.	YES
16.	Are you ready to take up the execution of the project immediately on receipt of the work order.	YES
17.	Do you provide complete design solution? If Yes, whether structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and	YES

	Earthquake Standard IS : 1893 If No, How do you propose to provide structural design.	
18.	Do you provide construction supervision services / Project Management consultancy services If No, How it is proposed to be done	YES
19.	Brief on the Training needs for Installing, Using and Maintenance along with readiness to execute the project using construction workforce with current skills in India.	Training Required: JK Structure Production Units With Our Licensees, And Provide Maintenance And Training
20.	Note on Guarantees / Warrantees provided to the user/customer.	**WE INSTALL** • JK structure production units with our licensees, and provide maintenance and training • Quality of installation of the system on site is the responsibility of the trade persons engaged by the agency • Quality of maintenance of the building is the responsibility of the building owner.
21.	Attach a brief note on the Sustainability issues such as environmental friendliness, energy efficiency use of waste materials recyclability etc.	**GREEN TECHNOLOGY:** The polystyrene inside the Advanced Building System panels, Expanded polystyrene (also known as EPS), when evaluated over the whole of its life cycle shows that it affects the environment less than other more biological insulators: It is SAFE: It does not release toxic or harmful substances and is totally inert. It does not contain chlorofluorocarbons (CFCs) or (HCFCs). Furthermore, as it contains no organic material, the growth of micro-organisms and mould is inhibited. The mechanical and thermal characteristics are supplied for the whole life of the building in which it is installed. It does not suffer permanent damage if exposed to vapor or humidity. It is RECYCLABLE: No waste materials are produced during production. Moreover, the production process for the Advanced Building System panel aims to optimize its cut, reducing waste to a minimum. Any leftover EPS is recycled directly in the production plant itself. It is NON-TOXIC: It does not entail the release of allergens or toxic substances ensuring that there is no damage to the health of those producing or installing it. It is SELF-EXTINGUISHING: The EPS used for the Advanced Building System panels is self-extinguishing so once the flame, i.e. the trigger, has been eliminated, neither does the material produce flames, nor does it continue to burn.
22.	Note on Upkeep / Maintenance facilities that will be available to the user / customer during guarantee / warranty period and after. Availability of annual maintenance	A proper maintenance guide shall be given by the PAC holder to the client. When building is to be repainted with fresh coat of paint after scraping existing paint, check for joint sealant, pipe joint, sun shade etc. and carry out required

	contract.	maintenance and apply primer before paint is applied**.**	
23.	Attach note on case studies of use of the Technology in the country/ other countries with date (month/year) of use/ installation.	No information	
24.	Analysis of Life Cycle Cost including Initial cost, cost of maintenance, and comparison with conventional system, if any	No information	
25.	Speed of construction vis-à-vis conventional system.		
26.	Brief on Performance Characteristics & related Standards	1. Structural Stability	OK
		2. Durability	OK
		3. Behavior in Earthquake	Safe
		4. Fire Safety	Safe
		5. Rain	Safe
		6. Thermal performance	OK
		7. Acoustic performance	OK
		8. Behavior under high wind/cyclones	Safe
		9. Floods	Safe
		10. Under high moisture /Humid conditions.	OK
		11. Any other, please specify)	No
27.	Is there Standard on technology formulated by Your Company	YES.	
28.	Attach Photographs / Diagrams showing Components, Installation /assembly details, Finished Structure		
			
29.	Name & Contact details of Professionals / Architects / Engineers involved with this technology Attach a list, if it is exhaustive Give list of trained Artisans, if any	Shri Ashoke Aggrwal Group Executive Director M/s J.K. Structure Ltd. 42, Swan Street, Peters field, Hampshire,	

		GU32 3AD, United Kingdom Tel. 044-20 79001570, 1730 267913 Fax 044-20 7900 3957 Mob 09820348924 E mail: ashoke.aggrwal@gmail.com Web www.JK-structures.com
30.	Provide additional information you may like to supplement.	Completed Projects Residential building, S.N. Roy Road.Residential building, Justice Chandra Madhab RoadResidential building, Dr. Rajendra Road.Residential Bldg, Kabi Sabitri Chattopadhyay RoadResidential building,Ganga Prasad Mukherjee Road.Residential building, Naresh Mitra Sarani.Residential building, Chakraberia Road.Residential building, Chandrnath Chatterjee StreetResidential building, Bankim Mukherjee Sarani

Emerging Technology No. 15

Name of Technology: Kayson's Formwork System

1.	Name of Organization/Company	KAYSON A Leading Engineering and Construction Comp Kayson provides comprehensive design, engineering, procurement, construction and project management services for mass housing projects and multipurpose complexes. At Kayson we look at a project through the technical eye of a construction expert, and yet we are equally sensitive to the issues which make a project functional to the user and financially successful to our client. Thus, our cost control procedures begin with pre-construction cost input and continues through the life cycle of the project. During design we analyze cost/benefit factors for various building systems, components and materials to achieve maximum cost savings for our customers, without compromising quality. In the housing sector, which is probably the largest segment of the Iranian construction industry, Kayson has developed a unique technique, known as Cast-in-Situ Monolithic Reinforced Concrete Construction System for building large scale housing faster, better, and at a lower cost.
2.	Postal Address and Website	**Iran:** **Headquarter:** No.18, 2nd St. (Abghari), Sa'adat Abad Ave., Tehran 1998618871, Iran **Telephone:** (+9821) 24801000, 22131032 **Fax:** (+9821) 22134992 **Emails:** CV's & Human Resources: hr@kaysonir.com Tenders: busdev@kayson-ir.com Exhibitions: pubrel@kayson-ir.com Other: info@kayson-ir.com
3.	Name, Designation and details of Contact Person (Telephone, Fax, E-mail) (Technical Person)	**Iran:** **Headquarter:** No.18, 2nd St. (Abghari), Sa'adat Abad Ave., Tehran 1998618871, Iran **Telephone:** (+9821) 24801000, 22131032 **Fax:** (+9821) 22134992 **Emails:** CV's & Human Resources: hr@kaysonir.com Tenders: busdev@kayson-ir.com Exhibitions: pubrel@kayson-ir.com Other: info@kayson-ir.com
4.	Name and details of Foreign Collaborator, if any	No information
5.	Name of the Technology/System	**Kayson's Formwork System**
6.	Is it a patented system?	Yes
7.	Brief Write- up on Technology / System	• The Cast-in-Situ Monolithic Reinforced Concrete Construction System utilizes a large steel formwork

		system. • Notwithstanding their size, the forms are easy to install, more durable, more precise and produce higher quality structures. What is more important is that Kayson's formwork system enables the builder to repeat the entire construction cycle within a period of merely 48 hours. • The Cast-in-Situ Monolithic Reinforced ConcreteConstruction System uses a formwork system that allows the contractor to cast foundations, walls, and ceilings according to a pre-defined cycle. It combines the speed; quality and accuracy of factory/off site production with the flexibility and economy of in-situ construction. The result is a reinforced concrete structure, the surfaces of which are of sufficiently high quality to require only minimal finishing for direct decoration, while the end walls and facades are easily completed with thermally insulated material that can be clad as required. • The forms are lighter than most other formwork systems. The weights of wall and ceiling forms are 68 kg and 40 kg per square meter respectively. The average weight of a complete set of forms used in constructing two 84-meter residential units is about 298 kg per square meter of floor space. • The wall forms can be removed within merely five to eight hours. Each set of forms can be used up to two hundred times, provided it is properly maintained and serviced. This cycle can be repeated following a thorough overhaul of the formwork components. One of the main difficulties encountered by other in-situ concrete systems is the deformation of window frames after the concrete is poured. This problem has been totally resolved, thanks to an innovative method developed by Iranian engineers. • Ceiling forms are made up of light steel panels with spans of less than 3.5 meters. They are mounted on two rows of rail supported by steel piles. • In Kayson's formwork system, the problem of fitting the window frames into the forms prior to pouring concrete and the leakage of concrete have been fully solved by developing a unique formwork design which sums up years of experience and practice. • Due to the forms considerable strength and flexural rigidity fewer nuts and bolts are used to join the constituent parts of the formwork system. • Kayson's formwork system has substantially less joints compared with other methods. For example, spaces of up to 20 square meters are often covered with a single monolith form. • The large, yet light, exterior and interior wall forms are quickly mounted by a tower crane and fixed in place and fastened to each other by nuts and bolts specially made for this purpose. In general,

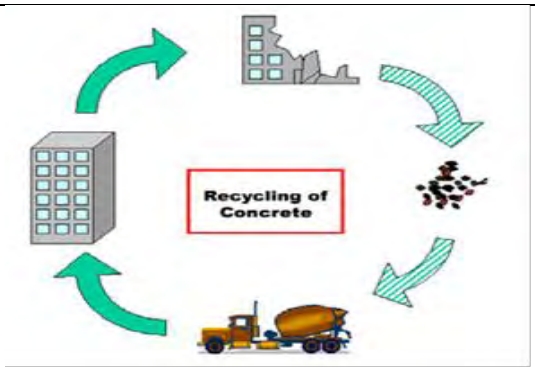
		a complete set of forms encompassing two 84-meter apartments are installed within five hours.
8.	If any evaluation/certification carried out. If yes, Give Details	**NO INFORMATION**
9.	Advantages of the Technology vis- a- vis. conventional system	The Advantages • Shorter site preparation and establishment. • Provides better protection against natural hazards such as windstorm and earthquake, as well as against fire and explosion. • Extraordinary speed of execution and more effective and precise schedule control. • Less manpower, particularly unskilled labor, and more efficient personnel management. • Easily adaptable to diverse topographical and climatic conditions. • Produces greater savings in men, material, equipment, transportation costs and time. • Offers more possibilities for variety in architectural design. • Readily lends itself to quality control and assurance. • Ensures a longer useful life. • Costs substantially less than conventional methods. • Easier cost control, and more accurate cost forecast. When appropriately insulated, the concrete mass of walls and floors provides an enormous heat sink and stores energy for later use. While this thermal mass/heat storage concept is well understood in terms of reducing winter heating costs, its reverse summer effect is not so well known: the thermal capacity of concrete ceilings and walls reduces peak temperatures during summer by around five degrees Celsius, providing a more comfortable environment during hot weather. Structural and Architectural Features The system creates an efficient load-bearing structure for use in a variety of applications. It is particularly effective in projects suited to repetitive construction, especially large-scale mass-housing projects. The solid, strong monolithic structure can be 2-20 stories in height and the accuracy of the system suits the installation of prefabricated elements such as cladding panels and bathroom pods, offering more Modern Method Construction (MMC) options. • The entire structure, including the foundation, the walls and the ceilings functions as an integrated whole.

		• Since all the constituents of the structure are load bearing, the overall weight of the building is nearly 300 kg per square meter less than steel structures. • The walls, 10-20 cm. thick, are joined to the foundation and the ceiling slabs by means of dowel bars. The high levels of dimensional accuracy achieved with the continuous formwork system and the superior load distribution result in a strong, solid monolithic structure suitable for a multitude of uses. The system'sexcellent structural integrity provides opportunities to use non-load bearing internal partitions that can be moved to provide alternative layouts. • Due to the overall integrity of the structures, problems arising from the use of low-quality materials, such as cracks and foundation settlement, are avoided. • Since the plan design closely conforms to architectural requirements, it eliminates the need for using traditional load-bearing or modular systems. • To achieve greater architectural flexibility, some internal partition walls can be built with gypsum boards, panels, or masonry materials. • One of the most important features of any building is its ability to protect human life and an earthquake is the most demanding condition that any building may be requiredto survive during its life time. To survive the nurture's might, safety, and security has also historically posed the greatest challenge to architects and structural engineers. Kayson's in-situ concrete, monolithic system, with its unparalleled structural integrity, provides excellent protection against earthquakes of the highest magnitude. • The system creates no restrictions as far as finishing work is concerned. • Although the system is only utilizable in large-scale construction, it gives us the freedom to build a variegated assortment of architectural designs and facades.
10.	Limitations of the Technology, if any	The viability depends upon the quantum of work • **Since in industrialized construction the builder has to use extremely expensive types of equipment and machinery, he has to make a much larger initial investment than is the case in traditional**.
11.	Whether the manufacturing of components is on-site or factory made.	The Cast-in-Situ Monolithic Reinforced Concrete Construction System utilizes a large steel formwork system.
12.	In case of Factory made, whether Manufacturing Facility is established in	NO. • The wall forms can be removed within merely

	India. (present status) If Yes, Location and Present Manufacturing Capacity. If No, what scale of project (No. of Dwelling Units) needed to establish the factory?	five to eight hours. Each set of forms can be used up to two hundred times, provided it is properly maintained and serviced. This cycle can be repeated following a thorough overhaul of the formwork components. One of the main difficulties encountered by other in-situ concrete systems is the deformation of window frames after the concrete is poured. This problem has been totally resolved, thanks to an innovative method developed by Iranian engineers
13.	In case of on-site production, scale of the project (No. of Dwelling Units) needed to establish the facility on site.	**On-site production** NO **needed to establish the facility on site.**
14.	What is the economical lead distance in case factory made components?	1OOKM
15.	Do you also execute the project, If yes, present capacity. If No, How it is proposed to be done.	YES
16.	Are you ready to take up the execution of the project immediately on receipt of the work order.	YES
17.	Do you provide complete design solution? If Yes, whether structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893 If No, How do you propose to provide structural design.	YES Design and Construction Stages • The foundation, the wall, and ceiling formwork systems are designed in strict compliance with the architectural plan. • The components of the formwork system are manufactured in the fabrication plant in accordance with the design specifications. • The construction site is leveled and compacted according to the project's technical requirements. • A layer of lean concrete is applied to the foundation site. • Sewerage pipes are laid. • Reinforcement bars of the foundation are installed after the lean concrete gains sufficient strength. • The foundation forms are installed and poured. • The wall reinforcement mesh which has already been put in place is connected to the starter bars of the foundation. • The window and door frames, electrical conduits and sockets, water pipes and sewer ducts are all built into the forms, thereby eliminating the need for drilling, boring and excavation work. • Ventilator and chimney conduits are also pre-fitted

		into the forms. There is, therefore, no need to use precast concrete pipes, as is the case in traditional methods, for ventilation and the chimney. The wall forms are then installed and poured monolithically. • After removing the wall forms, first the ceiling reinforcement mesh and then the ceiling forms are installed. • The ceiling reinforcement bars are joined to the wall by means of starter bars. At this stage,junction boxes, electrical conduits and water pipe ducts which pass through the ceiling are built into the forms.
18.	Do you provide construction supervision services / Project Management consultancy services If No, How it is proposed to be done	YES
19.	Brief on the Training needs for Installing, Using and Maintenance along with readiness to execute the project using construction workforce with current skills in India.	**Training required.**
20.	Note on Guarantees / Warrantees provided to the user/customer.	**Quality Assurance** • **Integrated Total Quality Management** • **In Kayson's system, all phases of construction process are controlled with exacting accuracy by implementing an integrated total quality management system. Indeed, without such system it is impossible to integrate and industrialize the construction site. This system encompasses design, engineering, procurement, construction, quality assurance and quality control, value engineering, human resource management, logistics, as well as environmental protection and occupational health and safety. Such comprehensive integrated approach to mass housing construction radically improves the quality, durability, safety, environmental performance, energy efficiency and affordability of homes built by Kayson. We also evaluate the efficiency of our quality management system through regular audits, the results of which become part of our continuous improvement systems.** • **A key element of our total quality management is customer satisfaction. Shortly after construction begins, a strategic communication plan is drawn up which includes such action items as distributing project brochures and newsletters about the project, holding informational events, launching an information-**

		packed website, and inviting clients, local people and potential end-users to visit the site.	
21.	Attach a brief note on the Sustainability issues such as environmental friendliness, energy efficiency use of waste materials recyclability etc.	**Long Life Cycles: As buildings components are manufactured & cured in controlled conditions the resulting elements have better strength & durability. This results in buildings having much longer life cycles than conventional construction**	
22.	Note on Upkeep / Maintenance facilities that will be available to the user / customer during guarantee / warranty period and after. Availability of annual maintenance contract.	AS PER REQUREMENT	
23.	Attach note on case studies of use of the Technology in the country/ other countries with date (month/year) of use/ installation.	No information	
24.	Analysis of Life Cycle Cost including Initial cost, cost of maintenance, and comparison with conventional system, if any	**Since in industrialized construction the builder has to use extremely expensive types of equipment and machinery, he has to make a much larger initial investment than is the case in traditional**	
25.	Speed of construction vis-à-vis conventional system.	**Prior to describing in detail Kayson's mass housing system, it is appropriate to outline some of the main features of industrialized housing construction:** • **Industrialized construction is not necessarily synonymous with prefabrication.** • **The most important characteristic of industrialized construction is the use of advanced machinery and equipment and trained workers to increase the speed of construction, improve quality and optimize the utilization of resources.** • **Since in industrialized construction the builder has to use extremely expensive types of equipment and machinery, he has to make a much larger initial investment than is the case in traditional construction methods. It is obvious that such a big investment only pays off in large-scale, mass productionSaving in Cost: Precast Prefab buildings can be constructed in less than half the time it takes to construct using conventional construction. This results in huge financial savings.**	
26.	Brief on Performance Characteristics & related Standards	1. Structural Stability	OK
		2. Durability	OK
		3. Behavior in Earthquake	Safe
		4. Fire Safety	Safe
		5. Rain	Safe
		6. Thermal performance	OK
		7. Acoustic performance	OK
		8. Behavior under high wind/cyclones	Safe
		9. Floods	Safe
		10. Under high moisture /Humid conditions.	OK

		11. Any other, please specify)	No
27.	Is there Standard on technology formulated by Your Company		
28.	Attach Photographs / Diagrams showing Components, Installation /assembly details, Finished Structure		
29.			
			
30.	Name & Contact details of Professionals / Architects / Engineers involved with this technology Attach a list, if it is exhaustive Give list of trained Artisans, if any	. **Iran:** **Headquarter:** No.18, 2nd St. (Abghari), Sa'adat Abad Ave., Tehran 1998618871, Iran **Telephone:** (+9821) 24801000, 22131032 **Fax:** (+9821) 22134992 **Emails:** CV's & Human Resources: hr@kaysonir.com Tenders: busdev@kayson-ir.com Exhibitions: pubrel@kayson-ir.com Other: info@kayson-ir.com	
31.	Provide additional information you may like to supplement.	**Kayson's Industrialized Mass Housing System** **A Fast and Cost-Effective Solution to Global Housing Crisis The problem of inadequate or non-existent housing has reached global proportions. The world population passed 6.1 billion in 2001 and is expected to**	

		exceed 9 billion by 2050. This shear volume exerts enormous pressure to create new homes. **Some 70 million people mainly in Asia, Africa and Latin America move from rural villages to urban communities every year. Moreover, a large number of existing homes are extremely vulnerable against earthquakes, hurricanes and other natural disasters. To avert a massive urban crisis in the near future, governments will have to take the lead in constructing some 35 million housing units per year, requiring an annual investment outlay of over one trillion dollars. Therefore, the scope of the global housing crisis demands fast-track cost-effective solutions. Looking at other industries such as cars and electronics, it becomes clear that industrialized mass production is the most effective way to get the most goods to the most people for the lowest cost in the least amount of time. Kayson's housing system makes this possible by turning the construction site into a highly efficient mass production line. In the 10,000-unit housing project we recently built in Venezuela, this system enabled us to construct the reinforced concrete structure of 24 housing units per day. In a 20,000-unit mass housing project, we just commenced building in Iran, we plan to build 56 units per day.**

Emerging Technology No. 16

Name of Technology: M O D U L A R H O U S I N G S Y S T E M

1.	Name of Organization/Company	MODULARHOUSINGSYSTEM.COM PO BOX 51478
2.	Postal Address and Website	Modularhousingsystem.com PO Box 51478 IRVINE CA 92619 USA voice: 877-880-5979 Fax: 949-266-8925 Email: office@modularhousingsystem.com
3.	Name, Designation and details of Contact Person (Telephone, Fax, E-mail) (Technical Person)	Modularhousingsystem.com PO BOX 51478 IRVINE CA 92619 USA Voice: 877-880-5979 Fax: 949-266-8925 Email: office@modularhousingsystem.com www.schnell.it schnellhome@schnell.it
4.	Name and details of Foreign Collaborator, if any	***MHS prefab providing the practical pre-fabricated modular-component housing. Utilizing the advanced innovative system in the prefab building industry*** .it
5.	Name of the Technology/System	MODULAR HOUSING SYSTEM
6.	Is it a patented system?	YES Copyright: 2008 US SYSTEMS LLC
7.	Brief Write- up on Technology / System	***MHS prefab technology: MHS prefab providing the practical pre-fabricated modular-component housing. Utilizing the advanced innovative system in the prefab building industry*** Can be used for any number of applications including commercial, residential, hotels, condos, townhouse, cabanas, camp, portable offices, school, portable medical units, beach facilities, pool stands, and much more. MHS prefab technology is a green solution for mass housing construction. Using local contractors, materials and labors to help community grow, create a job, cost effective and true sustainable green construction ***MHS prefab providing the practical pre-fabricated modular-component housing. Utilizing the advanced innovative system in the prefab building industry,*** MHS prefab the winner product in the Aluminum construction industries for: • **Originality** of the use of the materials: the degree to which the metal aluminum is used in an original and useful manner. • **Functionality** of the product: the degree to which the part meets both its primary user function and its technological function, as a result of use of materials, construction and any ergonomically adjustments. • **Design:** the degree to which the design as a whole reaches a harmonic unity or a solution - by the construction of the design and the details of the shape, all this in relation to the material used. • **Durability:** in relation to Life Cycle Costs.

		• **Recycling:** the possibility to recycle the applied materials and the raw materials used. • MHS need only a small set of tools for assembly, the MHS prefab unit can be assembled in a fraction of the time of typical homes. Anyone able to handle the assembly of a furniture set is likely to be able to work with this MHS system. MHS is not just a new product it is a new construction system for years to come. • MHS prefab technology can offer builders, developers a huge savings from reduced labor and quick assembly • The following is your MHS structural framing estimate, exterior, and interior finishing, electrical, mechanical and plumbing could be done and estimated easily by local contractors without any problems with our project design manual guidelines.
8.	If any evaluation/certification carried out. If yes, Give Details	Tested and meet International Building Codes 2006, Los Angeles Building Codes 2008
9.	Advantages of the Technology vis- a-vis. conventional system	MHS prefab technology Can be used for any number of applications including commercial, residential, hotels, condos, townhouse, cabanas, camp, portable offices, school, portable medical units, beach facilities, pool stands, and much more. MHS prefab technology is a green solution for mass housing construction. Using local contractors, materials and labors to help community grow, create a job, cost effective and true sustainable green construction ***MHS prefab providing the practical pre-fabricated modular-component housing. Utilizing the advanced innovative system in the prefab building industry,*** MHS prefab the winner product in the Aluminum construction industries for: • **Originality** of the use of the materials: the degree to which the metal aluminum is used in an original and useful manner. • **Functionality** of the product: the degree to which the part meets both its primary user function and its technological function, as a result of use of materials, construction and any ergonomically adjustments. • **Design:** the degree to which the design as a whole reaches a harmonic unity or a solution - by the construction of the design and the details of the shape, all this in relation to the material used. • **Durability:** in relation to Life Cycle Costs. • **Recycling:** the possibility to recycle the applied materials and the raw materials used. MHS need only a small set of tools for assembly, the MHS prefab unit can be assembled in a fraction of the time of typical homes. Anyone able to handle the assembly of a furniture set is likely to be able to work with this MHS system. MHS is not just a new product it is a new construction system for years to come.MHS prefab technology can offer builders, developers a huge savings from reduced labor and quick assembly.

		The following is your MHS structural framing estimate, exterior, and interior finishing, electrical, mechanical and plumbing could be done and estimated easily by local contractors without any problems with our project design manual guidelines.
10.	Limitations of the Technology, if any	MHS prefabricated parts comes to the site for assembly.
11.	Whether the manufacturing of components is on-site or factory made.	Modular Housing Systems tries to offer solutions to the limitations of prefab. A modular home is divided into smaller factory-made components designed for easy assembly on a home-site. Depending on the design of these modules, you can have more variations realized in that on-site assembly while still having the benefits of box factory production. It can be as large as you like, even if the individual modules can still be no larger than a normal mobile home or even smaller Kithaus. Unfortunately, the true potential of modular housing has never been realized until now, because designers have never worked with modular component units. Modular housing has typically been identical in character to prefab housing except that a house is composed of a few pre-fabricated parts rather than just one box. The modular components can more easily to replace individually and maintenance during the life of structure. MHS prefab with its modular components allows a home to be built faster, stronger, more efficiently, with much less labor and waste than is common with conventional home construction.
12.	In case of Factory made, whether Manufacturing Facility is established in India. (present status) If Yes, Location and Present Manufacturing Capacity. If No, what scale of project (No. of Dwelling Units) needed to establish the factory?	**Other MHS Aluminum sections and accessories available by request** Order Desk: FAX; +1-949-266-8925, email: ussystems@aol.com ***Delivery*** **Your order may take 45-60 days for delivery depends to the size of your projects.** We are packing and shipping MHS components by truck or container to all over the world. Payment: Terms and conditions 50% deposit, balance COD 3 days before shipping. You may pay by **US Check, Cashier Check,** international **money order or wire transfer** to our banking account. All orders F.O.B. California or from China plant. Product specifications and pricing subject to change without notice. Please read our Terms and Conditions of Sale 2009
13.	In case of on-site production, scale of the project (No. of Dwelling Units) needed to establish the facility on site.	MHS pre-finished, pre-fabricated components that all tested and ready to assemble. It is designed and built like a high-tech luxury aluminum products where every part is finely crafted for a perfect connection and details. MHS prefab framing is mechanically attached by locking mechanism systems invented by architectural engineer Tim Siahatgar, rather than relying on adhesives, nail and screw or even welding.
14.	What is the economical lead distance in case factory made components?	NO INFORMATION
15.	Do you also execute the project, If yes, present capacity.	YES

	If No, How it is proposed to be done.	
16.	Are you ready to take up the execution of the project immediately on receipt of the work order.	YES
17.	Do you provide complete design solution? If Yes, whether structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893 If No, How do you propose to provide structural design.	YES
18.	Do you provide construction supervision services / Project Management consultancy services If No, How it is proposed to be done	YES ***MHS Responsibility*** We provide you architectural design, complete drawings, structural calculations components fabrication, panels, project design manual and delivery to building site for assembly. MHS engineering dept. can help with local permit application with your architect and contractor. We can also provide a construction consultant and expert MHS supervisor for your project to work with your team. ***Your Builder/developer*** Are responsible for all permits, all site work including the foundation, rough in for plumbing and electrical. You may even chose to complete MHS prefab house with the local finishing materials. (pre approval). We provide you with framing of the house including structure, roof, wall, floor and accessories with an installation design manual. ***How long does it to build*** *Times vary based on the size* of the house, however typically for a good size home delivery will take 6 months and construction will take 6 weeks. Smaller houses are normally built more quickly. Factors such as weather, etc. can affect construction time. ***What is the cost*** With so many choices of floor plans and finishing materials prices can vary widely. In addition the type of kitchen chosen, the size of the house, the number or bathrooms all determine the cost. In general cost from manufacturing is varied (please contact us for update) Cost of the exterior and interior finishing of MHS prefab building system is much less than conventional construction. It's easy to install and replace all. ***Modern furniture*** We offer a variety of interior furnishing design for MHS prefab home owners from one of our licensee to meet your expectation of the modern environment as well as floor covering and landscaping. ***MHS prefab plans*** MHS prefab construction allows for almost unlimited configuration possibilities. This allows the house to fit perfectly on your site, positioned to maximize views, sun or natural features. Living rooms,

		bedrooms and bathrooms can be located virtually anywhere allowing for an endless choice of configurations, including, but not limited to rectangular, u-shaped, square, and even circle if you prefer. We work with you and your architect to maximize the site and your opportunity. Shown here are a selection of images for our model home designs and their possible floor plan variations. Our professionally developed designs have been crafted to produce an elegant synthesis of Modernist style and casual comfort while making the most of the many virtues of our unique building system. We offer designs to suit a variety of locations and lifestyle needs. MHS homes could be design custom with a variety of building materials for interior and exterior use. Many of the items could be selected from our project design manual to help achieve the interior architecture as many style residential vision. ***Materials*** MHS pre-finished, pre-fabricated components that all tested and ready to assemble. It is designed and built like a high-tech luxury aluminum products where every part is finely crafted for a perfect connection and details. MHS prefab framing is mechanically attached by locking mechanism systems invented by architectural engineer Tim Siahatgar, rather than relying on adhesives, nail and screw or even welding
19.	Brief on the Training needs for Installing, Using and Maintenance along with readiness to execute the project using construction workforce with current skills in India.	Training Required.
20.	Note on Guarantees / Warrantees provided to the user/customer.	Guarantees provided
21.	Attach a brief note on the Sustainability issues such as environmental friendliness, energy efficiency use of waste materials recyclability etc.	The insulating envelope provided by polystyrene core eliminates thermal bridges and ducts within the panel. This brings high level of energy efficiency. The system provides significant improvements in indoor thermal comfort by greatly reducing energy consumption and promoting strategies aimed at sustainable development
22.	Note on Upkeep / Maintenance facilities that will be available to the user / customer during guarantee / warranty period and after. Availability of annual maintenance contract.	**ENGINEERING SERVICES** Our Structural Engineer is licensed in all 50 states and can certify all your building plans including the foundation plan as long as our advertised structural requirements meet your local building requirements. Additionally, we can certify your home for energy codes throughout all 50 states. Depending on where you are building your home. Your permit set will include all the required information to meet all code requirements as mandated by your local building authorities to ensure you can get a building permit for your MHS prefabricated component home.
23.	Attach note on case studies of use of the Technology in the country/ other countries with date (month/year) of use/ installation.	No information
24.	Analysis of Life Cycle Cost including Initial cost, cost of maintenance, and	Less than conventional

	comparison with conventional system, if any		
25.	Speed of construction vis-à-vis conventional system.	The system has been used in many countries worldwide. The construction experiences using the system show a marked reduction in construction time compared to traditional building methods. Panels are industrialized, and for this reason, assembly processes are optimized, labour is significantly reduced, and construction time decreased by roughly 40%.	
26.	Brief on Performance Characteristics & related Standards	1. Structural Stability	OK
		2. Durability	OK
		3. Behavior in Earthquake	Safe
		4. Fire Safety	Safe
		5. Rain	Safe
		6. Thermal performance	OK
		7. Acoustic performance	OK
		8. Behavior under high wind/cyclones	Safe
		9. Floods	Safe
		10. Under high moisture /Humid conditions.	OK
		11. Any other, please specify)	No
27.	Is there Standard on technology formulated by Your Company	**M O D U L A R H O U S I N G S Y S T E M** If you require custom design assistance, it will be charged as an additional expense. We can provide any type of architectural and interior design service. Pricing for customization will vary in accordance to the degree of customization you require. You can contact us, so we can discuss your project and provide you an estimation of the costs associated. Below is our fee for design customization and convert your existing design to MHS. **DESIGN FEES** Our hourly rates are as follows: Designer's consultation $ 220.00/ hr. Project Management $110.00/ hr. Drafting fees $ 45.00/ hr. **ENGINEERING SERVICES** Our Structural Engineer is licensed in all 50 states and can certify all your building plans including the foundation plan as long as our advertised structural requirements meet your local building requirements. Additionally, we can certify your home for energy codes throughout all 50 states. Depending on where you are building your home. Your permit set will include all the required information to meet all code requirements as mandated by your local building authorities to ensure you can get a building permit for your MHS prefabricated component home. Preliminary MHS Design $1500.00 engagement deposit required for rendering this service. We will prepare schematics drawings to facilitate the preliminary loan and appraisal processes. The drawings will include a basic floor plan with overall dimensions.	

28.	Attach Photographs / Diagrams showing Components, Installation /assembly details, Finished Structure	
29.	Name & Contact details of Professionals / Architects / Engineers involved with this technology Attach a list, if it is exhaustive Give list of trained Artisans, if any	**MODULARHOUSINGSYSTEM.COM PO BOX 51478** **IRVINE CA 92619 USA Voice: 877-880-5979** **Fax: 949-266-8925** **Email: office@modularhousingsystem.com**
30.	Provide additional information you may like to supplement.	**<u>MHS prefabricated unit comes in the parts as follow for each projects.</u>** 1. MHS 170 extrusions, precut base on our shop drawings for selected design. 2. Accessories including interlocking connections, etc. (specified for each connection of the framing) 3. SIP Panels for walls, roof and floor. (Precut to each project.) 4. Windows and doors base on each design. (From our vendor directly shipped to the site for installation), or shipped with installation manual. 5. Finishing materials, base on each design could be selected from our project design manual 6. Solar unit, AC mechanical, etc. could be choosing from our project design manual. ***<u>What need to do by a local contractor with local labor under the supervision of MHS ENGINEERS</u>*** 1. Preparation of land survey and foundations construction base on project foundation plan. 2. Assembly of the MHS structure base on MHS assembly manual for the project. 3. Installation of exterior and interior finishing base on project installation manual. 4. Electrical assembly base on electrical plan. 5. Installation of Mechanical base on mechanical engineering plan. 6. Assembly of the framing deck base on design and standard parts. 7. Landscaping

Emerging Technology No. 17

Name of Technology: Panel building system using steel mesh, polystyrene core and chipping concrete

1.	Name of Organization/Company	**Ritman Group of Companies**
2.	Postal Address and Website	Ritman Group of Companies Ritman House 14, Syed Amir Ali Avenue Kolkata 700017 Tel. 033-20 40001898/99 Mob 09831075624 E mail: Parag@ritman.co.in, paragmajmudar@gmail.com Web www.ritman.co.in
3.	Name, Designation and details of Contact Person (Telephone, Fax, E-mail) (Technical Person)	Shri Parag Majmudar CMD Ritman Group of Companies Ritman House 14, Syed Amir Ali Avenue Kolkata 700017 Tel. 033-20 40001898/99 Mob 09831075624 E mail: Parag@ritman.co.in, paragmajmudar@gmail.com Web www.ritman.co.in
4.	Name and details of Foreign Collaborator, if any	Ritman Infra Ltd is introducing a panel construction technology. This technology has been used in the world for more than 3 decades. It is both inexpensive and of high standards. Light-weight and energy-efficient, this technology has many advantages. It is versatile as well safe. Its greatest advantage, however, is that it is a 'green' technology that causes no harm to the environment. As a result, it has been shortlisted by BMTPC under Ministry of Urban Poverty Alleviation, Govt of India, in its global tender for Alternate Building Technology. Ritman has also collaborated with Fullmark, based out of Singapore to bring high quality printer consumables to India. Ritman Fullmark Inks will cater to the Indian consumer's printing requirements across all categories of printers: inkjet, laser, dot matrix, line printers and thermal printers to name a few
5.	Name of the Technology/System	Panel building system using steel mesh, polystyrene core and chipping concrete
6.	Is it a patented system?	YES (RIL partnered Silkflex, Malaysia, to bring in an eco-friendly and environmentally non-hazardous product to India.)

7.	Brief Write- up on Technology / System	The panel Building system is a load bearing wall construction which is seismic resistant and thermally insulated. It is reported that buildings of any typology or architectural structure, ranging from most simple to the most complex one, could be constructed. The base element of the building system is a modular panel composed of two electro-welded galvanized steel meshes , reciprocally joined by connectors , in the middle of which is a suitably shaped foam polystyrene plate. High resistance steel meshes composed of bars having dia. 2.5 to 5 mm. are made in factory. Panels could be supplied with meshes having different dia. and different geometrical characteristics. Polystyrene is self- extinguishing foam polystyrene suitably shaped, used both as a disposable form and as an insulating layer. The EPS is made of carbon, hydrogen and for 98% air. Thickness, shape and density of the polystyrene core may change according to specific requirements. The minimum density normally used is equal to 15 kg / m3. Once the panels are installed, they are anchored and finished with the application of light concrete on both of their sides. Thus, buildings with load bearing walls consisting of two reinforced concrete plates are made integral by a thick network of connectors, with an insulating core. Single panel is finished, by applying on each a layer of chipping concrete having characteristic resistance of 30 Mpa at least. As load bearing element, the double panel and the floors are finished during the installation with concrete of suitable grade placed into the slab ribs as well. Should the panels carry out a non load bearing function , a concrete plaster , even a pre mixed one , is applied for a thickness of at least 25 mm. **Materials used:** Meshes manufactured using high resistance steel bars of dia. 2.5 – 5mm, Self - extinguish- ing Polystyrene core (min density 15 kg / m3), Chipping Concrete having characteristic strength 30 Mpa **Salient features**: Good heat and sound insulation properties, versatility in construction, lightweight but strong, resistance to seismic, hurricane/tornado forces including blast explosion of 50 psi, fire rating of 60 min, cost effective building system utilizing local raw materials and labour force, speed of construction (30% less than conventional construction system), environment friendly being, CFC free and non-toxic, energy efficient
8.	If any evaluation/certification carried out. If yes, Give Details	Several laboratory tests carried out in different areas of the world as well as in Italy have put into evidence the high load resistance of the Advanced Building System panels. For example, compression tests with centred load carried out on a "nished single panel, cm 270 high, have shown that the same panel can sustain a maximum load of 1530 kN/m.
9.	Advantages of the Technology vis-a- vis. conventional system	LIGHTNESS: The panels are lightweight and sufficiently sturdy even before they are finished with spritz-beton. Thus, they are extremely manageable, easy to handle and to assemble even in the most challenging operating conditions. VERSATILITY: Equipped with a full range of building

		elements such as load-bearing walls, curtain walls, doors and stairs, this system favours absolute design flexibility. Furthermore any kind of geometrical form, either plane or curve, is easily obtainable just by simply cutting the elements at the site. ENERGY-SAVING: New constructions are made energy-efficient by creating a tight building envelope. This is done by using structural insulated panels that are completely integrated: in a single phase it is possible to obtain excellent thermal insulation conforming to the strictest energy standards. The high-level insulation of SIP walls and roofs serves to lower heating and cooling energy consumption up to 60 percent making it more energy-efficient than traditional methods. RAPID INSTALLATION: There is a remarkable shortening of the time of realization for constructions carried out with the Advanced Building System in comparison to those carried out with the traditional systems. This is because SIPs are provided in pre-cut, labelled pieces that can instantly be installed. This optimizes the assembling sequences and reduces the dependence on site personnel to a minimum. INEXPENSIVE: This system is advantageous for the final users as well as the firms. Proper insulation and freedom from leakage serve to minimize the utility costs. Moreover, the SIPs are sturdy and easy to maintain, thus, reducing maintenance and replacement costs. As a result, this system offers true value for money obtaining better performances at reduced costs. ACOUSTIC INSULATION: Acoustic insulation materials (such as cork, cocoa fibre, plasterboard, rock wool) can be applied to the panels for complete soundproofing. These successfully optimize the insulation of the walls in accordance with the strictest acoustic legislation. FIRE-RESISTANT: The quality of the foam polystyrene used for our panels is of the self-extinguishing type. Moreover, the two concrete layers which coat the panel sides further prevent its combustion. This ensures complete fire-resistance. It has further been verified in tests carried out at different laboratories, in compliance with the minimum requirements of even the most demanding regulations. CYCLONE RESISTANT: Buildings realized with the R-Panel system have a capacity to withstand the passing of the most destroying cyclones, thus confirming the high resistance of R-Panel buildings to the complex strains and thrusts of the force generated by cyclones.
10.	Limitations of the Technology, if any	The viability depends upon the quantum of work.
11.	Whether the manufacturing of components is on-site or factory made.	Factory made

12.	In case of Factory made, whether Manufacturing Facility is established in India. (present status) If Yes, Location and Present Manufacturing Capacity. If No, what scale of project (No. of Dwelling Units) needed to establish the factory?	Yes
13.	In case of on-site production, scale of the project (No. of Dwelling Units) needed to establish the facility on site.	The viability depends upon the quantum of work. Generally
14.	What is the economical lead distance in case factory made components?	The viability depends upon the quantum of work. Generally
15.	Do you also execute the project, If yes, present capacity. If No, How it is proposed to be done.	YES
16.	Are you ready to take up the execution of the project immediately on receipt of the work order.	YES
17.	Do you provide complete design solution? If Yes, whether structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893 If No, How do you propose to provide structural design.	YES
18.	Do you provide construction supervision services / Project Management consultancy services If No, How it is proposed to be done	YES
19.	Brief on the Training needs for Installing, Using and Maintenance along with readiness to execute the project using construction workforce with current skills in India.	Training Required.
20.	Note on Guarantees / Warrantees provided to the user/customer.	• Quality of installation of the system on site is the responsibility of the trade persons engaged by the agency

		• Quality of maintenance of the building is the responsibility of the building owner.
21.	Attach a brief note on the Sustainability issues such as environmental friendliness, energy efficiency use of waste materials recyclability etc.	**GREEN TECHNOLOGY:** The polystyrene inside the Advanced Building System panels, Expanded polystyrene (also known as EPS), when evaluated over the whole of its life cycle shows that it affects the environment less than other more biological insulators: It is SAFE: It does not release toxic or harmful substances and is totally inert. It does not contain chlorofluorocarbons (CFCs) or (HCFCs). Furthermore, as it contains no organic material, the growth of micro-organisms and mould is inhibited. The mechanical and thermal characteristics are supplied for the whole life of the building in which it is installed. It does not suffer permanent damage if exposed to vapor or humidity. It is RECYCLABLE: No waste materials are produced during production. Moreover, the production process for the Advanced Building System panel aims to optimize its cut, reducing waste to a minimum. Any leftover EPS is recycled directly in the production plant itself. It is NON-TOXIC: It does not entail the release of allergens or toxic substances ensuring that there is no damage to the health of those producing or installing it. It is SELF-EXTINGUISHING: The EPS used for the Advanced Building System panels is self-extinguishing so once the flame, i.e. the trigger, has been eliminated, neither does the material produce flames, nor does it continue to burn.
22.	Note on Upkeep / Maintenance facilities that will be available to the user / customer during guarantee / warranty period and after. Availability of annual maintenance contract.	A proper maintenance guide shall be given by the PAC holder to the client. When building is to be repainted with fresh coat of paint after scraping existing paint, check for joint sealant, pipe joint, sun shade etc. and carry out required maintenance and apply primer before paint is applied**.**
23.	Attach note on case studies of use of the Technology in the country/ other countries with date (month/year) of use/ installation.	No information
24.	Analysis of Life Cycle Cost including Initial cost, cost of maintenance, and comparison with conventional system, if any	

25.	Speed of construction vis-à-vis conventional system.	The Advanced Building System panels are lightweight and rigid at the same time, even before their "finishing with spritz-be ton, so that they turn out to be extremely manageable and easy to handle and to assemble even in the most uncomfortable operating conditions. The system has been used in many countries worldwide. The construction experiences using the system show a marked reduction in construction time compared to traditional building methods. Panels are industrialized, and for this reason, assembly processes are optimized, labour is significantly reduced, and construction time decreased by roughly 40%.	
26.	Brief on Performance Characteristics & related Standards	1. Structural Stability	OK
		2. Durability	OK
		3. Behavior in Earthquake	Safe
		4. Fire Safety	Safe
		5. Rain	Safe
		6. Thermal performance	OK
		7. Acoustic performance	OK
		8. Behavior under high wind/cyclones	Safe
		9. Floods	Safe
		10. Under high moisture /Humid conditions.	OK
		11. Any other, please specify)	No
27.	Is there Standard on technology formulated by Your Company	YES. .	
28.	Attach Photographs / Diagrams showing Components, Installation /assembly details, Finished Structure		
29.	Name & Contact details of Professionals / Architects / Engineers involved with this technology Attach a list, if it is exhaustive Give list of trained Artisans, if any	Shri Parag Majmudar CMD Ritman Group of Companies Ritman House 14, Syed Amir Ali Avenue Kolkata 700017 Tel. 033-20 40001898/99 Mob 09831075624 E mail: Parag@ritman.co.in, paragmajmudar@gmail.com Web www.ritman.co.in	
30.	Provide additional information you may like to supplement.	Completed Projects Residential building, S.N. Roy Road. Residential building, Justice Chandra Madhab Road Residential building, Dr. Rajendra Road. Residential Bldg, Kabi Sabitri Chattopadhyay Road Residential building,Ganga Prasad Mukherjee Road.Residential building, Naresh Mitra Sarani.Residential building, Chakraberia Road.Residential building, Chandrnath Chatterjee StreetResidential building, Bankim Mukherjee Sarani	

Emerging Technology No. 18

Name of Technology: Factory Made Fast Track Modular Building System

1.	Name of Organization/Company	Synergy Thrislington
2.	Postal Address and Website	Synergy Thrislington A-1, Phase 1, Industrial Area Mohali, Chandigarh - 160062 Mob 09876032324 E-mail: yashjeet.gupta@synergythrislington.com
3.	Name, Designation and details of Contact Person (Telephone, Fax, E-mail) (Technical Person)	Mr. Yashjeet Gupta COO Synergy Thrislington A-1, Phase 1, Industrial Area Mohali, Chandigarh - 160062 Mob 09876032324 E-mail: yashjeet.gupta@synergythrislington.com
4.	Name and details of Foreign Collaborator, if any	No Information
5.	Name of the Technology/System	Factory Made Fast Track Modular Building System
6.	Is it a patented system ?	No Information
7.	Brief Write- up on Technology / System	Factory Made Fast Track Modular Building System is based on prefabricated steel structure with different walling components. About 70 percent of the work is done in the factory with minimal usage of concrete, which enables system to deliver the building within a few days of work at site. The steel modular are pre-fitted with flooring, ceiling tiles, electrical and plumbing fittings. The assembled steel modular are transported to the site for installation which is done using crane and other required machineries. Once all the components are assembled and erected at site, wall panels are fixed, using factory made 3–D Expanded Polystyrene (EPS) panels and shortcreting from both sides. The uniqueness of system is the efficient and simultaneous activities of site preparation and building construction in factory, rather than two phased customary process.
8.	If any evaluation/certification carried out. If yes, Give Details	Under Performance Appraisal Certification Scheme, PAC No. 1011-S/2013 has been issued for the system to M/s Synergy Thrislington, A1 Phase- I, Industrial Area, Mohali. Seismic Performance Evaluation of Model of a G+7 CRC framed structure for ground motion compatible to zone V spectrum was performed at SERC, Chennai and found to be satisfactory.
9.	Advantages of the Technology vis- a- vis. conventional system	Evaluation on the behavior of reinforced EPS Panel under flexural and Axial Compression load on 100 mm and 150 mm thick panels were satisfactory. Other performance characteristics are: Thermal transmittance of Single Panel 0.537 w/m2k

		Acoustic Behavior 37 dB (noise reduction)Water Penetration No penetration after 3h Resistance to impact with softbody Impacts of 90 & 1200 J –No crack and hardbody ***Structural*** • High strength to weight ratio. Earthquake force generation is less due to lightweight. Chance of progressive collapse are marginal due to highly ductile andload carrying nature of closely spaced studs/joists. ***Speed in Construction*** • Construction speed is very high. A typical four storeyed building can be constructed within one month. ***Saving in foundation*** • Structure being light, does not require heavy foundation. ***Mobility*** • Structural element can be transported any place including hilly places to remote places easily and structure can be erected fast. • Structure can be shifted from one location to other without wastage of materials. ***Environment friendly*** • Steel used can be recycled when required.
10.	Limitations of the Technology, if any	Transportation are carried out in mainly two stages: i) From manufacturing plant to stacking yard. ii) From stacking yard to erection site. The transportation is carried out by using trucks of desired capacity and length. Erection is carried out by cranes of suitable capacity at site.
11.	Whether the manufacturing of components is on-site or factory made.	Factory made.
12.	In case of Factory made, whether Manufacturing Facility is established in India. (present status) If Yes, Location and Present Manufacturing Capacity. If No, what scale of project (No. of Dwelling Units) needed to establish the factory?	YES
13.	In case of on-site production, scale of the project (No. of Dwelling Units) needed to establish the facility on site.	-
14.	What is the economical lead distance in case factory made components?	100km

15.	Do you also execute the project, If yes, present capacity. If No, How it is proposed to be done.	YES
16.	Are you ready to take up the execution of the project immediately on receipt of the work order?	YES
17.	Do you provide complete design solution? If Yes, whether structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893 If No, How do you propose to provide structural design?	YES Foundation shall be either strip or raft designed and constructed as per IS 1904:1986 and other related Indian Standards, as applicable. Steel Structure :The structure consists of steel pillars, modules and other components designed for worst loading conditions as per design code i.e. IS 800:2007 and IS 801:1975. It shall provide, besides other requirements, the required bearing resistance for earthquake and wind forces as per IS 1893(Part 1): 2002 and IS 875 (Parts 3):1987, both individu- ally and in combination, as applicable. Steel pillars shall be made by welding MS plate of 16mm thickness and steel tubes of size 200mm x 200mm and of thickness varying from 3mm to 16mm depending upon the number of floors. The smaller pillar is fixed with sub-assemblies for modules. All the columns shall be checked for their safety and computations shall be done for the same for satisfying requirements of IS 800:2007 and IS 801:1975
18.	Do you provide construction supervision services / Project Management consultancy services If No, How it is proposed to be done	YES
19.	Brief on the Training needs for Installing, Using and Maintenance along with readiness to execute the project using construction workforce with current skills in India.	TRAINING REQUIRED
20.	Note on Guarantees / Warrantees provided to the user/customer.	No information on Guarantees
21.	Attach a brief note on the Sustainability issues such as environmental friendliness, energy efficiency use of waste materials recyclability etc.	**Environment friendly** • Steel used can be recycled when required.
22.	Note on Upkeep / Maintenance facilities that will be available to the user / customer during guarantee / warranty period and after. Availability of annual maintenance contract.	As per contract terms
23.	Attach note on case studies of use of the Technology in the country/ other countries with date (month/year) of use/ installation.	As practiced in other countries.
24.	Analysis of Life Cycle Cost including Initial	

	cost, cost of maintenance, and comparison with conventional system, if any		
25.	Speed of construction vis-à-vis conventional system.	Speed of construction is higher to conventional system.	
26.	Brief on Performance Characteristics & related Standards	1. Structural Stability	OK
		2. Durability	OK
		3. Behavior in Earthquake	Safe
		4. Fire Safety	Safe
		5. Rain	Safe
		6. Thermal performance	OK
		7. Acoustic performance	OK
		8. Behavior under high wind/cyclones	Safe
		9. Floods	Safe
		10. Under high moisture / Humid conditions.	OK
		11. Any other, please specify)	No
27.	Is there Standard on technology formulated by Your Company	yes	
28.	Attach Photographs / Diagrams showing Components, Installation /assembly details, Finished Structure		
29.	Name & Contact details of Professionals / Architects / Engineers involved with this technology Attach a list, if it is exhaustive Give list of trained Artisans, if any	Mr. Yashjeet Gupta COO Synergy Thrislington A-1, Phase 1, Industrial Area Mohali, Chandigarh - 160062 Mob 09876032324 E-mail: yashjeet.gupta@synergythrislington.com	
30.	Provide additional information you may like to supplement.	The sectional are manufactured using a Centrally Numerical Control (CNC) automatic four Pinnacle Roll Forming machine having production speed of 450-900 m/h with very high precision	

Emerging Technology No. 19

Name of Technology: Precast concrete panels using concrete, welded mesh and plates, polystyrene core

1.	Name of Organization/Company	**MOORELIVING INDIA BUILDING SOLUTIONS LLP** Mooreliving Building System® is the ideal choice for both single storey and low rise multi-storied buildings, as it combines the best of both worlds – the speed and convenience of modular construction and strength and superior durability than that of conventional method of construction. In the Mooreliving Building System® the wall panels of the entire building is manufactured as modules in 3-4 days in the controlled environment of a factory and then assembled quickly. This approach reduces the construction turnaround time by over 80%.
2.	Postal Address and Website	**MOORELIVING INDIA BUILDING SOLUTIONS LLP** 611, Som Dutt Chambers II, 9 Bhikaji Cama Place, New Delhi - 110066, India Telephone:+91 (11) 2616 9340 Facsimile:+91 (11) 6617 3667 e-mail us at info@moorelivingindia.com
3.	Name, Designation and details of Contact Person (Telephone, Fax, E-mail) (Technical Person)	**Biswas Kumar** **Ashok Kumar Jai**n Registered office: 611, Som Dutt Chambers II, 9 Bhikaji Cama Place, New Delhi - 110066, India Telephone:+91 (11) 2616 9340 Facsimile:+91 (11) 6617 3667 e-mail us at info@moorelivingindia.com
4.	Name and details of Foreign Collaborator, if any	
5.	Name of the Technology/System	Precast concrete panels using concrete, welded mesh and plates, polystyrene core
6.	Is it a patented system?	NO information
7.	Brief Write- up on Technology / System	Pre-cast concrete load bearing panels are made of reinforced concrete with a polystyrene insulated core that varies in size from 40mm to 200mm depending upon the insulation requirements. The reinforced concrete panels are moulded in specially designed steel moulds under controlled factory conditions. Then the panels are removed from the moulds and stacked vertically for curing. Power and water conduits are installed in the panels during production. The buildings and houses can be designed to suit any geographical position or environment and can withstand wind speed in excess of 285km/hr. The system does not impose any design restrictions and can be used for any kind of architectural and aesthetic design as these panels are custom designed and manufactured. The panels have smooth surfaces. However, any kind of texture can be added on to the panel surface. Due to cohesive structural design, the system requires only strip foundation for most buildings.

		Concrete panels can be designed with strength of 5000 psi. These results in stronger panels than concrete blocks or most poured concrete walls but are thinner and light weight. The panels are of good quality and uniformity as they are cast and cured in controlled factory environment. The panels can be installed in fraction of time. The foundation takes two hours to prepare and the panels are set in three hours
8.	If any evaluation/certification carried out. If yes, Give Details	SERC, Chennai, India (Structural Engineering & Research Centre) for load tests. JNTU, Hyderabad, India (Jawaharlal Nehru Technological University) for load tests. BMTPC, India (Building Material and Technology Promotion Council) has shortlisted and recommended our technology for housing projects in India.Several laboratory tests carried out in different areas of the world as well as in Italy have put into evidence the high load resistance of the Advanced Building System panels. For example, compression tests with centred load carried out on a "nished single panel, cm 270 high, have shown that the same panel can sustain a maximum load of 1530 kN/m.
9.	Advantages of the Technology vis- a-vis. conventional system	Reduced labour cost due to quicker/easier assembly, in some cases no mason is required; tornado/hurricane damage resistance, fire, termite and dry rot resistance; requires less insulation; low maintenance and improved sound proofing; can be erected in cold temperature, preventing concrete pour delays; buildings constructed using the system are resistant to earthquakes measuring up to 6 on Richter Scale; save air conditioning energy; higher upfront cost, requires on-site crane including certified installer sometimes; offers a 10 year warranty on the structure using the technology. **TECHNICAL ADVANTAGES:** • Houses built using this technology meet the seismic, wind resistance as well as load requirements. • Earthquake resistance compliance for Zone V • Resistance to hurricane wind velocity of 288 kmph (179 mph) • Energy saving of 32% for cooling & 44% for heating while using insulated panels • Sound rating of STC50+ using insulated panels ECONOMICAL ADVANTAGES: The cost to build the homes using our technology is comparable to conventional system by taking into account of the savings in the time and cost of duration for the investment. **OTHER ADVANTAGES**: - Zero requirement of water for curing - Zero wastage of construction materials - Minimal chances for human errors as minimal manual work involved - Strict quality control & production in controlled factory environment
10.	Limitations of the Technology, if any	The restrictions with regard to our technology are that there should be clear access to the sites for the trucks and trailers, total plan of the structure should be finalized before

		starting the production as well as curved walls in the architectural plans will not be possible
11.	Whether the manufacturing of components is on-site or factory made.	All modules are manufactured and assembled at the factory itself and transported to the site where they have to be installed. Necessary foundations, drainage/waste water/sanitary connections are pre-made at the site before the modules are installed. Only final connections to the modules are required at the site with respect to all external connections like water, electricity, sewerage, etc. The stairs are cast as separate modules and assembled together.
12.	In case of Factory made, whether Manufacturing Facility is established in India. (present status) If Yes, Location and Present Manufacturing Capacity. If No, what scale of project (No. of Dwelling Units) needed to establish the factory?	Yes In 2009 the first vertical mould system was built and tested. This new system is capable of producing 20 precast panels per 8 hour shift by utilizing the same area of one horizontal mould. This has system has helped us to reduce the production costs drastically enabling us to compete with existing conventional methods.
13.	In case of on-site production, scale of the project (No. of Dwelling Units) needed to establish the facility on site.	The viability depends upon the quantum of work. Generally
14.	What is the economical lead distance in case factory made components?	The viability depends upon the quantum of work. Generally
15.	Do you also execute the project, If yes, present capacity. If No, How it is proposed to be done.	YES
16.	Are you ready to take up the execution of the project immediately on receipt of the work order.	YES
17.	Do you provide complete design solution? If Yes, whether structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893 If No, How do you propose to provide structural design.	YES
18.	Do you provide construction supervision services / Project Management consultancy services If No, How it is proposed to be done	YES
19.	Brief on the Training needs for Installing, Using and Maintenance along with readiness to execute the project using construction workforce with current skills in India.	Training Required.

20.	Note on Guarantees / Warrantees provided to the user/customer.	No information.
21.	Attach a brief note on the Sustainability issues such as environmental friendliness, energy efficiency use of waste materials recyclability etc.	**GREEN TECHNOLOGY:** The polystyrene inside the Advanced Building System panels, Expanded polystyrene (also known as EPS), when evaluated over the whole of its life cycle shows that it affects the environment less than other more biological insulators: **It is SAFE:** It does not release toxic or harmful substances and is totally inert. It does not contain chlorofluorocarbons (CFCs) or (HCFCs). Furthermore, as it contains no organic material, the growth of micro-organisms and mould is inhibited. The mechanical and thermal characteristics are supplied for the whole life of the building in which it is installed. It does not suffer permanent damage if exposed to vapor or humidity. **It is RECYCLABLE:** No waste materials are produced during production. Moreover, the production process for the Advanced Building System panel aims to optimize its cut, reducing waste to a minimum. Any leftover EPS is recycled directly in the production plant itself. **It is NON-TOXIC:** It does not entail the release of allergens or toxic substances ensuring that there is no damage to the health of those producing or installing it. **It is SELF-EXTINGUISHING:** The EPS used for the Advanced Building System panels is self-extinguishing so once the flame, i.e. the trigger, has been eliminated, neither does the material produce flames, nor does it continue to burn.
22.	Note on Upkeep / Maintenance facilities that will be available to the user / customer during guarantee / warranty period and after. Availability of annual maintenance contract.	
23.	Attach note on case studies of use of the Technology in the country/ other countries with date (month/year) of use/ installation.	No information
24.	Analysis of Life Cycle Cost including Initial cost, cost of maintenance, and comparison with conventional system, if any	
25.	Speed of construction vis-à-vis conventional system.	The Advanced Building System panels are lightweight and su!ciently rigid at the same time, even before their "nishing with spritz-beton, so that they turn out to be extremely manageable and easy to handle and to assemble even in the most uncomfortable operating conditions. The system has been used in many countries worldwide. The construction experiences using the system show a marked reduction in construction time compared to traditional building methods. Panels are industrialized, and for this reason, assembly processes are optimized, labour is significantly reduced, and construction time decreased by

		roughly 40%.	
26.	Brief on Performance Characteristics & related Standards	1. Structural Stability	OK
		2. Durability	OK
		3. Behavior in Earthquake	Safe
		4. Fire Safety	Safe
		5. Rain	Safe
		6. Thermal performance	OK
		7. Acoustic performance	OK
		8. Behavior under high wind/cyclones	Safe
		9. Floods	Safe
		10. Under high moisture /Humid conditions.	OK
		11. Any other, please specify)	No
27.	Is there Standard on technology formulated by Your Company	YES.	
28.	Attach Photographs / Diagrams showing Components, Installation /assembly details, Finished Structure		
		 	
29.	Name & Contact details of Professionals / Architects / Engineers involved with this technology Attach a list, if it is exhaustive Give list of trained Artisans, if any	**Biswas Kumar** **Ashok Kumar Jai**n Registered office: 611, Som Dutt Chambers II, 9 Bhikaji Cama Place, New Delhi - 110066, India Telephone:+91 (11) 2616 9340 Facsimile:+91 (11) 6617 3667 e-mail us at info@moorelivingindia.com	

Emerging Technology No. 20

Name of Technology: 9 Types Energy Conservation Technologies For Residential And Commercial Buildings

1.	Name of Organization/Company	S.P.A. ASSOCIATES
2.	Postal Address and Website	3282, ALOK VIHAR – I, SECTOR – 50, NOIDA, UTTAR PRADESH. PIN – 201303.
3.	Name, Designation and details of Contact Person (Telephone, Fax, E-mail) (Technical Person)	ASHOK SHUKLA, PARTNER. PHONE : ® 0120-4347300, MOBILE : 09810145598, EMAIL : spa.associates@hotmail.com, ashokshukla26@hotmail.com
4.	Name and details of Foreign Collaborator, if any	NA
5.	Name of the Technology/System	9 TYPES ENERGY CONSERVATION TECHNOLOGIES FOR RESIDENTIAL AND COMMERCIAL BUILDINGS
6.	Is it a patented system ?	NA
7.	Brief Write- up on Technology / System	It is a combination of the following different technologies (all or few applicable depending upon type of building and geographical area) : *a. Natural Air Drafting technology to take care of your building cooling needs.* *b. Rain harvesting to at least partially meet your water requirements.* *c. Weather based water drafting to take care of your building cooling and heating needs.* *d. High efficiency – medium cost solar electricity generation.* *e. Insulation of building interiors / exteriors for better heat management.* *f. Utilization of exhaust air energy for ambient maintenance efficiency.* *g. Power LED Lighting for electricity cost cut as well as to enhance wiring life.* *h. Painting of exteriors by metalo-plastic paints (sun reflect plasto paints).* *i. Specially designed windows to cut heat loss / gain through convection currents*
8.	If any evaluation/certification carried out. If yes, Give Details	NA
9.	Advantages of the Technology vis- a- vis. conventional system	Compared to conventional technologies, the modifications in building design, walls, roofs and addition of extra hardware and software **SAVES UP TO 45 % ENERGY. The savings are good enough to pay back building construction cost within 8 to 16 years depending upon how many technologies are used, geographical area, abundance of water and solar illumination.**
10.	Limitations of the Technology, if any	Limitations of water availability or solar illumination depending upon geographical area.
11.	Whether the manufacturing of components is on-site or factory made.	Factory made.
12.	In case of Factory made, whether Manufacturing Facility is established in India. (present status)	Yes. In house for manufacturing of different customized insulation materials and components (address : S.P.A. Associates, A – 24, Phase – II, Noida, U.P. 201305).

	If Yes, Location and Present Manufacturing Capacity. If No, what scale of project (No. of Dwelling Units) needed to establish the factory?	Other components (like solar panels etc.) are bought out from local sources.
13.	In case of on-site production, scale of the project (No. of Dwelling Units) needed to establish the facility on site.	No on site production. Only assembly as per designs. Extra water tanks (where applicable) to be constructed as per modified design of the building to adopt the technologies.
14.	What is the economical lead distance in case factory made components?	Depending upon the site where components are to be used. In case of bulk usage (e.g. large housing colony or a large commercial complex, **a temporary components manufacturing site can be erected for partial processes of components manufacturing).**
15.	Do you also execute the project, If yes, present capacity. If No, How it is proposed to be done.	Yes, we execute the project in our supervision only. Up to 150,000 sqr ft building area per quarter capacity. Upgradation of scale up to multiple times possible with increase in business by self as well as development of franchisee channel partners.
16.	Are you ready to take up the execution of the project immediately on receipt of the work order.	Yes.
17.	Do you provide complete design solution? If Yes, whether structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893 If No, How do you propose to provide structural design.	Yes. Confirms to standards specified or required by adopting suitable NVH Insulations and mechanical vibration / shock absorption components between different component joints.
18.	Do you provide construction supervision services / Project Management consultancy services If No, How it is proposed to be done	Yes.
19.	Brief on the Training needs for Installing, Using and Maintenance along with readiness to execute the project using construction workforce with current skills in India.	Installations to be done by our personnel. Specially trained manpower required for day to day maintenance. We provide the requisite trainings.
20.	Note on Guarantees / Warrantees provided to the user/customer.	We provide warrantees for designs and our own components. Vendors provide warrantees for other components as suitable.
21.	Attach a brief note on the Sustainability issues such as environmental friendliness, energy efficiency use of waste materials recyclability etc.	Technologies are specifically ENVIRONMENT FRIENDLY. The very purpose of technologies is to conserve energy.
22.	Note on Upkeep / Maintenance facilities that will be available to the user / customer during guarantee / warranty period and after. Availability of annual maintenance contract.	Maintenance will be provided within warrantee period as suitably applicable by our firm or vendors as applicable. Thereafter, maintenance shall be provided at extra cost as applicable practically, for components, dismantling, installation, and man power involved per diem basis.
23.	Attach note on case studies of use of the	NA

	Technology in the country/ other countries with date (month/year) of use/ installation.		
24.	Analysis of Life Cycle Cost including Initial cost, cost of maintenance, and comparison with conventional system, if any	While minimum component life of various portions is 10 years, maximum life may be up to 50 years or even more. Average cost of extra hardware and installations, maintenance etc. is less than 30 % of the savings achieved by usage of these technologies.	
25.	Speed of construction vis-à-vis conventional system.	While the addition of hardware and construction modifications may start from the beginning itself, 5 to 10 % extra time taken after completion of basic construction and furnishing.	
26.	Brief on Performance Characteristics & related Standards	1. Structural Stability	As per applicable BIS Standards.
		2. Durability	As per applicable BIS Standards.
		3. Behaviour in Earthquake	As per applicable BIS Standards.
		4. Fire Safety	As per applicable BIS Standards.
		5. Rain	As per applicable BIS Standards.
		6. Thermal performance	As per applicable BIS Standards.
		7. Acoustic performance	As per applicable BIS Standards.
		8. Behaviour under high wind/cyclones	As per applicable BIS Standards.
		9. Floods	As per applicable BIS Standards.
		10. Under high moisture / humid conditions.	As per applicable BIS Standards.
		11. Any other, please specify)	Improves Building Insulation characteristics for interior temperature maintenance.
27.	Is there Standard on technology formulated by Your Company	No (these are new applications of existing technologies generally), except solar and LED lightings, which are as per applicable BIS standards.	
28.	Attach Photographs / Diagrams showing Components, Installation /assembly details, Finished Structure	To be designed specifically for each project.	
29.	Name & Contact details of Professionals / Architects / Engineers involved with this technology Attach a list, if it is exhaustive Give list of trained Artisans, if any	To be submitted only when a project work order is available and specific personnel are hired.	
30.	Provide additional information you may like to supplement.	For certain applications (e.g. Foam Injection), help from international vendors may be required. Necessary tie ups have been done.	

Emerging Technology No. 21

Name of Technology: Light Gauge Framing System

1.	Name of Organization/Company	Loom Crafts Shade Systems Pvt Ltd
2.	Postal Address and Website	A-7/98 South Side GT Road Industrial Area, Ghaziabad-201009, UP http://prefab.loomcrafts.com
3.	Name, Designation and details of Contact Person (Telephone, Fax, E-mail) (Technical Person)	Mr. Surinder Jindal Managing Director Tel: 9958744211 Email: info@loomcrafts.com
4.	Name and details of Foreign Collaborator, if any	Scottsdale Framing System, New Zealand
5.	Name of the Technology/System	Light Gauge Framing System
6.	Is it a patented system ?	No
7.	Brief Write- up on Technology / System	Light Gauge Framing System comprises of different panels used in Walls, Roof, Ceiling etc which are made of CR sections of Galvanised steel ranging from 0.75 to 1mm thickness. The machines creates different parts by rolling the steel into LIP sections which are joined together to create the structure.
8.	If any evaluation/certification carried out. If yes, Give Details	NO
9.	Advantages of the Technology vis- a- vis. conventional system	Faster and Durable in terms of Seismic. Dry construction except Civil work of foundations. Light weight so less transportation cost.
10.	Limitations of the Technology, if any	Can go upto 12 Floors
11.	Whether the manufacturing of components is on-site or factory made.	Both
12.	In case of Factory made, whether Manufacturing Facility is established in India. (present status) If Yes, Location and Present Manufacturing Capacity. If No, what scale of project (No. of Dwelling Units) needed to establish the factory?	Our manufacturing unit is in Ghaziabad, UP
13.	In case of on-site production, scale of the project (No. of Dwelling Units) needed to establish the facility on site.	We produce the sections in the factory and the assembly is done on site.
14.	What is the economical lead distance in case factory made components?	Around 500 Kms or else there is a provision of shifting the machines from the factory to the site.
15.	Do you also execute the project, If yes, present capacity.	Yes. The capacity of 1 machine is around 2000 Sq ft per day which can be increased just by adding more machines.

	If No, How it is proposed to be done.	
16.	Are you ready to take up the execution of the project immediately on receipt of the work order.	Yes
17.	Do you provide complete design solution? If Yes, whether structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893 If No, How do you propose to provide structural design.	Yes. Scottsdale has its own designing software, which does the engineering. We get all our designs analyzed and approved by structural engineers before proceeding for the production. One of our buildings is also approved and tested by IIT Delhi.
18.	Do you provide construction supervision services / Project Management consultancy services If No, How it is proposed to be done	Yes
19.	Brief on the Training needs for Installing, Using and Maintenance along with readiness to execute the project using construction workforce with current skills in India.	We have all trained supervisors and contractors, which executes the project.
20.	Note on Guarantees / Warrantees provided to the user/customer.	All our steel structures are warranted for 50 years.
21.	Attach a brief note on the Sustainability issues such as environmental friendliness, energy efficiency use of waste materials recyclability etc.	With our technology there is no wastage on site as all the material sent on site is ready to be used. As it is made of steel, it can be recycled after the life of the building. There is minimum usage of water on site so it protects our nature. There is minimum noise pollution as there are small hand tools used on site.
22.	Note on Upkeep / Maintenance facilities that will be available to the user / customer during guarantee / warranty period and after. Availability of annual maintenance contract.	Maintenance of such buildings is very similar to the conventional construction such as the paint work, exterior and interior finishes etc. Even the plumbing and electrical can be repaired by any local person with the help of our trained staff. We can provide annual maintenance contract.
23.	Attach note on case studies of use of the Technology in the country/ other countries with date (month/year) of use/ installation.	This technology is a very old technology being used all across the globe. We can provide lot of data in terms of this technology.
24.	Analysis of Life Cycle Cost including Initial cost, cost of maintenance, and comparison with conventional system, if any	Initial cost might be little higher than conventional cost but if considered the bank interest and time then this is much more efficient. Life cycle cost is lower than conventional system as there are less problems of water leakage, expansion contraction etc in our technology.
25.	Speed of construction vis-à-vis conventional system.	Almost 4 times faster

26.	Brief on Performance Characteristics & related Standards	1. Structural Stability	As per the IS Codes
		2. Durability	Equal to Conventional system
		3. Behaviour in Earthquake	Much better performance than conventional system as its all steel which has the elasticity to withstand heavy earthquakes.
		4. Fire Safety	All materials used are tested Fire rated
		5. Rain	All the exterior are water proved for better performance
		6. Thermal performance	Much better than conventional system as the walls are hollow which doesn't transfer heat from outside.
		7. Acoustic performance	Depends on the client which can be achieved using different product combinations.
		8. Behaviour under high wind/cyclones	Engineered as per the IS codes and different wind regions of the country
		9. Floods	Safe if compared with conventional system as its all steel so little impact of water.
		10. Under high moisture / humid conditions.	Best results can be achieved by changing the material specifications.
		11. Any other, please specify)	
27.	Is there Standard on technology formulated by Your Company	Yes	
28.	Attach Photographs / Diagrams showing Components, Installation /assembly details, Finished Structure	Will attach the test reports of IIT Delhi along with our website name on which all the data can be found 	

29.	Name & Contact details of Professionals / Architects / Engineers involved with this technology Attach a list, if it is exhaustive Give list of trained Artisans, if any	Mr. Surinder Jindal Managing Director Tel: 9958744211 Email: info@loomcrafts.com

Emerging Technology No. 22

Name of Technology: ADVANCED BUILDING SYSTEM – EMMEDUE (Expanded Polystyrene Core Panel System)

1.	Name of Organization/Company	**EMMEDUE S.P.A**
2.	Postal Address and Website	EMMEDUE S.P.A, Via Toniolo, 39/b Z. I. Bellocchi 61032FANO (PU), Italy Tel: 39 0721 855650, 39 0721 856211 E-mail: info@mdue.it M/s BK Chemtech Engineering (India) Pvt. Ltd, No. 8, Jeremiah Road 3rd Floor, Frazer Town, Bangalore – 560005 Tel: 080-41657945
3.	Name, Designation and details of Contact Person (Telephone, Fax, E-mail) (Technical Person)	EMMEDUE S.P.A, Via Toniolo, 39/b Z. I. Bellocchi 61032FANO (PU), Italy Tel: 39 0721 855650, 39 0721 856211 E-mail: info@mdue.it M/s BK Chemtech Engineering (India) Pvt. Ltd, No. 8, Jeremiah Road 3rd Floor, Frazer Town, Bangalore – 560005 Tel: 080-41657945
4.	Name and details of Foreign Collaborator, if any	EMMEDUE S.P.A, Via Toniolo, 39/b Z. I. Bellocchi 61032FANO (PU), Italy Tel: 39 0721 855650, 39 0721 856211 E-mail: info@mdue.it
5.	Name of the Technology/System	***ADVANCED BUILDING SYSTEM*** **– EMMEDUE** (Expanded Polystyrene Core Panel System)
6.	Is it a patented system ?	YES
7.	Brief Write- up on Technology / System	Polystyrene Core Panel System is based on factory made panels, consisting of self extinguishing expanded polystyrene sheet (generally corrugated) with minimum density of 15Kg/m3 and thickness not less than 60 mm, sandwitched between two engineered sheet of welded wire fabric mesh, made of high strength galvanized wire of 2.5 mm to 3 mm dia. A 3 mm – 4 mm dia galvanized steel truss wire is pierced completely through the polystyrene core at the offset angle for superior strength and welded to each of the outer layer sheet of steel welded wire fabric mesh. The panels are finished on the site using coat of minimum 30 mm thick shortcrete (1:4) applied under pressure. The technology (developed about 30 years back) is now in use successfully in many other countries like Morocco, Algeria, South Africa, Kenya, Austria, Malasiya, Ireland, Romania & Australia with involvement of different agencies and brand names.
8.	If any evaluation/certification carried out. If yes, Give Details	BMTPC under Performance Appraisal Certification Scheme has evaluated the System by EMMEDUE SPA,

		Italy and issued Performance Appraisal Certificate No 1010-S/2014 PAC No. 1010-5/2014 : • Manual on M2 System by EMMEDUE, S.P.A. Italy. • Manual on Schnell Home, Schnell Wire, Italy. • Certificate No. 06/0241, Irish Agreement Board, Ireland. • Technical Report on Experimental Evaluation of Building System M2 by Structure Lab. Department of • Engineering, Ponitificia Universidad Catolica Del Peru. • Review of EVG-3D Technology for residential buildings in India, IIT Mumbai. • Report on Performance Tests conducted on EMMEDUE Panel System at Hesarghalta, Bangalore Civil Aid Techno Clinic Pvt. Ltd., Bangalore.
9.	Advantages of the Technology vis- a- vis. conventional system	Compared to traditional products, panels achieve far better results, at considerably reduced cost. The speedy construction represent additional savings.The building system gives full design flexibility as it offers a complete range of building elements such as load-bearing walls, curtain walls, floors and stairs. The panels are easy to use in the construction of any type of structure, and can be shaped to any geometric requirement i.e. flat or curved by simple cutting the panels at site.
10.	Limitations of the Technology, if any	The viability depends upon the quantum of work. Generally requirements of 1.5 lakh sqm of panel per year for minimum period of three years makes the plant viable.
11.	Whether the manufacturing of components is on-site or factory made.	Factory made
12.	In case of Factory made, whether Manufacturing Facility is established in India. (present status) If Yes, Location and Present Manufacturing Capacity. If No, what scale of project (No. of Dwelling Units) needed to establish the factory?	No details available
13.	In case of on-site production, scale of the project (No. of Dwelling Units) needed to establish the facility on site.	The viability depends upon the quantum of work. Generally requirements of 1.5 lakh sqm of panel per year for minimum period of three years make the plant viable.
14.	What is the economical lead distance in case factory made components?	The viability depends upon the quantum of work. Generally requirements of 1.5 lakh sqm of panel per year for minimum period of three years make the plant viable.
15.	Do you also execute the project, If yes, present capacity. If No, How it is proposed to be done.	YES

16.	Are you ready to take up the execution of the project immediately on receipt of the work order.	YES
17.	Do you provide complete design solution? If Yes, whether structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893 If No, How do you propose to provide structural design.	YES
18.	Do you provide construction supervision services / Project Management consultancy services If No, How it is proposed to be done	YES
19.	Brief on the Training needs for Installing, Using and Maintenance along with readiness to execute the project using construction workforce with current skills in India.	Training Required.
20.	Note on Guarantees / Warrantees provided to the user/customer.	• Specific design using *EMMEDUE* Advanced Building System is the responsibility of the designer with the instructions, supervision and guidance of EMMEDUE S.P.A. • Quality of installation of the system on site is the responsibility of the trade persons engaged by the agency • Quality of maintenance of the building is the responsibility of the building owner.
21.	Attach a brief note on the Sustainability issues such as environmental friendliness, energy efficiency use of waste materials recyclability etc.	The insulating envelope provided by polystyrene core eliminates thermal bridges and ducts within the panel. This brings high level of energy efficiency. The system provides significant improvements in indoor thermal comfort by greatly reducing energy consumption and promoting strategies aimed at sustainable development
22.	Note on Upkeep / Maintenance facilities that will be available to the user / customer during guarantee / warranty period and after. Availability of annual maintenance contract.	A proper maintenance guide shall be given by the PAC holder to the client. When building is to be repainted with fresh coat of paint after scraping existing paint, check for joint sealant, pipe joint, sun shade etc. and carry out required maintenance and apply primer before paint is applied**.**
23.	Attach note on case studies of use of the Technology in the country/ other countries with date (month/year) of use/ installation.	No information
24.	Analysis of Life Cycle Cost including Initial cost, cost of maintenance, and comparison with conventional system, if	No information available.

	any		
25.	Speed of construction vis-à-vis conventional system.	The system has been used in many countries worldwide. The construction experiences using the system show a marked reduction in construction time compared to traditional building methods. Panels are industrialized, and for this reason, assembly processes are optimized, labour is significantly reduced, and construction time decreased by roughly 40%.	
26.	Brief on Performance Characteristics & related Standards	1. Structural Stability	OK
		2. Durability	OK
		3. Behavior in Earthquake	Safe
		4. Fire Safety	Safe
		5. Rain	Safe
		6. Thermal performance	OK
		7. Acoustic performance	OK
		8. Behavior under high wind/cyclones	Safe
		9. Floods	Safe
		10. Under high moisture / Humid conditions.	OK
		11. Any other, please specify)	No
27.	Is there Standard on technology formulated by Your Company	YES. A site Erection Manual and a Manual for Health & Safety shall be provided for each project incorporating the EMMEDUE Advanced Building System.	
28.	Attach Photographs / Diagrams showing Components, Installation /assembly details, Finished Structure		
29.	Name & Contact details of Professionals / Architects / Engineers involved with this technology Attach a list, if it is exhaustive Give list of trained Artisans, if any	EMMEDUE S.P.A, Via Toniolo, 39/b Z. I. Bellocchi 61032FANO (PU), Italy Tel: 39 0721 855650, 39 0721 856211 E-mail: info@mdue.it M/s BK Chemtech Engineering (India) Pvt. Ltd, No. 8, Jeremiah Road 3rd Floor, Frazer Town, Bangalore – 560005 Tel: 080-41657945	
30.	Provide additional information you may like to supplement.	Numerous lab tests, performed in different parts of the world, have highlighted the high load resistance of the panels which after compression testing with centred load performed on a single finished panel, 2700mm high,	

		have shown that they withstand a maximum load of up to 1530 kN/m ≈ 153 ton/m. The Monolithic joints of the building system provide a high level of structural strength to buildings. The prototype houses tested using both artificial and natural accelerograms with peak values over 1.0g, came through unscathed. Buildings made using panels are particularly lightweight, so have a low seismic mass, but are at the same time rigid due to two sheets of reinforced plaster that interact to create an enveloping 'shell' of the whole structure The thickness and density of the panel can be customized to deliver specific thermal insulation requirements. Furthermore, the EPS core extends throughout the surface which makes up the building envelope eliminating thermal bridging. For example, a wall with a 80 mm core and finished thickness of about 15cm provides the same thermal insulation as an insulated solid masonry wall of about 40cm, with obvious advantages in terms of additional space.

Emerging Technology No. 23

Name of Technology: Architectural Hardware, ball bearing Hinges, modular kitchen, floor spring, door closer, wooden floor Hdf

1.	Name of Organization/Company	CHASE GLOBAL
2.	Postal Address and Website	GF 7 Saffron Complex NR BOB Ambawadi
3.	Name, Designation and details of Contact Person (Telephone, Fax, E-mail) (Technical Person)	Kedar Shawrikar 9824645702 National Manager
4.	Name and details of Foreign Collaborator, if any	
5.	Name of the Technology/System	Architectural Hardware, ball bearing Hinges, modular kitchen, floor spring, door closer, wooden floor Hdf
6.	Is it a patented system?	no
7.	Brief Write- up on Technology / System	Stainless steel hinges with ball bearing Ball bearing with salt water tested Floor spring ss plate with dye cast iron Wooden floor ac3/ac4 Modular kitchen with water resistant
8.	If any evaluation/certification carried out. If yes, Give Details	
9.	Advantages of the Technology vis- a- vis. conventional system.	
10.	Limitations of the Technology, if any	
11.	Whether the manufacturing of components is on-site or factory made.	yes
12.	In case of Factory made, whether Manufacturing Facility is established in India. (present status) If Yes, Location and Present Manufacturing Capacity. If No, what scale of project (No. of Dwelling Units) needed to establish the factory?	If no- Trading/mfg
13.	In case of on-site production, scale of the project (No. of Dwelling Units) needed to establish the facility on site.	
14.	What is the economical lead distance in case factory made components?	
15.	Do you also execute the project, If yes, present capacity. If No, How it is proposed to be done.	50 crore
16.	Are you ready to take up the execution of the project immediately on receipt of the work order.	yes
17.	Do you provide complete design solution? If Yes, whether structural design conforms	Yes modular kitchen design Shower cubical design Spider fitting design

	to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893 If No, How do you propose to provide structural design.	Only shower cubical ,spider &kitchen design	
18.	Do you provide construction supervision services / Project Management consultancy services If No, How it is proposed to be done	no	
19.	Brief on the Training needs for Installing, Using and Maintenance along with readiness to execute the project using construction workforce with current skills in India.		
20.	Note on Guarantees / Warrantees provided to the user/customer.	Yes 18 month	
21.	Attach a brief note on the Sustainability issues such as environmental friendliness, energy efficiency use of waste materials recyclability etc.		
22.	Note on Upkeep / Maintenance facilities that will be available to the user / customer during guarantee / warranty period and after. Availability of annual maintenance contract.		
23.	Attach note on case studies of use of the Technology in the country/ other countries with date (month/year) of use/ installation.		
24.	Analysis of Life Cycle Cost including Initial cost, cost of maintenance, and comparison with conventional system, if any		
25.	Speed of construction vis-à-vis conventional system.		
26.	Brief on Performance Characteristics & related Standards	1. Structural Stability	
		2. Durability	
		3. Behaviour in Earthquake	
		4. Fire Safety	
		5. Rain	
		6. Thermal performance	
		7. Acoustic performance	
		8. Behaviour under high wind/cyclones	
		9. Floods	
		10. Under high moisture / humid conditions.	
		11. Any other, please specify)	Water resistant and HARDWARE 20,000 cycle tested
27.	Is there Standard on technology		

	formulated by Your Company	
28.	Attach Photographs / Diagrams showing Components, Installation /assembly details, Finished Structure	
29.	Name & Contact details of Professionals / Architects / Engineers involved with this technology Attach a list, if it is exhaustive Give list of trained Artisans, if any	Adani Power,Adani Shantigram,Apple Woods Real Estate
30.	Provide additional information you may like to supplement.	Approved NBCC SVNIT surat

Emerging Technology No. 24

Name of Technology: The Quik Build system uses modular panels that are prefabricated with utility add-ons.

1.	Name of Organization/Company	**Beardsell Limited** is a leading international company in the business of prefabricated building construction, clean room erection, material packaging and insulation products.. Achieved Rs. 1 billion in revenue for the 2011-12 financial year, with continued growth of 50% expected over the next two years. Branch offices and manufacturing facilities in ten cities in India, with an international presence in over 20 countries. Beardsell Corporate Office Location:47 Greams Road Chennai Tamil Nadu – 600 006 Website www.beardsell.co.in Phone 044 28293296 / 0900 / 0901 Sales Contact Mr. Amrith Anumolu qb@beardsell.co.in
2.	Postal Address and Website	**47 Greams Road,** **Chennai.** **Tamilnadu – 600 006** **Phone : 044 2829 3296 / 0900 / 0901**
3.	Name, Designation and details of Contact Person (Telephone, Fax, E-mail) (Technical Person)	**Branch** offices and manufacturing facilities in ten cities in India, with an international presence in over 20 countries. **Beardsell Corporate Office** Location :47 Greams Road Chennai Tamil Nadu – 600 006 Website www.beardsell.co.in Phone 044 28293296 / 0900 / 0901 Sales Contact Mr. Amrith Anumolu qb@beardsell**.co.in**
4.	Name and details of Foreign Collaborator, if any	No Information
5.	Name of the Technology/System	The Quik Build system uses modular panels that are prefabricated with utility add-ons.
6.	Is it a patented system?	NO information
7.	Brief Write- up on Technology / System	**The Quik Build** system uses modular panels that are prefabricated with utility add-ons.The panels consist of A super-insulated Polystyrene Core Two engineered layers of Galvanised Steel Mesh Galvanised Steel Trusses The Steel Trusses are pierced through the Polystyrene Core and welded to the outer layer sheets of Galvanised Steel Mesh. The utility add-ons can be pre-built into the Core material. **Product Specification** Quik Build panels are available in the following sizes: Width1200 mm Length2850 (9'), 3000 (10'), upto 5000mm EPS Slab Thickness50, 80mm

		EPS Slab TypePlain or Corrugated Mesh50 x 50 mm , 100 x 100 mm Mesh wire thickness2.5 mm dia (std.), 2.0 mm, 3.0 mm Utility Fittingsper Customer Construction Method Foundation is built using conventional methods Starter bars are cast into the slab The panels are erected vertical and plumbed and temporarily supported by way of bracing. Rebar is set between the mesh and the polystyrene (for easy wall alignment). Fixing of splice meshes using fastener tool. Door and window openings cut out (can be cut both before or after panel erection) Erection of roof panels and fastening with joining mesh. Concealed plumbing and electrical wiring installed (can be pre-built into the panels) The window and door frames are fixed. Shotcreting of both interior and exterior walls. Concreting of exterior side of roof panel. Additional Product Benefits **ThermalInsulation:** The core material used in Quik Build is EPS which is an excellent thermal insulator. It maintains the indoor temperature and lowers HVAC costs 50%-70%. Fireproof: The Quik Build panel has passed the 120 minute fireproofing test of NCI. It is approved as a fireproofing material for internal & external construction. Moisture proof: The panel is excellent for preventing condensation/absorption on interior walls. The external walls can use waterproofing mortar for additional protection. Soundproof: The panels have superior sound dampening culpability compared to masonry walls and can be further enhanced if both sides are plaster-boarded. Lightweight: It is only 25% of the weight of a regular masonry wall, which alleviates the fixed load of a structure and facilitates its use in additions/upgrades to existing buildings.
8.	If any evaluation/certification carried out. If yes, Give Details	What building standards does Quik Build system comply with? The Quik Build panel has been tested by IIT-Chennai (Indian Institute of Technology – Chennai) for the relevant building standards and codes in use today. The Quik Build panel has passed all the requirements and the test results are listed below in the Appendix.

9.	Advantages of the Technology vis- a- vis. conventional system	**Low Cost:** Direct cost savings due to reduced labor, reduced material and cheaper construction equipment. Low weight of the product also reduces logistical costs. Fast Implementation: The simple design, efficient production, easy transportation and quick erection of the building unit reduces time-lines of projects of all sizes by up to 60%. Structural Integrity: The monolithic structure created by the panel in conjunction with concrete enables it to withstand earthquakes, hurricanes and high winds. Uniform Quality: As a standardized factory product, the Quik Build panel brings uniformly high quality to a construction project of any size. Simple Construction: The Quik Build system consolidates the masonry, insulation, plastering and utilities addition steps thus reducing the construction complexity - Strict quality control & production in controlled factory environmentHow does the Quik Build Construction System compare to conventional building systems? **The Quik** Build system has various advantages over the conventional building systems currently in use. The savings in material, labor, capital and time are substantial while at the same time providing additional benefits like thermal insulation and waterproofing.
10.	Limitations of the Technology, if any	The restrictions with regard to our technology are that there should be clear access to the sites for the trucks and trailers, total plan of the structure should be finalized before starting the production as well as curved walls in the architectural plans will not be possible
11.	Whether the manufacturing of components is on-site or factory made.	All modules are manufactured and assembled at the factory itself and transported to the site where they have to be installed. Necessary foundations, drainage/waste water/sanitary connections are pre-made at the site before the modules are installed. Only final connections to the modules are required at the site with respect to all external connections like water, electricity, sewerage, etc. The stairs are cast as separate modules and assembled together.
12.	In case of Factory made, whether Manufacturing Facility is established in India. (present status) If Yes, Location and Present Manufacturing Capacity. If No, what scale of project (No. of Dwelling Units) needed to establish the factory?	Yes
13.	In case of on-site production, scale of the project (No. of Dwelling Units) needed to establish the facility on site.	The viability depends upon the quantum of work. Generally
14.	What is the economical lead distance in case	The viability depends upon the quantum of work.

	factory made components?	Generally
15.	Do you also execute the project, If yes, present capacity. If No, How it is proposed to be done.	YES
16.	Are you ready to take up the execution of the project immediately on receipt of the work order.	YES
17.	Do you provide complete design solution? If Yes, whether structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893 If No, How do you propose to provide structural design.	YES
18.	Do you provide construction supervision services / Project Management consultancy services If No, How it is proposed to be done	YES
19.	Brief on the Training needs for Installing, Using and Maintenance along with readiness to execute the project using construction workforce with current skills in India.	Training Required.
20.	Note on Guarantees / Warrantees provided to the user/customer.	No information.
21.	Attach a brief note on the Sustainability issues such as environmental friendliness, energy efficiency use of waste materials recyclability etc.	**GREEN TECHNOLOGY:** The polystyrene inside the Advanced Building System panels, Expanded polystyrene (also known as EPS), when evaluated over the whole of its life cycle shows that it affects the environment less than other more biological insulators: It is SAFE: It does not release toxic or harmful substances and is totally inert. It does not contain chlorofluorocarbons (CFCs) or (HCFCs). Furthermore, as it contains no organic material, the growth of micro-organisms and mould is inhibited. The mechanical and thermal characteristics are supplied for the whole life of the building in which it is installed. It does not suffer permanent damage if exposed to vapor or humidity. It is RECYCLABLE: No waste materials are produced during production. Moreover, the production process for the Advanced Building System panel aims to optimize its cut, reducing waste to a minimum. Any leftover EPS is recycled directly in the production plant itself. It is NON-TOXIC: It does not entail the release of allergens or toxic substances ensuring that there is no damage to the health of those producing or installing it. It is SELF-EXTINGUISHING: The EPS used for the Advanced Building System panels is self-extinguishing

		so once the flame, i.e. the trigger, has been eliminated, neither does the material produce flames, nor does it continue to burn.	
22.	Note on Upkeep / Maintenance facilities that will be available to the user / customer during guarantee / warranty period and after. Availability of annual maintenance contract.	No information	
23.	Attach note on case studies of use of the Technology in the country/ other countries with date (month/year) of use/ installation.	No information	
24.	Analysis of Life Cycle Cost including Initial cost, cost of maintenance, and comparison with conventional system, if any	No information	
25.	Speed of construction vis-à-vis conventional system.	The system has been used in many countries worldwide. The construction experiences using the system show a marked reduction in construction time compared to traditional building methods. Panels are industrialized, and for this reason, assembly processes are optimized, labour is significantly reduced, and construction time decreased by roughly 40%.	
26.	Brief on Performance Characteristics & related Standards	1. Structural Stability	OK
		2. Durability	OK
		3. Behavior in Earthquake	Safe
		4. Fire Safety	Safe
		5. Rain	Safe
		6. Thermal performance	OK
		7. Acoustic performance	OK
		8. Behavior under high wind/cyclones	Safe
		9. Floods	Safe
		10. Under high moisture /Humid conditions.	OK
		11. Any other, please specify)	No
27.	Is there Standard on technology formulated by Your Company	YES.	
28.	Attach Photographs / Diagrams showing Components, Installation /assembly details, Finished Structure		

		
29.	Name & Contact details of Professionals / Architects / Engineers involved with this technology Attach a list, if it is exhaustive Give list of trained Artisans, if any	**Beardsell Corporate Office** **Location :47 GREAMS ROAD CHENNAI TAMIL NADU – 600 006** **Website www.beardsell.co.in** **Phone 044 28293296 / 0900 / 0901** **Sales Contact Mr. Amrith Anumolu** **gb@beardsell.co.in** **Mr. Tarun Kumar Malpani** **SV Consultants** **M:98448 23123 / 080-2286 5324** **Email:Sv_consultants@yahoo.co.in**
30.	Provide additional information you may like to supplement.	QUIK BUILD VS OTHERS

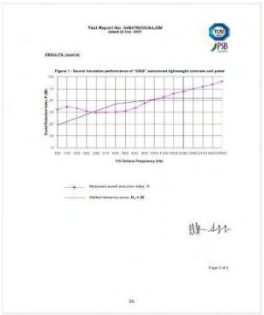
QUIK BUILD VS OTHERS

	Quik Build	Masonry	Imported Pre-Fab	Siporex	Sintex
Material	Concrete/EPS/Steel	Concrete/Bricks/Steel	FerroCement/Steel	Fly-Ash/Concrete/Steel	Plastic/Concrete/Steel
Thermal Insulation	K-value of 0.033	K-value of 5.000	K-value of 3.900	K-value of 0.122	K-value of 0.970
Fire Proof	120 min	120 min	120 min	240 min	60 min
Water Proof	GOOD	BAD	FAIR	FAIR	GOOD
Sound Proof	GOOD	BAD	BAD	FAIR	BAD
Strength-Weight Ratio	GOOD	BAD	FAIR	GOOD	FAIR
Load Bearing (Panels)	YES	YES	YES	YES	NO
Structural Integrity (Seismic/Winds)	YES	YES	YES	YES	NO
Light Weight (For additions, etc.)	GOOD	BAD	BAD	BAD	GOOD
Uniform Quality	YES	NO	NO	YES	YES
Logistical (Modular Shipping)	YES	NO	YES	YES	NO
Labor Savings (Ease of erection)	GOOD	BAD	BAD	FAIR	FAIR
Utility Add-ons	Pre-Built OR On-Site	On-Site only	On-Site only	On-Site only	On-Site only
Workability (Ability to modify, etc.)	GOOD	GOOD	GOOD	BAD	FAIR
Form Factors	Multiple, incl. curved	Multiple, incl. curved	Blocks and Flat Slabs	Blocks and Flat Slabs	Flat Slabs only

Emerging Technology No. 25

Name of Technology: External Wall use ALC (Auto clave light weight concrete) Panel, External Mount on structure members.

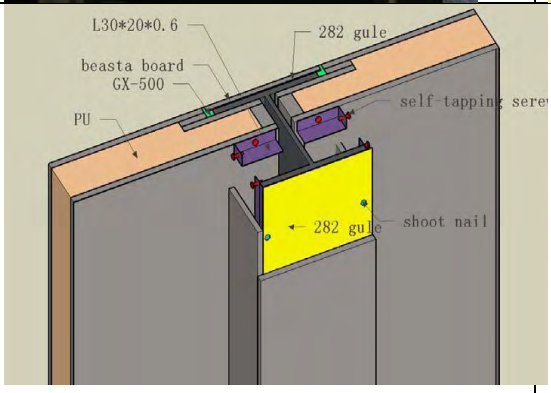
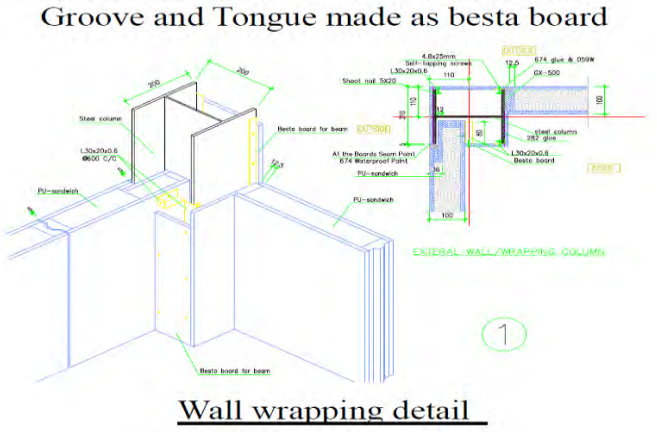
1.	Name of Organization/Company	**Innovative Civil Engineering Solutions Pvt Ltd** Product : Building Materials PRE-FABRICATED & PRE-ENGINEERED COMPOSITE TECHNOLOGY USING HIGH FREQUENCY WELDED STEEL, ALC PANEL, BESTA (MgO) BOARD
2.	Postal Address and Website	76, 6th Street, Chowdary Nagar, Valasaravakkam, Chennai – 600087, India. Phone: +91-44-24865334 Telefax: +91-44-24869552 Mobile: +91-9884725775 Email: info@innovativecivilengineering.com Website: http://innovativecivilengineering.com
3.	Name, Designation and details of Contact Person (Telephone, Fax, E-mail) (Technical Person)	**Mr. Shanmugasundaram** **76, 6th Street, Chowdary Nagar, Valasaravakkam,** **Chennai – 600087, India.** **Phone: +91-44-24865334 Telefax: +91-44-24869552** **Mobile: +91-9884725775** **Email: info@innovativecivilengineering.com** **Website: http://innovativecivilengineering.com**
4.	Name and details of Foreign Collaborator, if any	OW&A International 瑞能国际有限公司 Green Building Systems INNOVATIVE CIVIL ENGINEERING SOLUTION PVT. LTD.
5.	Name of the Technology/System	'**InnoBuild-Prefab**', is the brand and Trademark that ICES has applied for in India. All our products will come under this tag **External Wall use ALC (Auto clave light weight concrete) Panel, External Mount on structure members.**
6.	Is it a patented system?	Yes
7.	Brief Write- up on Technology / System	**Innovative Civil Engineering Solutions Pvt. Ltd (ICES)** is a Modular Pre-Engineered Construction System provider, wherein the technology has been developed by **Well and Able International Pte. Ltd., Singapore.** The system has been established in Singapore in various types of buildings and which has been certified by **Building and Construction Authority (BCA), Singapore**, with highest **Buildability** and **Constructability** points. **ICES** along with **Well & Able** has registered itself as a company in Singapore to develop this technology and spread across the same across the Asian Countries. **ICES India**, a professional organization headed by **Mr. Shanmugasundaram** and other eminent professionals from various professional background and proven leaders in their own respective profession like Management,

		Finance, and Marketing...etc have joined hands to develop this organization in India to spread this technology. ICES has a foundation from its parent organization, which is **Sree Sai Management and Project Consultants Pvt. Ltd**., primarily operating in Project Management services, handling projects of various nature including Hospitals, Malls, Hotels, and Residential Conglomerations ... Etc The experience of Engineering coupled with Project Management has made **ICES** technically strong to disburse the **High-end Modular Pre-Engineered Construction System** in a Professional Way. • Particular job conditions. **Autoclaved Aerated Lightweight Concrete, or ALC**, is concrete that has been manufactured to contain lots of closed air pockets. • Lightweight and fairly energy efficient, it is produced by adding an Air Entertaining Agent to concrete in a mould, then wire-cut into panels from the resulting 'cake' and 'cooking' them with steam (autoclaving). • Dry Density is just 550-600Kgs / m³. • Silica Sand • Gypsum • Lime • Cement • Aluminum Powder two-way and welded steel reinforcement mesh(reinforcing bar) processed by special anti-rust liquid
8.	If any evaluation/certification carried out. If yes, Give Details *(Test By PSB Singapore on AS 1191) ALC panel shows excellence performance during quake test of 8 on the Richter Scale in the laboratory of Tongji University*	 4.2 AIRBORNE SOUND INSULATION TEST – AS 1191 : 2002 Test Report No. S4S07603S/A/LCM 
9.	Advantages of the Technology vis- a- vis. conventional system	• Fast construction time to maximize returns for developers • Advantages • Large cost savings by reducing structure weights, as structural members could be customized manufacture to specific design thicknesses, cross sections and lengths • Maximize container loading thereby reduces shipping costs • Minimum wastages during production and fabrication • Efficiency & Flexibility for architectural and

		structural designs • High precision • Sawable and drillable • Used in dry operation • It is convenient to install in a simple process • Greatly shortened construction period and Improved the efficiency and quality of construction. The range of end uses include : • General individual Houses Lightweight • High strength • Thermal insulation • Fire resistance • Sound insulation • Durability • Anti-seismic • High softening coefficient • No radiation • Good creativity • Scientific installing method and • convenient • Multi-storey residential blocks • Single and multi-storey retail developments • Mezzanine floors • Car parks and storage buildings • Multi-storey office complexes etc. The installation node is scientifically designed, with high strength and a certain amount of rotating performance. It can bear an interlayer displacement between 1/200 and 1/50 without damage or only a minor damage. Regarded as constructional elements with flexible connection in terms of seismic design, so their stiffness and seismic bearing capacity are not counted. Structure members supporting the ALC external panels can count the effect of seismic action of ALC wall panel as an additional effect, and meet the anchoring requirement ***of connecting accessories***• Structure can be shifted from one location to other without wastage of materials. ***Environment friendly*** • Steel used can be recycled when required.
10.	Limitations of the Technology, if any	Initial high investment.
11.	Whether the manufacturing of components is on-site or factory made.	Factory made
12.	In case of Factory made, whether Manufacturing Facility is established in India. (present status) If Yes, Location and Present Manufacturing Capacity.	YES

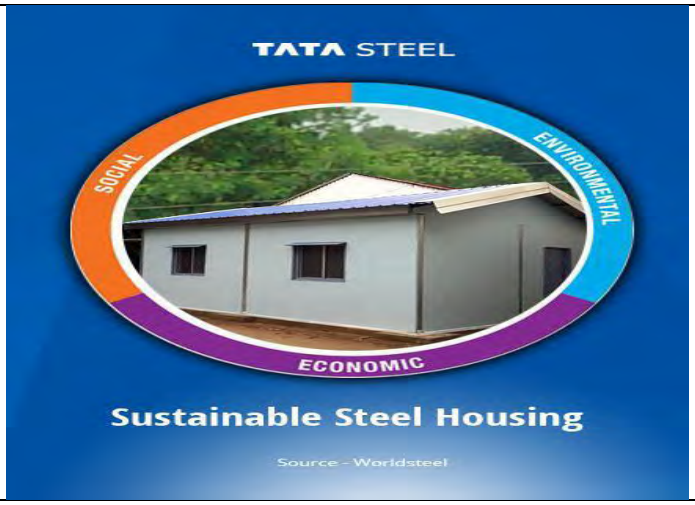
	If No, what scale of project (No. of Dwelling Units) needed to establish the factory?	
13.	In case of on-site production, scale of the project (No. of Dwelling Units) needed to establish the facility on site.	-
14.	What is the economical lead distance in case factory made components?	1000km
15.	Do you also execute the project, If yes, present capacity. If No, How it is proposed to be done.	YES
16.	Are you ready to take up the execution of the project immediately on receipt of the work order?	YES
17.	Do you provide complete design solution? If Yes, whether structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893 If No, How do you propose to provide structural design.	Yes The design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893
18.	Do you provide construction supervision services / Project Management consultancy services If No, How it is proposed to be done	YES
19.	Brief on the Training needs for Installing, Using and Maintenance along with readiness to execute the project using construction workforce with current skills in India.	TRAINING REQUIRED
20.	Note on Guarantees / Warrantees provided to the user/customer.	No information on Guarantees
21.	Attach a brief note on the Sustainability issues such as environmental friendliness, energy efficiency use of waste materials recyclability etc.	Steel used can be recycled when required.
22.	Note on Upkeep / Maintenance facilities that will be available to the user / customer during guarantee / warranty period and after. Availability of annual maintenance contract.	Maintenance free
23.	Attach note on case studies of use of the Technology in the country/ other countries with date (month/year) of use/ installation.	Projects outside India
24.	Analysis of Life Cycle Cost including Initial	Initial cost is high, cost of maintenance is less

	cost, cost of maintenance, and comparison with conventional system, if any		
25.	Speed of construction vis-à-vis conventional system.	Speed of construction is higher to conventional system.	
26.	Brief on Performance Characteristics & related Standards	1. Structural Stability	OK
		2. Durability	OK
		3. Behavior in Earthquake	Safe
		4. Fire Safety	Safe
		5. Rain	Safe
		6. Thermal performance	OK
		7. Acoustic performance	OK
		8. Behavior under high wind/cyclones	Safe
		9. Floods	Safe
		10. Under high moisture / Humid conditions.	OK
		11. Any other, please specify)	No
27.	Is there Standard on technology formulated by Your Company	Technical manual of the Company	
28.	Attach Photographs / Diagrams showing Components, Installation /assembly details, Finished Structure		
29.			

30.		
31.		
32.	Name & Contact details of Professionals / Architects / Engineers involved with this technology Attach a list, if it is exhaustive Give list of trained Artisans, if any	**Mr. Shanmugasundaram** **76, 6th Street, Chowdary Nagar, Valasaravakkam,** **Chennai – 600087, India.** **Phone: +91-44-24865334 Telefax: +91-44-24869552** **Mobile: +91-9884725775** **Email: info@innovativecivilengineering.com** **Website: http://innovativecivilengineering.com**
33.	Provide additional information you may like to supplement.	• **Cost** Compared to traditional masonry construction, autoclaved aerated panel enables rapid installation, requiring less construction manpower, resulting in a cleaner work environment. All these translate to a more cost effective building solution. • **Space** Using the autoclaved aerated panel with thickness of 100mm, more Internal space is achieved, as compared to double brick construction method. • **Weight** The dry specific gravity of autoclaved aerated panel is only 0.5. As The above rate is 1/5 of common concrete and 1/3 of hollow block, the total weight of a building constructed with this panel is much lighter, thus reducing the cost of base and frame, as well as reducing ground sill preparation. This increases overall build quality.

Emerging Technology No. 26

Name of Technology: Composite Engineered Steel Building Solution System.

1.	Name of Organization/Company	
2.	Postal Address and Website	Tata BlueScope Steel Limited Address:The Metropolitan, Final Plot No 27, Survey No 21 Wakdewadi, Shivaji Nagar, Pune - 411005. India. Telephone:+91 20 6621 8000, Facsimile: +91 20 6621 8001 Email: communications@tatabluescopesteel.com
3.	Name, Designation and details of Contact Person (Telephone, Fax, E-mail) (Technical Person)	Tata BlueScope Steel Limited Address:The Metropolitan, Final Plot No 27, Survey No 21 Wakdewadi, Shivaji Nagar,Pune - 411005. India. Telephone:+91 20 6621 8000, Facsimile: +91 20 6621 8001 Email: communications@tatabluescopesteel.com
4.	Name and details of Foreign Collaborator, if any	TATA BLUESCOPE BUILDING SOLUTIONS (A Division of Tata BlueScope Steel Limited) **WELCOME** Tata BlueScope Building Solutions is a division of Tata BlueScope Steel Limited, which is an equal joint venture between Tata Steel and BlueScope (Australia) in the field of coated steel, steel building solutions and related building products. The division supplies a range of engineered steel building solutions that can be used for application in varied segments and takes single source responsibility for its design, manufacture, shipment and erection. It has manufacturing facilities in Pune, Chennai and Bhiwadi, four regional offices and a wide network of sales offices that offer the best-in-class services and solutions
5.	Name of the Technology/System	BUTLER A Globally Renowned Engineered Steel Building Solution with Exceptional Credentials. ECOBUILD A Reliable and Advanced Building Solution that offers a unique combination of Quality, On Time Project Execution,

		Safety and Cost Efficiency.
6.	Is it a patented system ?	Yes
7.	Brief Write- up on Technology / System	**WIDESPAN™ Structural Systems** The ECOBUILD™ WIDESPAN™ Structural Systems is our most basic building system, it is also one of the most versatile. The proven practicality of a rigid frame is combined with almost unlimited design flexibility to meet your needs.  Combine the proven practicality of a rigid frame with almost unlimited size flexibility Clearspan framing systems allow for maximum use of interior space which is particularly important in manufacturing plants, warehouses, offices and retail stores where uninterrupted space is required The width extension matches the eave heights and roof slopes for additional space or future expansion Corrosion Protection: The mainframe sections are fabricated in the state-of-the-art facility in Pune, optional shot blasted and come with primer coat, which protect the base steel for much longer time than any conventional fabricated steel structure **WIDESPAN™ Structural System comes with galvanised purlin and girt known as CEE-plus™ & ZED plus™, which last much longer without any requirement of regular maintenance, when compared with conventional unprotected structural elements** **MULTISTOREY Structural System** The MULTISTOREY Structural System is an extension of ECOBUILD™ BUILDING SYSTEMS. It offers the benefits of single source advantages of a ECOBUILD™ MULTISTOREY Structure. ECOBUILD™ BUILDING SYSTEMS offer a variety of roof and wall cladding options in various colours using long lasting coated steel manufactured from ZINCALUME® steel & COLORBOND® steel products.

The multi-storey buildings share many of the same advantages as the low rise construction buildings

Provides the most comprehensive array of proven products and services

Used for almost any multi-storey building from 2 to 5 stories

Faster design, manufacturing and installation of building in comparison to any conventional RCC building

Corrosion Protection: The mainframe sections are fabricated in the state-of-the-art facility in Pune, optional shot blasted and comes with primer coat, which protects the base steel for much longer time than any conventional fabricated steel structure

ECOBUILD™ MULTISTOREY Structural System comes with galvanised purlins and girts known as CEE-plus™ & ZED-plus™, which last much longer without any requirement of regular maintenance, when compared with conventional unprotected structural elements

Roof Systems

CONCEALED FIXED ROOF SYSTEMS

KLIP-LOK™ 700 Roof System

KLIP-LOK™ 700 is a strong, durable roof cladding profile. Combining smart micro fluted pans and a lock-action rib design with concealed fastening, KLIP-LOK™ can be used for many applications.

Special Features:

Longer span and wider coverage

Extra strong, light weight and economical Clip fixed system - no piercing on wall sheeting KLIP-LOK™ 700 profile has cross- micro flutes which allow profile curving Concealed fix system controls thermal expansion and contraction most effectively On-site roll forming option to provide single length sheet Manufactured from high strength ZINCALUME® steel

		or COLORBOND® steel **KLIP-LOK™ 770 Roof System** SCREW FIXED ROOF SYSTEM
8.	If any evaluation/certification carried out. If yes, Give Details	MR-24® standing seam roof system, MR-24® roof system with liner panel and BR-II™ lap seam roof system are certified by the prestigious Factory Mutual Approval (FM Approvals). The MR-24® Roof System meets the widest range of FM Approvals class. The FM Approvals certified roof systems are widely regarded by all customers as the best-in-class roofs, tested forwind uplift and fire rating. ANAB ACCREDITED · UKAS · UL REGISTERED · ISO 9001 ISO 14001 OHSAS 18001 · An ISO 14001:2004 Certified Company · FM APPROVED .
9.	Advantages of the Technology vis- a- vis. conventional system	Tata BlueScope Building Solutions is a member of Indian Green Building Congress. The solutions offered follow design and construction practices that significantly reduce or eliminate the negative impact of buildings on the environment and occupants. Our solutions come with roofing and wall cladding manufactured from ZINCALUME® steel and COLORBOND® steel, widely acknowledged as a strong and light weight building material, which has many advantages over conventional materials. The lower thermal mass and higher heat reflectivity of ZINCALUME® steel, combined with its flexibility, helps in efficient environment control and energy conservation.Standards. ***High Precision*** • Fully integrated computerised system. ***Structural*** • High strength to weight ratio. Earthquake force generation is less due to lightweight. Chance of progressive collapse are marginal due to highly ductile and load carrying nature of closely spaced studs/joists. ***Speed in Construction*** • Construction speed is very high. A typical four storeyed building can be constructed within one month. ***Saving in foundation*** • Structure being light, does not require heavy foundation. ***Mobility*** • Structural element can be transported any place including hilly places to remote places easily and structure can be erected fast. • Structure can be shifted from one location to other without wastage of materials. ***Environment friendly***

		• Steel used can be recycled when required.
10.	Limitations of the Technology, if any	Initial high investment.
11.	Whether the manufacturing of components is on-site or factory made.	Factory made.
12.	In case of Factory made, whether Manufacturing Facility is established in India. (present status) If Yes, Location and Present Manufacturing Capacity. If No, what scale of project (No. of Dwelling Units) needed to establish the factory?	YES **Manufacturing Plants - India** Bhiwadi, Rajasthan Description:Manufacturing Facility: LYSAGHT® building components and systems Address:Plot No.298-299,RIICO Industrial Area, Chopanki, Bhiwadi,Rajasthan, 301019, India Telephone:+91 1493 691010, Fax:+91 1493 691014 Sriperumbudur, Tamil Nadu Description:Manufacturing Facility: LYSAGHT® building components and systems Address:G10 & G11, South Avenue Road, Sipcot Industrial Park,Irrungattukottai Sriperumbudur, Kanchipuram District Tamil Nadu, 602105, India Telephone: +91 44 27145000 Hinjewadi - Pune, Maharashtra Description:Manufacturing Facility: BUTLER™ building solutions and LYSAGHT® building components and systems. Address:Survey No.247 & 250, Hinjewadi, Phase II,Taluka, Mulshi, Pune, 411057, India Telephone: +91 20 66742000, Fax: +91 20 66742001 Jamshedpur, Jharkand Description:Coated Steel Project. Project phase of Manufacturing Plant Address:Bara, AGRICO, Jamshedpur 831009, India Telephone: +91 657 6624200 Fax: +91 657 2270751
13.	In case of on-site production, scale of the project (No. of Dwelling Units) needed to establish the facility on site.	No Information
14.	What is the economical lead distance in case factory made components?	1000km (Aprox.)
15.	Do you also execute the project, If yes, present capacity. If No, How it is proposed to be done.	YES
16.	Are you ready to take up the execution of the project immediately on receipt of the work order?	YES
17.	Do you provide complete design solution? If Yes, whether structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893	Yes The structural design conforms to loading conditions conforming to Indian Standards IS 875 Part I to V and Earthquake Standard IS : 1893 .

	If No, How do you propose to provide structural design.	
18.	Do you provide construction supervision services / Project Management consultancy services If No, How it is proposed to be done	YES
19.	Brief on the Training needs for Installing, Using and Maintenance along with readiness to execute the project using construction workforce with current skills in India.	TRAINING REQUIRED
20.	Note on Guarantees / Warrantees provided to the user/customer.	No information on Guarantees
21.	Attach a brief note on the Sustainability issues such as environmental friendliness, energy efficiency use of waste materials recyclability etc.	Steel used can be recycled when required.
22.	Note on Upkeep / Maintenance facilities that will be available to the user / customer during guarantee / warranty period and after. Availability of annual maintenance contract.	As per contract terms
23.	Attach note on case studies of use of the Technology in the country/ other countries with date (month/year) of use/ installation.	A case study on how Tata BlueScope Building Products' EZYBUILD Solutions provided an ideal solution to build a warehousing facility in the remotest part of Madhya Pradesh with its PEB-lite product offering. Reliance Power,a subsidiary of Reliance Infrastructure that deals in coal mining and power generation required a storage house for components of coal-digging machineries and other utilities at the start of their project. The major challenges included working in Sasan area (Waidhan District) in MP with extremely poor connectivity of roads to the city as well as unavailability of drinking water coupled with regular electricity failures. The governing points for this project of Reliance Power Ltd. included construction at this remote location in MP as well as a quick and reliable solution. EZYBUILD Solutions' PEB-lite galvanised portal framing proved to be effective and budgetary option for the project. Highlighting features • The building main frame and its secondary members are made from galvanised, high strength steel ensuring corrosion-free performance for years • The light-gauge steel frame members ensured quick, easy installation. • The galvanised silver finish of the main frames adds to the interior aesthetics of the buildings thus eliminating painting and maintenance work • The roofing and wall cladding sheets are manufactured from high strength Colorbond Steel, ensuring long lasting and superior aesthetics. • The entire system has nut-bolt connections, and all the fasteners used are protected with galvanised

		coating ensuring better performance and durability of the connection system The entire building was installed in just 25 days by an authorised Ezybuild Solutions Provider (ESP). A total of 3 similar buildings each of approximately 5,800 sq.ft. Have been installed at the site effectively. Generalised PEB-lite design offering for prospective buyers • Clear span: 3 m to 21 m • Maximum eave height: 2.1 m to 7 m • Length: as per requirement
24.	Analysis of Life Cycle Cost including Initial cost, cost of maintenance, and comparison with conventional system, if any	**ECOBUILD™ BUILDING SYSTEM** ECOBUILD™ Building Systems is a reliable solution that offers unique combination of Quality, On Time Project Execution, Safety and Cost Efficiency. ECOBUILD™ Building Systems is specially customised to match various design & load codes, functions, sizes as well as other special requirements, so as to provide the Best Value and help enhance Return On Investment (ROI). All these inherent credentials of ECOBUILD™ BUILDING SYSTEMS enable effortless execution of projects and facilitate our customers to focus on their core business priorities! .
25.	Speed of construction vis-à-vis conventional system.	ECOBUILD™ Building Systems is a reliable solution that offers unique combination of Quality, On Time Project Execution, Safety and Cost Efficiency. ECOBUILD™ Building Systems is specially customised to match various design & load codes, functions, sizes as well as other special requirements, so as to provide the Best Value and help enhance Return On Investment (ROI). All these inherent credentials of ECOBUILD™ BUILDING SYSTEMS enable effortless execution of projects and facilitate our customers to focus on their core business priorities!
26.	Brief on Performance Characteristics & related Standards	1. Structural Stability — OK 2. Durability — OK 3. Behavior in Earthquake — Safe 4. Fire Safety — Safe 5. Rain — Safe 6. Thermal performance — OK 7. Acoustic performance — OK 8. Behavior under high wind/cyclones — Safe 9. Floods — Safe 10. Under high moisture / Humid conditions. — OK 11. Any other, please specify) — No
27.	Is there Standard on technology formulated by Your Company	• Indian Standard IS 801: 1975 Code of Practices for use of cold formed and welded section and light gauge steel structural members in general building construction. • British Standard BS 5950 (Part 5):1998 – Structural

		use of steel in Building Part 5 – Code of Practice for design of cold formed thin gauge structure. • British Standard BS 5950 (Part 1): 2000 Structure use of steel work in Building Part • 1 with loading requirement as per IS 875 (Part 1) • Indian Standard IS 875 : 1987 Code of Practice for design loads • Part 1 - Dead Loads - Unit Weights of Building Material and Stored Materials • Part 2 - Imposed Loads • Part 3 - Wind Loads • IS 1893 (Part 1):2002 Criteria for Earthquake Resistant Design of Structures - Part
28.	Attach Photographs / Diagrams showing Components, Installation /assembly details, Finished Structure	
		
29.	Name & Contact details of Professionals / Architects / Engineers involved with this technology Attach a list, if it is exhaustive Give list of trained Artisans, if any	For Roofing, Wall Cladding and Allied Products Company:Tata BlueScope Steel Limited – Building Products Division Address:The Metropolitan, 4th Floor, Final Plot No.27, Survey No.21,Wakdewadi, Shivajinagar, Pune, 411005, India Telephone:+91 20 66218000, Fax: +91 20 66218001 Email: buildingproducts@tatabluescopesteel.com
30.	Provide additional information you may like to supplement.	Nil