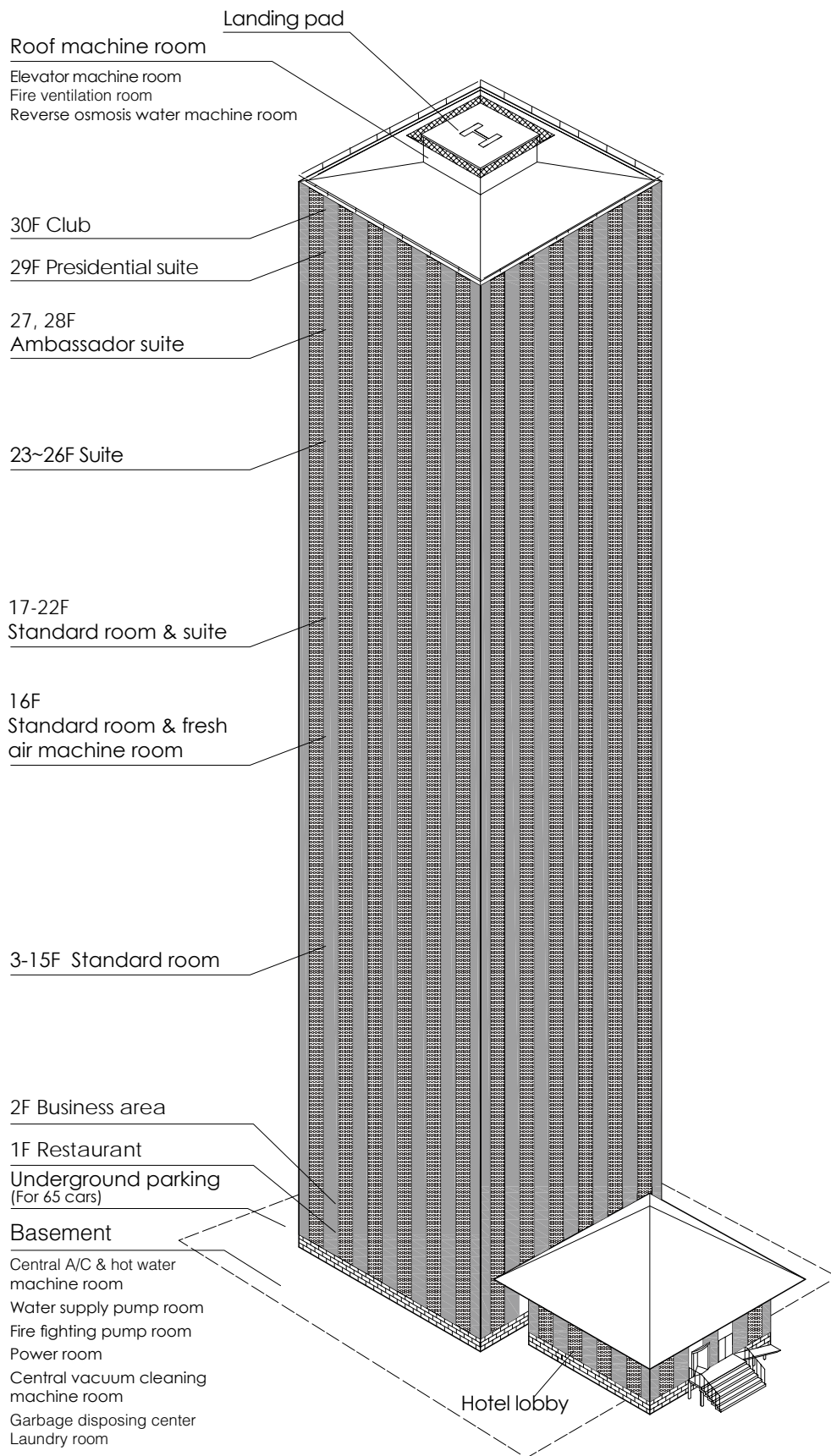


T30A

TOWER HOTEL technical briefing





BSB Technological Features

Sustainability

"BSB" is the abbreviation for BROAD sustainable building (factory-made). Its sustainability is derived from 8 aspects: earthquake resistance, energy conservation, air purification, durability, material saving, recyclable construction materials, construction materials free of formaldehyde, lead, radiation, asbestos and no construction sewage, dust or wastes. BSB has accomplished the extremity of these 8 aspects that today's human technologies can ever imagine.

9 Magnitude Earthquake Resistance

BROAD was a central air conditioning manufacturer who exported its products to over 70 countries. We developed sustainable buildings due to Wenchuan Earthquake in 2008. One year since the earthquake, a team of 300 BROAD R & D engineers has done hundreds of testing, and then invented integrated earthquake-resistance technology of "steel structure + diagonal bracing + light weight". China Academy of Building Research conducted earthquake resistance tests for 7-storey and 30-storey sustainable building simulators scaled at 1:4 & 1:10, and accurately verified that earthquake resistance of BROAD Sustainable Building is 3~12 times higher than that of conventional buildings in the world (Magnitude 6~7, 0.05~0.12g on average; Magnitude 8, 0.22g highest). (See details in [Earthquake Resistance Comparison List](#), test report & video documentary)

5X More Energy Efficiency

BSBs adopt at least 30 different energy-saving technologies. Ordinary people can understand thick thermal insulation of exterior wall & roof, multi-paned windows, external solar shading, heat recovery fresh air, LED lighting, power generation by elevator descending & water-saving toilets.

Most countries in cold areas adopt 10cm thermal insulation & double-paned windows, whereas BSBs adopt 35 cm thermal insulation and 5-paned windows; in warm winter and hot summer areas as well as torrid areas, most countries use only 3 cm thermal insulation or no thermal insulation at all, whereas BSBs adopt 15 cm and 3 or 4-paned windows, which make BSBs like a sleeping bag in winter and a cooler in summer. Another significant energy-saving technology of BSB comes from BROAD-invented heat recovery fresh air system. By exchanging heat between outdoor fresh air and indoor exhaust air, it recovers 70%~90% of energy and ensures extreme freshness of the indoor air of BSBs with little energy loss. If we convert the HVAC energy consumption of buildings around the world into oil, it equals 35~70 L/m²a, whereas BSBs is 7~12 L/m²a, which is 5 times more energy efficient. (See details in [Energy Conservation Comparison List](#), and energy metering for each BSB is available for your check)

RATED PARAMETER SHEET

Items		Main Building	Lobby	Basement
Code		T30A	JT240A	DXS3000A
Floors		30	1	1
Main functions		330 hotel rooms, 700 beds	Hotel lobby	Parking, machine & laundry rooms
Nominal area	m ²	About 16200 (about 540 each floor)	240	/
Building area	m ²	17338 (578 each floor)	264	3039
Overall dimensions	m	L24.04 x W24.04 x H99.9	L16.24 x W16.24 x H13.7	L59 x W51.5 x H4.5
Total building weight	t	9840	190	13000
Building dead load	kg/m ²	320	470	4000
Building live load	kg/m ²	250	250	400
Storey height/clear height	m	3.3/2.75	13.7/11.9	4.5/3.9
Distance between columns	m	7.8	15.6	7.8
Building structure		Steel structure	Steel structure	Reinforced concrete
Earthquake resistance level		9 magnitude (0.6g)	9 magnitude (0.6g)	8 magnitude (0.22g)
Fire protection rating		Per fire protection of public buildings A	Per fire protection of public buildings A	Per fire protection of public buildings A
Energy consumption of A/C and ventilation	m ² a	70 kWh	150 kWh	40 kWh
Indoor temperature		Winter 20~24 °C; summer 24~27 °C	Winter 20~24 °C; summer 24~27 °C	No air conditioning, ventilation only
Fresh air exchange frequency		5 times/h	2 times/h	6 times/h
Indoor air cleanliness		20 times purer than outdoor	10 times purer than outdoor	No air purification

20X Purer Air

Air purification is the most crucial technology to each household. For it is closely related to people's life expectancy and various kinds of human diseases. WHO certifies that 68% of human diseases are related to indoor air pollution. However, the value of air purification can be ignored most easily, because air pollution is invisible to naked eyes. We install air quality detectors in each room, residents can check the indoor PM (PM0.3, PM2.5 and PM10), formaldehyde and CO₂ level at any time and can at the same time compare with the outdoor PM. In common people's opinion, this detector seems to be so expensive that a public debate needs to be held on whether a country should invest a few sets of PM2.5 monitoring devices for each city. But BROAD installs a detector in every room. It's definitely a technological revolution for the miniaturization and cost-lowering R & D process, which is like putting a building-like computer some decades ago into a small cellular phone today.

Another challenge is how to actualize "super filtration ". At present, for the whole world, only IT chip assembly lines and surgical operating rooms are using "super filtration" equipment that is even more costly than the building itself. Nevertheless, BROAD invented a low-cost "super filtration" technology and integrated it into the heat recovery fresh air machine. It is a combined system with 3-stage filters. The first stage adopts the traditional coarse filter, collecting big particles; the second stage utilizes BROAD-invented "electrostatic cleaner", following the principle of "positive attracts negative" to filtrate 98% of PM0.3, PM2.5 & PM10, and then the remaining PM is filtrated by expensive "HEPA filters". The final air filtration efficiency can be as high as 99.8%. When the fresh air is completely purified, PM can only be brought in by people from outside. Therefore, indoor air is at least 20 times purer than outdoor air (See details in Air Quality Comparison List, and air quality monitoring for each room of BSB is available for your check).

Factory Made

BSB is the most profound innovation in human history. It has broken all the preconceived concepts of people in all aspects from revolution scope to innovation profundity, integration intensity of resources to classification density of information, architectural industry mode to real estate consumption mode.

The most revolutionary element about BSB is its construction mode: a 3.9×15.6m "main board" including flooring and ceiling, embedded shafts of ventilation, water supply & drainage, electricity and lighting. All needed pillars, diagonal bracings, doors, windows, walls and even sanitary & kitchen wares for the room installation are placed on main board for factory shipment. One truck can carry 120m² main boards and then deliver them to the construction site to be hoisted in installation place. What all workers need to do is just screwing bolts, painting.....Such a high-efficiency construction mode makes on-site installation only account for 7% of the total construction hours. Therefore, BSB can be 93% factory-made, whereas the current world's highest is only 40%.

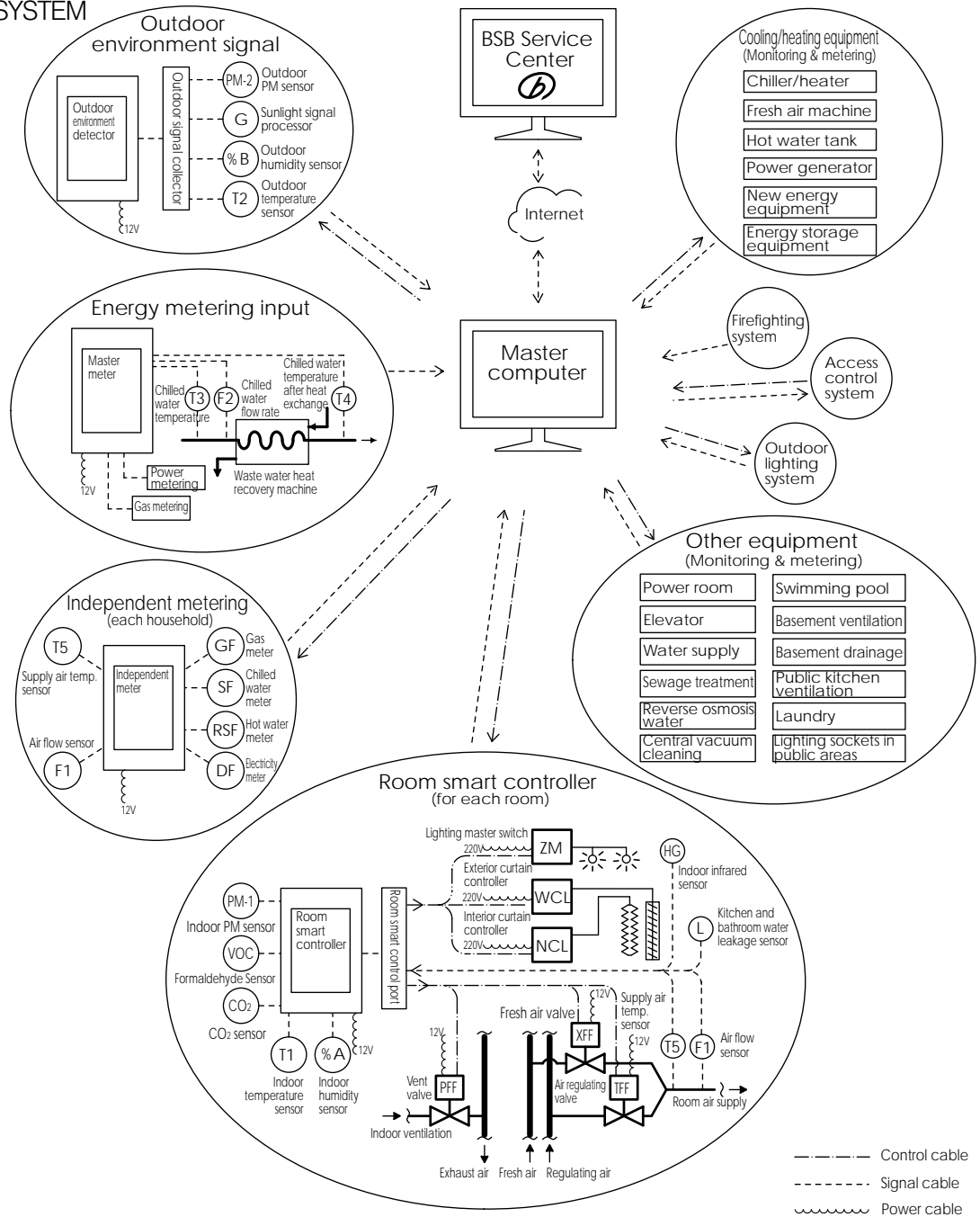
Amazing

When hundreds of millions of people were amazed at the video of "30-storey built in 360 hours" in the second week of 2012, most of them were still not aware of the more amazing figures hidden behind the building in the video:

- 9 magnitude earthquake resistance, compared with conventional buildings, the steel consumption is 10~20% less and concrete consumption is 80~90% less.
- 5 times energy efficiency, 20 times purer air, 10%~30% lower in cost than that of conventional ones.
- Low cost, while the building automation level is even higher than that of the most advanced smart buildings in the world.
- Amazing construction speed, while zero injury during construction process.
- Perfect construction quality, while no fire, no water & no dust (no welding, no concrete, and no polish with emery cloth), construction waste is less than 1% of that of conventional buildings.
- We built the 30-storey hotel in 360 hours just to avoid the rainy season. However, building a starred hotel with 700 beds from ground breaking to opening in 48 days is definitely a miracle!

BSB is rewriting human history.

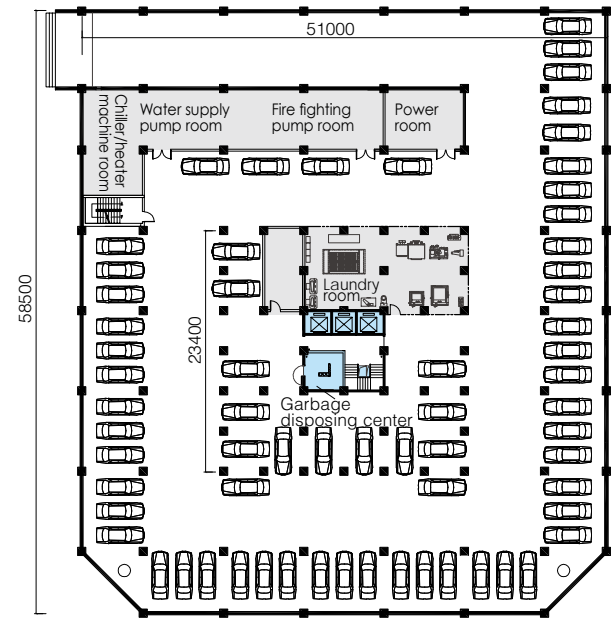
BUILDING AUTOMATION SYSTEM



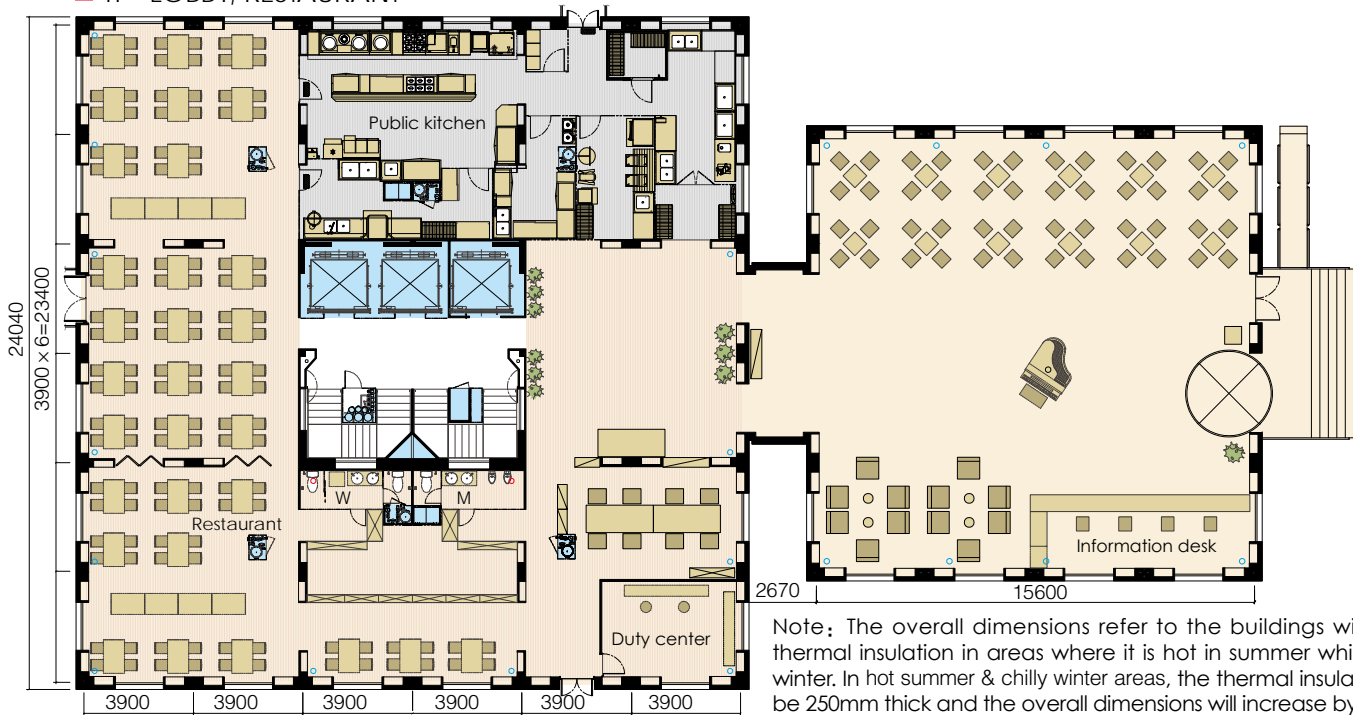
PUBLIC AREAS LIST

No.	Name	Floors	Quantity	Area m ²
1	Elevator room	1~30	30	363
2	Stair case	-1~31	32	710
3	Gallery	2~28	54	1144
4	Lobby and restaurant	1	7	600
5	Conference & office area	2	8	420
6	Club	30	7	480
7	Public restroom	1,2,30	6	32
8	Public kitchen	1	1	120
9	Laundry room	-1	1	120
10	Machine room	-1,16	6	380
11	Underground parking	-1	For 65 cars	2380
12	Total			6749

■ UNDERGROUND PARKING & MACHINE ROOMS

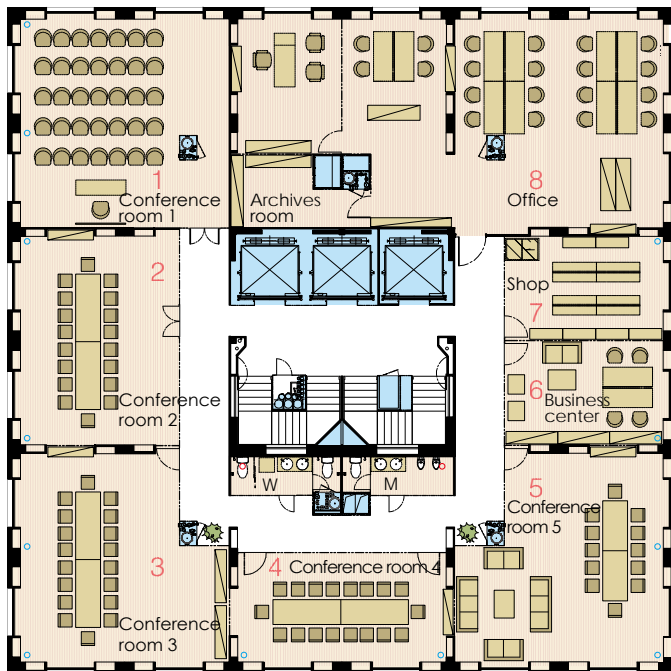


1F LOBBY, RESTAURANT

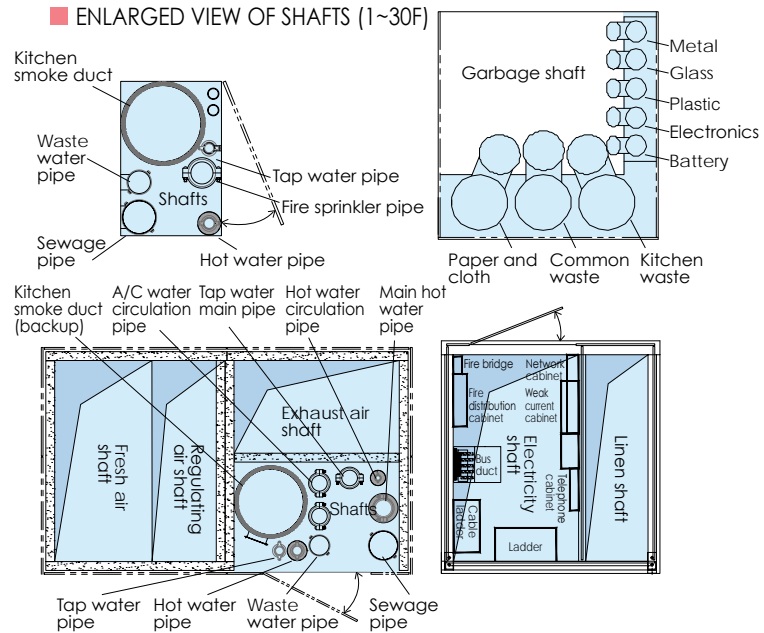


Note: The overall dimensions refer to the buildings with 150mm thermal insulation in areas where it is hot in summer while warm in winter. In hot summer & chilly winter areas, the thermal insulation should be 250mm thick and the overall dimensions will increase by 0.2m.

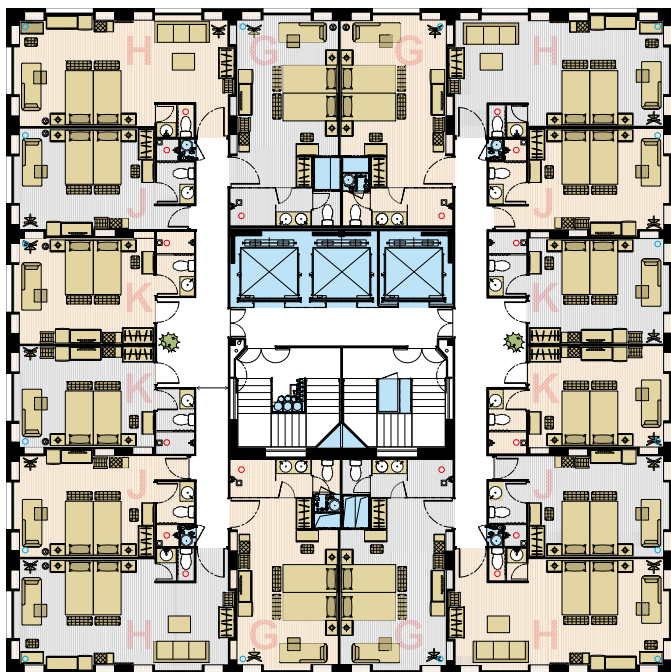
2F BUSINESS AREA



ENLARGED VIEW OF SHAFTS (1~30F)



3~15F STANDARD ROOM



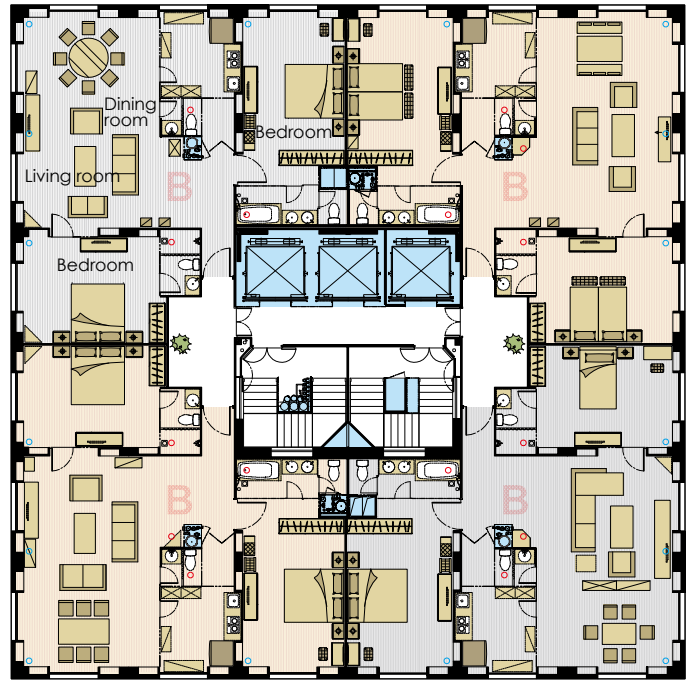
16F STANDARD ROOM, FRESH AIR MACHINE ROOM



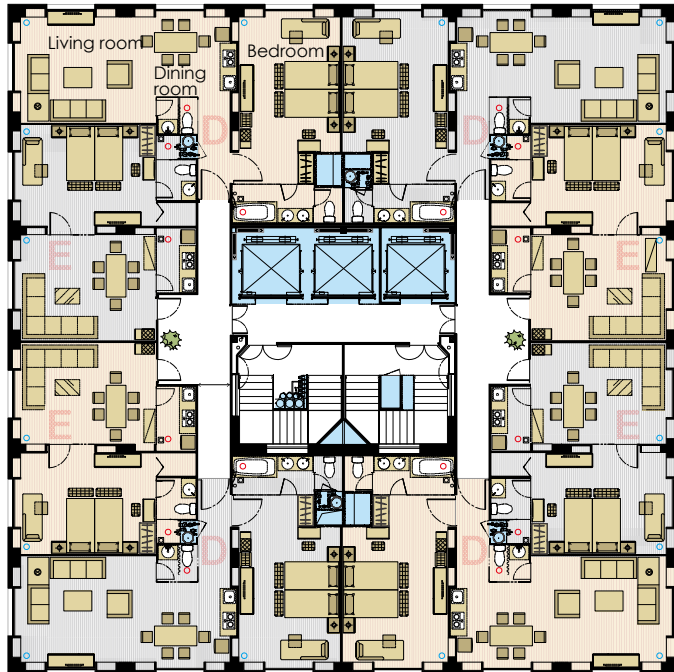
■ 17~22F STANDARD ROOM, MEDIUM SUITE



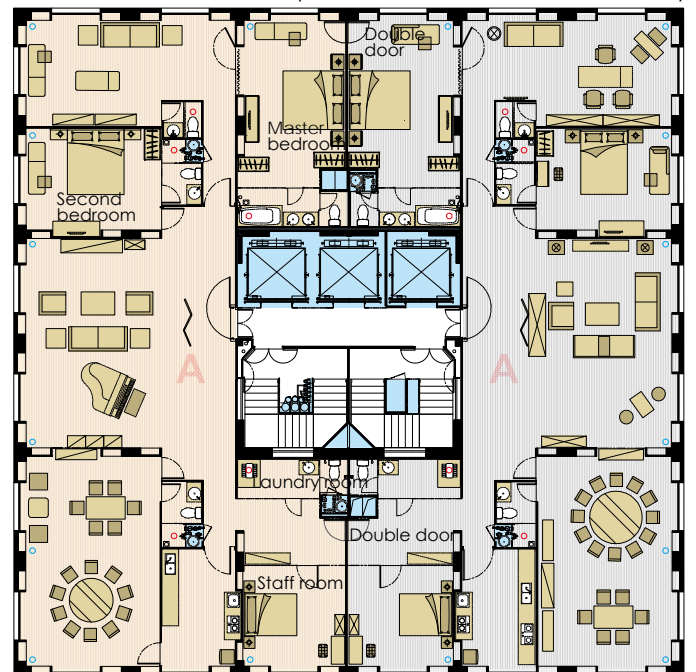
■ 27, 28F AMBASSADOR SUITE



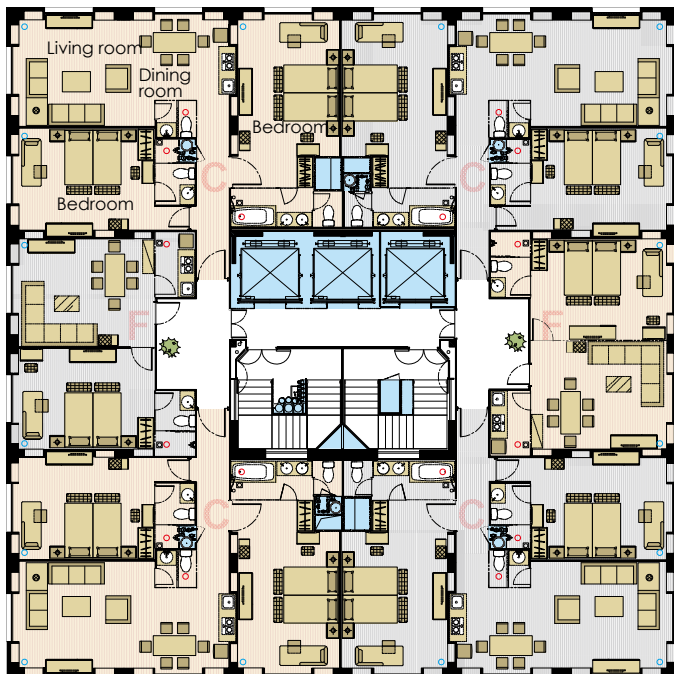
■ 23, 24F SMALL SUITE, MEDIUM SUITE



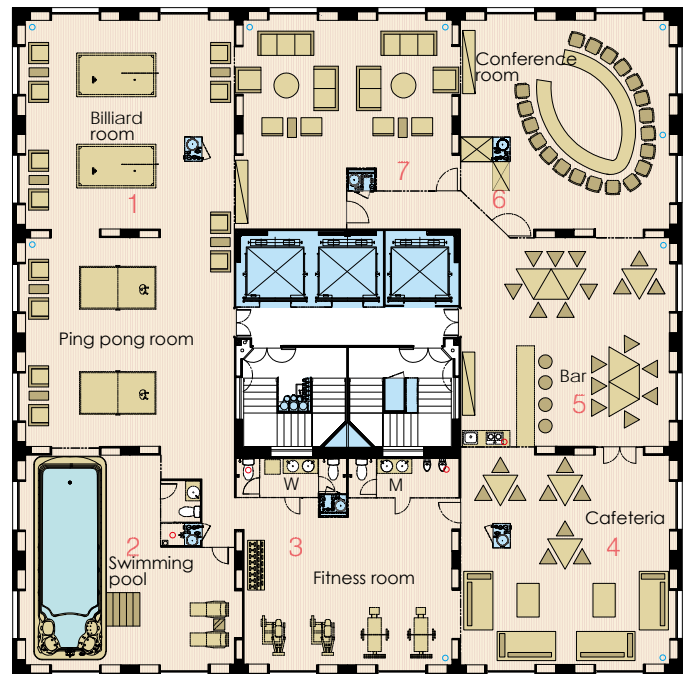
■ 29F PRESIDENTIAL SUITE (Remove double, 2 suites become one)



■ 25, 26F SMALL SUITE, LARGE SUITE



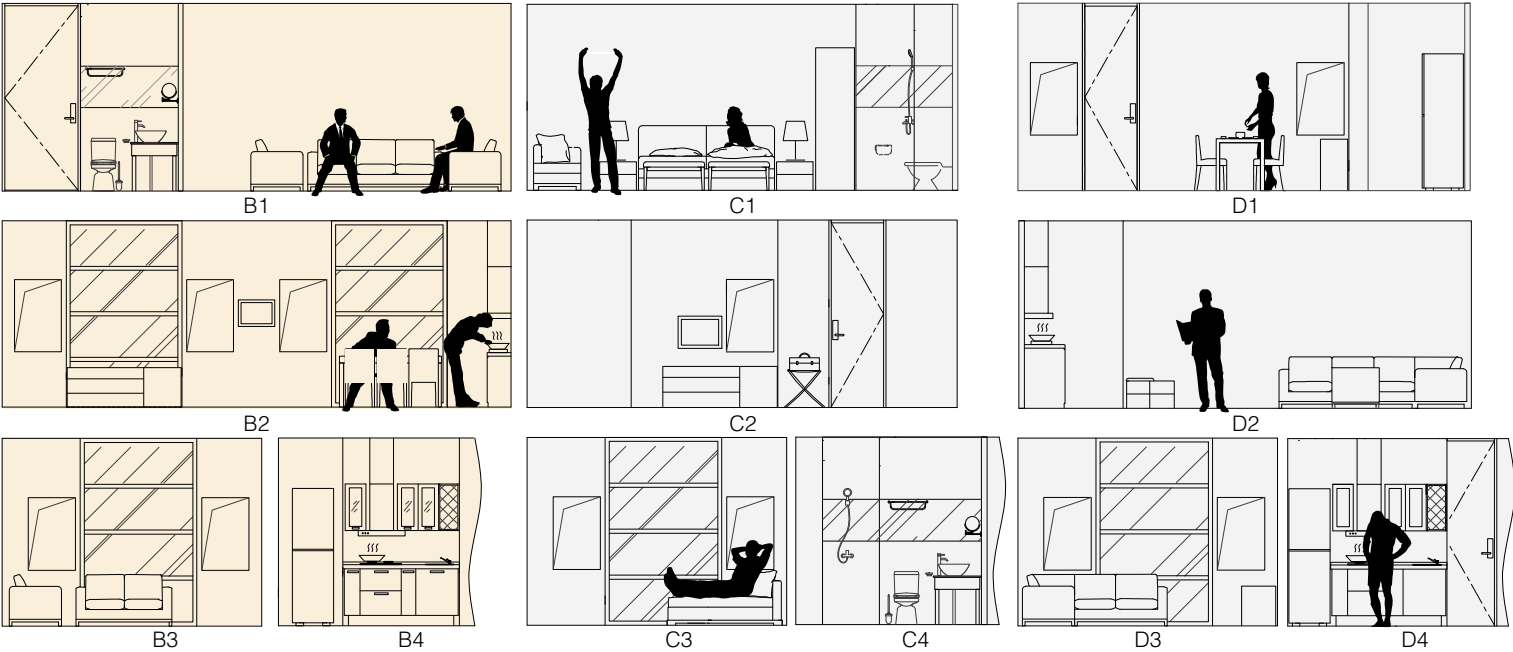
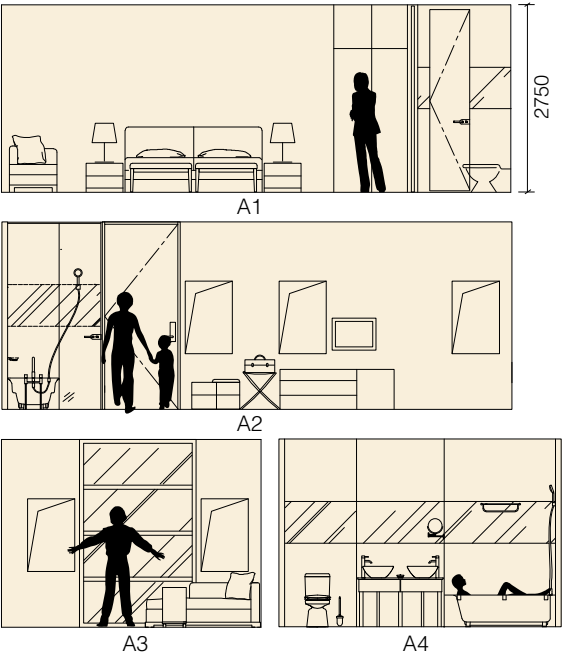
■ 30F CLUB



GUEST ROOMS LIST

Type	Code	Name	Floors	Quantity	Room area (m ²)	Kitchen & bathroom area (m ²)	Subtotal room area (m ²)	Subtotal kitchen & bathroom area (m ²)	Sanitary ware	Kitchen ware	Furniture	Electric appliance
Standard room	K,J	Standard room with medium bathroom	3~22	160	19.5	3.4	3120	544	3 large pcs 6 small pcs	/	15-pc set	5 pcs
	H	Standard room with small bathroom	3~16	56	28.3	1.7	1584.8	95.2	3 large pcs 5 small pcs	/	17-pc set	5 pcs
	G	Standard room with large bathroom	3~15	52	24.6	5.4	1279.2	280.8	4 large pcs 7 small pcs	/	15-pc set	5 pcs
Suite	F,E	Small suite	23~26	12	39	6.8	468	81.6	3 large pcs 6 small pcs	Small cabinet & appliances	22-pc set	8 pcs
	D	Medium suite	17~24	32	52.9	8	1692.8	227.2	8 large pcs 12 small pcs	Small cabinet & appliances	24-pc set	8 pcs
	C	Large suite	25~26	8	72.4	10.5	579.2	84	11 large pcs 18 small pcs	Small cabinet & appliances	37-pc set	12 pcs
Deluxe suite	B	Ambassador suite	27~28	8	95.2	19.2	761.6	153.6	11 large pcs 28 small pcs	Small cabinet, cupboard & appliances	31-pc set	12 pcs
	A	Presidential suite	29	2	182.6	58.8	365.2	117.6	16 large pcs 29 small pcs	Large cabinet, cupboard & appliances	66-pc set	13 pcs
Total				330	/	/	9851	1598	1356 large pcs	62 kitchens	5811 pcs	1886 pcs

DETAILED DRAWING OF ROOMS



ENERGY CONSERVATION COMPARISON LIST


No.	Category	Items	BSB	Traditional buildings (including 5-star hotel)
1	Key index	A/C and ventilation energy consumption (per primary energy)	70kWh / m ² a (equivalent to 7 kg oil)	350kWh / m ² a (equivalent to 35 kg oil)
2		Average heat-transfer coefficient of building envelop	0.3W / m ² K	2W / m ² K
3		Power distribution for lighting (on average)	2W / m ²	6W / m ²
4		Toilet water consumption (each time)	3 liters	12 liters
5	Thermal insulation	Materials of external wall thermal insulation	Rock wool 150mm 0.23W/m ² K (inside glass curtain wall)	Little or no thermal insulation
6		Window, glass layers	4 layers	1 or 2 layers
7		External solar shading	Automatic shutters (in glass curtain wall)	Internal solar shading
8		Internal window thermal insulation	Automatic curtain	No
9	Ventilation	Ventilation equipment	Heat recovery fresh air machine	No heat recovery
10		Ventilation power consumption	0.6~0.9W / m ³	1.2~1.8W / m ³
11		Fresh air heat recovery efficiency	70~90%	No
12		Fresh air by pass	Air does not go through heat exchanger during transitional seasons	No
13		Air supply method	Underfloor air supply	Ceiling air supply
14		Fresh air flow route	7~15m	3~5m
15	Equipment	Chiller/heater	Non-electric air conditioning Total COP 112%	Electric air conditioning Total COP 52%
16		Power consumption of A/C water distribution system (electricity/cooling)	3%	10%
17		Room temp. regulating methods	Central fan coils (2 sets for entire building), Mix of fresh air & exhaust air can be adjusted automatically in each room	One set of fan coils for each room
18		Indoor humidity regulating methods	High pressure water mist	Steam
19		Elevator	Generate power when ascend empty-loaded or descend fully loaded	No power generation
20		Kitchen ventilation	Inverter controlled	Fixed
21		Laundry drier	Waste heat from Chiller/heater & power generation	Steam or electricity
22		Drinking water	Produced by hotel itself (reverse osmosis water)	Outsourced bottled water
23	Smart control	Fresh air & air conditioning	Automatically turned off 2 hours after people's departure	No
24		Fan frequency regulating	Inverter controlled	Fixed
25		External solar shading	Automatically start when temp. ≥23°C	No
26		Internal thermal insulation curtain	Automatically closed when temp. ≥33°C or ≤14°C (no people inside)	No
27		Lighting in rooms	Automatically turned off half an hour after people's departure	No
28		Lighting in public areas	Automatically turned off when people leave	No
29		Energy metering	Independent metering, total metering	Total metering
30	Others	Lighting source	All LED lighting (100 lumen / W)	Incandescent or fluorescent lighting (10~70 lumen/W)
31		Garbage classification, recycle	8 garbage shafts for each floor	No
32		Recover heat from bathing waste water	Heat up tap water in winter	No
33		Utilize toilet sewage water	Produce biogas	No
34		Thickness of A/C water & hot water pipe thermal insulation	80mm	20 mm
35	Total energy consumption a year (per primary energy)		2.2 million kWh	11 million kWh

Notes: 1. Energy consumption, thermal insulation & window layers are per the standard of "Hot summer & warm winter areas". See the comparison list in the following page for other climate areas.

2. Calculation basis: Converted primary energy/electricity: 4kWh/kWh, converted oil/electricity: 0.25L/kWh, annual lighting hours: 2000, hotel occupancy rate: 80%.

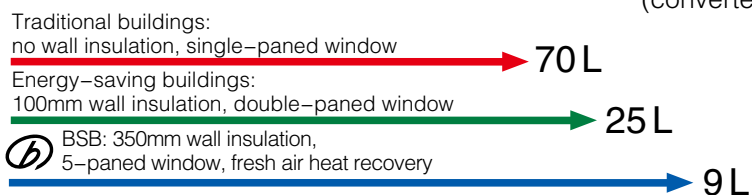
3. Compared with traditional buildings(including 5-star hotels), this hotel saves 8.8 million kWh a year in terms of the total energy consumption of air conditioning, ventilation, lighting, elevators, water pumps, etc. If we convert it into oil per primary energy (10kWh/L), it equals 880,000 liters or 730 tons of oil saving and 2000 tons of CO₂ cutting each year, which is equivalent to 110,000 tree planting.

AIR QUALITY COMPARISON LIST

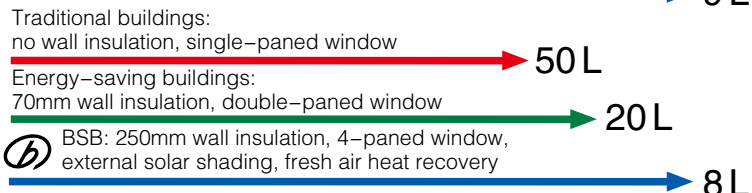
No.	Category	Items		 BSB	Traditional buildings (including 5-star hotel)
1	Technical mode	Ventilation mode		100% fresh air	30% fresh air, 70% exhaust air
2		Fresh air filtration mode		Coarse filter+ electrostatic cleaner+ HEPA filter	Coarse filter
3		Air conditioning mode		Central fresh air+ central A/C coils	Central fresh air+ terminal fan coils
4		Indoor temp. regulating mode		Regulated by proportion between fresh air and exhaust air in machine room	Regulated by terminal fan coils (on/off)
5	PM pollution	Fresh air filtration efficiency	PM0.3	99.8%	0
6		(PM means particles, figures are in microns)	PM2.5	100%	0
7			PM10	100%	< 50%
8			Indoor PM concentration		20~100 times lower than outdoor
9		Cleaning interval of indoor tabletops		10~30 days	Every day
10	Chemical pollution	Fresh air exchange frequency		5 times/h (per air flow cross section)	0.5~1 time/h (per volume)
11		Indoor CO ₂ concentration		< 800 ppm	< 1800 ppm
12		Indoor VOC (formaldehyde,etc.)		< 0.01 ppm	< 0.1 ppm
13		Indoor fresh air inlet location		Underfloor air supply, ceiling air exhaust	Ceiling air supply & air exhaust
14		VOC , lead & radiation from construction materials		E1 (top-grade in Europe)	Uncertain
15	Bacteria pollution	Air cross contamination inside buildings		Zero pollution (no exhaust air)	Polluted (70% exhaust air)
16		A/C coils		Sterile	Infected
17		Air supply duct		Sterile	Infected
18		Bacteria pollution of condensate pipe		Only the machine room (2 rooms)	All rooms
19		Sterilization of fresh air		High voltage static electricity	No
20	Detection and control	Dust (PM)		Each room (every 8 hours)	No
21		CO ₂		Each room (every 1 hour)	No
22		VOC (formaldehyde, etc.)		Each room (every 1 hour)	No
23		Fresh air flow		Each room (every 1 hour)	No
24		Fresh air flow regulating		Automatic	No
25	Overall assessment of indoor air quality			20~100 times purer than outdoor	Dirtier than outdoor (WHO certifies it is 5 times worse than outdoor)

ENERGY SAVING MEASURES COMPARISON IN DIFFERENT AREAS Energy consumption/m²a (converted into oil L)

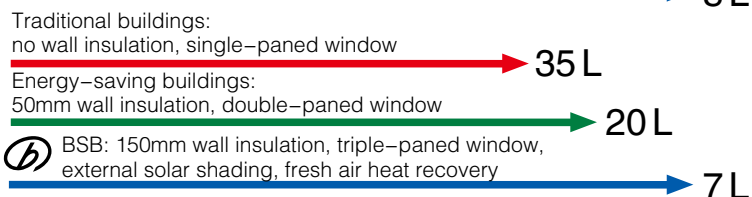
Chilly areas like Moscow & Harbin



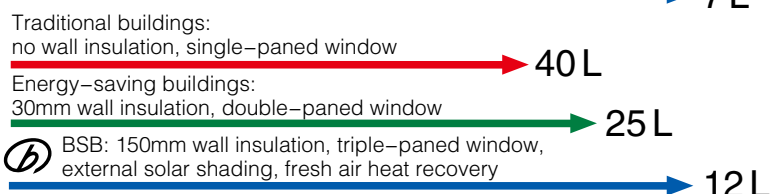
Hot summer and chilly winter areas like New York, Tokyo & Beijing



Hot summer and warm winter areas like Athens, Shanghai & Changsha



Hot areas like Dubai, Bombay & Hongkong



COMFORT COMPARISON LIST

No.	Items	BSB	Traditional buildings (including 5-star hotel)
1	Clear height	2.75m	About 2.4~2.6m
2	Distance between pillars (span)	7.8m	About 3~5m
3	Cold (heat) radiation of exterior wall & windows	No (feel comfortable with temp. at 22 °C in winter and 26 °C in summer)	Yes (only feel comfortable with temp. at 26 °C in winter and 22 °C in summer)
4	Indoor odor	No	Yes
5	A/C noise	No	Yes
6	Toilet ventilation noise	No	Yes
7	Window transparency	Transparent (clear glass)	Opaque (coated glass)
8	Adjustment of sunlight from windows	Automatic(remote control & wiring control)	Manual
9	Lighting adjustment	Luminance Level 2 or 3/ lighting	Luminance Level 1 / lighting

BUILDING LIFE DESIGN COMPARISON LIST


No.	Items	BSB	Traditional buildings (including 5-star hotel)
1	Life design of building structure	600 years (do inspection & maintenance every 60 years)	60 years
2	Inspection feasibility of load-bearing structure	Can be 100% inspected (remove the interior wall plate)	Inconvenient for check
3	Anticorrosion of steel structure	Cold galvanized	Anticorrosion painting
4	Thermal bridge of exterior wall & window	<0.01% (per area)	Large area (cause condensate corrosion)
5	Interior wall board	Fiber cement plate (over 60 years life span)	Gypsum board (less than 20 years life span)
6	Glass curtain wall frame	Stainless steel	Aluminium alloy
7	Water supply pipe(city water, hot water, A/C water)	Copper	Steel

CONSTRUCTION MODE COMPARISON LIST

No.	Items	BSB	Traditional buildings (including 5-star hotel)
1	Construction waste	25t	About 3000t
2	Construction dust	No	Yes
3	Construction ignition work (welding & gas cutting)	No	Yes
4	Construction water consumption	No	About 5000t
5	Wall & Ceiling decoration	No plaster	Plaster
6	Steel consumption	68 kg/m ²	Reinforced concrete: about 75kg/m ² Steel structure: about 140kg/m ²
7	Concrete consumption	100 kg/m ²	About 1000 kg/m ²
8	Construction site material delivery	150 vehicles	About 1000 vehicles
9	Construction scaffold	No	Yes
10	Topsealing & Elevation	15 days	About 1 year
11	Interior decoration	1 month	About 1 year

Note: The foundation is not included. Designed by construction design institute per BSB parameters & local geological features, BSB foundation is similar to that of conventional buildings, only that it can be reduced due to lighter building weight.

EARTHQUAKE RESISTANCE COMPARISON LIST

No.	Items	 BSB	Traditional buildings (including 5-star hotel)
1	Earthquake resistance level	9 magnitude (0.6g)	Per local standard (generally 7 magnitude, 0.1g)
2	Earthquake resistance test	Equivalent model simulation test scaled at 1:10	No
3	Building weight (foundation excluded)	350kg / m ²	Generally 1200kg~1500kg / m ²
4	Building structure	Unique diagonal bracing steel structure	Reinforced concrete structure
5	Special structure of earthquake resistance	Diagonal bracing	No
6	Quality & safety assurance of structures	Factory-made, quality controllable	On-site construction, poor quality control

中国建筑科学研究院

Earthquake Resistance Test Conclusion of 30-storey BROAD Sustainable Building

30-storey BROAD Sustainable Building (BSB) is a new structural system designed and developed by BROAD Sustainable Building Co., Ltd, which is made of steel and diagonal bracing structures. Entrusted by BROAD, China Academy of Building Research conducted scaled simulation earthquake resistance test on this structure. The simulator is designed by our academy at a scale of 1/10, and produced and set up by BROAD.

The test was carried out on May 6, 2011 at the State Key Laboratory of Building Safety and Environment of China Academy of Building Research (CABR) according to Specifications for Seismic Test Methods (JGJ101-1996).

30-storey BSB experienced 42 times of simulated earthquakes with different amplitudes in total, using 3 earthquake waves (natural and artificial waves). Tests showed that under the common earthquake intensities of 7 magnitude, 8 magnitude & 9 magnitude, no obvious damage occurred to the main structure. After the rarely-occurred earthquake of 9 magnitude (0.6g), the overall structure did not collapse.

Details and suggestions can be referred to the test report.

China Academy of Building Research

May 6, 2011



Shandong YuandaTechnology Co., Ltd.

Was located in Rushan City, Shandong Jiaozhou peninsula. the company has a total of 666 Million square meters of high-quality industrial and commercial land development rights According to company development plan in the first stage, we are not only occupies 1,332,000 square meters, the planning product capacity is an annual thirty million square meters (approximately \$ 12 billion annual output value) of YUANDA buliding, but also the remaining approximately 5,328,000 square meters of land will be used for the construction of ancillary products in our Industrial park, which will satisfy the market demands from North China and East China ,also overseas market demand .

Totally product capacity is output of 150 million square meters of YUANDA's building products, annual output value forcaste exceeds 50 billion dollars.

Broad expectations, in the near future, every three new building is Sustainable Building all over the world, Let the whole person share the care from Broad. confirmed to all mankind, the environment and earth Human life can be synchronous improve as long as the responsible use of technology.



SHANDONG BROAD SUSTAINABLE BUILDING

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