

1/4 HOUSE

Project for “Houses for change” competition

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The proposed project of a two-storey individual residential building has a shape of $\frac{1}{4}$ dome. It has a built-up area of 51.7 m², a total area of 50.7 m², a living area of 23,1 m². Height of the 1st floor is 3000 mm, Height of the 2nd floor is 3000mm. The house is designed for a permanent living of a family of three. Because of its shape, it can be put on a separate site. Such houses can be combined in few ways: 2 houses or several in a row. It gives an advantage in space planning of streets or villages consisted of them.

Wood was chosen for a framework structure, because coniferous and deciduous forests are widely grown in this region (Primorsky Kray, Russian Federation). Consequently, price of the house was lowered as compared to the metal and concrete. Besides, housing made of wood is more humanistic and eco-friendly.

This project proposes to house social class for three indwellers. To achieve efficiency was taken dome shape as the most cost-saving for material resources. The house has two vertical walls and a roof-wall. Vestibule and a porch are situated outside of the bulk of the house (also to reduce costs). It is evident from the construction cost estimates 1 343 690 rub (\approx 41091 USD). With a minimum wage of a young specialist in 25000 rubles per month, young family (average age 25 years old) with comprehensive income 50 000 rub, it's possible to repay the loan for the house 12000-17000 rubles per month. It is equal to a rented two-room apartment of 45 m² and a period of 7-10 years to fully pay for the house.

Functional-spatial solution

There are porch-terrace, vestibule, hallway, and dining room with kitchenette on the 1st floor. Besides the 1st floor is provided with a toilet, a pantry and an utility room.

There are two bedrooms on the 2nd floor connected with staircase hall.

Entrance area of the house is solved with an open porch-terrace (1700 x 2000 mm). The project has a vestibule gateway (1200x1880 mm), solved as attached volume, designed for the harsh conditions of Siberia and Far East. Hallway (2010x1930 mm) is solved as a niche of the 1st floor main room. These dimensions of the hallway are needed for free processes of dressing of a family of three. There is a door to the pantry (970x1990 mm) in the hallway. Finished pantry can store seasonal sports equipment and street cleaning equipment. Also there is a bathroom (1940x1940 mm), which includes a toilet, a sink and a deep 1500 mm long bath tub. Besides,

you can get to a small utility room from bathroom. It can be used for storing the equipment and life support systems of the house (heating, hot and cold water, air cleaning). From the entrance hall you can go to the largest room of the 1st floor – dining-living room (7.3 m²). Sunlight penetrates into the dining room through the 4 windows, arranged in a spherical wall. The dining area has a complex shape due to the kitchenette (4.5 m²), to accommodate the equipment and furniture. There is an area for family dinners and breakfasts, recreation and watching TV, as well as a transit zone, which includes a wooden staircase (1000 meters width). Staircase leads upstairs. It is lit by sunlight through the window.

The second floor provides a the staircase hall (5,4 m²), which leads to bedrooms. The 1st bedroom includes a double bed (2000x1750mm), bedside tables and a wardrobe. It's lit by one window. The 2nd bedroom's shape (7,2 m²) is almost identical to the dining room's. It's lit by sunlight through 2 windows arranged in a spherical wall. That room is divided into a working area and a sleeping alcove niche.

The house has a small space above the ceiling panel of the 2nd floor. It can be used as a technical floor.

Constructive solution

The house is designed in wooden structures of framework-panel structural system. Hardness of the framework is provided by two frame wall panels (installed at 90° angle). There is an arranged power column, on which spherical semi-arches lie.

Semi-arches are designed as prefabricated wooden elements of wooden section (100x140mm). They are connected by horizontal elements. Semi-arches and wall panels stand on the lower horizontal piping, which holds solid ceiling slab of the 1st floor. Decking of the 2nd floor lies on glulam beams of I-section. These beams are supported by the frame of the semi-arches wall panels and the intermediate column placed inside the walls perimeter. Collaborative work of beams and flooring creates horizontal diaphragming of framework. Collaborative work of rack panels and semi-arches provides vertical diaphragming.

Foundation of the house is arranged on screw piles. SVL-108/2500 screw piles are offered for use. For buildings such as projected one, this type and size of screw piles is applied the most. Stilt is a tube with diameter of 108 mm, wall thickness of 4 mm and length of 2500 mm. After screwing, concrete class B15 is pumped in the pipe to increase its durability.

At the upper end of the pile is welded with metal sheet 180x200 mm for supporting and securing the first timber of the bottom rail and the supporting frame with plinth . Plinth panel lower edge is not brought down to ground by 50-70 mm for ventilation of the underground space. The house is designed for the harsh conditions of Siberia and the Far East. Temperature fluctuations are from 35 to -40°C during the year. All exterior walls, 1st and 2nd floor plates have a layer of insulation (150 mm) of basalt fiber, produced in Khabarovsk.

Estimate

№	Types of works	Price of works, rubles	Price of materials, rubles	Notes
1	Foundation works	30 000	30 000	5 000 truncation of fertile layer
2	Erection of framework and walls	52 500	56 000	Including insulation, wind protection, vapor barrier, interior and exterior trim
3	Erection of the floor (1 st floor)	50 000	47 500	Including waterproofing, insulation, rooms' preparation for a clean floor, clean floor
4	Erection of the floor (2 nd floor)	28 000	35 000	Including soundproofing, cladding, preparation of a clean floor, actually clean floor
5	Erection of the ceiling (2 nd floor)	38 000	50 000	Including erection of waterproofing, insulation, vapor barrier and the inner cladding
6	Roofing	37 000	370 000	Soft roofing material on a bitumen basis for a spherical roof
7	Erection of partitions	31 200	38 400	Including soundproofing, bilateral cladding.
8	Erection of windows	20 000	120 000	Windows with double glazing
9	Erection of doors	20 000	90 000	Vestibule iron doors with insulation
	In total (box of the building)		1 143 690	
8	Erection of internal networks	50 000	150 000	Including heating, water, electricity, ventilation.
	Total estimated		1 343 690	

Technical and economic data

Built-up area 51.7 m²

Total area 50.7 m²

Living area 23,1 m²