World Housing Encyclopedia Report

Country: Russian Federation

Housing Type: Wood panel wall buildings (typical seria 181-115-77 cm of "Giprolesprom")

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1 General Information

1.1 Country
Russian Federation

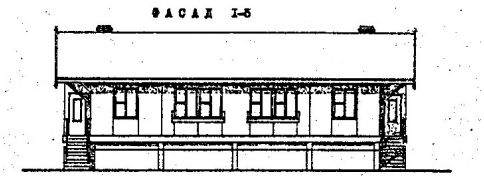

FIGURE 1: Typical Building

1.3 Housing Type
Wood panel wall buildings (typical seria 181-115-77 cm of "Giprolesprom")

1.4 Summary
This is a rural housing construction practice widespread in the Russian forest areas. Buildings of this type are common in seismically prone areas of Russia (Far East, Siberia, Baikal Lake Region). The load-bearing structure is made of wood panel walls. Buildings have timber roof and fieldstone or concrete strip foundations. Typical seria 181-115-77 cm of "Giprolesprom" for seismic regions is an example of this building type. Seismic resistance is relatively high, provided the quality of materials and the construction are satisfactory.

1.5 Typical Period of Practice for Buildings of This Construction Type

How long has this construction been practiced	
< 25 years	
< 50 years	
< 75 years	X
< 100 years	
< 200 years	
> 200 years	

Is this construction still being practiced?	Yes	No
	X	

Additional Comments: The Soviet Union construction practice followed in the past 50 years.

1.6 Region(s) Where Used
This construction accounts for 5 to 100% of the housing stock in several seismically prone areas of Russia (including Far East, Siberia, Baikal Lake Region).

1.7 Urban vs. Rural Construction

Where is this construction commonly found?	
In urban areas	
In rural areas	X
In suburban areas	
Both in rural and urban areas	

2 Architectural Features

2.1 Openings

Windows: 10-15%;
Doors: 5-8%.

2.2 Siting

	Yes	No
Is this type of construction typically found on flat terrain?	X	
Is this type of construction typically found on sloped terrain? (hilly areas)		X
Is it typical for buildings of this type to have common walls with adjacent buildings?		X

The typical separation distance between buildings is 10 meters

2.3 Building Configuration

All buildings of this type are rectangular in plan.

2.4 Building Function

What is the main function for buildings of this type?	
Single family house	
Multiple housing units	X
Mixed use (commercial ground floor, residential above)	
Other (explain below)	

2.5 Means of Escape

Each housing unit has its own entrance.

2.6 Modification of Buildings

Modifications in buildings of this type are not common.

3 Socio-Economic Issues

3.1 Patterns of Occupancy

One family per unit (apartment).

3.2 Number of Housing Units in a Building

2 units in each building.

3.3 Average Number of Inhabitants in a Building

How many inhabitants reside in a typical building of this construction type?	During the day / business hours	During the evening / night
< 5	X	
5 to 10		X
10-20		
> 20		
Other		

3.4 Number of Bathrooms or Latrines per Housing Unit

Number of Bathrooms: 1
Number of Latrines: 0

Additional Comments: Usually one bathroom per one family (unit), i.e.2 bathrooms per building.

3.5 Economic Level of Inhabitants

Economic Status		House Price/Annual Income (Ratio)
Very poor	X	/
Poor	X	/
Middle Class		/
Rich		/

3.6 Typical Sources of Financing

What is the typical source of financing for buildings of this type?	
Owner Financed	
Personal Savings	
Informal Network: friends and relatives	
Small lending institutions/microfinance institutions	
Commercial banks / mortages	
Investment pools	
Combination (explain)	
Government-owned housing	X
Other	

3.7 Ownership

Type of Ownership/Occupancy	
Rent	
Own outright	X
Own with Debt (mortgage or other)	
Units owned individually (condominium)	
Owned by group or pool	
Long-term lease	X
Other	

Additional Comments: Own outright (applies to a housing unit), Long-term lease (typical)

4 Structural Features

4.1 Lateral Load-Resisting System

Wood panel walls.

4.2 Gravity Load-Bearing Structure

Same as lateral load-resisting system.

4.3 Type of Structural System

Material	Type of Load-Bearing Structure	#	Subtypes	
Masonry	Stone masonry walls	1	Rubble stone (field stone) in mud/lime mortar or without mortar (usually with timber roof)	
		2	Massive stone masonry (in lime or cement mortar)	
	Earthen walls	3	Mud walls	
		4	Mud walls with horizontal wood elements	
		5	Adobe block or brick walls	
		6	Rammed earth/Pise construction	
	Unreinforced brick masonry walls	7	Unreinforced brick masonry in mud or lime mortar	
		8	Unreinforced brick masonry in mud or lime mortar with vertical posts	
		9	Unreinforced brick masonry in cement or lime mortar (various floor/roof systems)	
	Confined masonry	10	Confined brick/block masonry with concrete posts/tie columns and beams	
	Concrete block masonry walls	11	Unreinforced in lime or cement mortar (various floor/roof systems)	
		12	Reinforced in cement mortar (various floor/roof systems)	
		13	Large concrete block walls with concrete floors and roofs	
Concrete	Moment resisting frame	14	Designed for gravity loads only (predating seismic codes i.e. no seismic features)	
		15	Designed with seismic features (various ages)	
		16	Frame with unreinforced masonry infill walls	
		17	Flat slab structure	
		18	Precast frame structure	
		19	Frame with concrete shear walls-dual system	
		20	Precast prestressed frame with shear walls	
	Shear wall structure	21	Walls cast in-situ	
		22	Precast wall panel structure	
Steel	Moment resisting frame	23	With brick masonry partitions	
		24	With cast in-situ concrete walls	
		25	With lightweight partitions	
	Braced frame	26	Concentric	
		27	Eccentric	
Timber	Load-bearing timber frame	28	Thatch	
		29	Post and beam frame	
		30	Walls with bamboo/reed mesh and post (wattle and daub)	
		31	Wooden frame (with or without infill)	
		32	Stud wall frame with plywood/gypsum board sheathing	
		33	Wooden panel or log construction	X
Various	Seismic protection systems	34	Building protected with base isolation devices or seismic dampers	
	Other	35		

4.4 Type of Foundation

Type	Description	
Shallow Foundation	Wall or column embedded in soil, without footing	
	Rubble stone (fieldstone) isolated footing	
	Rubble stone (fieldstone) strip footing	X
	Reinforced concrete isolated footing	
	Reinforced concrete strip footing	X
	Mat foundation	
	No foundation	
Deep Foundation	Reinforced concrete bearing piles	
	Reinforced concrete skin friction piles	
	Steel bearing piles	
	Wood piles	
	Steel skin friction piles	
	Cast in place concrete piers	
	Caissons	
Other		

4.5 Type of Floor/Roof System

Material	Description of floor/roof system	Floor	Roof
Masonry	Vaulted		
	Composite masonry and concrete joist		
Structural Concrete	Solid slabs (cast in place or precast)		
	Cast in place waffle slabs		
	Cast in place flat slabs		
	Precast joist system		
	Precast hollow core slabs		
	Precast beams with concrete topping		
	Post-tensioned slabs		
Steel	Composite steel deck with concrete slab		
Timber	Rammed earth with ballast and concrete or plaster finishing		
	Wood planks or beams with ballast and concrete or plaster finishing		
	Thatched roof supported on wood purlins		
	Wood single roof		
	Wood planks or beams that support clay tiles		
	Wood planks or beams that support slate, metal asbestos-cement or plastic corrugated sheets or tiles		X
	Wood plank, plywood or manufactured wood panels on joists supported by beams or walls		
Other			

4.6 Typical Plan Dimensions

Length: 14.4 - 14.4 meters
Width: 14.4 - 14.4 meters

4.7 Typical Number of Stories

1

4.8 Typical Story Height

2.7 meters

4.9 Typical Span

3.6 meters

4.10 Typical Wall Density

8-12%

4.11 General Applicability of Answers to Questions in Section 4

This contribution describes a typical construction of this type.

5 Evaluation of Seismic Performance and Seismic Vulnerability

5.1 Structural and Architectural Features: Seismic Resistance

Structural/ Architectural Feature	Statement	True	False	N/A
Lateral load path	The structure contains a complete load path for seismic force effects from any horizontal direction that serves to transfer inertial forces form the building to the foundation.	X		
Building configuration	The building is regular with regards to both the plan and the elevation.	X		
Roof construction	The roof diaphragm is considered to be rigid and it is expected that the roof structure will maintain its integrity, i.e.. shape and form, during an earthquake of intensity expected in this area.	X		
Floor construction	The floor diaphragm(s) are considered to be rigid and it is expected that the floor structure(s) will maintain its integrity, during an earthquake of intensity expected in this area.		X	
Foundation performance	There is no evidence of excessive foundation movement (e.g. settlement) that would affect the integrity or performance of the structure in an earthquake.	X		
Wall and frame structures-redundancy	The number of lines of walls or frames in each principal direction is greater than or equal to 2.	X		
Wall proportions	Height-to-thickness ratio of the shear walls at each floor level is: 1) Less than 25 (concrete walls); 2)Less than 30 (reinforced masonry walls); 3) Less than 13 (unreinforced masonry walls).			X
Foundation- wall connection	Vertical load-bearing elements (columns, walls) are attached to the foundations; concrete columns and walls are doweled into the foundation.		X	
Wall-roof connections	Exterior walls are anchored for out-of-plane seismic effects at each diaphragm level with metal anchors or straps.	X		
Wall openings	The total width of door and window openings in a wall is: 1) for brick masonry construction in cement mortar: less than 1/2 of the distance between the adjacent cross walls; 2) for adobe masonry, stone masonry and brick masonry in mud mortar: less than 1/3 of the distance between the adjacent cross walls; 3) for precast concrete wall structures: less than 3/4 of the length of a perimeter wall.			X
Quality of building materials	Quality of building materials is considered to be adequate per requirements of national codes and standards (an estimate).	X		
Quality of workmanship	Quality of workmanship (based on visual inspection of few typical buildings) is considered to be good (per local construction standards).		X	
Maintenance	Buildings of this type are generally well maintained and there are no visible signs of deterioration of building elements (concrete, steel, timber).		X	
Other				

5.2 Seismic Features

Structural Element	Seismic Deficiency	Earthquake-Resilient Features	Earthquake Damage Patterns
Wall	Inadequate wood panel connections.		
Frame (columns, beams)			
Roof and floors	Inadequate quality of roof-to-ceiling or roof-to-tie beam joints		
Other			

5.3 Seismic Vulnerability Rating

	Vulnerability					
	High (Very Poor Seismic Performance) A	B	Medium C	D	E	Low (Excellent Seismic Performace) F
Seismic Vulnerability Class			0	>		

0 - probable value
< - lower bound
> - upper bound

6 Earthquake Damage Patterns

6.1 Past Earthquakes Reported To Affect This Construction

Year	Earthquake Epicenter	Richter magnitude(M)	Maximum Intensity (Indicate Scale e.g. MMI, MSK)

Additional Comments: Performance of this type of construction under destructive earthquakes has not been reported as yet.

7 Building Materials and Construction Process

7.1 Description of Building Materials

Structural Element	Building Material	Characteristic Strength	Mix Proportions/ Dimensions	Comments
Wall	wooden (larch) panels	500 - 800 kg/cm²		
Foundations	concrete	10 MPa (cube compressive strength)		
Roof and floors	wooden (larch) beam	800 kg/cm²		

7.2 Does the builder typically live in this construction type, or is it more typically built by developers or for speculation?

Anyone can live in buildings of this construction type.

7.3 Construction Process

Typically contractor builds construction of this type. Wood panels are fabricated in the workshop. For building assembly, in addition to the carpentry tools, auto-cranes and concrete mixers are also required.

7.4 Design/Construction Expertise

Expertise for design of buildings of this type was available, including the construction quality procedure developed by the author of this contribution.

7.5 Building Codes and Standards

	Yes	No
Is this construction type addressed by codes/standards?	X	

Title of the code or standard: Seria 181-115-77cm according to the Building Catalog of Typical Housing Projects, Vol.1, Part 2, Div.1, Seria 115, #15, 1984.
Year the first code/standard addressing this type of construction issued: 1984
National building code, material codes and seismic codes/standards: SNiP II-7-81. Building in Seismic Regions-Design Code
When was the most recent code/standard addressing this construction type issued? 1981

7.6 Role of Engineers and Architects

The design is carried out by Professional Engineers and Architects.

7.7 Building Permits and Development Control Rules

	Yes	No
Building permits are required	X	
Informal construction		X
Construction authorized per development control rules	X	

7.8 Phasing of Construction

	Yes	No
Construction takes place over time (incrementally)		X
Building originally designed for its final constructed size	X	

7.9 Building Maintenance

Who typically maintains buildings of this type?	
Builder	
Owner(s)	X
Renter(s)	
No one	
Other	

Additional Comments: The maintenance is performed either by the owner (city) or (periodically) by a contractor - a maintenance firm.

7.10 Process for Building Code Enforcement

The process consists of issuing permits for the design and construction, including the architectural permits and urban planning/municipal permits. Designers need to have license to practice and are responsible to follow the building codes. Building inspection is performed and the permit is issued.

7.11 Typical Problems Associated with this Type of Construction

- Fire-resistance;
- Inadequate quality of (roof and wall) panels, joints and construction in general.

8 Construction Economics

8.1 Unit Construction Cost (estimate)

160 rub /m² (50-100 $US/m²)- per the official rate.

8.2 Labor Requirements (estimate)

376 person-hours/building

9 Insurance

9.1 Insurance Issues

	Yes	No
Earthquake insurance for this construction type is typically available	X	
Insurance premium discounts or higher coverages are available for seismically strengthened buildings or new buildings built to incorporate seismically resistant features		X

Additional Comments: The insurance is available as a part of the usual property insurance.

9.2 If earthquake insurance is available, what does this insurance typically cover/cost?

About 3-5% of the total estimated property value

10 Seismic Strengthening Technologies

10.1 Description of Seismic Strengthening Provisions

Type of intervention	Structural Deficiency	Description of seismic strengthening provision used
Retrofit (Strengthening)	Wood panels	Strengthening of joints

10.2 Has seismic strengthening described in the above table been performed in design practice, and if so, to what extent?

No. In general, seismic strengthening of this construction is not considered feasible.

10.3 Was the work done as a mitigation effort on an undamaged building, or as repair following earthquake damage?

N/A

10.4 Was the construction inspected in the same manner as new construction?

N/A

10.5 Who performed the construction: a contractor, or owner/user? Was an architect or engineer involved?

N/A

10.6 What has been the performance of retrofitted buildings of this type in subsequent earthquakes?

N/A

11 References

Manual on Certification of Buildings and Structures in the Seismic-Prone Areas, Second Edition, CENDR, Petropavlovsk, Kamchatka, Russia, 1990.

Building Catalog of Typical Housing Projects, Vol.1, Part 2, Div.1, Seria 115, #15, 1984.

12 Contributors

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Webpage			

13 Figures

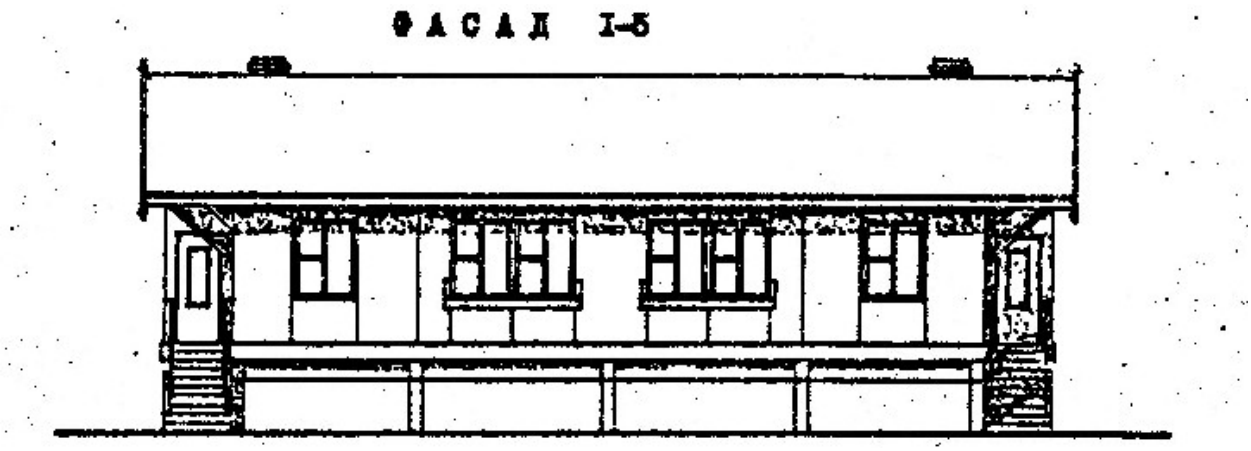

FIGURE 1: Typical Building

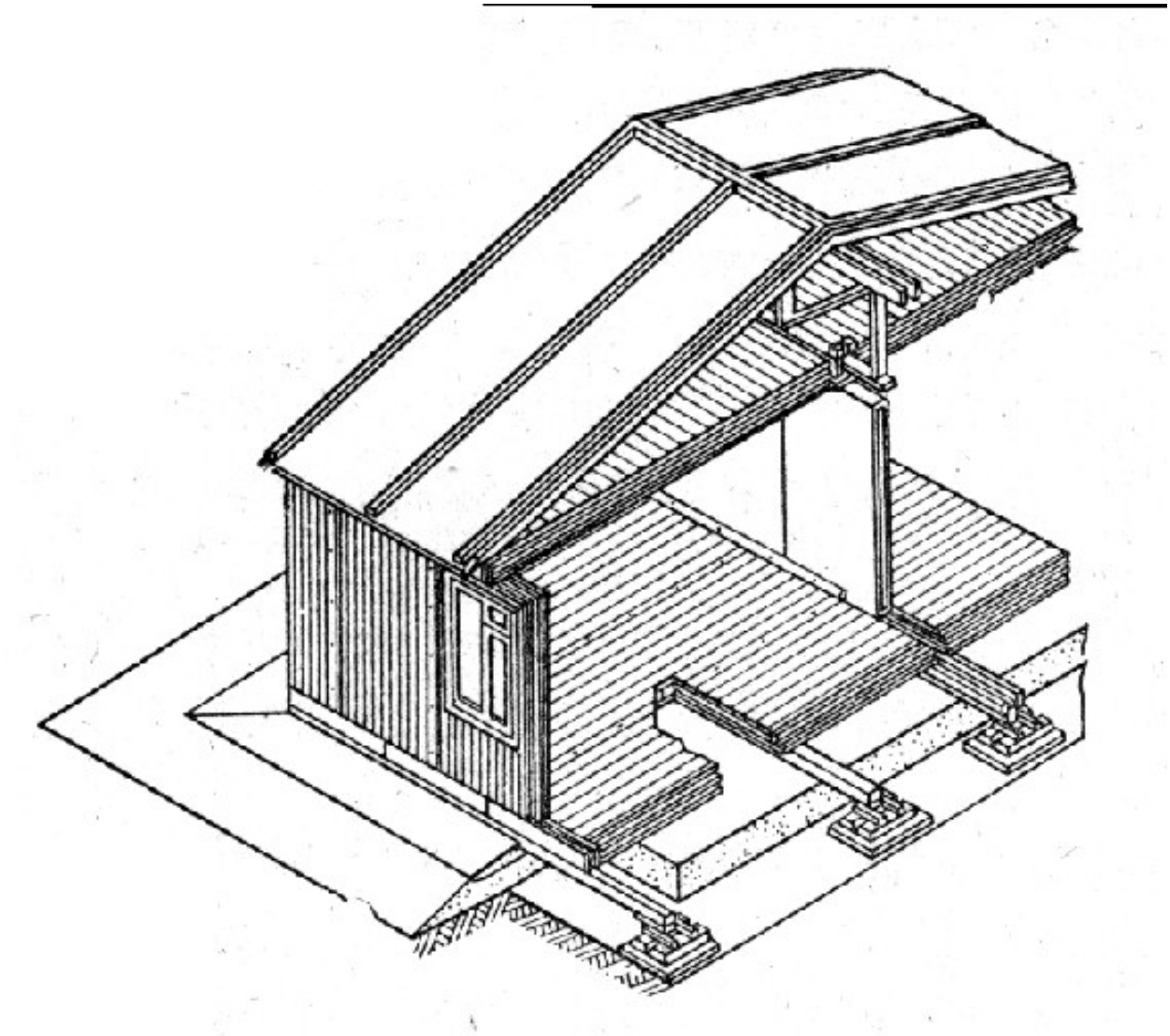

FIGURE 2: Key Load-Bearing Elements

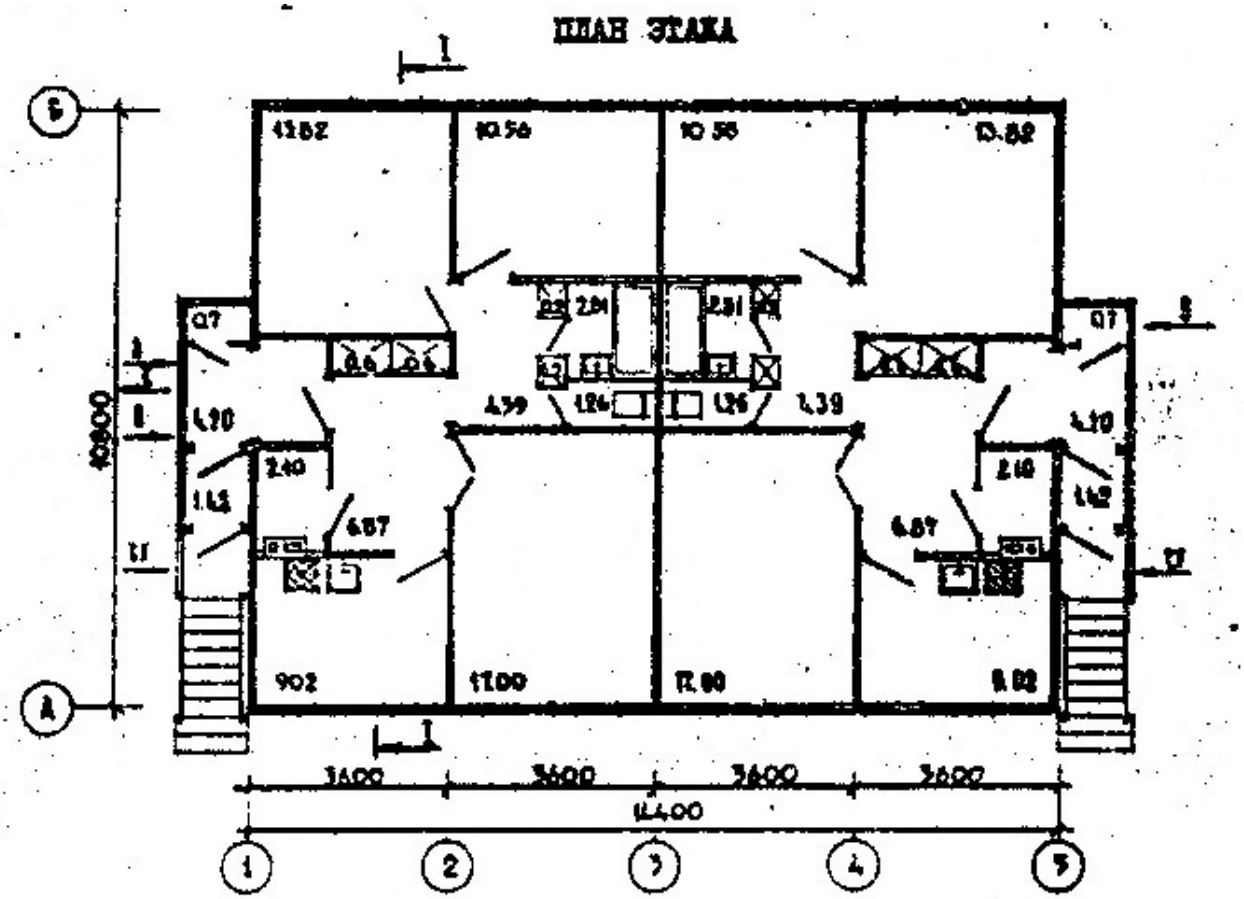

FIGURE 3: Plan of a Typical Building

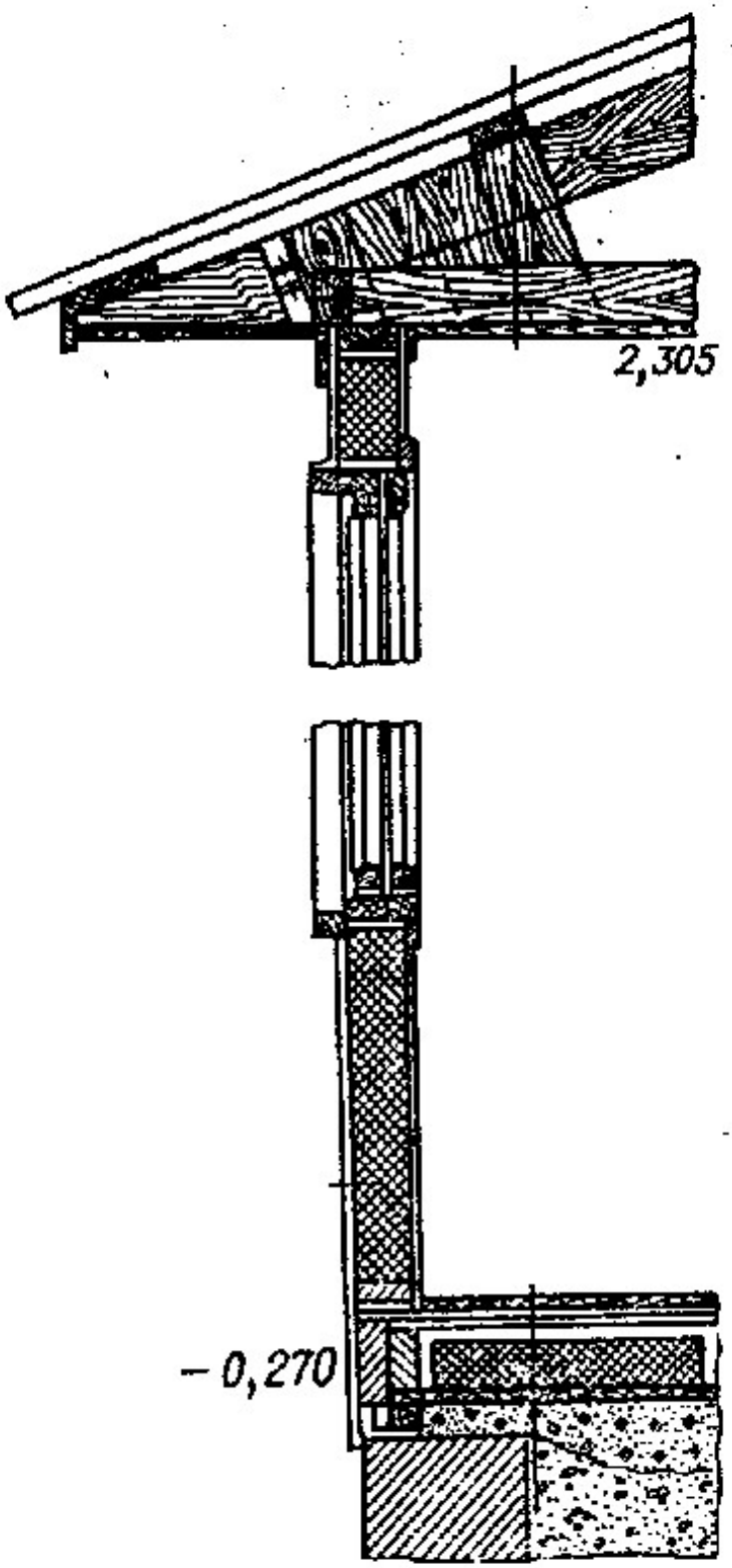
2,305
– 0,270

FIGURE 4: Critical Structural Details - Vertical Sections Through the Wall