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WOODEN STRUCTURE OF HISTORIC 19TH C HOUSES IN BULGARIAN LANDS

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Abstract

The paper introduces a historically established wooden structure, used in dwelling houses building in Bulgarian Lands in the Revival Period (end of 18th C – second half of 19th C). Features that exemplify structural peculiarities of 19th C dwelling houses in rural and urban conditions are considered. These buildings, studied in the 20th C by authors in order to preserve the knowledge of the patrimony of Bulgarian national architecture and construction, represent the works of an art that has been totally supplanted by different building techniques today. It has remained as vernacular heritage to be conserved and seen as national identity. In the paper, different vernacular regions in Bulgaria, in France and Turkey were considered in order to give an idea of structural diversity. The paper introduces comparisons with wooden structures in the above mentioned countries in order to reveal the differences and establish general features in the studied regions. General house architecture, functional requirements, climatic conditions, construction materials for wood and half-timber structure were studied. More specifically, foundations, stonework walls, half-timber and wooden walls, roofs, cantilever overhangs and bracings are considered.

Key words*: rural and urban timber houses; vernacular architectural types; timber structure; roofs and roof cover; overhang system, bracing, timber wall.*

INTRODUCTION

Vernacular wood structures became a particularly interesting subject in the last years due to the fact that wood is considered to be a renewable construction material. Authors investigated traditional methods of building in order to find out sustainable solutions that emerge from historical tradition and their implementation today, in search for identity of a given region. Such scientific research was done initially with the aim of preserving and restoring national architectural heritage, but it has also encouraged new architecture in countries like France. The paper focuses on principal characteristics of wooden structures in Bulgarian lands during a period of century and a half before the Liberation from Ottoman Rule (1878). Case studies of wood structures in other countries were included with the aim of comparing methods and local indigenous features and pointing out important common principles.

OBJECTIVE, METHOD

The objective of the paper is to present a concise architectural description of different regional types of dwellings. A general analysis is made of the structure, including foundations; basement walls, upper story wooden frame structure, and roof. Five vernacular types were selected from different areas in Bulgarian lands in the 19th C, compared to examples from other regions in Europe (French Alps, Normany, Bresse) and Turkey (Sariyer, Safranbolu), aiming at finding similar features and outlining major differences. A synthetic approach was used, based on comparisons between wooden houses from the above mentioned countries. Examples were selected from mountainous and plane regions, on the one hand, and structures in rural and urban conditions, on the other. The former were chosen to clarify basic structural types and their conditioning, the latter for explaining the elaboration and development of functional or representative types. Graphically plans, sections, façades, perspective views and photographs were juxtaposed for visual comparison.

EXPOSITION

Historical Evolution

Wooden structure of 19th C dwellings in Bulgarian lands has been studied in the past by numerous authors. Todor Zlatev (1955) stated that till the end of the 17th C mountain houses were built with log structure: walls consisted of thick joists, or logs with removed bark, superimposed one over the other. Joists were locked by 'saddle notch' in the corners; the superimposing included grooving in the lower side, so that sealing was achieved between two logs. Stefan Stamov (2004) writes that log structure was eventually supplanted by wooden skeletal structure with thick horizontal planks inserted in grooves, cut into the vertical bearing members. This structure also had notching in the corners,

where the two sets of planks met. This structure was typical, among other places, for Strandja Mt. region to the East of the country (Stefan Stamov 2004). Log construction was supplanted by timber structure in the 18th and the 19th C, due to deforestation of the land. It consisted of joists and posts that divide the wall into separate spans, filled with planks or knitted wooden branches (wattle), rendered on both sides with clay, mixed with straw; or covered with board cladding etc. (Zlatev1955). In Bulgarian lands during the 19th C, both all-wooden type and mixed-structure type existed; the foundation and the basement of the buildings were usually made of stonework, while the living storey plus *chardak* (or wooden gallery) were of a mixed structure with wooden skeleton. Roof and cover varied considerably in different regions. In rural areas in planes, as well as in towns they featured a ridge to cover a rectangular plan, with traditional roof tiles ("Spanish tiles"). In mountain areas, roofs were hipped with four slope shape and had to be much heavier to resist strong mountain winds. Stone slabs were used, fixed over heavy oak roof structures with a pitch of 20°to 22°, to keep them from slipping. Thatch or plank cover existed, but were an older extinct form; such houses had a steep roof pitch (Stamov 2004).

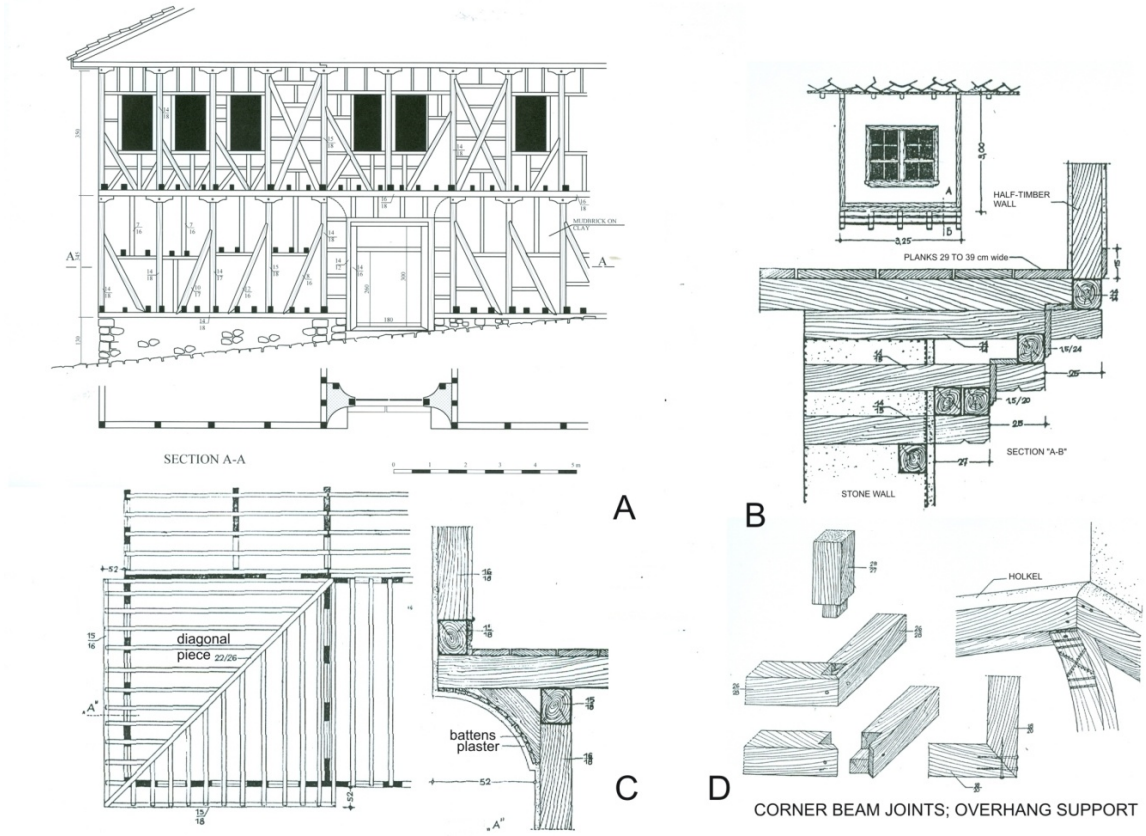

Fig. 1.
A. Timber structure of a house in Plovdiv; B. Bay window overhang (Rhodope Mt.); C. Corner overhang with a diagonal timber; D. Carpenter joints (drawings Hr. Peev)

Wooden wall structure consisted of vertical and horizontal members, locked together to form frames. Stiffness was achieved by diagonal bracing on the façade that was jointed to the vertical and horizontal structural members (Fig. 1). The filling was made of different inert materials, such as mud bricks, fired bricks, broken roof tiles, stone rubble, inserted into the formed triangulated spaces. Instead of making a filling, the wooden posts would also be nailed on both sides with weather-boarding, in-filled inside with cinder; in such cases they could have diagonal members (braces) on top of the boarding to secure stiffness. The filled wall was plastered on both sides with a mixture of clay, lime and straw. This rendering covered the wood skeleton completely. Wooden structure, Hr. Peev points out, proved to be sturdy and long-lasting and resistant to weathering and earthquakes, common in our lands. Being light, wood structure turned out to be especially appropriate for bay overhangs, wide eaves, porticoes, arches etc. Accessibility and low cost of the material allowed a fast and cheap construction of buildings (Peev 1956).

This structural scheme resulted in a typical architecture and view of the façade. T. Zlatev classified the types of buildings according to their location into: rural houses, built in agricultural areas

with flat terrain; mountain houses, built in stockbreeding mountainous regions, and urban houses, which were usually owned by craftsmen, merchants etc. According to location, he classified traditional dwellings into six separate typological groups of houses, each featuring local peculiarities according to geographic context and the way of earning a living: Eastern, Central and Western Stara Planina, Black Sea Coast, Rhodope Mt., and Plovdiv houses of the Late Revival Period. Apart from these large territories, he outlined towns such as Melnik, Bansko, Arbanassi, for their specific building tradition. Other authors add Strandja Mt. region, with characteristic wooden houses (Stefan Stamov 2004).

Vernacular Types of Houses

We have selected 5 vernacular types for their important distribution: Eastern and Central Stara Planina, Black Sea Coast, Rhodope Mt. and Plovdiv urban type. They were built in different historical periods; the rural examples were built during Early Revival Period (end of 18th – beginning of 19th C), while Plovdiv urban houses illustrate the High Revival period (second half of 19th C).

Eastern Stara Planina Mt. (Kamtchiya House)

In the past, this used to be a densely forested mountainous region, part of the „Great Sylva Bulgarica". Wooden houses were built all over due to abundance of structural material. The so-called Kamtchiya house inherited features of a medieval structure.

Sheep-breeding and weaving were basic crafts in this region. The house in Zheravna was used for textile production.

The house type is two-storeyed, basement is built with stone masonry, and the main storey has timber frame. The frame structure includes in-fill of sun-dried bricks and daub in the bays between structural members (posts) with wooden cladding of large boards.

Stonework basements had different height, depending on the slope of the terrain; while the upper floor had a constant height of 2.20m. The bay overhangs protect the stone masonry and floor beams from moisture. In other instances, when the basement plan has an irregular form due to lot irregularity, the overhang completes the plan to a regular rectangle. The roof eaves are wide and formed by the rafters and joists of the ceiling, supported by diagonal wood braces that are a feature of the façade architecture. The overhang joists are doubled, and their butt ends are beautifully carved to a decorative effect.

Central Stara Planina and Sredna Gora Mt.

The area is rural, with developed crafts. The house type is two-storeyed, with basement built of stone masonry, and the upper floor features half-timber frame, like Kamtchyia house type. Timber spans are filled in with mud-brick on clay composition, or are covered by wattle, plastered on both sides by thick clay plaster, mixed with straw; another structure is nailed wood boarding on both sides of the posts, while the space between the two layers is filled in with cinder, bulrush or other insulation. The substitution of wood cladding of the wall with mud-brick changed the view of the house: walls plastered with lime mixture are an important compositional element. Thus, a rectangular façade is formed by the basic structural members: bottom and top beam and corner posts form a frame; façades have a predominantly horizontal proportion (Fig. 2. B). The underlaying stone wall of the basement is treated like an extension of the terrain, with the same material – stone (Zlatev 1955), the *santrach* levelling timbers add more horizontals. Heavy roof eaves bring more horizontals as well as the shade on the white façade, interrupted only by the vertical bracings. Three materials participate in the façade composition with their colours: whitewashed walls, dark wood and stone.

Rhodope Region

Due to severe mountain climate, the Rhodope house features a '*poton*' (closed chardak). The stair is either closed in the *poton*, or in a smaller space called '*kliot*'. The whole basement is used as a farming yard. The urban house has a broken hipped roof to cover the symmetrical plan. The illustrated house (Fig. 3. B, C) originally had a single large *poton*; the heirs of the property divided it into two halves, as Matei Mateev wrote (Mateev 2004). 'Twin' symmetrical houses are a feature of this region. Urban houses had 'washbasins' and a ovens on exterior overhang supports as a typical architectural feature. Inside, wall closets formed a wooden wall including the door in a niche; they are called 'musandri'. Because of sloping terrain and Muslim religion, the houses had two entrances: one from the 'kliot' and a separate one for the upper floor.

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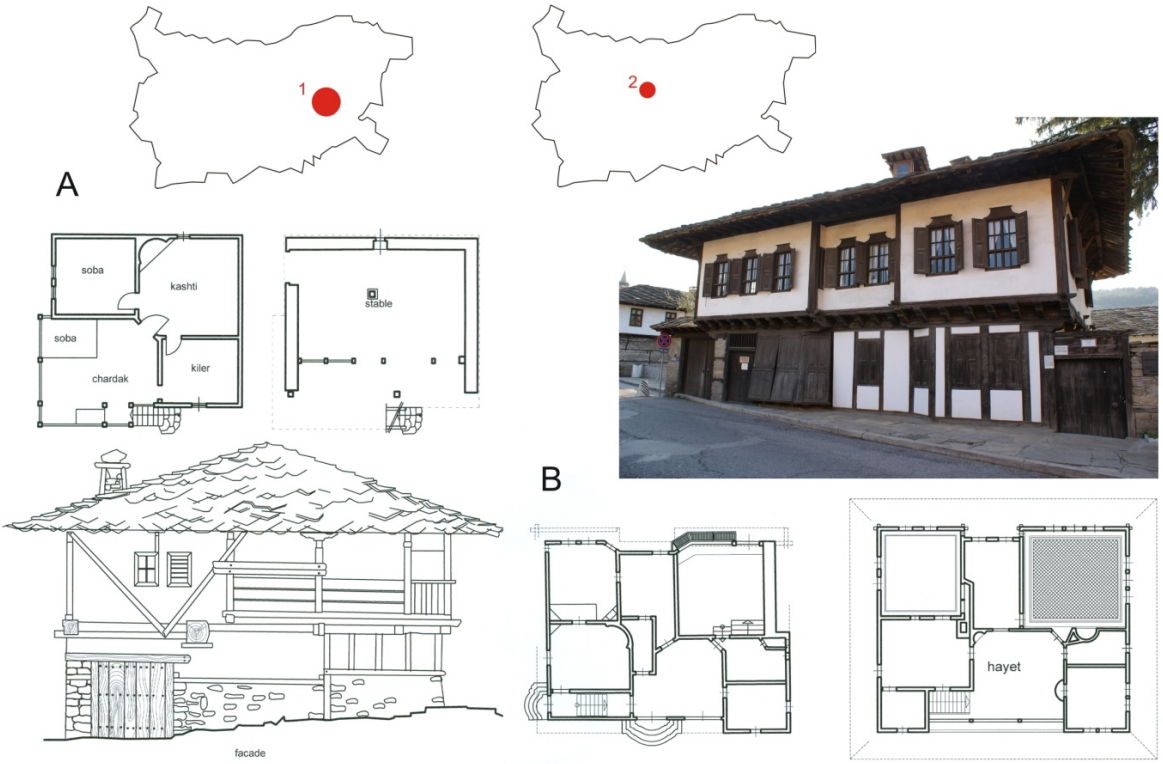

Fig. 2.
A: Eastern Balkan Houses: Plans and facade of a house in Bojentzi (after T. Zlatev); B. Central Balkan Houses: plans and picture of Raykov House in Tryavna

Black Sea Coast House

Black sea coast house is a Kamchiya house variation, with a closed architecture, to protect from sea winds. The basement features a cow-shed, storage or cellar; with stonework walls on clay composition and levelling timbers (santrach). The stair leading to the main floor is closed in a separate space. A workshop or small shop can be part of the basement, looking onto the street. The chardak is replaced by a closed hall, used as a circulation space leading to the rest of the rooms; it may be in the corner or the centre of the composition of the floor, surrounded by rooms. The facade has many windows and shorter eaves for better sun-lighting. The floor has a skeletal wooden structure with a wood cladding of horizontally placed oak planks. This cladding is made in two layers: the inner layer is nailed directly on the bearing posts and closes the inner spaces. The second layer, which consists of narrow split wooden slats, is nailed on top of the thick planks in order to protect them from atmospheric conditions (Georgi Arbaliev 1977). Such is the case with the house of Anna Batinyoti in Sozopol, where the facade boards hide the skeleton completely; short eaves and ceramic „Turkish" tiles finish up the facade on top. The curved bracings under the bays of the main floor create memorable architecture.

Plovdiv Town Houses

The dwelling and representative needs of urban house-owners have placed higher requirements to the builders; the floor plan structure, the spatial structure and decoration were correspondingly changed.

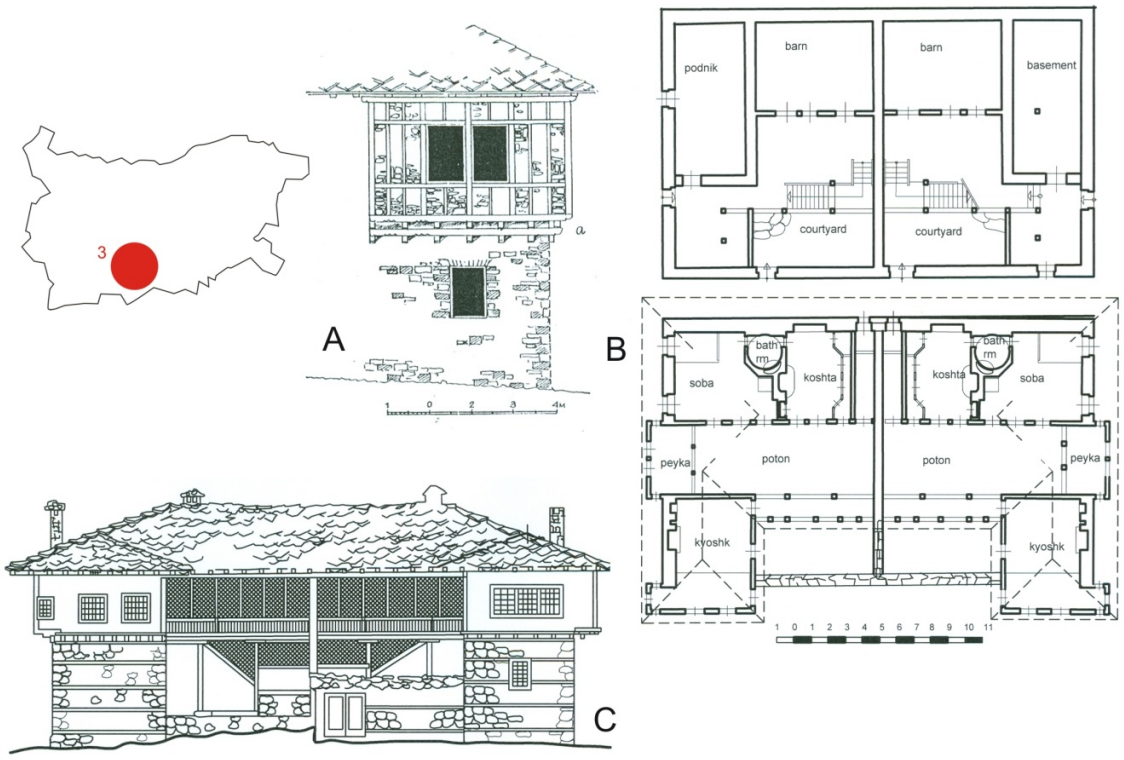

Fig. 3.
A. Drawing of a wall with wooden skeleton and stone infill.
B, C. Plans of basement and first floor and facade of a house in Smolyan (after T. Zlatev)

The main entrance is a formal one, always in the axis of movement. It is placed under a portico formed either by the upper storey bay overhang or a bow pediment, typical for urban buildings. Behind the main entrance, the basement reception hall is situated on the compositional axis, as a centre of the basement rooms. The inner staircase is the third compositional element on the other end of the compositional axis. The basement plan is a symmetrical arrangement on both sides of the hall, including two or three rooms: kitchen, soba, closets. Functionally, the basement is the actual living space, while the upper floor is a reception space. It features a large hall, which is the last element of the axis; it is bigger and higher than the adjacent rooms. This reception room is formal in character: it is the place for major family festivities and gatherings (marriages, baptisms), with a podium for musicians. Rich colourful painted decoration, both on the facades and the interior walls, gives a festive character to the house.

Other Examples of Rural Vernacular Architecture
France

Six regions of vernacular architecture are outlined by Schweitzer (2002) in a study of wooden indigenous architecture. Two basic building techniques are studied: of long and short beams. The technique of long beams is considered to be archaic, since it uses long and heavy beams that have to be lifted and housed in place. It is used in farm houses in the Alps; walls are built of round logs with peeled bark, piled on top of one another, and are jointed (notched) in the corner of the building. These walls are self-supporting and carry the loads of ceiling and roof, and besides insulate inner space. The building technique with short beams supplanted the long beams method, allowing the use of lighter pieces, better jointing between the elements, a more sturdy structure, and the cantilever overhanging

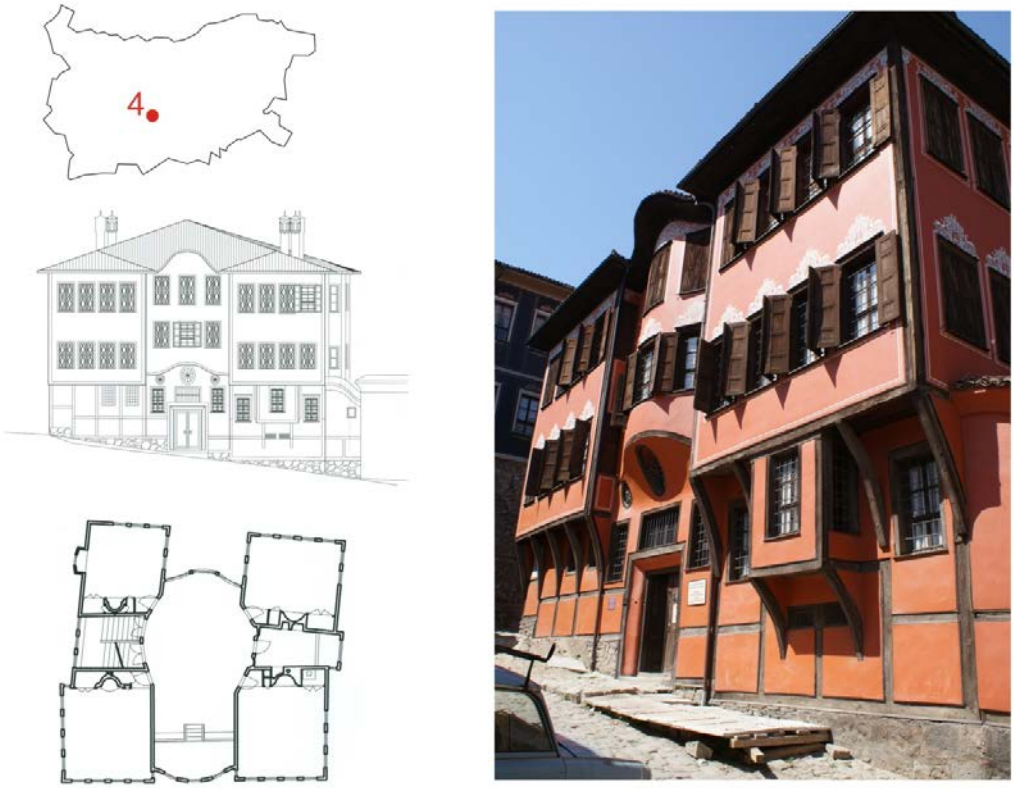

Fig. 4.
Plovdiv. Georgiadi House (1846). Second floor plan and street facade, picture of street façade

of the upper floor as well as building a multi-story structures. Finding wood resources and long beams with large section became difficult, because they were supplied for shipbuilding. The short beam technique is used for the skeletal building system with wooden posts and horizontal spans of inserted secondary timbers between them. The wooden elements have two different functions to play: supporting skeleton and filling elements between posts of outside/inside wood cladding. The other system is a skeletal one that forms spans of wooden frame with an infill of inert materials, such as clay, plaster, brick masonry. With regard to roofs, two big zones are established: the South of France: there, flat roofs are used, with 20° to 30° pitch angle, covered with 'Spanish' roof tiles; the North, where steep roofs of straw or clay tiles cover is typical. On Fig. 5, an alpine chalet of the Haute-Savoy region is illustrated. The structure is principally used for stock breeding; it is built on a sloped terrain with a stone mason basement and log bearing walls with a large two-sloped roof housing a vast space for barn. The roof is covered by wooden tiles, kept in place by long wooden poles, anchored by heavy stones. The pyramidal chimney is made entirely of wood; the fireplace beneath is of stone. The roof ridge is perpendicular to the slope, on the southern side, the building is three storeys high, on the northern side it has just one floor with access directly from terrain to the roof barn. The gabled facade is looking south and features wide vertical boards cladding nailed on top of the structural wall and a separate roof awning to guard the wall under the gable. The lateral facade has strongly projecting eaves, supported by a horizontal beam and diagonal bracings under it, each one of which is supported by shorter cantilever horizontal beams projecting from the wall.

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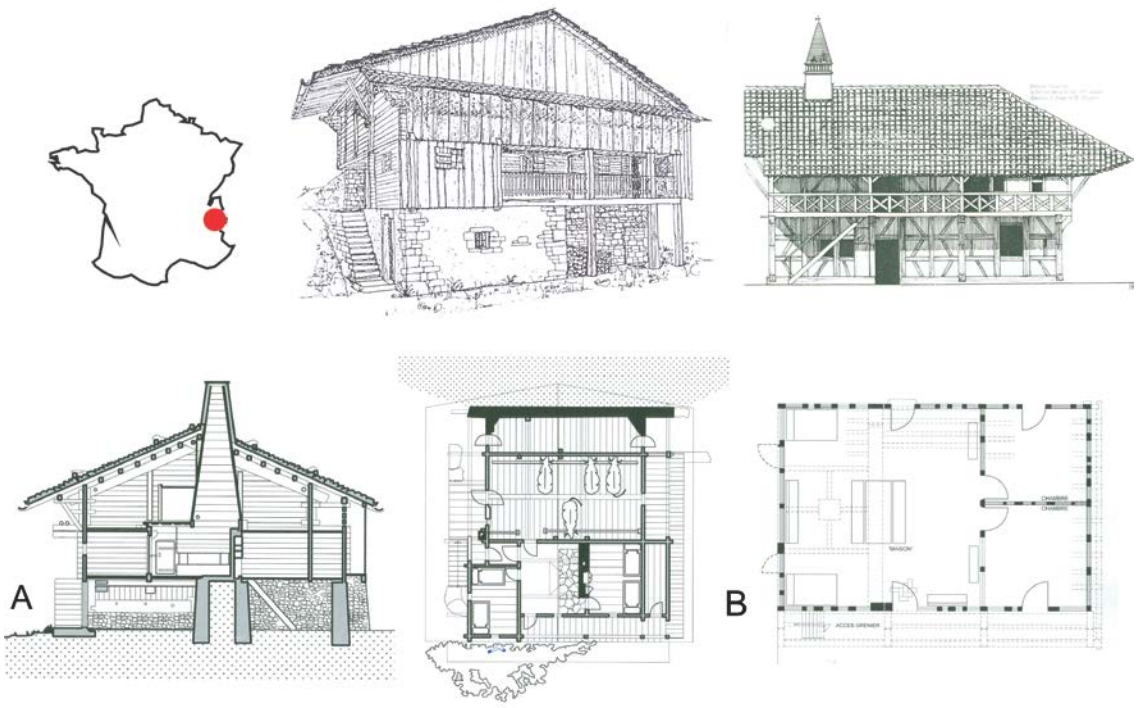

Fig. 5.
A: Plans and section of a 'chalet d'alpage' at Grand-Bornand, Haute-Savoie, the French Alps (after Roland Schweitzer); B: Plans and facades of a farm house in Bresse-courtes (after Roland Schweitzer)

A second typical zone is Bresse; one example of a timber rural house is shown here (Fig. 5. B). Typical features of Bressan houses include: rectangular plan, low wall height and a great volume of the roof. The roof has three slopes, the gable being on the southern facade. The roof features wide overhangs, at the gable and lateral façades. They protect the structure, and constitute a real extension of the building. The structure of the eaves of the barn includes a regular rhythmical structural bracing under the eaves corresponding to the columns of a gallery. The Sarrasine chimney, a feature of Bressan habitat, demonstrates respect to tradition and resistance to external influences. Certain dwellings integrate an upper floor with a gallery (Fig. 5 B). The structural system consists of a wooden structure, wooden spans with infill of mud-bricks. The roof cover is with „Spanish tiles". Structures are large and overpowering. Buildings are situated in scattered groups in the rural terrain (Roland Schweitzer 2002).

Normandy is another region of characteristic traditional wooden structures. The abundance of woods (the valley of Seine is covered with large forests of oak), the lack of hard materials for in-fillings and the fantasy of builders have encouraged the richness and variety of wooden structures of houses in the Pays d'Auge and Haute-Normandy. Facades are enlivened by motifs of repeated verticals, chevrons, crossings, and oblique timbers.

Wooden structures have their origin in the Middle Ages and Renaissance. Urban structures of houses are characterized by tall proportions, and the rhythm of vertical pieces, broken by cantilever braces, sculptured corner posts and X-form timbers of the walls. Construction with wood and mud-brick is an ancient technique; the discovery of remnants of Gallo-Roman building testify in this sense. Free-standing rural houses develop in large terrains and tend to grow in length, while urban houses that develop in a limited lot between two neighbours, have to grow in height and gain floor area by cantilevering overhangs to the street. Houses at Bayeux, Normandy, illustrate the architectural view with towering proportions, densely spaced timbers and a steep roof. Schweitzer describes two different systems of cantilevering. The first one uses beams that project perpendicularly to the façade wall, they are fixed over the plate beam from the lower storey. Between the beams, shorter timbers are mounted to prevent lateral movement and sacking of the beam of the upper storey. The second system uses doubled beams, parallel to the façade, placed on braces fixed on vertical timbers. In this way, the floor joists remain hidden on the façade. Roof cover features straw, but in the 19th C, this

was changed to slate and tiles, which caused the reduction of roof structure, because the higher load of ceramic tiles and lesser need of storage roof space.

Turkey

The historical development of dwelling structures in Turkey is the result of adopting the existing Byzantine architectural types and adding features of nomadic life, brought from Central Asia by Turks. The houses differ widely according to their locality: from North Anatolia to Black Sea Coast, wooden houses from forested regions; Central Anatolia with stone and mud-brick houses; West Anatolian stone and in South Anatolia, stone and wooden structures (Akurgal 1980). Turkish houses are two- or three-storey structures. The upper storey constitutes the main living area; the ground floor generally has a high, solid stone wall, almost like a fortification; this floor is blind to the street and open to an inner court behind high walls. The upper floor extends over the street; it is open to the outside world by many windows toward the street. The main storey is usually the summer living area and features greater height for climatic reasons; similar to the antique concept of atrium space in Roman houses. Windows have a double row arrangement on the facade, the lower row equipped with shutters, the upper row of fixed smaller windows is built for lighting purposes; sometimes of decorative stained glass. The roof is a hipped one, of a simple form, avoiding indents or extensions. Eaves are wide and horizontal. The basic structural system is half-timber, with in-fill of rubble, bricks and plaster.

The plan types of Turkish houses feature arrangement of the rooms around a sofa (hall). Rooms follow social requirements of extended family: in traditional Turkish society the house is divided into men's quarter (selyamlik) and women's quarter (haremlik). The arrangement of rooms around a central space follows the nomadic custom of building up tents around a central courtyard. Rooms have a multi-functional role: in the day, they are used for eating, resting; the basoda (the houseowner's room) receives guests; in the night, they are used for sleeping. This central zone developed into an open space (called in Turkish 'sofa'), and eventually into a closed space with eyvans (recesses) that form a cross-like configuration of the main living floor (Fig. 6 B).

Turkish houses feature wooden structure, especially in the regions to the north (Black Sea Coast) and Thracian Region. Due to seismic conditions, wooden structure is preferable. Fast construction was suited to the needs of an expanding society which is always on the move. The structure is simple: nailing and simple joints are preferred. Quick repairing within a short time after destroying fires was also an objective. It was only natural for people that a house should be built to last for a temporary period only (Andrew Finkel). Timber frame allowed projections to be built (cantilever overhanging bay windows), more windows on the upper floor and wider eaves. The house could be aerated more easily in moist conditions and prevent condensation in rooms. Facade treatment with wood cladding was done to fight corrosion of plaster in humid sea coastal areas. (Reha Günay 1998).

RESULTS AND DISCUSSION

The following conclusions were established: depending on local material in forested regions, structure falls into two categories: half-timber or all-wood structure. Structures differ in height: one or two-storey for rural purposes, versus two-, three- or more storey structures for urban buildings (or villages built on a strong sloping terrain). The two-storey morphology is kept throughout Europe and Asiatic part of Turkey especially for rural structures; typically based on ancient Roman or ancient Greek archetypes. Cattle-shed at the basement is a feature for rural houses, also for terrain adaptation and the use of warmth generated by animals. Structurally, stone masonry (with *santrach*, a hidden wooden under-structure to level the stonework) for foundations/basements is ubiquitous. Plans are square or oblong. Structurally, timber frames or spans form a system of in-fill wall, used all over Europe in mountainous or plane regions. All-timber is the more archaic case (chalet in the Alps) with log structure, now extinct.

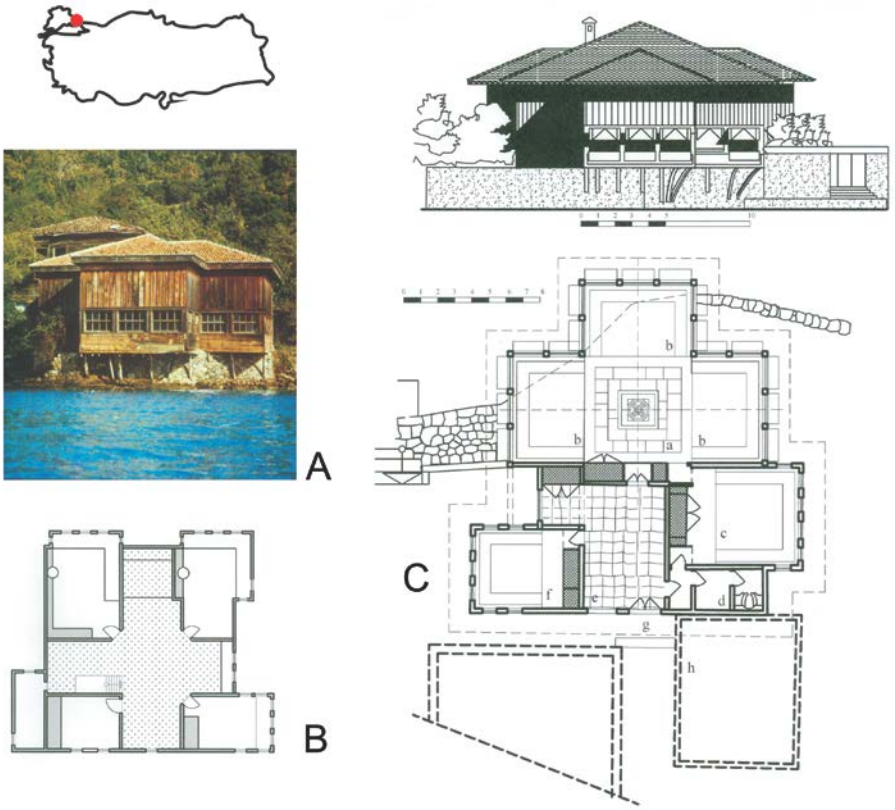

Fig. 6.
A. Façade of a house on the Bosphorus; B. Plans of a Turkish house with sofa with eyvans (after S. Eldem); C. Hüseyin Köprülü Pasha (Amcazade) House on the Bosphorous (1698)

Organization of plan reveals rooms surrounding a wooden gallery (*chardak*) or hall (urban houses). This is typical for the Balkans and Anatolian houses; French farm houses have different organization: basically cattle-shed and barn plus smaller living zone; although a wooden gallery as circulation device/shaded working space is also present in French rural houses. Roof structure is four-sloped or hipped roof with a ridge; wide eaves to guard walls are indigenous to Bulgarian mountainous regions (Tryavna, Zheravna), wide eaves feature at Bressan and Alpine rural chalet. This is due to the tendency to extend the roof structure to protect the underlying walls. Stone, ceramic tiles ("Spanish tiles", called "Turkish tiles"), wooden tiles and thatch (Normandy) feature as roof cover.

Roof slope is another persisting antique feature: southern regions against northern feature gentle slopes, the cases studied fall mostly into the „Roman" type of roof with a gentler slope. Eaves reach to 2m width, in such case, support bracings are developed as structural feature, resulting in characteristic architectural view. Terrain is sloped or flat; buildings tower on the lower side; in planes rural houses feature a tendency to grow in length. Upper floor façade overhangs to overcome odd lot shape, while French rural houses feature really monumental simple geometry with a massive roof volume for barn storage. Roof cover varies from stone slabs (Bulgaria) to roof tiles (Turkey), wooden tiles, anchored on top with stones, and thatch (France). Architecturally, the facade from the lower terrain side is a grand one in all examples, featuring typical white-washed overhanging walls framed with dark wood under heavy roof and large eaves with bracing (Bulgaria), to high structures with braced overhanging main storey with beautiful window treatment and horizontal eaves (Turkey, Bulgarian towns), and massive triangular facade of wood cladding (Alpine Chalet in France), to tall structures with rhythmical repetition of vertical wood posts (Normandy). Lime plaster hides the timber members in Bulgarian houses, while façade treatment differs in Normandy, France, by leaving wood braces and posts uncovered and even painting them dark red to contrast with the plastered in-fill, creating a geometric pattern on the surface. Proportions differ from horizontal low houses in Bulgaria to high towering structures of white rectangles sitting on high stone walls in Turkey, Safranbolu, to

large wood-covered structures with huge roofs in rural France and high urban wooden houses to the North.

CONCLUSIONS

Vernacular wooden structures in historical aspect have attracted attention lately; for this have been found several reasons: wood is a sustainable material that can be grown and used for construction. Structures can withstand earthquakes; those on Balkan Peninsula and Turkish Anatolia are an example, some having survived for more than 200 years. Building is fast and so is repair, when this is the case. Wood is a light material that provides simple and effective construction solutions. Typical architecture was achieved of projecting main floors and wide eaves over the walls, supported by braces. The wall structure demonstrates the best use of mechanical properties of wood to build the load-bearing frame, which is in-filled with inert materials. Wood has good insulating properties that achieve appropriate microclimate. Wooden cladding is a known solution to supplant corrosion of façade plasters in coastal cities. As a widely versatile structural system, timber proves to generate a range of original architectural vernacular languages and construction solutions.

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