

ARCHITECTURAL ASPECT OF SOLUTIONS FOR AMBIENTAL CONDITIONS IN THE FRESH FRUIT AND VEGETABLE WHOLESALE MARKET BUILDINGS

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Abstract. *Provision of healthy nutrition, continuous supply with fresh, quality and price acceptable food, along with the intensive increase in the number of citydwellers, shows that the planning and construction of fresh food wholesale markets is necessary. Modern wholesale markets are technological and commercial complexes with considerable size of built-up areas, roads and extensive infrastructure. Large number of factors affects the planning and design of wholesale markets. Important factor affecting the spatial and functional solution for fruit and vegetable promotion and sale facilities buildings, is ambiental condition requirements. Ambiental condition requirements include temperature and humidity, as well as hygienic and health requirements.*

Regulations and guidelines that exist in the agri-food system supply chain "from farm to fork" are also valid for fresh food wholesale markets. The organizations that provide recommendations are Food Agriculture Organisation (FAO), World Health Organisation (WHO), and World Union of Wholesale Markets (WUWM). Respect of the cold chain, traceability and hygiene and health standards are recommended in their Guidelines. These recommendations are to be implemented in the national regulations. This research assumption is that changes in ambiental conditions, caused by regulations and guidelines, significantly contributed to the transformation of spatial and functional wholesale fruit and vegetables building solutions. By those regulations and guidelines and new technology solutions this spatial and functional transformation has been accelerated

The paper also presents a comparative analysis of spatial and functional solutions by the basic parameters such as facility size, functional layout, type and size of premises. Spatial-functional solutions of the buildings in wholesale market in Halles-e in Paris, Rome and the CAR-Corbas Lyon in Lyon were analysed. The research results confirmed the assumptions that changes in ambiental conditions entail changes in the spatial-functional solutions i.e. change of the complete geometry of buildings and premises. The results have important application for practical use in planning and design of modern fresh fruit and vegetable market buildings.

Key words: *Wholesale markets of fresh fruit and vegetable, promotion and sale facilities, ambiental conditions, spatial and functional solutions.*

1. INTRODUCTION

Provision of healthy nutrition, continuous supply with fresh, quality and price acceptable food, along with the intensive increase in the number of citydwellers, shows that the planning and construction of fresh food wholesale markets is necessary.

Wholesale market is the physical space, a place where wholesale fresh food trade occurs. Wholesale market represents one of the links in the agricultural and food systems chain. Agri-food system is "the way people organize themselves in order to provide and consume food in time and space " [1]. This system consists of a series of successive and parallel participants who provide the physical flow of food.

In the production, processing, distribution and consumption of a product main flows are the trade flows of goods, services and information. Wholesale market has primary intermediary function in marketing channels [2] of perishable products. Wholesale market is an industrial-commercial complex with buildings that meet all technical and hygienic requirements for food that they sell or storage. A complex network of roads, parking lots, infrastructural facilities and utilities also exist. Fresh fruits and vegetables, milk and dairy products, fish, meat and flowers trade usually take place at the fresh food wholesale market .

Globalization and European integration processes initiated intensive changes in the agricultural and food system way of functioning. In the same time these processes demanded national systems regulations and guidelines adjustment and adaptation. These regulations have an impact on architectural and urban planning and design of wholesale markets and buildings within. This research assumption is that changes in ambiental conditions, caused by regulations and guidelines, significantly contributed to the transformation of spatial and functional wholesale fruit and vegetables building solutions. By those regulations and guidelines and new technology solutions this spatial and functional transformation has been accelerated.

During the last fifty years the research in nutrition evolved under the pressure of social demands, scientific and technological progress [3]. Evolution of food consumption pattern and its impact on certain diseases, have become scientific research topics, and engagement in the biotechnology field has brought significant research in the plants and animals science, especially with regard to the acceptability of genetically modified foods. Since 1990, research priority was given to safe and hygienic food.

2. CHARACTERISTICS OF FRUITS AND VEGETABLES AS AMBIENTAL CONDITIONS CRITERIONS FOR WHOLESAL MARKET BUILDINGS

Fresh fruits and vegetables has a specific "status" in our nutrition. This is the "gift of nature" that anyone can choose, pick and eat without any treatment, except washing before eating. Fruits and vegetables have a number of nutritional properties and benefits [4] such as high water content, low fat content and significant amounts of minerals, vitamins and fibres. Thanks to those characteristics, fruit and vegetables are major components of national programs for health nutrition of the population. Fresh fruits and vegetables that we use in our nutrition is "First gamut" of fruit and vegetables which are classified according to the process or group of processes that are applied to them.

The irreversible loss of quality characteristics (appearance, texture, nutritional value, aroma) and amount (weight and size) is accelerated in unsuitable storage conditions [5]. The loss could not be avoided, as it is a fresh fruits and vegetables and can only be slowed by using appropriate systems for cooling and humidification. The three main variables for proper storage of fruits and vegetables are temperature, relative humidity and physical damages.

The temperature is decisive for the level of respiration and ethylene production. Without sufficient cooling, gradual rise in temperature increases the rate of decay. The correct temperature for the products that are exposed for sale should be around 0°C, which means close to its freezing point, that is from a technical and economic point of view not possible.

Relative humidity is a major cause of decay products. Water loss creates negative factors in terms of weight and product quality. The decline in nutritional value of fruits and vegetables is directly proportional to water loss. In principle, the ideal relative humidity for the fruits and vegetables preservation varies between 85% and 95%. Physical damages are usually "wounds" on the product surface, which occurred after the harvest, transport, storage and handling. Such damages accelerate the deterioration and leads to a dramatic expansion of fungi and bacteria.

For the storage of fresh fruits and vegetables cold rooms are used. In the cold room environmental air parameters are regulated according to the needs of product type. Requirements must be defined (the possibility of cooling, high relative humidity, etc.). Health control of products it is necessary during storage, as well as non-mixing of different kinds of products [15].

3. PARTICIPANTS AND ACTIVITIES AT THE WHOLESALE MARKET

The owners, managers and users are the main participants of a fresh food wholesale market, from whose work, duties and responsibilities depend successful operation of the wholesale market. The most common forms of ownership of wholesale markets are public, semi-public and private wholesale markets. Management of the wholesale markets can be public or private company, authorized by the State or local administration [6]. Wholesale users are professional traders and agents, producers and their organizations and professional customers. Demands and needs of participants should be taken into account when planning and designing.

One of the critical points in wholesale markets planning and designing is certainly, an understanding of the wholesale markets functioning as a series of phases and activities. At the wholesale market, in addition to transport, that includes products delivery and dispatch, products handling activities that include sorting, categorizing, packaging of fresh products, selling promotion or storage for the specified time are carried out. To keep products fresh till the place of final sale, passing through the wholesale market should be as short as possible.

Wholesale market working time rhythm follows the needs of the users. It is not the same for all wholesale market users and is determined according to the product being promoted and sold. At the end of selling time, wholesalers leave and lock the facility. The most common time for fruit and vegetable trade is from 5:30 to 11:00 am.

4. REGULATIONS AND GUIDELINES IN AGRI-FOOD SYSTEM AND IN WHOLESALE MARKETS

The planning and design of fresh food wholesale markets is affected with a number of factors that define micro and macro environment. Special attention is paid to the institutional and legal environment, as well as the context of regulations and guidelines for a particular group of facilities and products. In the current conditions of global environmental pollution and the information that about 70% of poisoning origin from contaminated food, protection and food security is imperative in health assurance[7]. As mentioned, priority in nutrition research is food safety. That research priority developed recommendations at global level and regulations and guidelines at EU or national level

Organizations involved in food safety at the global level are: Food agriculture Organization (FAO), World Health Organization (WHO), Codex Alimentarius Commission (CAC) and the World Union of Wholesale Markets (WUWM), non-profit organizations involved in fresh food wholesale markets promotion.

Codex Alimentarius Commission [8]. established by FAO and WHO in 1963. adopted Codex Alimentarius [9], that is a set of international standards for processed, semi-processed, and raw foods. Code of hygienic practice for fresh fruits and vegetables (CAC / RCP 53-2003), Code of practice in health care for the transport of food products in bulk and semi-packed state (CAC / RCP 47-2001), and recommended international code of practice for packaging and transport fresh Fruits and Vegetables (CAC/RCP 44-1995, AMD.1-2004) offer recommendations to achieve safe and hygienic food consumed in the fresh market, including manufacturing, packaging, transport and commercialization.

4.1 Traceability and cold chain

With Council Decision 2003/822/EC, Europe Union joined the Codex Alimentarius Commission with the main objective to define international standards and recommendations related to food.

Regulation (EC) 178/2002 of the European Parliament and of the "General food law". and covers all stages of food production, processing and distribution. Food law is based on risk analysis, protection of consumer interests, mandatory traceability, establishing procedures for product withdrawal. Traceability of fruit and vegetables means that it is possible to check and identify product and actor in any point of food chain. In respect of the cold chain, each operator is to receive information about the history of temperature conditions in function of time from the previous operator and forward it to the next operator, entering his additional information.

Directive 93/43 / EC as amended by Regulation (EC) 1882/2003 of the European Parliament and the Council and Regulation (EC) 852/2004 and Regulation (EC) 853/2004 regarding the hygiene preparation, processing, manufacturing, packaging, storage, distribution and sale of food in accordance with the HACCP concept. It also establishes microbiological criteria and **temperature control** on the basis of scientific practice, in order to manage risks related to food.

Establishment of cold chain in the agro-food system [10] is crucial to the health safety of food. Cooling technologies can slow or completely prevent microbial growth and formation of toxins. Refrigeration is present throughout the food chain, and is related to perishable foods. That means taht we talk about the cold chain from raw agricultural products to the consumer table. The task of each governments is to define strategies in

relation to the food, setting priorities in addressing demands for quality, safety and food sufficiency, but also to create conditions for food to reach freely the world market. International organizations, established by the United Nations and regional organizations are, as a rule, the sources and basis for legislation [11].

4.2. Community guide to good hygienic practices specific to wholesale market management in the European Union

WUWM and its European regional sections, published 2010 the Community Guide to Good Hygienic Practices Specific to Wholesale Market Management in the European Union [6]. The Guide is a document of the wider significance and is a landmark for all participants in the wholesale markets management, but also for all those involved in planning and designing of wholesale markets. The Guide only applies to the wholesale market, and was prepared under applicable regulations of the European Parliament and the Council and takes into account the international code of conduct, the general principles of food hygiene, Codex Alimentarius and existing national guides.

In Chapter V and its subchapter I- Chapter: general requirements for food premises including outside areas and sites 10 legal requirements are given, guide to compliance and advice on good practice. Here we will give an example of the Legal requirement 2a.

Legal requirement	Guide to compliance	Advice on good practice
2. The layout, design, construction, location and size of food premises are to:	The wholesale market management should take into account specific requirements corresponding to the type of food business concerned, both in terms of the products and the quantities to be dealt with	
(a) Permit adequate maintenance, cleaning and/or disinfection, avoid or minimise air-borne contamination, and provide adequate working space to allow for the hygienic performance of all operations;	<p>Materials used for construction should allow for the type of cleaning appropriate to the area. The layout and design of food premises should allow access for cleaning to all parts of the premises. The design, construction and surface finishes within food premises determine how easily they can be cleaned.</p> <p>It is essential that the correct materials are chosen for all ceiling, wall and floor finishes and that they are properly fixed or applied. Ventilation, air conditioning or cooling should be checked regularly and records maintained.</p> <p>The flow of ventilation, air conditioning or cooling should be in accordance with the size of the premises and volume of goods to be dealt with by the food business operator</p>	<p>The wholesale market management and/or food businesses responsible should ensure that adequate systems and precautions are in place to prevent adverse chemical reactions occurring between cleaning products and/or construction materials.</p> <p>There should be an effective separation between clean and unclean processes to reduce cross contamination.</p> <p>Colours and materials should be appropriate for food use</p>

From the previous example, we can see that the conditions to be met in the planning and design are clearly defined and represent a hygienic point of view for wholesale market. Hygienic aspect is extremely important in the food chain, so consideration should be given.

Principle of HACCP (Hazard Analysis Critical Control Point) was proposed for managers as a mean of control to carry out physical, microbiological and chemical control in areas for which they are responsible. This Guide is, therefore, focused on contamination risks managing of, especially in terms of spatial conception and premises organisation in layout of facilities and utilities. The Guide has exceptional importance for all participants in the wholesale markets planning and design.

5. BUILDINGS FOR FRUIT AND VEGETABLE PRESENTATION AND SALE IN SELECTED WHOLESALE MARKETS

Assessment of the fruit and vegetable presentation and sale facilities area requirement usually done using the basic data [12]: consumption of fruits and vegetables per capita per year, estimate of the population increase for a specific period of time, the expected turnover, i.e. the amount of fruits and vegetables sold per m² of wholesale market area. Wholesale market buildings should ensure scheduled process effective functioning, and to provide comfort, functionality, modularity and expandability.

Buildings size, their dimensions: length, width and height, as well as other architectural elements: walls, windows, doors, which are result of the facilities function and their position within the complex, give the visual identity to the wholesale markets.

The parameters by which we can analyze the spatial-functional solution of the building for fruit and vegetable presentation and sale are: dimensions of objects (length, width, height), functional units and their relationship, applied materials, ambient conditions (temperature, air humidity) and internal utilities (heating, ventilation, air conditioning), which provide ambient conditions. The analysis include fruits and vegetables facilities in selected wholesale markets, as following: The Halles in Paris, the CAR in Rome, the Lyon - Corbas in Lyon.

5.1. Halles in Paris

Halles in Paris were built in mid of 19th century and were in the first arrondissement, in the heart of Paris, in Saint Eustache church neighborhood and Rambuteau street.



Fig. 1. Halles in Paris

Ten pavilions were built between 1853 and 1870, and the eleventh and twelfth were built in 1936 (Fig. 1). The Halles architect was Victor Baltard (1805-1874). In 1969th Halles were demolished due to insufficiency of space, unhygienic sale conditions and frequent infections [13].



Fig. 2. Plan of Pavilions with numbers and types of food

Halles wider zone is 2 ha, and the perimeter of pavilions and streets between pavilions is 4.6 ha. The total built Halle area is 83,000 m² (ground floor and basements, galleries). Twelve pavilions are separated by a wide road, into two groups of six pavilions. Within each group, pavilions are functionally linked by roofed streets. Halle Paris are an example of clearly separated pavilions by type of food that are sold in them. Fruits and vegetables, dairy products, meat, fish etc.. were sold on market (Fig.2), feeding Paris, which at that time had 1.5 million people.

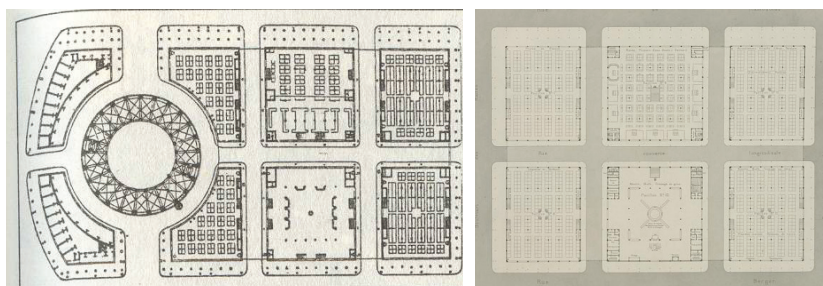


Fig. 3. Pavilions layout with its internal organization

Pavilions are square and rectangular in shape. Internal functional solution of each pavilion is a unique space with a repetitive pattern of stands (Fig.3). The dimensions of the pavilion are 42 × 54 m or 54 × 54 m, designed and constructed in a modular system of 6 m. At twelve feet around the edges and inside the pavilion row of columns are placed so

that the spans of roof steel girders in the middle part were 18m and 30m. Height of the pavilion is 24m (Fig.4). Being made of steel, pavilion presents an example of steel structural elements prefabrication and industrial revolution result.

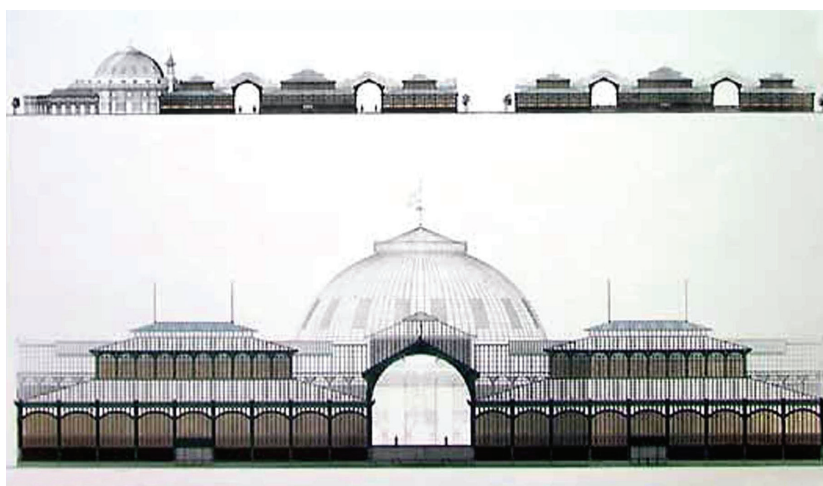


Fig. 4. Longitudinal and lateral elevations of Halles

Potable water, sewage and gas utilities were installed, which at that time were considered as "luxury" systems, allowing cleaning and night work [14]. Pavilions were admired by contemporaries, who were enthusiastic about the lightness and transparency of this masterpiece (Fig.5). From the technical point of view, Halles were a triumph of industrial architecture that was applied to many buildings from that period. Steel and glass implementation offered better hygiene conditions, thanks to the size of wide areas. Effective ventilation and natural lighting were achieved through glass blinds. Benefits notwithstanding, the pavilions were still cold in winter and sweltering in summer, which presented unfavourable conditions for food safety.

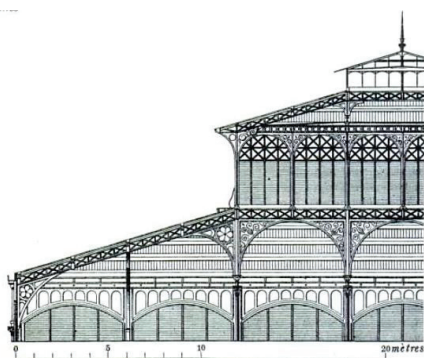


Fig. 5. Cross section through the Pavilion



Fig. 6. Interior of the Pavilion

5.2. Wholesale market CAR in Rome

Agri-Food Center Rome (CAR), built in 2002, is located in a suburb of Rome. The location area is 140 ha, and area under buildings is 117,816 m². CAR is composed of four zones. One of the zones is fruit, vegetables and fish wholesale market (Fig.7). Annual fruits and vegetables turnover is 750,000 tons Wholesale market supply the city of Rome with about 3.8 million people.

Fruits and vegetables wholesale market consist of two parallel buildings of the same size. Each building has central core that allows forming of structures at an angle. Buildings are located opposite each other. The total area of both buildings is 45,000 m².



Fig. 7. Satellite image of CAR



Fig. 8. Central corridor interior view

Each facility has 60 stores, one opposite another arranged around the central corridor for customers. Central corridor has a product promotion and sale function. On both sides of the building there are loading and unloading ramps. Width of the building is 72 m, the grid is 3 × 24m. Longitudinal grid is 12 m. Thus, the total length of the building excluding the central core is 360 m (Fig.9)

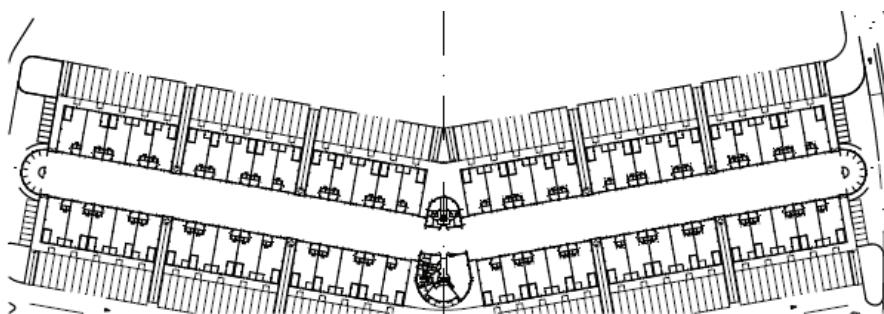


Fig. 9. Ground floor layout with wholesalers stores

Each store, 12m × 24m, has a small cold room, toilet, office upstairs so that the total available area 355 m² per store (Fig.10). Each store has a large door to the loading-unloading ramp and the central corridor. Height of the building in the stores area is 8 m,

while in the central semi-circular roofed area is 16 m (Fig.11). Central corridor natural lighting is obtained through the windows on the semi-circular roof. The central core is designed for cafes, banks, offices. Semi-circular parts on the sides of the building are intended for agricultural goods producers daily sales.

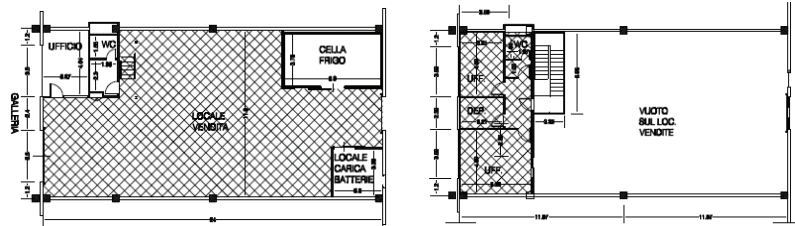


Fig. 10. Ground floor layout and upstairs wholeseller's store (author Tommaso Valle, proprietary of CAR)

The stores structure is made of reinforced concrete with thermally insulated prefabricated concrete panels. Partition walls are made of prefabricated concrete. Central corridor roof structure is made of steel, while roofing is combination of sandwich sheet panels and semicircular formed polycarbonate plates, allowing for zenithal natural light.

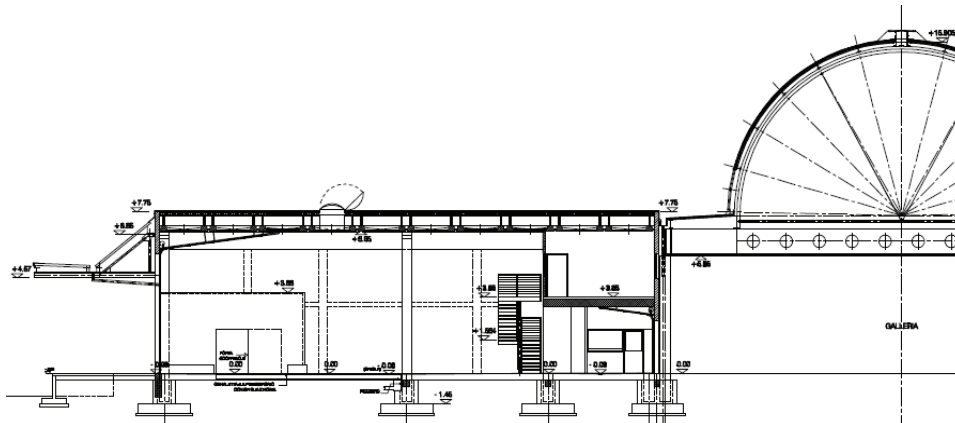


Fig. 11. The building cross-section (author Tommaso Valle, propriatery CAR)

Floors are smooth finished, epoxy coated. In the central corridor there are wide drain channels to receive water from floor washing (fig.8). Internal walls are smooth and painted with washable paint. All stores have suspended ceilings. There are ramps at building entrances, leading to the floor level. These entrances have low metal gates, so there is neither heating not controlled cooling in the building. Only natural cross ventilation exists, since both ramp doors and promotion space doors are usually opened, so the cold chain is clearly interrapted.

5.3. Wholesale market Lyon-Corbas in Lyon

Wholesale market Lyon-Corbas was built in 2009. It is located in the agro-food zone of Lyon. The site area is 11 ha and the buildings area is 38.000 m²



Fig. 12. Two opposite buildings for fruit and vegetable promotion and sale

Wholesale market Lion-Corbas is an example of a modern exclusive wholesale market for fruit and vegetable sale, dimensioned for a fruit and vegetable turnover of 300.000 tons / year. Wholesale market supplies a population of 2 million people. Two buildings, opposite to each other (Fig.12), has an area of 35.000 m². Area of 27.000 m² has controlled air temperature. Two buildings for wholesalers are in length 300 m and 350 m, respectively, and are 40 m wide. They are located opposite one to another at a distance of 50 m (Fig.13). In longitudinal direction column grid is 12.5 m and in transversal direction is 40 m.

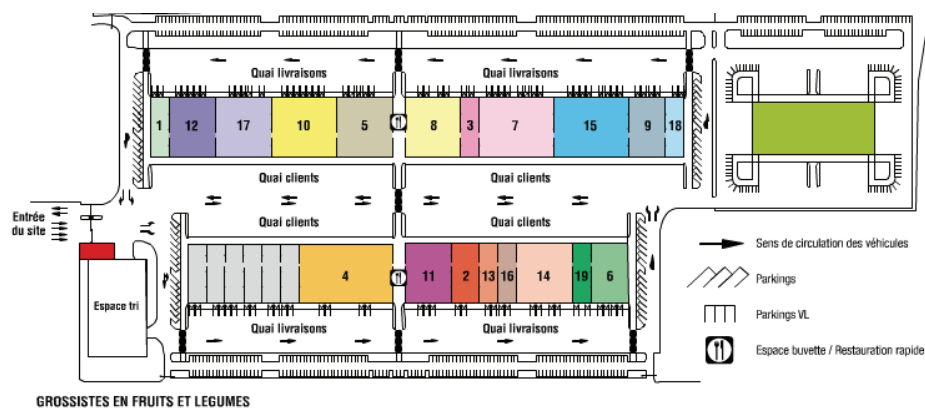


Fig. 13. Site plan indicating numbers of the wholesale market stores

One module has dimensions of 12.5 m × 40 m, which is an area of 500 m². Wholesalers may choose multiple modules or half modules for store, depending on the needs and opportunities. Average size per store is approximately 1.500 m². Wholesalers stores are interconnected by a central passageway doors. This passageway for customers is 3 m wide. In each store, the air temperature is controlled at around 10 ° C (Fig.15). Wholesalers office are on the first floor, with natural light.

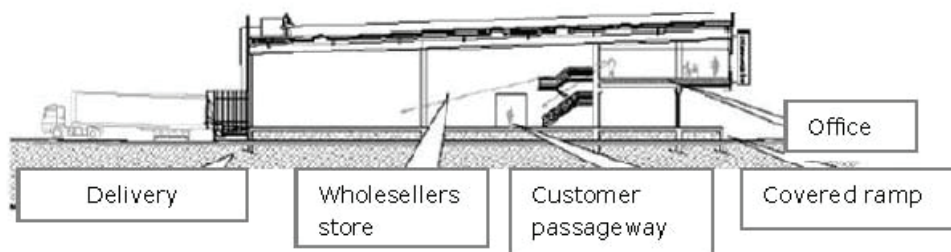


Fig. 14. Cross section view through wholesaler store

Height of the building is 8 m. The ramps height is 1.10 m from the road level. Four meters wide ramps, on the delivery to customers side are covered. On the supplier side, on the other side of the building, the receiving is provided through a door equipped with "auto-docks" (Fig.14). Therefore, the cold chain is totally maintained on the gross suppliers side.

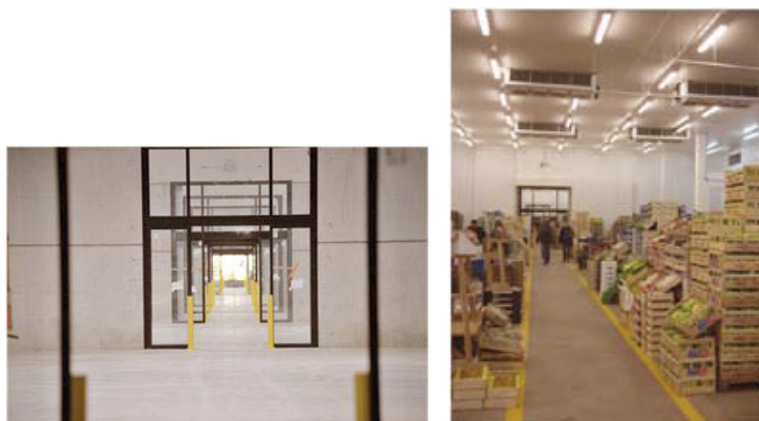


Fig. 15. Central passageway for customers in the wholesalers building view

Efficient flow through buildings is also achieved with the spatial solution of the site. In that way, the "customers area" is located between two buildings, so the mixing of suppliers and customers is avoided. Buildings and utilities are in accordance with strict food safety standards, as well as with optimized flow of goods.

Taking care of cold chain and sanitary requirements for the area intended for food handling, the primary structure is reinforced concrete skeleton, smooth epoxy floors without drain channels are foreseen. Facade walls and roofing are made of thermally insulated sandwich sheet panels. All doors on the facade walls are roller shutters.

5.4. Comparative analysis of solutions for wholesale market buildings and ambient conditions in them

Case studies include examples of typical wholesale markets at the time of construction: Halles were built in Paris 1853, at the location that had eight hundred years of marketplace tradition, wholesale market CAR, Rome, opened in 2002 and new wholesale market Lyon-Corbas, Lyon, opened in 2009. Wholesale markets were built in the cities that had more than one million inhabitants.

Halles, Paris, is an example of market for selling fruit and vegetables, meat, dairy products, fish and flowers. CAR, Rome, for selling fresh fruits, vegetables and fish, and at the wholesale market Lyon-Corbas, Lyon, is exclusively selling fresh fruits and vegetables.

Three types of building spatial-functional solution were observed in relation to realised ambient conditions in them.

The first type is Halles, Paris, with a square or slightly rectangular base of the buildings and a unique space where vendors stalls were located in a regular pattern, like the pattern in retail markets. That is not surprising because at the market, selling was retail and wholesale. Buildings height was significant and modular in shape. Common areas, such as cafes, toilets etc. are located at the edge of buildings. Ambient conditions are: natural lighting and ventilation. Buildings are practically open and protect internal ambient such as "umbrella". Utilities for lighting gas and potable water at fountain taps were installed at specific places in the pavilions. After all, these ambient conditions were a "luxury" in the 19th century.

The second type (two-sided) is an example of the wholesale CAR, Rome, with a three-aisled nave almost completely closed, elongated buildings. Wholesellers stores are located in the side aisles, while in the middle one goods are promoted for passing by customers. Along the longitudinal sides, outside of the building, loading and unloading ramps are located. Outside, on the top of the inclined ramps short metal gates are located. The buildings are modular. The middle aisle nave has a considerable height and is provided with lighting from the roof zenith. The common areas are cafes, offices, space for waste containers. Ambient conditions are provided with natural lighting and ventilation. In the zone of wholesalers stores are cold rooms, with its own refrigeration system, for storing unsold goods. In the wholesalers store offices toilets are located. Floors are equipped with drains for distributing dirty water from washing.

The third type (flowing type) of the spatial-functional solution is an example of the wholesale market Lyon-Corbas, Lyon. Buildings are elongated, single-aisled nave with only one row of stores. Goods are unloaded from one side of the building through the "auto-dock", promoted in the house, and delivered the other side of the building through the roofed ramp. Both buildings are divided in lateral intersected parts. Those parts, with sides for goods loading and unloading on opposite sides, are wholesalers stores. Customers is passing through successive stores serial. Each store has an office and toilet. The common areas are technical spaces. Air temperature is 10°C. Area for promotion and sale is completely air conditioned. Floors are smooth, without drains. The walls are flat sheet metal panels.

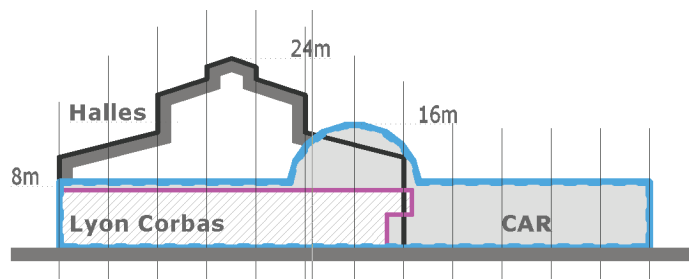


Fig. 16. Comparative schematic plan cross-sectional buildings for all three models

All these types of spatial-functional building solution derived from the traditional ways of buying and selling. The buyer wants to see or test the goods before deciding to buy. In Fig. 16 is clearly shown that geometry and spatial-functional building solutions for fruits and vegetables promotion has changed over time. From 2002 to 2009. year we can note significant changes

Building changes are caused by following changes in ambiental conditions. To reach the air temperature of 10°C with air conditioning in the Lyon-Corbas wholesale market buildings, for savings in energy consumption, the optimal rooms and buildings volume are requested. The high, middle aisle nave are lost, but a function of goods promotion and customer passage is preserved.

Each wholesale market, mentioned in this reserch, applied structural solutions and materials that in the period of erection were contemporary and were according to current requirements and regulations. It is clear that only in the wholesale market buildings Lyon-Corbas, Lyon the materials applied for walls, floors and ceilings are easy to maintenance and sanitary proper.

6. CONCLUSION

Cold chain maintenance is a priority request that should be applied to all building for promotion and sale of goods in wholesales market, especially fresh fruit and vegetables. Cold chain means that specified temperature and humidity are respected, that implied installation of air conditioning units with all necessary equipment and utilities. This ambiental request respect implied planning and design of "rational buildings", with optimal dimensions of premises (width, length and height) in order to save energy

Sanitary regulations and guidelines require that functional building solutions prevent any contamination. They also require application of materials for walls, floors, ceilings that are resistant to cleaning agents, easy to maintain and sanitary proper, not to compromise goods being kept inside.

The research clearly demonstrated that the regulations and guidelines in the field of ambiental and health and sanitary conditions are changing spatial-functional building solutions, and applied materials. Bearing in mind that buildings for fruits and vegetables on wholesale markets have sizeable areas and have to meet required ambiental conditions, planning and design becomes a challenge to find modern solutions to increase energy efficiency and sustainable building. This is why it is necessary to follow the rules and

recommendations, because only those fresh fruit and vegetable wholesale markets that meet required conditions can obtain certificates for international trade. It is essential that professionals involved in planning and design of wholesale markets, especially architects, are aware of the regulations and recommendations and examples of realised wholesale markets, that their work in interdisciplinary teams could be successful.

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ARHITEKTONSKI ASPEKT REŠENJA AMBIJENTALNIH USLOVA U OBJEKTIMA VELETRŽNICA SVEŽEG VOĆA I POVRĆA

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Obezbeđivanje zdrave ishrane stanovništva, kontinuirano stambedavanje svežim, kvalitetnim i po ceni prihvatljivih namirnica, pri intenzivnom povećanju broja žitelja gradova, pokazuje da je planiranje i izgradnja veleprodajnih pijaca (veletržnica) neophodno.

Savremene veletržnice su tehnološko-komercijalni kompleksi sa značajnom izgrađenom površinom objekata, saobraćajnica i sa obimnom infrastrukturom. Na planiranje i projektovanje veletržnica utiče veliki broj faktora, a jedan od bitnih faktora koji utiče na prostorno-funkcionalno

rešenje objekata za izlaganje i prodaju svežih namirnica, posebno voća i povrća su zahtevani ambijentalni uslovi. Ambijentalni uslovi obuhvataju pored zahtevanih temperatura i vlažnosti vazduha i higijensko-zdravstvene zahteve.

Propise i preporuke koje važe u ukupnom poljoprivredno-prehrambenom sistemu-lancu "od njive do trpeze", obhvataju i veletržnice. Organizacije koje donose preporuke na svetskom nivou su Organizacija za hranu i poljoprivredu pri Ujedinjenim nacijama (FAO), Svedska zdravstvena organizacija (WHO), Svedska unija veletržnica (WUWM), i upravo se njihovim preporukama zahteva poštovanje hladnog lanca, sledljivosti i higijensko zdravstvenih standarda. Preporuke se ugrađuju u nacionalne zakone.

Predpostavka istraživanja je da su promene u ambijentalnim uslovima, nastale i propisane zakonima i preporukama, bitno uticale na promene prostorno-funkcionalnih rešenja objekata veletržnica voća i povrća, i da su te promene ubrzane. U radu je data uporedna analiza prostorno-funkcionalnih rešenja po osnovnim parametrima kao što su dimenzije objekata, funkcionali raspored, vrste i dimenzije prostorija. Na taj način su sagledane promene prostorno-funkcionalnih rešenja u vremenu. Analize su obuhvatile prostorno-funkcionalna rešenja objekata na veletržnici Halles-e u Parizu, CAR u Rimu i Lyon-Corbas-a u Lionu. Rezultati istraživanja su potvrdili postavljene pretpostavke, odnosno potvrdili promene u prostorno-funkcionalnim rešenjima i kompletnoj geometriji objekata i prostorija, kao posledicu zahtevanih ambijentalnih uslova, a samim tim dobijeni rezultati imaju aplikativni značaj za praktičnu primenu u planiranju i projektovanju savremenih objekata svežeg voća i povrća na veletržnicama.

Key words: *Veletržnice svežih namirnica, objekti za voće i povrća, ambijentalni uslovi, prostorno-funkcionalno rešenje.*