RAILWAY STATIONS – THE BORDERLINE BETWEEN ARCHITECTURE AND STRUCTURE

「鉄道駅・建築と構造との間の境界線」

木戸エバ
Ewa Maria KIDO
株式会社建設技術研究所 国土文化研究所
〒103-8430 東京都中央区日本橋人形町2-15-1-6F
E-mail: kido@ctie.co.jp

Railway stations are the very unusual combination of architecture and structure. They serve people but they have also to consider structural requirements of trains. Currently, the modern stations are multifunctional complexes, connecting multi-modes of transportation. Architecture and structure at these stations are complementary to each other. The true aesthetic design can be only achieved by their coordination from the very beginning of the design process. The paper is formulating the conditions to achieve a well-balanced aesthetic station. Some parts of the station – such as platforms, canopies, are very much determined by the outstanding structure and other, like station building are very much dependent on architecture. Together these facilities are on the borderline between architecture and structural engineering. The article is analyzing this relationship and is categorizing the recent stations in Japan and Europe.

Keywords: Railway station; architecture; structure, station-city; station-complex; station-tower; station-gate; station-identity.

1. Introduction

Railway stations are facilities, at which the level of interaction between architecture and structure is of paramount importance. Railway stations are facilities, at which the level of interaction between architecture and structure is of paramount importance. Station usually consists of the combination of a station building with platform to allow the passengers to get on and off the train, or shelter, or only one of either. In the past, large station buildings with spacious train sheds built for train terminals in major European cities were top achievements among engineering structures that flourished in 19th century. They also displayed outstanding architectural features. Today, along with “station renaissance”, some of these splendid stations have been modernized and adapted for high-speed trains (HST). Also, the last two decades saw a development of both – the impressive large-size stations that have been built to respond to the re-urbanization of cities – and the development of local stations with significant designs.

Current multi-modal stations, often resembling air terminals, must respond to different requirements than before. They provide access for airplanes, other rails, bus, underground and LRT services, and as a part of new urban and commercial centers, they accommodate businesses, hotels, and shopping centers. Station buildings must include all the facilities arranged for ticketing, waiting, transfer, and also those non-transportation facilities – for shopping, recreation and administration. Nowadays, among interesting achievements are completely new facilities, and also refurbished stations. Historical stations that underwent renovations and combine preserved architecture with new extensions are structurally and functionally innovative. New station facilities, responding to current standards, apply all the possible architectural technologies and structural solutions.

Kanazawa (2015). Examples of European local stations also include stations for conventional trains, such as Nordpark Cable Railway stations (2007), Station Leuven (2007), and Station Delft (2015), as well as stations serving high-speed trains: Gare d’Avignon TGV (2001), Montabar Bahnhof (2002), and Station Brugge (2009).

The borderline between architecture and structural engineering at modern railway stations seems rather fluid because it is natural that good structures influence the forms of buildings and the best shapes are delivered from the structures or, the other way – architectural concepts demand innovative construction systems. The conclusion is that, when creative architectural concepts are expressed through the cutting edge structures and stations are conceived with the help of new construction methods, such approach results in splendid stations. They have a strong visual influence and such stations identify their surrounding landscape.

2. Elements of the Railway Landscape and their aesthetic requirements (stations, train cars and corridors)

2.1 “Railway Landscape” and aesthetics of railways

Transportation infrastructure is one of the most dominating elements in the cities and the open landscape. It has the power to define an urban landscape and its natural surroundings. “Railway Landscape” (RL) refers to the landscape of railway stations and their facilities, as well as to all the spatial configurations in station surrounding, such as station square and street. It includes, as its elements, both the agreeability of the station (an element depending largely on the form and function), and aesthetics of the station as well as the safety and accessibility (convenience). The RL is perceived in this study in the context of the visual amenity and functional efficiency. It consists of a three-dimensional network of railways, subways, and Light Rail Transit (LRT), which contain three basic elements of the rail infrastructure: railroads, stations and train cars.

Aesthetics in general relates to the beauty of objects, of their refined taste. Aesthetic qualities of built forms depend upon their design and are examined via perception. The concept of aesthetics is a broad one – not only limited to purely visual qualities based on the well-established principles of formal analysis, such as size, shape, texture, color, etc. – but is also including more subjective aspects, such as utility, intentions of the designer, visual and mental impressions, context, invention of structural form, sense of place, etc. [1]. Aesthetics depends on the relation between form, function and beauty. These relations have been changing in time along with architectural styles. For engineers, function was always important because their structures always had explicit functions. Railroad stations were invented for the travel and they always had to fulfill a number of purposes, including its main transportation function. Station design was a completely new task for 19th century engineers, as a new architectural form was required. In the past, the European and American train depots reflected qualities of architectural styles, and later became more standardized until a recent revival which has seen station buildings again become structurally, formally and functionally innovative.

Although aesthetics in relation to buildings has a long tradition, aesthetics of engineering infrastructure has been discussed since the 1980s, mainly in aspects of bridge design [2], [3]. Aesthetics of railways can be defined as a balance between the exterior and interior of a station, and between building architecture, engineering structure and transportation function – in consideration of its planning, layout, details and the context. Other station functions need to be sensitively distributed and clearly distinguished from those that are purely transportation-related. Railway station need to be seen in a broad sense – as a combination of station hall, concourses and platforms, as a station building with various facilities, with engineering structures (bridges, tunnels), overhead lines, electrical facilities and trains. Aesthetic factors include such visual images as space (provides security and comfort), light (preferably daylight and top light – creating a secure environment and enhancing architectural features); scale (preferably large spaces with human–scale elements); and details of the railway. It also embraces the landmarks, brand design of the operator (e.g., marking station entrances, such as the Art Deco entrances at the Paris Metro), and even public art, commercial activity, and advertising [4].

Currently the implementation of aesthetics is being realized by the railway companies – through their policies, including amenity improvement programs, new concepts of corporate design, and modern architectural designs achieved through the involvement of the well-known architects. Aesthetics and economy have often been considered to contradict each other. Since the separation of architectural and engineering professions, some engineers believed that satisfying aesthetic requirements involved additional cost. However there are many examples of structures and buildings being beautiful and economical at the same time.

2.2 Stations

Railway stations are important public buildings, which besides giving access to trains perform a variety of
functions – such as meeting places, shopping centers, administration and cultural centers, and very often as urban landmarks. How the station affects the landscape depends on its functional type. In theory there are several kinds, such as suburban station, city center terminal, interchange, small station, airport station, and LRT station but nowadays stations have become more complex and now fulfill more than one functional role [5], [6]. The complexity of contemporary stations is reflected in their spatial conception, which is a combination of a building with a train shed or canopies, concourses, and an outdoor environment.

2.3 Train cars

Comfort of train cars is associated with aesthetics – pleasant cars and nice interiors give the passengers a comfortable feeling. Japanese and European trains are usually comfortable, provide many types of seats. In Europe it is allowed to carry bicycles, while in Japan it is not. The compartments of Shinkansen trains are spacious. At many European trains it is possible to charge the portable phones. In Japan trains have many advertisements, which sometimes distract from information. Electronic displays are popular – in Japan they are very sophisticated and installed at the commuter trains and long-distance trains alike.

2.4 Corridors

Except station buildings and their spaces, there are also other elements, which amenity plays an important role in the total perception of the railways. Earthworks, structures such as elevated tracks, viaduct and tunnels, alignments and line equipment – all are part of the railway corridors infrastructure, which is one of elements of the “Railway Landscape”. Earthworks are necessary to adjust sharp curves or steep gradients of a route on natural levels. Cuttings or embankments are the works needed for such adjustments. Hilly country, like Japan, requires more earthwork than flat countries; therefore railways here intrude more into natural scenery. Cuttings are less visible in railways than embankments. In Europe much care is put into evaluation of route alignment and into blending their embankments with natural scenery. Alignments – which are the routes upon which trains travel and the tracks are constructed and line equipment – such as gantries and masts from which catenaries are suspended are difficult to be modified by the designer because of their fixed parameters.

Particular considerations are need in design of elevated railway and viaducts. In spite of technological success of high-speed trains, visual impact of elevated tracks obstructing view can be particularly negative. Commenting on visual impact of railroads Carpenter (1994) observed that “An embankment may be disguised by trees whereas a high viaduct or railway building is necessary prominent; architecture determines their visual acceptability” [7]. Very difficult is planning of rail infrastructure in the urban environment, particularly in city centers as dense as Tokyo. One of successful examples is the Chūō Viaduct at Tokyo Station, where a lot of care has been taken to design aesthetically structural elements and apply colors. Such a viaduct sensitively designed is enhancing urban scenery around railway station (Fig. 1). Although some structures may be regarded neutral or as eyesores, some urban viaducts have in fact became city landmarks, recognized as important visual amenities. Some old structures have been even worth of presentations, such as the large brick-built Usui Viaduct (Fig. 2) between Yokokawa and Karuizawa, which was used by JNR and was replaced in around 1960s by an alternative route. The viaduct has been preserved as a historic monument. In 1999, a museum founded by local government and businesses was opened at the end of the steep grade near the Usui Station.

Fig. 1 Chūō Viaduct, Tokyo

Fig. 2 Usui Pass No.3 Viaduct (Meganebashi), Gunma Pref.

3. Architecture and structure

3.1 Architecture

Architecture is a process and a product. It is planning, designing and constructing of physical structures – particularly buildings, although it can also refer to bridges and other engineering infrastructure. Architecture
combines form and structure – and architectural design needs to find a particular equilibrium between functional, technical, social, environmental and aesthetic considerations. In the case of railway stations, there are particular aesthetic criteria which describe to proper combination of form and function with the structure. Architecture of station building can be very distinguishable feature of urban railways and the station building can define to neighborhood, and even the city.

3.2 Structure and the structural art

Structural art is an art accomplished in the work of structure. Art forms have developed after Industrial Revolution in late 19 century along with the introduction of new materials – iron, structural steel, reinforced concrete, PC concrete, and later – structural glass, composite timber, other composites and fiber reinforced plastic. New materials allowed for new structural forms, such tensile structures, shells, grid shells, space frames, etc. These forms have determined the shape of engineering structures such bridges and buildings. Billington (1983) has defined three goals of structural art – efficiency, economy, and elegance [8]. These goals correspond with the need of the conservation of environment and accountability of funds while satisfying the need of aesthetics in public life and preservation of historical monuments. Structural art – as opposed to fine architecture which seeks the beauty of pleasing shapes independent of the structural skeleton of the building – is based on engineering structure that is fully visible and aesthetically pleasing in its own right being the prime source of the beauty of the building. Many writers have emphasized that works of engineering, such as infrastructure, can achieve the status of the art [2], [4].

Structure has a very strong influence on the station forms and it is determining its spatial conception. Therefore the architects should works with engineers from the initial phase of the project to collaborate on the spatial layout of the station. The beauty of station is also related to structural design. For example, the Gare de Liège-Guillemins in Belgium, designed by Santiago Calatrava (2009), has a very huge roof above the platforms, which became the main visual element, while station hall is organized below the elevated railway (Fig. 3). Additionally, the structural members on the platform and the concourse and hall have similar stylistics and they unify the design of the station.

The collaboration between architects and structural engineers is essential to achieve architecturally and structurally sounded stations. The process of collaboration should start form the early stage of the project and develop along with the project. The effect of this collaboration should be the integration of structure within the overall architectural concept. This requires an engineer to have a deep understanding of the architectural intention – and an architect to have an understanding of the possibilities and limitations of the supporting structure. It thus requires cross-disciplinary skills and interdisciplinary ability. Achieving harmony between form, structure, materials, function and design of all building components is one of the greatest goals of design of buildings and facilities, including railway stations. This is possible only if the boundaries between architect and engineer are dissolved.

3.3 Aesthetic factors of station design

Structures and buildings to be united in total design, and aiming to achieve the structural art, need to fulfill particular aesthetic criteria. The important factors necessary to be fulfilled are: a meaningfully designed station building with sufficient space and clearance, with easy to understand passengers’ moves, with commercial facilities which do not interfere with pedestrian corridors, with advertisements that do not block the railway information and guidance, and a barrier-free [9]. The appropriate coordination between station architectural form and structure with function is reflected in related criteria to form and function.

3.3.1 Function: transportation

Obviously for a station the transportation function is the most essential one. In Japan for the first time modern stations designed for passenger transit have been transformed into multifunctional spaces serving a variety of purposes [10]. Recently also European stations have acquired this multifunctional image. They do not only provide a link with other modes but also serve as shopping and entertainment centers. At the station very important is
relation between form and function. Railway station spatial conception is aiming to set up this relationship in a proper manner. Transportation function directly depends on the accessibility of the station, proper information system, quality of stations building and its landmark value, visibility of the entrance, the quality of the hall, concourses and platforms.

- **Accessibility**
  Railway stations should be accessible to all potential users; therefore universal design is very important. Nowadays stations are equipped with barrier-free access through escalators, elevators, signs for visually impaired and various verbal announcements. Facilities responding to universal design should also have aesthetic values – e.g. colorful glass elevators, interesting forms of ramps, etc. Very often glass is adopted for elevators, which gives them, and the station itself, very modern look.

- **Information**
  In spite of verbal announcements, there is plenty of information which is visual, e.g. various signs, posters, plasma displays, etc. It is very important that the information signs have clear messages, easy to understand, and that their size is appropriate. The example of clear information signs are at the Shibuya Station. Such information adds additional quality to station design.

- **Quality of station building**
  Main station components include: station building, station entrance, station hall and circulation areas, such as concourses, platforms with train sheds or canopies, various facilities including shops, shopping malls, post office, etc., and outdoor environment – such as station plaza and street in front of station. Within the history of station architecture, the buildings were changing. Both in Europe and Japan there were times when station architecture was particularly impressive and times of stagnation of railways and not standardized stations.

  Station building, or station entrance in case of subways, should be clear and station name and logo of rail operator should be visible. If station is original, it can become a local landmark, important place, even meeting place for local community and its importance as a transportation node would be signaled by the architecture. Modern railway stations often resemble airport terminals but unlike airports, railway stations do not segregate arrival and departure levels. Railway station has all the attitudes to become a bustling urban space, even more vigorous that an airport. Railway terminals are important expression of national and corporate prestige. Edwards (1997) observed that for example Canary Wharf DRL Station in London (1999; arch. I.M. Pei) and Sloterdijk in Amsterdam (1996; arch. H. Reijndersof, Holland Railconsult) proclaimed of using good design for the benefit of passengers [5].

  Buildings of a big terminal or airport station have particular meaning of urban gateways and landmarks. Smaller stations are suitable for serving a community needs by attaching a particular value to design supporting architectural dignity of railway station and its functions. At modern multi-functional stations, sometimes the functions are complex and diverse and it is difficult to distinguish station building from attached functions. Edwards noticed that therefore there is need for architects to ensure that stations will have clarity and will carry the visual and formal codes of railway architecture. But in future these codes may become more fluid and already railway stations have been undergoing transformation towards more multifunctional and multimodal transportation nodes [5]. Nevertheless, the clarity of function of modernized or modern station building must be maintained. In Europe there are many historical stations among which large terminals have very distinguished architecture, such as renovated London’s St Pancras International (2007).

  In Japan, stations were rebuilt after earthquakes and after the last war, and there are only few original historical stations. Some station buildings built since 1960s have more clear facades and recognizable form, particularly smaller stations, but most of them are system-buildings built according to standard design, such as for example: Sakata and Masuda in Yamaguchi Prefecture, Aomori Station in Aomori Prefecture. They represent neither a diversity of styles nor a perceptible house-style, or integration with urban environment. Many medium–size stations and large are very complicated buildings without clear form, and often covered by the advertisements (e.g. Shinjuku, Shibuya, Ikebukuro). Only, when one looks closer, one can find a name of the station on the bottom of department store. However in recent years the design of station building became more meaningful (e.g. Hyūga-shi, Kōchi, Asahikawa, Shin-Minamata, Osaka, and Itoigawa).

- **Quality of station entrance**
  In Europe, station building has usually clear design and well visible entrance. Architecturally they are sometimes interesting or rather standardized but they are always well visible. Entrances to elevated stations are visually exposed – therefore they should be harmonized with their surroundings. Sometimes such elevated stations are rather typical, or not particularly aesthetically pleasing, such as some stations on Tokyo’s Yamanote Line which was constructed in 1885. Nowadays, many such stations in Tokyo are under renovation.
In case of subways, entrances are even more important because there is not often station building. In case when there is a building, it is difficult to find an appropriate design connecting building with the subway station. But when the design is good, such station entrance can be very well distinguished. Some subway entrances emphasize the company logo – like at London’s Underground, some other have very careful design reflecting total concept of the subway lines – like Art Deco entrances in Paris. Also in Japan, some recent entrances, such as at Omotesandō, have interesting design and show well subway operator’s logo. Some station entrances are very distinguished architecturally and have the quality of urban landmarks that identify particular city very well (e.g. stations on subway at Bilbao – Metro Bilbao, 1995) [11].

In front of station entrance should be located a plaza, which provides direct vehicular access to station by private vehicles, by forms of public transportation and for passengers arriving on foot. Station entrance often provides a shelter for people waiting for a bus or taxi. Therefore the front of the station is important because the station plaza, canopy, entrance and concourse are all related elements in the progression from the city to the train. The station entrance should be designed as practical – to enable traffic flow, and also as symbolic element of the station – to mark the starting point of the journey. The large glass entrance provides good orientation and ease of movement. From architectural and aesthetic point of view, the entrance can be larger than estimation would indicate.

- Quality of station hall and concourse
  Generally all elements of station, such as station building with entrance, station ticket halls and concourses, platforms, and station plaza should be located without obstruction or ambiguity. The progression through all the elements should be clearly defined, and they should be easily found by travelers. The circulation through the station should be achieved with ease of movement, comfort and speed. Station hall and concourses are the main areas of circulation. The design of circulatory spaces usually depends upon number factors – density of use, type of trains, fluctuation during peak hours, barrier-free access, etc. The location of commercial facilities at circulation areas often runs counter the efficient flow of passengers and can trigger the problems of safety and orientation. Except retail, there are other facilities located at the station, such as, cafes, bars, bookstalls, toilets, telephones, internet facilities, railway information, tourist information, hotels, offices, and museums.

  Station hall includes circulations areas, ticket sales and retail space, and post office at large stations. Station halls and concourses are the areas where there is a lot of activity and they need appropriate dimensions to allow the visibility and orientation – passengers need to know how to move around and how to disembark from the train and how to go to the platform. At most of European station these requirements of space, visibility and orientation have been satisfied at new stations, and at the recently modernized historical terminals, such as London’s St Pancras International. In Japan, these requirements have been sometimes problematic because of relatively smaller spaces available and large number of passenger using metropolitan stations but recently this situation has been improving. According to Ross, there are three goals in planning of space within stations: the avoidance of congestion, resilience to surges in demand for trains or disruption of service, and capacity for evacuation in some non-usual situations [6]. Particularly nowadays, stations have to be safe and prepared to deal with terrorist attacks.

  Station design should promote circulation at the station – both the flow of passengers through station concourses and other public spaces and comfort in waiting areas through provision of furniture, amenities and through separation from main passengers flow area. Station design should naturally lead the passengers to pass facilities and timetables, ticket-selling facilities, etc., in particular order associated with the process of travel. Walking routes at concourses should be free from constrictions. There is usually a pressure to insert as much as possible commercial uses, which may affect the adequate space, needed for passengers activities. Retail or leisure activities should be the secondary, the ticket sales points need to have primacy in the term of station layout, because passengers first have to buy tickets than, while waiting, they may involve in other activities. Shops, kiosks, cafes and other facilities should be rather located at the fringes of the station hall or at different levels, such as at the entresol at the Liverpool Street Station in London, or underground, such as at the 3-storeys underground shopping mall “Promenaden” at the Leipzig Hauptbahnhof.

- Quality of stations platform
  There are two basic types of station in regard to rail tracks and platforms: terminals – where trains begin and end their journeys, and through stations – where trains stop or pass through on their way from one place to another. Many city center terminals are quite literally the end of the line. Such terminals are for example all major stations in London and Paris, and in German cities (Leipzig, Frankfurt-am-Main and Stuttgart). In Japan, many private lines have terminals at the city centers (e.g. Seibu-Ikebukuro Line and Tōbu Tōjo Line at the Ikebukuro Station; Odakyū and Keiō Lines at Shinjuku Station). Through stations are the most popular. These stations in Europe are descendants of the roadside points, where stagecoaches called and replaced the coaching inns. In Japan through stations are descendants of the ancient Edo post-stations (shukuba), where the travelers often traveling on foot had to submit to control and could stay overnight in nearby inns (yadoya). Most of railway stations in Japan are through
stations. At large stations in Tokyo or Osaka less lines terminate than in large European stations. Osaka Station was initially designed by foreign engineers in Meiji Period as the starting point – a type of terminal station but later the project was changed into through station [12]. Even though some terminals in Tokyo (e.g. Ueno) are starting and ending points for some railway lines, they are other lines running through them. Only one station in Tokyo – Asakusa (1931) is a real terminal station for Tōbu Iseasaki Line offering service to Nikkō. Tōbu-Asakusa Station has developed according to popular scheme of private railway companies, which constructed department stores in the city centers and leisure facilities at the end of line. Asakusa Station had the first in Tokyo department store.

While planning of platforms determinates the type of station, the platforms themselves can have two types of the layouts. They may be planned of the side or as an island type. When there are more platforms at the station, an “island” platform is in the middle. Platforms are important and sensitive part of the station; they are accumulation areas, when passengers wait for their trains. They must be planned for the anticipated passengers’ number to avoid crowds. Platforms also have access from and to the concourses. Platforms need to be provided with effective arrangement of exists and entrances. This is particularly important at the subway stations that passengers can enter or leave the stations easily even during rush hours. In deep underground, interconnecting passageways can largely separate longitudinal flows of passengers from waiting areas. Platforms are usually fixed elements in architectural design, however their width greater than estimated is making the space visually safer and more convenient.

Platforms perform circulatory function, which depends on their accessibility. Accessibility means convenient, step-free access for mobility-impaired people. Platforms length is generally determined by train length, while the width is calculated according to the number of passengers (for example, 1 passenger per 1.0 m² in the UK). Platform design should be harmonized with other parts of the station, to provide total design and high quality of stations spaces. The design is particularly important for subway stations, which are in confined environment. At the railway stations the best solutions are glass walls to see through the station and surrounding landscape. At the subway stations, composition of station walls – arrangement of advertisements, stations names, information signs – are the elements that contribute to station visual appeal. At Paris Métro and London Underground or other European subways, and on recent subway lines in Tokyo, these elements on the wall are usually well coordinated and good composition of the walls is a common sight. In Japan however, station platforms have sometimes too many obstructive elements.

Platforms perform circulatory function, which depends on their accessibility. Accessibility means convenient, step-free access for mobility-impaired people. Platforms length is generally determined by train length, while the width is calculated according to the number of passengers (for example, 1 passenger per 1.0 m² in the UK). Platform design should be harmonized with other parts of the station, to provide total design and high quality of stations spaces. The design is particularly important for subway stations, which are in confined environment. At the railway stations the best solutions are glass walls to see through the station and surrounding landscape. At the subway stations, composition of station walls – arrangement of advertisements, stations names, information signs – are the elements that contribute to station visual appeal. At Paris Métro and London Underground or other European subways, and on recent subway lines in Tokyo, these elements on the wall are usually well coordinated and good composition of the walls is a common sight. In Japan however, station platforms have sometimes too many obstructive elements.

3.3.2 Function: commercial
Commercial function is important at the station, in spite of its main transportation function. It brings revenue to rail operators. Along with the process of evolution of railway stations, more functions have been added, such as retail, hotels, restaurants, and leisure. Ross has listed forms of retail that include: small shops, small size walk-in units, kiosks often located at the platforms, trade stands, vending machines, public telephones, ATMs, promotional activities and internet facilities [6]. Also advertisements are the visual form of retailing. Shops and other services need to be clearly distributed in regard to station space and accessibility to trains.

- **Shops**
  Stations have become transportation nodes offering many attractions and experiences as a part of efforts of changing railway companies trying to improve their products to reflect their corporate prestige. Shops are the most important commercial function at the stations. Shopping malls and convenience stores have been often installed at the station halls and around stations concourses. It is very convenient for people to have easy access to the shops but shops should not interfere with the passageways, tickets vending machines, etc. The problem of separation of transportation and commercial function and at the same time making commercial facilities easily available is difficult to solve at the modern and renovated stations. Commercial developments can be designed as “concentrated shopping malls” integrated with public areas of the station and distinguished from other services for passengers or as “lines of shops” usually developed in the form of corridors of retail surrounding the main operation areas. One of the ways to separate the functions is to locate commercial facilities at different levels than transportation (e.g. Leipzig Hauptbahnhof and Berlin Hauptbahnhof).

- **Advertisements**
  Commercial advertising has been source of income of railway companies in Europe from the early days. However there was care and control of the quality posters and billboards located at the stations. Currently, advertising is a source of several percent of income for Japanese and European rail operators and because of this income, there is a strong tendency to include more advertisements, like to include other commercial functions at the stations. Treatment of advertisement reflects approach to aesthetics in public spaces. A wide range of advertising media is available, such as various kinds of posters – traditional, illuminated, back-lit posters in illuminated casing, which are often applied at the subway platforms. It also includes moving displays, TV and plasma displays, and other displays at the staircases and along escalators, on the train bodies, inside the trains, branding the entire stations to one advertiser, various sales and campaigns installations.
Advertisements are inevitable and their design should be a part of total design concept. For example, it can be associated with the context of the station environment, have a reference to healthy lifestyle products, or culture, etc. – to enhance the value of the station image. Particularly sensitively should be handled the advertisements at historical stations, where they should be well integrated with station architecture. Careful design management is required for railways, if the railway corporate image is not to be lost in the flood of advertising material. Ross pointed out that the regulation of visual environment is required to establish priorities in which the corporate design and graphics takes the highest place [6]. There should be a balance between corporate graphics including information, building aesthetics and other users’ graphics, which includes commercial advertising and retail spaces graphics and arrangement.

In Japan the trend to place many advertisements at public spaces has been very strong. It is because of social acceptance for strong rights of the owners. Aesthetics of public facilities has been somehow sacrificed by the high economic growth, which led to the destruction of landscape since 1970s. At that time station design was economically-oriented, and according to Ashihara “despite their public character, station buildings are literally covered with so much commercial advertising that it is often difficult to tell whether they are station facilities or commercial buildings” [13]. Some railway stations have been often virtually covered by advertisements. Even the renovated elevation of Shibuya Station (2003) designed by architect Kengō Kuma, has been covered with large advertisement panels.

3.3.3 Function: cultural
Many railway operators realize that association of station with a culture is increasing the attractiveness of the station for the customers and at the same time increasing its commercial value.

- Public art
Public art is well perceived by passengers and may play a significant role in enhancing image of railways. Railway companies understand the importance of introducing a design and culture into stations and both in Japan and Europe works of art are present at the stations [11]. Art has become a part of cultural value of the rail brand design. In Europe, some transport agencies have introduced a “percent for the art” policy, based on a fixed percentage (from 0.5% to about 1%) of all budgets for new developments allocated to the purposes of art. The issue of the art and design at public transportation has been discussed for the first time at the International Union of Public Transport (Union Internationale des Transport Publics – UITP) Congress in 2001. In Newcastle, in the effect of collaboration with private sector, the city developed a “percent for art” policy which gives up to 1% of their annual capital construction program on arts projects. In the course of the program which has been running for 26 years, at the beginning mostly permanent art works were installed at the stations but later more often temporary works such as lighting installations and live art events were installed and organized. In Europe, public art projects are often financed by the government; for example the art program run in Brussels is financed by a government body set up in 1990 by the Public Works Ministry and it is related to artwork at all transit facilities. In Japan art is also applied at many stations – for example at the station halls and concourses are works conceived by local artists (e.g. stained-glass artworks at the Ueno Station, artworks at the Ōedo Line, Minato Mirai Line and Fukutoshin Line).

3.4 Form

Form of the station is the shape of its buildings, platforms and other related facilities. It depends not only on the spatial configuration of the station but also on the characteristics on the volumes and the voids and their aesthetics. Very important is the view of elevation. When the station is large, like for example the Amsterdam Centraal (Fig. 4), with clearly displayed façade, it becomes also an urban landmark.

3.4.1 Aesthetics criteria
Aesthetics of railways can be defined as a balance between exterior and interior of station, between building architecture, engineering structure and transportation function – in consideration of its planning, layout, details and context. Aesthetic factors of station design include objective qualities, such size and scale, proportion, form and shape, space, visual weight, light, texture, color, composition, movement and rhythm [9]. In subjective response to build form, there are image-based elements related to design context, representation of the image of railways, of a brand of train operators, landmarks features, and to inclusion of artistic elements. These are related to transportation and commercial station function.

- Size and scale
The size of building and its interiors affects emotional response and visual weight generated by their impression. The size of the station depends on how many passengers use it. The scale of station building is perceived in comparison to human scale. In case of large European railway terminals, like London’s St Pancras, Paddington or Victoria, they were designed not only to provide adequate space for passengers but also to impress by their large
scale. Such stations like Gothic cathedrals had many meanings – political, social and urban. Smaller stations were designed more in relation to human scale. The light contributes to the perception of scale – even if the station is small, good lighting design can make station visually more spacious. Large scale of recent European stations is accompanied by human-scale elements. These stations respond to different objectives than in the past; they have been built with spacious spaces designated for various functions connected with a chain of a “seamless journey”. Large scale stations are accompanied by human-scale elements, which produce more familiar atmosphere.

- **Proportion**
  Station building should have harmonious shape achieved by good proportions. Proportion is related to shape – for example slender or squat, and to scale. In the history of built forms, there have been favored proportions, such as 1.6 to 1 – the so called “golden mean”, developed in ancient architecture by architects and aestheticians, or in modern times – based on the analysis of buildings which are generally considered as beautiful, such as “modulor” system by Le Corbusier [14]. Modern architecture offers sometimes completely different proportions than in the past because aesthetic taste is changing in time. It is probably good, if the proportions of station building delivered from the geometry are based on the laws of nature.

- **Form and shape**
  There is a slight difference between “form” and “shape”. While “form has more solid meaning, shape is more outline of the object. Buildings are three-dimensional and there are some clues that are relevant to their perception, like distance, angle, colors, and amount of textural details. Complex forms can be identified through relationship to simpler forms. According to Ching, forms are built of primary elements: points, lines, planes, and volumes [15]. Such arrangements can be centralized, linear, radial, clustered, or grid-like. Station building should be recognizable and therefore it needs a comprehensive form.

- **Space**
  Station buildings cover particular space. According to some concepts, space exists between objects and permeates them (Plato). Ching envisaged a relationship between form and space as a “unity of opposites” [15]. Space may possess a “direction”, particularly when in a sequence, one space comes after another. Such sense of directionality is important at the railway stations. Space is an essential factor for railway stations because it enables users to move through it, to wait, to purchase tickets, to prepare before embarking for a travel and after arriving at the destination. Appropriate and well-designed space provides security and well-being. Glass, which is recently often used in architecture, encloses spaces but leaves their visual connections. Such space can be “permeable”. Glass elevators decrease the feeling of confinement, and as a part of universal design provide convenient access for physically challenged passengers. Transparency of glass creates station more spacious and understandable. Depending on the surface design, it is possible to speak about the “degree of permeability” and the “degree of closure”.

- **Visual weight**
  “Visual weight” is often referred to when we speak about the lightness of structures. As Holgate pointed out, visual “weight” of areas and volumes is of major importance in the unity, balance, and composition of built forms. It is influenced by light, color, and texture [1]. Modern frame and shell structures at the stations tend to look “light” and nowadays it is synonymous with “beautiful”.

- **Light**
  The nature of the form is emphasized through the light and shadow. Light can also distinguish the texture and color. The quality of space is affected by changes in the angle and color of the daylight. Light at the station is necessary. Brighter stations are livelier and probably safer. Design of lighting may create desirable atmosphere. At large stations, where the role of architecture and structure is paramount, the admission of daylight can increase the expression of structure which can become a landmark feature. Daylight in daytime is preferable; therefore a provision of glazing increases the possibility of natural light’s penetration inside the station. Artificial lighting is functional as well, and it can increase visual expression of the station. Top lights create secure environment and enhance architectural features of the interior. Lighting has also informative function – properly lit signs, information posters, stations names, etc., enable passengers to move in right direction easily and safely. Successful lighting depends on combination of lighting levels and types of lighting fixtures.

- **Texture**
  Texture is an additional value of the surface. It is the nature of the surface – size and organization of the particles constituting a surface. The texture can be smooth or rough; can be also rich by the repetition of small design elements and can have a pattern. Texture has a great effect on visual weight. Objects with smooth surfaces are perceived less “heavy” than those which have rough surfaces.
• **Color**
Perception of color is subjective and influenced by size, other colors and light. Colors may have also influence on the “visual weight”. Some colors, which are “warm”, make spaces visually smaller, while “cool” colors make them visually larger. At the station, color can be created by using colorful materials and colorful artificial lighting. Bright colors visually increase space; warm colors increase the feelings of safety. Colors are also used to express the design concept. They can be also used as a guiding or safety tool – for example by emphasizing railings or elevators by particular color. Colors combined with light can be used for aesthetic and functional arrangement at the station, to underline particular functional elements or to show directions.

• **Composition**
Composition may provide balance, unity, and harmony. “Balance” in built forms provides comprehensive equilibrium between visual forces. “Unity” is sometimes equaled with “beauty” of built form. In complex composition it can be referred to situation when all elements are grouped together or descend in some direction, or are integrated through broader outlines, through texture, colors and details. It is related to “harmony”, which means that all elements fit to each other and to their context, wider surrounding, etc. Composition is a very important factor of railway stations, because it also guarantees solving out functional issues.

• **Movement and rhythm**
It is affected by human eye-sight and brain. Impression of “movement”, for example by use of columns, can help to direct flow of passengers. At the stations, rhythm of some facades can underline main entrance and main station hall and distinguish them from other spaces.

• **Image-based elements**
Image illustrates the design idea. Built forms often express their association with certain location – “sense of place” (genius loci). In case of railway stations, which are gateways to particular cities, they might express the image of the city. Image of railways can be created for example through marking station entrances with company logo. The logo applied by many European operators has an informative, decorative and signature values.

• **Outstanding elements – landmarks**
Stations are perceived as landmarks, if they are visible and their image-based elements are strongly related to their urban, historical, cultural, and social context. Historically, main railway stations in Europe were landmarks, distinguished by their elaborated large forms and by prominent location, since they were often facing the main street and had a plaza in front of the main entrance.

3.4.2 **Design styles**
Before, the concept of aesthetics has been the interest of philosophers such as Plato, Hume and Kant, who understood it as something pure and searched the essence of beauty. Nowadays, aesthetics refers also to the sets of principles underlying the works of particular movement in architecture or art. The interpretations of common aesthetical values have shifted towards locating social groups that form the contemporary artistic taste or fashion. For Kant, beauty was not a property of any object, but an aesthetic judgment based on a subjective feeling. He claimed that a genuine good taste did exist, though it could not be empirically identified. Fashion in a Kantian sense is an aesthetic phenomenon and source of pleasure.

Style in design is process of creating something. Style in architecture is related to the logic of construction and visual design (e.g., Greek architecture versus Baroque).Engineers would agree, along with modernists, that the best generator of style is a concern for functional efficiency. Architecture and structure are complementing each other to achieve a particular style. Before, stations acquired architectural styles of the 19th century, such as the Neo-gothic, Neo-baroque, Art Nouveau, and Modernism. Nowadays, also architects are pursuing architectural styles (e.g., Neo-modernism, Post-modernism, Deconstructivism, or utilitarian style); sometimes they develop their personal styles, or develop styles influenced by local vocabularies.

4. **Architecture and structure at the large multimodal stations**
Railway stations are not structures but also they are not typical buildings. They are somewhere on the border line between those two. Architecture is the quality which can be seen directly and appreciated. Structure is the foundation for the architecture and sometimes it takes a lead and expresses structural beauty by itself. Modern structures allow for particular architectural expression through for example expressive dimensions of the roof, or slim proportions of the beams and girders, or artistically shaped columns. Station can be organized as a one volume – with hall, concourses and platform under one roof (e.g., Gare de Liège-Guillemins) and in such a case usually expressive structure is directly affecting the form of the station. However, very common are stations with halls and platforms as separated volumes. In such cases, station building is usually expressing architecture, while platforms with canopies or under a single roof are based on structural design. In such case it is very important to apply similar
Modern structures have been applied in recent railway station projects – both at the large station complexes and at the local stations. Large multimodal stations are the effect of the land development policies and they play important urban role. Today these stations are no longer taken as the exclusively transportation-oriented facilities but rather as the integrated city spaces. They represent the cutting edge of the city through the inclusion of new design styles, fashion trends, new ideas in physical settings, as well as adjusting to new life-styles. There are numerous of larger stations in Japan and Europe, which like urban centers, in spite of transportation serve also various other functions.

4.1 Japan: “station-city”

Railway station conceived as a “station-city” has many facilities – like a city – above the ground and underground, and other urban functions accommodated in large station complex, with station squares on both sides [16]. The excellent examples of such type are: “Osaka Station City” (2011), “JR Hakata City” (2011), “Tokyo Station City” (2013), and Shinjuku. “Station-city” may also include high-rise buildings (such as at the Osaka Station City or Shinjuku Station). The largest station in Japan and in the world – Shinjuku – is also now under the development and new high-rise building on the south has been already constructed. The “station-city” type includes new or renovated historical buildings – preserved or rebuilt due to consideration of their structure and seismic standards. Some authors call large station complexes – “city-integrated stations” (e.g., Osaka, Hakata, Shibuya), which include “stations-cities” and “station-towers” altogether [17].

- Osaka Station City (2011)
  “Osaka Station City” is one of the largest stations in Japan (423,800 people/day; JR; 2014). New station building was designed by West Japan Railway Company, JR West Japan Consultants Company, Nikken Sekkei and Yasui Architects & Engineers. The concept was to design a building that will unify its northern and southern sides. On the northern side was constructed a high-rise, 28-story “North Gate Building”, and on the southern side existing building was developed into a 16-story tower. The buildings are connected by a large, 180 m-long and 100 m-wide roof, which is the most outstanding structure at this station complex (Fig. 5). The roof, made of steel frame, RC and filled with glass, is covering the platforms and a large hall above the platforms, where two clocks are located: a “Golden Clock” and a “Silver Clock”. The plaza – “Clock Square” (Tōki no hiroba) is a large panorama spot where passing trains and the structure of the dome can be observed. It was intended that the roof will protect the platforms against the rain. However it was not sufficient and additionally, also glass canopies directly above the platforms have been constructed. The total floor space of the new station (without towers) is 42,300 m². New 5-story station building contains station functions and commercial. North tower has shops, cinemas, sport facilities, station facilities and offices. South tower contains shops, hotel and parking. The station designed as a “station-city”, has like a city streets and also eight unique plazas with distinguished clocks and greenery.

In 2012, in the next stage of development was opened “Umeda Hankyu Building” with department store. Then, in 2013 was realized a commercial (Lucua) and office building – “Grand Front Osaka” (Fig. 6), as a part of the “Umedakita Advanced Development Zone”. “Grand Front Osaka” is connected by pedestrian walkways on the 2nd floor directly with the immediate station space. The station is also connected with the “Umekita Plaza” (Fig. 7; architect Tadao Ando, Nikken Sekkei) – a plaza covered with water feature, with commercial facilities at the underground. The station is undergoing further development based on the “Osaka Station North District New Urban Development Project”, which was formulated in 2014 (master plan). The plan is aiming to make the
urbanscape here more attractive. The principles of cityscape development include: “Symbolic axis” – from the Nishi Umeda area to the Hankyu Nakanatsu Station area, an extensive space created along the symbolic axis where a network of canals and trees is harmoniously integrated with throughfares and commercial facilities; “Knowledge Capital Zone”, a home to a number of R&D facilities, showrooms and offices generating new industries, facilitating creative activities, and presenting future lifestyles; and “Osaka North Gate Plaza” – a bustling plaza for pedestrians with water features, offering three-dimensional integration of the station above and below the ground. On the south, the “Central Post Office Building” is scheduled to be renovated in 2019, and the “Dai Hanshin Building”, with department store, is planned for 2013. Osaka Station City consists of many buildings with advanced structures. The station has the form largely determined by the advanced structural system, such as the roof, and by the architecture permeating each other.

Fig. 7 “Osaka Station City” – “Umekita Plaza”  
Fig. 8 “JR Hakata City” (2011), Fukuoka – entrance with canopy

- **Hakata Station** – “JR Hakata City” (2011)
  Hakata Station was refurbished in 2011, when a new station building was constructed in the preparation for the opening of Kyushu Shinkansen. The station serves 131,400 people/day (JR; 2014). Currently, the “JR Hakata City”, which is an urban transportation and commercial complex designed by Kyushu Railway Company, includes the 11-story building, which was planned bigger than before, to make multifunctional station that can revive the city. The local connection has been achieved by adoption of the tiles „Arita” used for a composition made of drawings by various authors called the „urban forest“. Except transportation function, the “JR Hakata City” has also commercial function (department store, restaurants), cultural (cinemas) and a hotel. Various functions at the station and a presence of a large multifunctional building qualify it to “station-city” type. Two sides of the railway are connected across the tracks by a connecting corridor (じゆうつるろう). A great clock of about six meters in diameter, which is installed on the fifth floor of the elevation and lit with LED lighting, has become a symbol of the station.

Regarding the structure, the outstanding feature is the large canopy covered with the glass cladding. It has expressive shape and is a distinguished feature on the building elevation (Fig. 8).

- **Tokyo Station** – “Tokyo Station City” (2013)
  Tokyo Station is a historical main terminal in Tokyo and the eighth busiest stations in Japan and in the world, serving 700,000 passengers per day (JR and Tokyo Metro; 2014). It is operated by JR West, JR Central and Tokyo Metro. It has two different sides: historical Marunouchi side – with the neo-renaissance “Marunouchi Building” (1914) designed by the architect Kingo Tatsuno; and modern Yaesu side – with the new office towers and new entrance portion. JR East, along with four other companies including Mitsui Fudosan, has been redeveloping Tokyo Station since the 2004, as a part of efforts to revitalize the heart of the capital.

The renovated and developed Tokyo Station realizes also a new concept of a conglomerate “station city”. On the Marunouchi side, a red brick “Marunouchi Building” has been demolished and restored again to its original shape from before wartime damage and in consideration of seismic standards – and it symbolizes past (2012; Fig. 9). Original bricks and stones have been re-used. Third story was added and octagonal domes have been rebuilt into original form. In the interiors, relief decoration was restored and existing structure was utilized. Huge glass canopy was built to mark entrances. The surrounding area is being converted into a station square giving more space for pedestrians and extending towards wide walkway to the Imperial Palace.

On the Yaesu side, the “Sapia Tower” with offices, Hotel Metropolitan Marunouchi and conference facilities, and the “GranTokyo” twin south and north 200-meters high-rise towers housing the “Daimaru Department Store” designed by Helmuth Jahn, were completed in 2007 – and they symbolize the future. Central part on Yaesu side have been replaced by a lower than before structure, with a 240-meter-long pedestrian deck under large dynamic and airy canopy covering outdoor and loading areas and of 10,700 m² plaza (2013). The deck, designed by architect Helmuth Jahn and structural engineer Werner Sobek, is covered by this huge canopy – the “GranRoof” (Fig. 10).
The canopy which resembles a sail is a wide-span membrane structure that covers the complete distance between the two towers. Because of its complex geometry, the calculation of the membrane demanded particular engineering proficiency. Shops have been positioned along the deck overlooking a spacious plaza.

Aside from the modernization of historical building and construction of new buildings, there are also newly developed underground interiors – “Tokyo Station Media Court” (2000), “Silver Bell” (2002) – a recreation space designed by architect Edward Suzuki, “Kitchen Street” (2004) – a mall with restaurants, and a “GranSta” (2009) – “a city” created for people to rest and enjoy various facilities that has been opened on the 1B. Aesthetics of Tokyo Station has been expressed through the combination of old and new – reconstructed historical building on the Marunouchi side, and new part with expressive structures on the Yaesu side. Tokyo station with its prominent location, large volume, dynamic forms and high-tech structures has the aesthetic qualities of a landmark station. This truly remarkable achievement of JR East has not gone unnoticed. Tokyo Station for its transformation was awarded in 2014 with the “Brunel Award”. The “GranRoof” project was awarded in 2014 with the “Grand Prix” of Association of Railway Architects (ARA). Currently, one hundred-years old Tokyo Station is not just a station – it is a symbol of Japan.

Shinjuku Station – Shinjuku Station redevelopment and “Shinjuku New South Exit Building” (uc, 2016) Shinjuku is the busiest station not only in Japan, but also in the world. It operated by the JR East and private companies: Keio Corporation, Odakyu Electric Railway, Tokyo Metro and Tokyo Metropolitan Bureau of Transportation. This large complex serves more than 1,670,000 per day (2014). JR East has been redeveloping Shinjuku Station for the past several years, to enhance the accessibility and to help to increase the vitality of Shinjuku Station as a major terminal. The plan includes development of the “East-West Public Access Passage”, as well as construction of “Shinjuku New South Exit Building”, which has been officially named the “JR Shinjuku Miraina Tower”. The name of the building suggests that it will become a new landmark and symbol of the area, as well as the “future of Shinjuku” and a “point of departure toward the future”.

Shinjuku is an example of a “station-city” with skyscrapers. In accordance with “JR East Group Management Vision V-Ever Onward,” JR East views railway stations as “towns” and is developing stations along with this concept and taking measures to heighten this developments value. In response to traffic congestion, currently the area of the “South Exit” is under remodeling. Artificial deck, approximately 1.47 hectares in size, which has been constructed above the tracks, is the ground on which will be completed a multilevel, urban infrastructure facility that will enable passengers to transfer more smoothly between trains, highway buses, taxis, and private vehicles. Taxi stands and long-distance bus stops will be built on the ground. Such structure required a sophisticated structural design. New multipurpose building will be 170 m high and will include offices, retail facilities, a multipurpose hall that serves as a hub for the dissemination of culture and information, an outdoor plaza, a nursery facility, and a clinic. A small part of the high-rise building was opened in 2013; the rest is scheduled for completion in the spring of 2016. This new 33-floor building, with total space of 110,000 m², will accommodate office, commercial, and cultural facilities.

4.2 Japan: “station-tower”

Large group of railway stations in Japan are characterized by a high-rise form of the station buildings – “eki biru”. A station of this type can be called a “station-tower”. This kind of stations has developed since the privatization of Japan National Railways and their development was stimulated by the impact of bubble economy. Important factor was the trend to maximize the use of land, which could be achieved by utilizing space over the tracks or the use of underground. Such hybrid stations have basic three components: tower (office building; hotel), block (shopping mall), and platform (transportation node). Among “stations-towers” can be distinguished: Nagoya (2000), Meguro (2002), Akihabara (2006, 2011), and Shibuya with a high-rise building “Hikarie” (2012). “Station-cities” have often high-rise buildings as well, but their dominating feature is their large size and urban character.
Nagoya Station (2000)

Nagoya Station in Nagoya-city, operated by the JR Central and Nagoya Municipal Subway, is serving more than 393,000 passengers per day (2013). The station complex known as the “Twin Towers” is a multimodal transit hub that houses railways, high-speed trains (Tōkaidō Shinkansen), subways, including a direct link to a new “Chubu Centrair International Airport” (2005). The station has a large central concourse linking both sides of the railroad. Much of the space is in twin high-rise towers – “JR Central Towers” designed by Kohn Pedersen Fox Assoc., and in underground concourses.

Fig. 11 Nagoya Station (2000)                           Fig. 12 Shibuya Station, Tokyo (2012) – „Hikarie”

The JR Central Towers is the world’s largest station building, with: 410,000 m² of floor space and a height of 245 m. The cylindrical towers with uninterrupted facades, which share common base 15 floors high – with another six floors below ground, are the outstanding structural feature of the station (Fig. 11). Having over 50 stories high, they are housing also “Marriott Associa Hotel”, offices, commercial facilities and department stores. Large department stores and shops include “JR Nagoya Station Takashimaya”, “Meitetsu Department Store”, “Kintetsu Pass’e”, “Yamada Denki Labi”, and “Midland Square”. One of the station’s unique features is Sky Street, a huge airy concourse that spans both towers on the 15th floor. It looks out on a dramatic vista of Nagoya through a massive bank of plate-glass picture windows. The contrast between the towers and their shared base also reflects the desire to integrate the building into the urban context. The uninterrupted vertical expression of the skyscrapers, combined with the sitting of the complex, forms a monumental gateway into the city. Meanwhile, a two-story Sky Street – reached from the ground level through a bank of exterior shuttle elevators – connects public functions below to the towers above as it affords sweeping views of the city. The structural design unified with architecture forms this unique railway stations. Another, third tower for additional hotel and offices, designed by KPF, will be completed in 2016. The “Nagoya Station North Tower” is a continuation of the vertical mixed-use program of the existing towers. The new project extends the 15th floor sky street and enhances the landmark status of station towers by maintaining the prominence of the gateway between existing towers. The station, adjacent to other stations – Meitetsu Nagoya and Kintetsu Nagoya, forms a large transportation and urban center hub, which is a gateway to the city and its surroundings.

Shibuya Station – “Shibuya Station Redevelopment Plan” and “Hikarie” (2012)

Shibuya Station in Tokyo, serving more than 1,570,000 passengers per day (2014), is the third busy station in Japan and in the world. It has been under the development as a part of the “Cosmos Plan” by the JR East, together with Tokyu Corporation, Keio Corporation and Tokyo Metro. “Shibuya Station Redevelopment Plan” consists actually of three projects: (1) “Shibuya Station Area Development Plan”, (2) “Dogenzaka Area Redevelopment Plan”, and (3) “Shibuya Station South Area Development Project” [18]. “Shibuya Station Plan” that includes construction of 46-stories above ground and approximately 230-meters high station building is a large-scale development and will serve as a symbol for the area – containing commercial facilities, fashion, tourism, and station facilities. “Dogenzaka” is a development of Shibuya” which will utilize Tōkyū Tōyoko Line platform and railway tracks that have moved underground, includes a multi-purpose high-rise building of 33-floors above ground and 180-meters high. The “East Tower” is scheduled to open in 2020, while the “West” and “Central Tower” are scheduled to open in 2027. The planned buildings include both the largest office building and commercial facility complex in the vicinity of Shibuya Station. One of the buildings already completed within the “Shibuya Station Area” is “Hikarie”, designed by Nikken Sekkei and Consulting Office of Tokyo Corporation (Fig. 12). The construction was associated with the commencement of the Fukutoshin Line and the move of Tōkyū Station underground in 2013, to connect with subway. Currently, the „Hikarie” contains the entrance to Fukutoshin Line. The building is connected with existing
station by a new structure – “Pedestrian Deck of the East Gate in Shibuya Station” designed by architect Hiroshi Naitō (2012).

“Hikarie”, which is a 182.5 m-high steel and glass tower, became a significant multifunctional station building of a new generation – joining in a modern way, on the area of 144,000 m², various services of a railway station with other enterprises. Station function, shopping center, theatre, art gallery, multifunction rooms and offices are located on 34 floors above ground and 4 underground. Above parking, on lower floors (B3-5F) Shopping center „ShinQs” is located on the lower floors (B3-5F), shops and restaurants are above (6F-7F). There are around 200 stores and 26 restaurants. At 8th floor (8F) called „8/” (hachi), there are art galleries and creative studios „Hachi”. They are designed for workshops, exhibitions, short movie presentations to serve people to communicate and to initiate a dialog between creators and public. „Hikarie Hall” is located on the next floor (9F), while a musical theatre with 2000 seats – „Tokyu Theatre Orb” occupies 11F-16F. The top of the building contains offices (17F-34F). An observation deck – „Sky Lobby” is located on the 11th-floor. “Hikarie” was designed according the concept of multifunctional center reflecting our age of information technology and it has become a landmark in Shibuya. The project was awarded in 2012 with the “Grand Prix” of the Association of Railway Architects (ARA).

4.3 Europe: “station-complex”

Large stations in Europe – “station-complexes” – are consisting of station buildings with platforms and outdoor environment and serve many functions. The newest large European “station-complexes” include: Berlin Hauptbahnhof (2006), St Pancras International (2007), Gare de Strasbourg (2007), Gare de Liège-Guillemins (2009), King’s Cross (2012), Gare Luxembourg (2012), Rotterdam Centraal (2014) and Vien Hauptbahnhof (2015). Some of these complexes, like Berlin Hauptbahnhof – are large, some like Gare Luxembourg – of medium size, but they have a common characteristics – they are central stations in their cities, they connect railways with other modes and services, and they are important nodes on the high-speed train networks [9].

- Berlin Hauptbahnhof (2006)

Deutsche Bahn AG polices promoting the “renaissance of railway stations”, as a part of marketing initiative aimed to make rail travel more competitive with automobile, by rehabilitation of adjacent urban areas around modernized or newly constructed railway stations, coincided the unification of Berlin in 1989. Before Berlin’s urban plans were drawn in 1992, the areas around Lehrter Bahnhof (the current location of Hauptbahnhof) were industrial plants, extensive derelict area and warehouses. New Hauptbahnhof, located at the symbolic capital city center – opposite the Reistag, the Chancellor’s Office, and Bundestag offices and on the bank of the Spree River, has been planned as a hub railway station of the Berlin rail network. About 300,000 commuters and visitors pass through the station every day (2014). Annually, the station is used by more than 10 million passengers (2014). Berlin Hauptbahnhof is a modern hub connecting conventional and high-speed railways (ICE) with urban transportation, such as commuter lines, subways lines (U-Bahn 5 and S-Bahn 21) and buses.

Design concept of the station has been developed under the strategies of Berlin’s land-use plan and selected through a competition. The master plan was commissioned by Oswald Mathias Ungers & Partners. The competition for a building was won by entry of Meinhard von Gerkan, Marg & Partners; Schlaich, Bergemann & Partners are responsible for structural design of barrel-vaulted arch roof and bridges. The main design feature of the station is a glass roof completed in 2003. The roof has been always a distinctive feature of railway station architecture; once the Anhalt Station opened in 1880 in Berlin was the biggest station in the city at the time, with a station hall with no supports of 167,79 m-long, 60,72 m-wide and 34,25 m-high. Station roof, which is a train shed at the same time – is a major feature that gives the station its artistic quality (Fig. 13).

- Berlin Hauptbahnhof (2006) – roof

Berlin Hauptbahnhof consists of a 321m-long glass-arched train shed (glazed grid steel shell with cable support), a 180m-long and 27m-wide station hall framed by two separate 46m-high buildings for retail, offices, hotels and
services, as well as of multileveled concourses (Fig. 14). The design concept is embracing the idea of the separation of transportation functions from commercial function. The complex consists of 20,000 m² of shopping space, which does not interfere with the transportation but at the same time is easy accessible. In spite of tied finances, the station part has been planned spacious. The concourses are open, the lowest platform can be seen from the top and a natural light can penetrate from the platform for the high-speed trains on the highest level due to large openings of the station hall. The area of 80.0 m by 80.0 m in the center of the station has been equipped in 53 escalators, 5 staircases, and 14 elevators. Six large elevators make possible to experience the spatial configuration of the station while changing trains. A transparent station has large spaces filled with natural light coming through a glass roof and glass walls. Large in scale, station has facilities – entrances, smaller spaces, staircases, benches, etc., which scale relates to human scale. The structure is an important part of visual perception of the station building. Overall structural design has been coordinated well with architectural finishes and details. The essential aesthetic factors – innovative structures and structural rhythm, considerations given to large space and provision of light have been included into this successful design.

A prominent location of the central station has been underlined by urban planning. Station is connected by a new pedestrian bridge over the Spree River and important government buildings can be easily accessed. This harmonious and dynamic station is a landmark “complex” that is an important component of the area development plans. Its huge shed set it apart from other building giving symbolic role in the composition of rebuilt area. Both structure and architecture contribute to this image.

- St Pancras International (2007)

St Pancras International in London, neglected through many years, is a very distinguished station, often termed in history as the “cathedral of the railways”. It was designed by an architect Sir George Gilbert Scott and completed in 1868. A single-span iron-and-glass train shed with beautiful and biggest of its kind for decades arch roof was designed by William Henry Barlow and Rowland Mason Ordish. When the station was first opened in 1868, a 74 m-wide train shed was a spectacular structure that held the world record for the largest enclosed space. It has recognizable red brick façade with neo-gothic arched windows and clock tower. St Pancras was successfully refurbished and developed and still remains one of the greatest Victorian buildings in London. The master plan for the extension was originally created by Sir Norman Foster and developed by Alistar Lanley and Arup. After a decade-long project the station was officially re-opened as the St Pancras International in 2007. It serves as a final destination for Eurostar and high-speed rail in the UK. After opening of the station, the number of Eurostar passengers increased for about 20%. Annually, the station is used by more than 29.5 million passengers (2013-14).

One of the structural-artistic features of the restored station is its roof which has been fitted with 14,080 glass panels giving a total area of nearly 10,000 m². The extension has been designed as a new and modern structure covering all 13 platforms. It has an aluminum-clad louver-blade and light glass roof floating above the platform deck. A glass roof allows natural light to penetrate the high-speed trains’ platform on the upper level. Street level provides approach to the trains and it is housing ticket offices and shops. “The Arcade” – independent and boutique retailers are located on the first floor, beneath the Victorian brick arches. The old and new structures are separated by a glass transept of more than 100 m (Fig. 15). The various domestic service platforms, both above and below ground level, are accessed via a street-level domestic concourse, named “The Market”, that runs east to west at the point where the old and new parts of the station meet – the domestic and international concourses meet at a right angle, forming a “T” shape. The main pedestrian entrance to the station is at the eastern end of this domestic concourse opposite the renovated and extended in 2012 the King’s Cross Station.

Restoration of the station has been accomplished with modern interventions that have been designed to be subservient to the original architecture whilst enhancing its grandeur. The train shed has been restored to as near original conditions as possible and the disused formerly industrial space has become a new 21 century feature – a vibrant public space within international terminal. The total design concept was to express the beauty of the
structure and details – a glass arched roof with painted ironwork, combined with red brick and modern materials such as glass railings, elevators and walls. Station is lit with light, spacious and elegant. Blue-painted newly extended train shed carries the artistic image of historical engineering with contemporary one, and a good sense of total coordination between the past the present. Several artworks have been installed at the station, including a 9-metre statue – “The Meeting Place”, designed by British artist Paul Day, which stands beneath the station clock. The artistic beauty of engineering has been enhanced by well-done coordination with architectural details, finishes and art. Redeveloped facility is a large “station-complex” that combines transportation and hotel, commercial and other services.

- **Gare de Strasbourg (2007)**

Gare de Strasbourg, which was originally opened in 1846 and rebuilt in 1883, is a main station in Strasbourg and the second largest train station in France. It was designed in 1883 by an architect Johann Jacobsthal. It currently serves also TGV lines, since 2012 – Frankfurt-Strasbourg-Marseille. It is used by about 15,000 people per day (2009). To adjust station quality to TGV services, in 2007 the station has metamorphosed into an intermodal transportation hub. The station was redesigned to handle about 60,000 passengers per day. Within this renovation project, a historical building was framed by a 120 m long glass shell designed by architects – Jean-Marie Duthilleul, the architect for the SNCF Gares & Connexions and AREP, and Michel Desvigne (Fig. 16). A transport gallery has been added to the historic façade, without, however, modifying its visual impact. The four hectares of a square in front of historical station, edged by a series of imposing buildings with the pink sandstone station facade and its long enclosing glass gallery serving as the main backdrop, have been transformed into a garden. The 25-metre high “winter garden” serves as the entrance building and as the link between train tracks and trains, trams, buses, taxis as well as the underground.

New modern glass structure not only plays important part governing all connections on several levels with the city – from the platforms, tram station, taxis, pedestrian and cyclist paths, and car parks – but also adds a new image of a “station-complex”, which has successfully become an urban landmark. The extension won the Brunel Award in 2008. Outstanding aesthetic design features structure that is light and expressive but does not overshadows historical architecture. The balance has been achieved between new intervention and old valuable heritage.

- **Gare de Liège Guillemins (2009)**

In Belgium, Liège, new high speed rail station – Gare de Liège-Guillemins TGV (2009) that serve to further connect Northern Europe’s rail lines, was designed by engineer and architect Santiago Calatrava. The beauty of the station building has been derived directly from a creative steel and glass structure. Thanks to its permeability, new building enables an elegant transition between the city and the station. A new steel and glass building with a white concrete has a monumental, 160 meters long and 32 meters high arch. The intention of the designer was to provide a meaningful station that will grab the attention of passengers riding on commuter trains passing through Liège. The concept was also that the station was art, and, as a gathering place, it should be a cultural and artistic place. Calatrava’s vision for the station was a building without a facade that provides greater connectivity within the city. The platforms on the top levels are enclosed by glass and steel framing, and the entire station makes great use of natural daylight (Fig. 3).
parking levels, a vehicular access deck linking with the footbridge, and a raised pedestrian walkway. At the station plaza level reinforcing the urban streetscape, is a continuous strip of commercial units. Pedestrian bridges and walkways under the tracks allow for fluid communication between the two sides of the station. The grand Passenger Hall and the SNCB ticketing area are located on the main axis. There are various commercial facilities and services located at the station hall. The design of the station hall beneath the platforms has similar features to overall design. This is an example of a totally designed “station-complex”, which beauty relies on the unification of architecture and structure. The station is also surrounded by extensive plaza with greenery.

- **King’s Cross Station (2012)**

King’s Cross Station, a historical London terminal, which was completed in 1852. It was designed by an architect Lewis Cubitt for Great Northern Railway, who also designed a nearby Great Northern Hotel. The restoration project started in the 1980s, with a development plan by Foster & Partners, which strengthened connections with neighboring St Pancras International. Around 60% passengers at King’s Cross, change trains between train and Tube, or between King’s Cross and St Pancras. In an effort to return the station to former glory and provide comfortable environment for 47 million annual passengers, Network Rail undertook in 1990s a conservation and redevelopment project by architect John McAslan & Partners.

King’s Cross Station renewal combined three different approaches of historical conservation: re-use, restoration and new build. The train shed and range buildings have been adapted and re-used. The station’s obscured Grade I listed façade has been very precisely restored. To deliver an efficient space, the new development included the insertion of a semi-circular building with glass façade – Western Concourse – that provided better environment for the purpose of an interchange (Fig. 18). The project including also re-glazing of the arched roof and various repair works, was opened in 2012. The area between St Pancras and King’s Cross stations was covered by new structure with a stunning roof. Historical heritage architecture has been exposed and ticket office retained its original decorations. The space is modern, bright and with an array of food and retail outlets has an image of an airport rather than a conventional station facility. It is spacious and easy to understand. The final phase ended in 2013 with the creation of a new public square – King’s Cross Square in front of the station (the landscape design by Stanton Williams Architects). The square has granite benches, stunning lighting, trees and an area dedicated to art. The two Underground entrances in the square have been upgraded; a glass canopy provides covered access from the station. The regeneration of King’s Cross Station has affected positively improved neighboring areas. The beauty of redeveloped station is relying on the combination of historical architecture with a modern one, and on the outstanding structural design making the architecture of the station. The station works as an interchange and as a “station-complex” providing various functions.

- **Gare Luxembourg (2012)**

This is the main station in Luxembourg City, serving about 80,000 passengers daily. Since 2007, the Gare Luxembourg has been connected to the high speed network through the LGV Est. The historical building built between 1907 and 1913 was designed by German architects – Rüdell, Jüsgen, and Scheuffel. The station reflects the architectural style of major other buildings in the city – the Moselle Baroque Revival.

The renovation has been carried out since 2006. The extension project is slightly similar to the project of the Gare de Strasbourg (2007), but on the smaller scale. The design was carried out by the AREP for the Luxembourg Railways (CFL). The space at the frontal elevation has been covered by a transparent material ETFE put on a metal structure (Fig. 19). An elegant transparent structure that extends station hall naturally fits into the subtle volumes of a historic Moselle Baroque Revival style inspired building. The station forecourt runs along the length of the historic façade and provides a major new public space that has been directly linked with the city and the different types of multimodal transportation. It looks particularly interesting and enhances historical building, when lit up at night. New structure plays important role at this historical station both from the aesthetic point of view and functional. The Gare Luxembourg is a “station-complex”, performing transportation and commercial function.
Rotterdam Centraal (2014)

Rotterdam Centraal Station is one of the most important transport hubs in the Netherlands. It serves about 110,000 passengers a day. It is connected to the high-speed networks, as well as to conventional railways and LRT. Former station building was too small and worn out, there was a need for station up to current requirements with respect to size, layout and image. Current new station is not only larger, brighter and more orderly than the former, but also has an international feel; it beautifully complements both the efficiency of the high-speed train stop and the Rotterdam city’s bold ambitions for urban development and renewal. The station matches in all respects the practicality, capacity, comfort and allure, of the central stations of Paris, London and Brussels.

The new station was designed by Team CS, cooperation between Benthem Crouwel Architects, MVSA Meyer en Van Schooten Architecten, and West 8. West 8 has been involved in the team as architects as well as urban designers and landscape architects [19]. The new building has a large hall that runs from Proveniersplein on the north, to Stationsplein on the south, and the 250-metre-wide platform roof that forms a whole with the main concourse and underground tunnel. On the side of the city center, the station displays that large-volume hall with a grand roof that is the main visual feature of the Rotterdam Centraal (Fig. 20). The roof cladded in stainless steel, partly with glass, with solar panels and with the underside structure also partly clad in wood, is a very remarkable structure. The station exhibits a new grandeur that is in keeping with the dimensions of the surrounding high-rise buildings. Rotterdam’s urbanity is reinforced by the station architecture, particularly by the welcoming station roof projected over the spacious plaza. The station has an appropriate structure and dimensions for the urban landscape, and also reflects human scape; through the interior with natural light and wooden finishes.

In spite of the interesting structure of the roof at the entrance, also the platforms feature an interesting structural design. The supports have the “Y” shape and look modern and light (Fig. 21). The new station is totally designed with architecture and structure well unified, composing a modern transportation complex with a vast outdoor plaza. Working as a transportation hub and commercial facility Rotterdam Centraal is an important European “station-complex”. The station received the Brunel Award in 2014 for its achievement of becoming a city within a city and for its urban landmark qualities. The jury described the “generous space overwhelming” [20].

Vien Hauptbahnhof (2014)

The new station, replacing the old Südbahnhof terminal station, serves high-speed and local trains. It is located at the junction of international, national and urban rail systems and subway. The station was designed by architect Theo Hotz Architects and Planners. The ÖBB-Infrastruktur AG is the owner, the station is operated by national Österreichische Bundesbahnen (ÖBB). The station is serving about 40,000 passengers per day (2013) but it is expected that some 150,000 people will pass through this central station every day. New station has improved connection with subway – Vienna U-Bahn and is also accessible by Vienna S-Bahn, tram and bus. The station officially opened in 2014 but since December 2015 is in full operation.

The new project involved construction of a new station building, through platforms with a 25,000 m² diamond-shaped translucent glass-and-steel roof, an underground space, and office buildings in the Belvedere district, as well as development of entirely new urban district. The most striking and dynamic element of the station consists of the 5 platform canopies that unfold geometrical pattern (Fig. 22). Measuring 210 m in length and between 6 and 15 m in height, they consist of a welded and bolted steel framework structure – a truss – clad on the underside in composite panels. The roof is supported by the transverse frames each 38 m.

The Hauptbahnhof is a large “station-complex” consisting of transportation and commercial services. There is a 20,000-m² shopping and service center below the level of the tracks with app. 90 shops and other services. Offices and residential buildings are still under development. Covering a total area of 59 hectares, a new residential district,
the “Sonnenwendviertel” is being created to the southeast of the central station, which will provide a new home for 13,000 people in a central location. New station is not only aesthetics thanks to modern structure and architecture, but also functional. It has an efficient information signs and total scheme that enables quick transfers between trains. There is also a spacious station plaza in front of the station. Vien Hauptbahnhof has become one of the most modern train stations in Europe.

5. Architecture and structure at the local stations

Local stations can be designed for conventional trains and also for high-speed networks. Both in Japan and Europe the HST networks are expanding and many local cities are connected with this convenient mode of transportation. Opening of HST has usually a big impact on local tourism and economy. Such stations building play important roles in inviting people and representing their regions to visitors from other part of the country and abroad. “Station-gate” type emphasizes more the entrance to the particular region, while “station-identity” emphasizes the characteristics of its location. The border between “gate” and “identity” is a fluid one and generally these stations in Japan and Europe play similar role of the distinguished local stations. In case of stations located on the conventional lines, the purpose to invite, represent, underline and connect with the region resembles the objectives of the HST stations. Station meaningful architecture has been often derived from the structural design, focusing on local materials.

5.1 Japan: “station-gate”

The third representative type of stations in Japan is a “station-gate” – a medium-size building with original design suiting local communities designed with the purpose of playing various functions addressed to the local residents [9]. Such stations have been designed in recent years for urban railways as commuter stations, for conventional trains and also for Shinkansen. New shinkansen lines and stations, with associated facilities such as station squares, are part of the JR policy aiming to attract people, businesses and to enliven local communities.

5.1.1 Conventional local stations

Although in Japan local stations have fewer passengers than large metropolitan complexes, they serve important function for local residents and therefore they have also often distinguished designs. The new wave of interesting local stations started during economic bubble in 1980s, and was influenced by such factors, as: postmodernism in architecture, development of the practice known as “machi-zukuri”, and privatization of JNR in 1987. “Machi-zukuri” had a considerable influence on the design of the public-private sector stations. Railway companies and local governments started to construct stations jointly; therefore municipal facilities have been often located at the railway station. Among these, there were stations designed by architects, which, while applying original design, have strengthened their public nature and explored their commercial side.


Some authors describe these innovative stations (e.g., Iwamizawa, Asahikawa, Hitachi, Ryūō, Sawara) incorporating local features, as “stations with special design features”, which distinguish them from typical stations [16]. The examples of discussed here recent conventional stations include: Hyūga-shi (2008), Ryūō (2008), Hōshakujii (2008), Kōchi (2009), Iwamizawa (2009), Asahikawa (2011), Sawara (2011), and Tsuruga Multipurpose Center ORUPARK (2014).

• Hyūga-shi Station (2008)

Hyūga-shi Station is located in Hyūga-city in Miyazaki Prefecture and is operated by JR Kyushu. The station serves more than 1,500 passengers per day (2012). It is a local station with distinctive design. Architect Hiroshi
Naitō (Naitō Architect & Associates) has designed several railway stations in Japan and Hyūga-shi in Miyazaki Prefecture is one of them. The adviser was Professor Osamu Shinohara of the University of Tokyo. The hybrid structure is based on steel frames and laminated wood made of locally produced cedar wood (*sugi*). It covers the space of the main terminal, which is 110 m long and 18 meters wide. The wood has been also adopted for details at the building and at the station plaza; therefore the border between the building and its surrounding, including approaching road, has been fluid. The platforms under the roof are located on the second floor. The structure seen at the platform level is simple, but elegant. The exterior walls are filled with glass therefore the platforms are very bright. At night the building is illuminated and the structure looks very ornamental. Such bright and spacious station with local wood reflecting local traditional architecture, a “station-gate” type, is very pleasing and convenient. The station displays unified “total design”. Similar design has been applied for all parts of the station building, platforms and a square in front of the station (Fig. 23). Hyūga-shi Station project received the “Brunel Award” in 2008 for its unique architectural design.

![Fig. 23 Hyūga-shi Station (2008)](image1)  ![Fig. 24 Ryūō Station (2008)](image2)

**Ryūō Station (2008)**

Ryūō Station is a local railway station operated by the JR East, located in Kai-city in Yamanashi Prefecture. The station is used by 2,200 passengers daily (2013). The building was designed by architect Tadao Ando. It provided a free passage between two sides of the railroad. Glass elevation permits to see Mt. Fuji. The concept is based on the development of the station building around this connecting corridor. The building consists of geometrical volumes; each is assigned to different function. This is a successful example of a “total design”, because all parts of the station – its architecture and structure are unified and designed in similar style. Geometrical volumes intersect at various angles; these edges are emphasized by special lighting and by a daylight coming into the building (Fig. 24). The station is spacious, functional, easy to understand and as a “station-gate” it has become a symbol for a new city. At the second stage of the project, station plazas on both sides have been realized. There is a northern-side plaza with the North Entrance – “Shōsen-kyō Gate”, and a southern-side plaza with “Fuji-san Gate”. Station squares provide relaxing atmosphere and comfortable access for pedestrians, and by bicycles, bus, taxi and private cars.

**Hōshakuji Station (2008)**

Another distinguished local station is located in Takanezawa-machi in Tochigi Prefecture. It is operated by the JR East. The station is used by about 2,200 passengers daily (2013). The building was designed by architect Kengo Kuma (Kengo Kuma & Architects (KKAA) and JR East Design Corporation. To connect the east and west sides of the town of Takanezawa, which had been divided by the railroad, architect opened the east exit of the station giving access to the “Chokkura Plaza” and shelters, also designed by Kuma. Having decided to preserve an abandoned rice storage house constructed of *ōya ishi* stone, the architect transformed the “pores” which occur in this stone into a new structural system, in which steel frame and *ōya ishi* are combined diagonally, and added the system to the warehouse. He then extended the diagonal skin to the other “pore” or “aperture” – the station. *Ōya ishi* is a unique stone and has all the softness of soil. The design focused very much on the ceiling (Fig. 25). On the upper concourse the ceiling depth is at its most shallow, while toward the edges and at the base of the stairs the ceiling drops to create enclosure for the structural members. There are approximately 1,500 diamonds in total that in plan share the same size and proportion [21].

The design of Hōshakuji Station not only linked the station's east and west exits, but also connected it with its wider location. The concept of the “station-gate” was to restore the community by meaningful design related to locality. For the structure of the station, in order to reduce the weight, plywood was used instead of *ōya* stone. By using wood the architect revived the warm atmosphere of station and connected the station building to the landscape of paddy fields and wooden houses in Takanezawa. Architect created a varied spatial experience by applying a diamond plywood motif to an otherwise steel station bridge. The station was awarded the “Encouragement Prize” at the International Design Competition of railway design – the “Brunel Award” in 2008.
Kōchi Station (2009)
This local station in Kōchi-city is operated by the JR Shikoku. It serves more than 5,000 passengers daily (2012). The building was designed by architect Hiroshi Naitō (Naitō Architect & Associates), Shikoku Railway Company, and Shikoku Kaihatsu Corporation. The station was built as a part of the project of the elevation of railway line, which improved transportation at the north-south direction. The main part of the station is a huge roof built of steel structure and arches made of laminated wood of locally produced cedar wood – *sugi*. The roof has been called the “Kujira Dome” (Whale Dome). It covers station hall, which is 38.5 m wide and 60.0 m long. The design of station hall and platforms under the roof has been completely unified – as a “total design”. The station has been linked to the local community. An expressive structure of the roof gives the station also the landmark quality. The “station-gate” invites to the city. The station project was awarded in 2009 with the “Grand Prix” of the ARA.

Iwamizawa Station (2009)
This station, located in Iwamizawa-city in Hokkaido, is operated by the JR Hokkaidō. More than 4,700 passengers per day use this station (2012). The building was designed by architect Hiroshi Nishimura (Workvisions Architects Office), who won the competition. The exterior and interior walls of the building, with RC structure, are finished with a local brick. The curtain wall is combined from the brick, re-used railroad rails and glass, giving the station light and familiar appearance (Fig. 26). The concept was to produce an image of a huge traditional paper lantern, which would be well distinguished. The building, playing the function of a “station-gate”, combines tradition and modernity with the local characteristics. The beauty of the building comes from the simple, elegant architecture based on the modern structure and technology. The project won in 2009 a prestigious „Good Design Grand Award“. The station project was also awarded in 2009 with the “Grand Prix” of Association of Railway Architects (ARA), and in 2014 – with the “Public Building Excellence Award” by the Public Buildings Association.

Asahikawa Station (2011)
Asahikawa Station located in Asahikawa-city – the second largest city in Hokkaido, operated by JR Hokkaidō, has around 4,500 passengers per day (2012). As a part of urban development of the “Kita Saito Asahikawa”, it has been subject of a planning and design for a long time. The building was designed by architect Hiroshi Naitō (Naitō Architect & Associates). Professor Osamu Shinohara of the University of Tokyo was one of the advisers. Like other stations designed by Naitō, it has been conceived with the use of local wood. The building, with transparent curtain-walls, has been designed in harmony with natural surroundings, including the Chūbetsu River, and well connected with urban network. The design concept was to conceive “a station that includes a river”. The Chūbetsu River has been converted indeed into the station design and it can be seen from the station hall and platforms. A beautiful park along the river has been designed in front of the station building (Fig. 27). It can be accessed directly through the free passage. The structure is made of RC; the wood has been used for windows, railings, benches and various finishes. There are wooden plates displayed at the “People Walls”, inside the station hall. They contain the names of people who donated for the project. In the evening the light coming out of the curtain walls gives the building organic character. All spaces, including station hall, elevated platforms, as well as furniture, have unified design. Except transportation function, the building has also commercial and urban functions, including, shops, restaurants and station-gallery. Asahikawa Station with its unique design is distinguished in the urbanscape and has the form and performs the function of a “station-gate”. The station project was awarded in 2012 with the “Grand Prix” of Association of Railway Architects (ARA).

Sawara Station (2011)
The station is located in Sawara district of the Katori city in Chiba Prefecture. More than 3000 passengers pass through this station every day. Sawara, a merchant town with its traditional buildings located along a historical canal, is a popular tourist destination. Station building designed by JR East Design Corporation, resembles a traditional Japanese architecture. It has a large gable roof with tiles and wooden screens on the elevation (Fig. 28). Inside, the building has a typical modern station interior. Traditional form contributes to “station-gate” image of a station, which invites to its preserved surrounding.
Tsuruga Multipurpose Center ORUPARK (2014)
The building of the “Multipurpose Center ORUPARK” is a new station building of Tsuruga, which is now under development for the future Hokuriku Shinkansen. Construction of a further section onward to Fukui and Tsuruga in Fukui Prefecture commenced in 2012 is scheduled to be opened in 2022. Nowadays Tsuruga is still a local station not connected to the high-speed railways. The redevelopment plan for the station and its neighborhood involves a construction of public spaces for the use of residents and visitors alike. Architect Manabu Chiba (Manabu Chiba Architects) has preserved the original station layout. The new building for the station, serving as a “station-gate”, is located between the rail tracks and new station plaza. The architects did not ignore the heritage of the former building that used to stand on the site, an old railway station constructed in 1909. According to the archive photos, the old building was a timber-frame complex with two wings joined by a passageway with a gabled roof, which was an expression of a long-lost form of vernacular architecture. This compositional layout, and the rhythm created on the facade by the tall, regular windows, underlined the design concept for the new Orupark.

The new building of the reinforced concrete structure consists of a single volume with large transparent curtain wall and of two symmetrical blocks arranged inside, around a central gallery (Fig. 29). The two blocks of wood reflect the rhythm of the windows that were present in the walls of the old station building, extending the openings over two levels to create doors as well ensuring plenty of communication between spaces. In functional terms, the building’s wooden heart contains shops, waiting areas and information desks on the ground floor, with civic spaces on the upper level to host events of various kinds. The veranda located outside, enables citizens to stroll under a sheltering roof and enjoy a view of the city.

5.1.2 New Shinkansen stations
In spite of stations on the existing lines, there are also new stations that have been built on new Shinkansen lines. Some stations, often designed by well-known architects, are outstanding rail facilities, which have been well connected with their surroundings and serve as “station-gates” (e.g., Shin Minamata; 2011). Some meaningful stations have been designed on the Tōhoku Shinkansen (e.g., Hachinohe; 2002), on the Yamagata Shinkansen (e.g., Shinjo; 1999), and on the Akita Shinkansen (e.g., Tazawako; 1997). The set of interesting stations has been completed on the Kyūshū Shinkansen, which was opened in 2011, and on the Hokuriku Shinkansen (2015). The examples of the new stations to come, which are still under construction, are the next stations on the Hokuriku Shinkansen and Hokkaido Shinkansen. “Migaku”, the goal of JR East policies, which aims to improve through service quality reforms – enhancing rail transportation network, is in line with the new operations of the Hokuriku Shinkansen to Kanazawa and the Hokkaido Shinkansen to Shin-Hakodate-Hokuto.

According to JR East strategy for the railway business, the Hokuriku Shinkansen has been extended from Nagano, through Jōetsu-Miyōkō and Toyama to Kanazawa and opened in 2015. The Hokkaido Shinkansen, which lies within the area of JR Hokkaido, is constructed from Shin-Aomori, through Oku-Tsugaru-Imabetsu, Kikonai,
Shinkansen stations. The 8-story “Metz Hotel” also contains a library and other public facilities on the 1st and 2nd floors, shops on the 3rd floor and the hotel rooms from the 4th floor upward. The building is connected to the free corridors ( "shōtai-gō" ) on the 2nd and 3rd floors. The hotel elevation, which is a part of the station complex, has blue and white colors which express local features such as the town’s festival culture and surrounding nature. The distinctive masts with original lightings. Passengers descend from the 2nd floor to the platforms, thereby experiencing the integrated continuity of the concourse and the platforms, which is a rare feature for the Shinkansen stations.


5.1.2.1 Tōhoku Shinkansen stations (1982-2010)

Hachinohe Station (2002)
Hachinohe Station in Hachinohe-city in Aomori Prefecture is the Shinkansen station operated by JR East. There are also conventional trains operated by the Aomori Railway Company. About 4,650 passengers use the station everyday (2013). The Tōhoku Shinkansen station was designed by architect Shinichi Okada (he also designed Shinanomachi Station located on the JR Chūō Line), JR East, JR East Design Corporation. It was developed under the “Sunflower Plan” of JR East “station renaissance” policy. The project was a typical case of a new station that was constructed for a Shinkansen line. Such projects were usually closely related to the neighborhood development projects undertaken by the national government and local municipalities. In other words, projects of the new stations in the “station renaissance” era have not been advanced solely by the railway operators but also they have required allocations from national, prefectural and municipal budgets. According to Tsuchihashi (2003), such stations have been characterized by two techniques: (1) construction of a free corridor ( "jūyū tōrō" ) connecting both sides of the station in order to prevent local areas being dissected by the tracks, and (2) provision of facilities, such as meeting halls, civic plazas, local products museum, etc., organized at the station to reflect character of the local community and to attract local residents [10].

In case of Hachinohe Station, a free corridor has been constructed over new Shinkansen line running parallel to the conventional Tōhoku Main Line, and a new station building serving both lines was constructed over the tracks. Also a new “Metz Hotel” was built next to the station, resulting that station-hotel facility serves as both – a station, and as a site of local everyday activity, while at the same time adding a new dimension to the urban landscape. Hachinohe Station has achieved a unique spatial composition in response to local conditions, weather and the need to have an over-track station. The characteristic features are – integrated platforms with the concourse, and interesting roof structure above the platforms (Fig. 30). As Tsuchihashi pointed out, platforms and concourses at this station make similar impression as the satellites and a lobby of an airport [10]. In particular, since Shinkansen stations are regarded as the more important travel bases than conventional stations, the fitting applied should have a high potential, like at the air terminals – both in architectural and functional terms.

In case of the Hachinohe, the platforms and tracks are located on the 1st floor and are visible from the concourse which is on the 2nd floor. Both platforms and concourse are indoor spaces and they are easy to understand and to use. The platforms are covered by a large, 300 m long shelter, shaped like an elliptic cylinder, creating a unique, continuous space. The main purpose of the shelter is to provide a protection against snowy and cold weather in the winter. As a result of this consideration, the platforms have been designed as a single and aesthetic space. Hachinohe Station has been composed of three major axes: the track axis, the axis of the free corridor that traverses the tracks, and the axis that runs parallel to the tracks on the level above. Adoption of the truss structure and the glass allows for the better understanding of the station’s spatial layout without relying on the guidance. The ticket gates are also spacious – the highest dimension is approximately 14.0 m and the structure here includes two distinctive masts with original lightings. Passengers descend from the 2nd floor to the platforms, thereby experiencing the integrated continuity of the concourse and the platforms, which is a rare feature for the Shinkansen stations. The 8-story “Metz Hotel” also contains a library and other public facilities on the 1st and 2nd floors, shops on the 3rd floor and the hotel rooms from the 4th floor upward. The building is connected to the free corridors ( "jūyū tōrō" ) on the 2nd and 3rd floors. The hotel elevation, which is a part of the station complex, has blue and white colors which express local features such as the town’s festival culture and surrounding nature. The station is distinguished – serving as a “gate” for the region of the northern Tōhoku.
The Tōhoku Shinkansen was extended in 2010 from Hachinohe to Shin-Aomori, marking its completion and improving access to Aomori and Hokkaido. It is currently Japan’s northernmost Shinkansen station and a gateway to Aomori Prefecture. Since March 2016, the Shinkansen will be extended into Hokkaido and there will be more Shinkansen stations in the north. It is operated by JR East and more than 8,000 passengers per day use this station (2013). New station in Aomori-city was designed by the Japan Railway Construction, Transport and Technology Agency (JRRT), whose proposal has been selected among other entries.

The design concept was conceived to reflect on time-span “from the Jōmon to the future” [22]. Therefore the station was designed as a fusion of the nostalgia and the future. Appearance of the building is reminiscent of the Jōmon Period, while the central part with a glass curtain wall represents the “future”. The view of the town can be enjoyed through the window (Fig. 31). This symbolic building is also a symbolic “gate” to the town. The station is elevated and has a large connecting corridor, and also a wide and comfortable Shinkansen concourse. Except of the transportation function, the Aomori Station has also services (tourist information), shops (e.g. “Ekinaka”), and offices of the Aomori Prefectural Government.

5.1.2.2 Kyūshū Shinkansen (2011)

Shin-Tosu Station (2011)
The station is located in Tosu-city in Saga Prefecture. It is operated by JR Kyūshū and serves about 900 persons per day (2011). All the Kyūshū Shinkansen stations have a similar functional scheme and layout. They are elevated; a station hall is on the ground floor and the platforms above. Each station has its own design concept, which has been often influenced by the local characteristics. The design concept of Shin-Tosu Station uses the image of the city bird’s wing (magpie), with its colors (white, black, blue) for the main color scheme [22]. Also an artwork by an artist Tomoya Tsukamoto is exploring that concept. Th is symbolic bird has been selected to provide a comprehensive design which will express locality and connect the station to the local communities. The motif is reflected in the dynamic elevation (Fig. 32). An associated artwork has been located near the rest-rooms. Almost all stations share the same concept that the restrooms are in the center of spacious station hall on the ground level (Fig. 33). The steel structure of the platform roof looks light and displays the contrast with the bolder looking columns (Fig. 34). The station was awarded in 2011 with the “Grand Prix” of the Association of Railway Architects (ARA).

Shin-Tamana Station (2011)
The station operated by JR Kyūshū is located in Tamana-city in Kumamoto Prefecture and serves the Kyūshū Shinkansen. Around 1,200 people pass through this station everyday (2013). The design concept explores the warm characteristic of wood, which has been used for the interior finish, the play of light and rhythm [22]. The wood with glass is also appearing on the elevation (Fig. 35), in the interiors and on the platforms. An artwork is located at the station hall on the central wall (Fig. 36). The roof above the elevated platforms is a combination of a steel and wood (Fig. 37). It makes the space more familiar. The new transportation facility, designed with the local materials, is functioning as a “station-gate” to the region, and to the local community. The Shin-Tamana Station was awarded in 2011 with the “Grand Prix” of the Association of Railway Architects (ARA).
Kumamoto Station

Kumamoto Station is a main railway station in Kumamoto-city and it is operated by JR Kyūshū. It serves the Kyūshū Shinkansen, Kagoshima Main Line and Hōhi Main Line. Approximately 13,500 passengers use this JR station every day (2013). The station was renovated in 2011 for the arrival of the Shinkansen. There is a tramway stop operated by the Kumamoto City Transportation Bureau located at the front of the “East Gate”. New station building, built for the elevated line, is located on the west (Fig. 38). Existing historical building “Shirakawa-guchi” (“Shirakawa Gate”) is located on the east (Fig. 39). The underground free-passage connects the western and eastern sides. On the “Shinkansen-guchi” (“Shinkansen Gate”), the station has a large hall (Fig. 40). The elevation has a glass curtain walls and brick. Also the interiors are finished with local wood, brick and glass. There is a shopping mall “Friesta” selling food and souvenirs. The station is very aesthetic but the platform has a loose design connection with the building (Fig. 41). The station building project was awarded in 2011 with the “Grand Prix” of the Association of Railway Architects (ARA).

There are specially designed two station squares – the “Kumamoto Station East Exit Square” (2010) and “Kumamoto Station West Exit Square” (2011), which are part of a large redevelopment program expanding station for Kyūshū Shinkansen. Both squares play, in spite of transportation function, also the roles of carefully landscaped urban plazas for relaxation and enjoyment.
**Shirakawa Gate (East Exit) Square of Kumamoto Station**

“Shirakawa Gate (East Exit) Square” is located at the front of an old station building on the eastern side. The first stage of the project – the “Kumamoto Station East Entrance Redevelopment Project” has been realized in 2010. The project is scheduled to be completed in 2018 and it will involve a total of six new roofs planned for the square. The roof shelter was designed by Structured Environment and an architect Ryue Nishizawa (Office of Ryue Nishizawa) is responsible for its architectural design. A large roof made of a steel frame and partly reinforced concrete, with a soft curvilinear shape, has been erected connecting the railway station with the tramway terminal (Fig. 42). The slab is a continuous surface without beams, supported by fourteen slender columns. The roof depth of 400 mm is also reduced thanks to the construction method – casting in place. This simple looking structure resolves the complex logistics generated by mass transit and also serves as a place for relaxation. Also its “cloud-like” shape helps to engage the station with the urban dialog – with other buildings in this rather chaotic environment.

**Shinkansen Gate (West Exit) Square of Kumamoto Station**

“Shinkansen Gate (West Exit) Square”, with its steel-frame structures, was designed by the Konishi Structural Engineers and an architect Mitsuhiko Sato (Mitsuhiko Sato Architect and Associates), and completed in 2011 (Fig. 43). The design has been selected through the competition held under the “Kumamoto Artpolis” [i]. The roof and the curvilinear walls divide the plaza for pedestrians from the territory for the traffic (taxis and bus). Both the walls and the canopies have a series of different sized openings in them to blur the distinction between inside and outside. A rotary is enclosed by a structural steel screen, which is an integral unit formed of a slab plate, painted in brown on the rotary side and in white on the pedestrian side. Landscaped plaza evoking a park-like space includes a resting area with a water garden.
Both plazas are not only part of the aesthetic and landscape design but also an important element of functional scheme of the station. The plazas provide modern and functional “gateways” to the city of Kumamoto.

- **Shin-Minamata Station (2011)**
  The station is located in Minamata-city in Kumamoto Prefecture and is operated by JR Kyūshū. It serves the Kyūshū Shinkansen and Hisatsu Orange Railway. The building was designed by an architect Makoto Sei Watanabe (he also designed a subway station – the Iidabashi, Kashiwa-Campus and Kashiwa-Tanaka). The concept was based on the fact that stations do not have doors, but there is a flow of movement at the station. This concept of “movement” has been explored in the design. The roof and walls consist of the rectangular pieces which look like being frozen in their movement (Fig. 44). The shape of the structure has been prepared to face weather conditions. The various pieces running parallel to each other, but with different angles, reflect differently light and also imitate the movement. The shimmering variations of the light remind about the sunlight on the waves of the Yatsushiro Sea. People can see different images while they approach the station. Station hall on the ground level is spacious and bright, with glass as finishing material (Fig. 45). Similar stylistic is applied at the elevated platforms. There are rectangular plates forming walls and roof, finished with glass escalators, walls and details (Fig. 46). The design of the building has been unified with the design of a plaza. The outstanding design of the station building underlines its function – of the “station-gate” to the Minamata city and surrounding community. In 2008 the station was awarded with the “Public Building Efficiency Award” by the Public Buildings Association.

- **Kagoshima-Chūō Station (2014)**
  The station is located in the center of Kagoshima-city and it is operated by JR Kyūshū. Except the Kyūshū Shinkansen, the station serves also the Kagoshima Main Line and Ibusuki-Makurazaki Line. A tram located in front of the station is operated by the Kagoshima City Transportation Bureau. The JR station serves approximately 22,500 passengers per day (2013). The previous station had a building with the grand stairs at the “Sakurajima Exit” which was connected to a large “Amu Plaza Department Store”. During the renovation in 2012 (Fig. 47), the
grand stairs have been dismantled and a new seven-stories building was completed in June 2014. Also station concourses have been renovated. The layout of the hall is similar to other Shinkansen stations but has better composition. Shops, not toilets occupy the central part of the hall (Fig. 48). Platform is rather functionally-oriented (Fig. 49). The station, like before, is connected to the “Amu Plaza”. There is a Ferris wheel on the top of the “Amu Plaza”, which is well visible from a distance. That Ferris wheel has become the characteristic spatial feature of the station and a landmark of Kagoshima-Chūō. Its visual image is stronger than that of station building but inevitably it is associated with the station serving as the “station-gate” to Kagoshima-city.

5.1.2.3 Hokuriku Shinkansen (2015)
The Nagano Shinkansen (between Takasaki and Nagano), which was built in 1997, was extended in 2015 to Kanazawa, as the Hokuriku Shinkansen, which is jointly operated by the East Japan Railway Company and the West Japan Railway Company. Except of Kanazawa Station (2005), which was built earlier as a very exceptional building, and Nagano Station that was rebuilt, other stations (Iiyama, Jōetsumyōkō, Itoigawa, Kurobe-Unazukionsen, Toyama, and Shin-Takaoka) have become completely new facilities, which were opened in 2015. Ueda Station has traditional motifs on the elevation; Nagano Station has been also rebuilt using motifs of the temple architecture inspired by the famous Zenkō-ji. The design concept for each station has been selected from several alternative proposals. The aim was to conceive the meaningful stations which could introduce the region to the wider community and serve as symbolic “gates”. All stations are elevated, they have similar layout schemes. The design concepts explore local history, architecture, tradition and nature from which come the motifs, colors and details. The stations are in state-of-art in the sense of technology. They have many amenities for the passengers, including a barrier-free (elevators and escalators) and facilities (e.g., clean toilets).

- **Nagano Station Zenkō-ji-guchi Entrance (2015)**
Nagano Station is one of the major stations in the Chūbu region, serving 20,884 daily (JR passengers; 2014). The station is also serving conventional lines, including the Shimano, Shinetsu Main Line (Shin'etsu-honten), Shinonoi and Iiyama Lines. Nagano Station has been prepared for the arrival of the Hokuriku Shinkansen by the construction of a new entrance on the side leading to the Zenkōji Temple (Fig. 50). The design of the new portion of the station has been inspired by the architecture of the famous temple. In front of the glass curtain wall there are wooden pillars decorated with traditional lanterns. There is also a handsome landscaped plaza separating pedestrian movement from the buses and cars. New entrance provides new “gate” to Nagano city.

- **Iiyama Station (2015)**
Iiyama is another station in Nagano Prefecture. It serves 588 passengers per day (2014). The design concept was to introduce the delicate nature of the Shinshū province at the “peaceful station” [22]. Shinshū provides the excellent opportunities for such activities as skiing at Hakuba and hiking in Kamikochi, as well as beautiful mountain views, other natural scenery and spas (onsen). To the east, lie towns filled with historical buildings and sites, including such treasures as the Zenkōji Temple and Matsumoto Castle. The station building has a large glass elevation allowing for the close contact with the surrounding (Fig. 51). The view can be also seen from the platforms and from the “Panorama Terrace” that is provided at the coffee shop. Interiors have design focusing on the local materials – such as wood, on colors and motifs typical for the region (Fig. 52). The station has the Tourist Exchange Center (Iiyama-eki kankō köryū centā), Shinshū Nature Township Activity Center (Shinshū shizengō akutibiti sentō), Tourist Information Center (Iiyama-eki kankō annaijo) promoting tourism in Shinshū, and shops selling local products.

- **Jōetsumyōkō Station (2015)**
This station on the Hokuriku Shinkansen is located in Niigata Prefecture. The station serves the Hokuriku Shinkansen and Myōkō Haneuma Line (Echigo Tomeki Railway) – it also replaced Wakinoda Station on the Shinetsu Main Line. Jōetsumyōkō was designed by the JR East Design Corp. and Niigata Prefectural Government. The design concept was based on the key word of the “memorable station” [22]. The building has an elevation with
emphasized high vertical windows with the wooden frames (Fig. 53). The dome gives the station building bolder image. The designers realized the concept by adopting elegant local cedar wood (*sugi*) for elevation and various interior finishes at the station hall (walls, suspended ceilings, benches; Fig. 54), and at the platforms (benches, ceilings). The Jōetsu *sugi* wood makes a beautiful composition of various colors and textures (Fig. 55). Benches have been composed of wood with metal details. Thus station building reflects locality through the materials – a local wood and color coordination. The images of sakura have been used at the interior walls and windows. At the entrance dome that displays traditional wooden structure are presented also the works of art (Fig. 56).

Structural design at the platforms is rather economically-oriented with wooden elements such ceilings, railings and benches expressing the design concept (Fig. 57). A beautiful view on the surrounding landscape can be observed through the large windows. Among the non-transportation function of the station there are shops selling local products, art exposition and the Tourist Information Center. Altogether the station has the form and performs the function of the “station-gate” welcoming people to the Jōetsumyōkō area.
Itoigawa Station (2015)
The station, located also in Niigata Prefecture, in the center of Iiyama-city, is operated by JR West on the Hokuriku Shinkansen and the local Ōito Line, as well by Echigo Tomeki Railway on the Nihon Hīsui Line. The station was designed by JR West and Yasui Architects & Engineers. Design concept relied on the particular location of Iiyama – between the Japan Sea and Northern Japan Alps [22]. The stylistics of the “symbolic station” employs the motifs of the Japan Sea, Northern Alps, jade stone, and “Itoigawa Geopark”. Symbolic design relied on the particular location. On the northern elevation – the “Japan Sea Entrance” – there are images inspired by the sea. On the façade on the south – the “Japan Alps Entrance” – there is a composition made of tiles with the image of the mountains and a large gate made of brick, which is a remainder of the former station (Fig. 58). Station building has also the design elements influenced by the Japanese traditional architecture, as the reflection of the historical wooden houses (Fig. 59). The structure relies on the conventional scheme for the elevated station. The emphasis is put on the elevations and interior displays. There is an exhibition introducing part of railway history in Japan – the train “Kiha52-156”, which was running until 2010 on the Ōito Line connecting Itoigawa with Minami Kotani.

The Itoigawa-city received recognition from the Global Geoparks Network in August 2009, making it the first Global Geopark in Japan, which is located at the new shinkansen station. Geoparks were created for the purpose of locating regions with the superior geological, natural, and cultural heritage. The “Itoigawa Geopark” encompasses the entire area of the Itoigawa city. Located atop a massive fault line between two continental plates, Itoigawa has been blessed with a wealth of unusual minerals and geological features. Its culture has thus developed a close connection with the Earth. Itoigawa is also home to the Kotakigawa and Omigawa Jade Gorges, two natural jade deposits which fostered one of the oldest jade working cultures in the world. The motif of the jade stones has been also reflected in the design of railway station.

The interiors and platform have design based on the same design code for the Hokuriku Shinkansen stations. A wood, glass and local design motifs are applied at the interior – at the hall (Fig. 60), and concourses (Fig. 61). The platform has economically-oriented design with elegant elements made of glass with texture resembling washi – Japanese traditional paper (Fig. 62). Like other stations, Itoigawa has also Tourist Information Center, shops with local products and other commercial facilities. New “station-gate” incorporating various local symbols welcomes visitors to its new building.

Kurobe-Unazuki Onsen (2015)
The station in Toyama Prefecture is operated by JR West and connected with the nearby Shin-Kurobe Station on the Toyama Chihō Railway Main Line. The name of the station contains the part “Unazuki Onsen” – which is the hot-spring resort from which runs a popular Kurobe Gorge Railway. The design concept for the station located in the environment rich with the natural beauty was specified as the “invisible, charming station” [22]. The Kurobe-city participated in the design. The station was designed to develop the region and attract tourists. Thus the station serves as a “station-gate” introducing the beautiful Kurobe region. At the east side of the station there is an exhibition space of the local products at the Kurobe Tourist Center and a gallery (Kurobe-shi chūki kankō gyarāri), which displays the regional natural resources, including a beautiful view on the Tateyama mountain range. There are also commercial facilities and shops with local goods. There are alrge station squares on both sides.

Both elevations, with a delicate motif of the wave, have some parts covered with the glass and other covered with the black natural stone (Fig. 63). The dominating colors are black-and-white. Similar colors have been adopted inside the building, with the addition of the bright color of the local wood (Fig. 64). The color scheme has been carried out up to the platforms. There are also some colored elevators there, as well as wooden benches and the interior decoration. The structure is conventional for an elevated station. The most expressive is the plaza with design influenced by the traditional Zen garden and the Kurobe Gorge. A large composition made of stones, with parts covered with glass and with flat pools of water, makes a landscaped garden that is surrounding the traffic plaza for the buses and cars on the east side of the station.

72
Toyama Station (2015)
The Toyama has been an existing station which was developed for the arrival of the Hokuriku Shinkansen. The station is operated by the JR West and some local operators. Located nearby on the south is the Dentetsu-Toyama Station – the terminal of the local Toyama Chihō Railway. On the north is located the terminal of the LRT. The design concept was specified as “the stage of the lights” – reflecting the beauty of Tateyama [22]. A station building has a glass curtain wall and interior in similar stylistic to the other Hokuriku Shinkansen stations, including wooden furniture, details and glass elevators (Fig. 65). The structure of the platform roof is more original; it has the originally shaped main supporting columns painted in white. There are also glass elevators and glass protecting walls on the platforms (Fig. 66). Bright design focusing on white color has been extended towards the station plazas, including the roofs of the bus stops and taxi. The station is the “gate” to Toyama-city.

Shin-Takaoka (2015)
This is another Hokuriku Shinkansen station located in Takaoka-city, Toyama Prefecture. The station is operated by JR West and serving also the Jōhana Line. The design concept embraced “a fusion of tradition, technology, and nature with the modernity” [21]. It was expressed through the materials – a stone, glass, wood, and through the colors – with the dominating white and brown. The building has an elevation in brown color combined with the black and white, with strong vertical accents (Fig. 67). The interiors have the balanced colors and design motifs which are influenced by the traditional architecture (Fig. 68). Tradition has been also reflected by a monument of the samurai helmet kabuto (Takaoka daikabuto) displayed at the hall, and by the landscaping based on the traditional Japanese garden. The monument is devoted to the 400-years long history of Takaoka, which has been well known as the largest production center of bronze ware in Japan, including helmets of the samurai warriors (Fig. 69). There are various facilities at the station. The structure visible on the platform level is rather conventional – the focus of the design has been put on the elevation, interiors of the hall and station plazas. The facility serves as a monumental “station-gate” to the historical Takaoka-city.
**Kanazawa Station (2015)**

It has been a major station in Kanazawa-city in Ishikawa Prefecture, operated by JR West and other operators – the Hokuriku Railroad and the Ishikawa Railway. The terminal of the Hokuriku Railroad Asanogawa Line is located below the square in front of the JR station. Kanazawa Station serves 20,807 passengers per day (2014; excluding Hokutetsu Kanazawa). Since 2015 it has been also serving the Hokuriku Shinkansen. Kanazawa is a historical city with preserved traditional architecture at the geisha district, samurai areas and temple areas, and with the Kenroku-en Garden – one of “three great gardens of Japan” – *Nihon sanmeien*.

The station was initially redeveloped in 2005, when a characteristic structure on the station east – a large wooden gate – the “Tsuzumi Gate”, resembling a traditional Japanese drum was constructed (Fig. 70). The gate is located in front of a gigantic steel-glass roofing – the “Motenashi Dome” (2005). The dome houses a recreation area having water arrangements, greenery and benches. The steel-glass station building itself is elevated – embracing all the station installations. The station was subsequently redeveloped for the arrival of the Hokuriku Shinkansen. Shinkansen platforms are adjacent to the east exit, between the Motenashi Dome and the conventional tracks. The design concept selected for the station aimed to conceive a “station reflecting the city”. The concept can be seen in the shape of the gate and the dome, in the traditionally arranged greenery at the station plaza, and at the interiors. Also at the platform, the columns have a shape reminiscent of the dynamic gate (Fig. 71). The symbolic structures at the Kanazawa Station have a strong recognition of the “gate” to the city.

**Europe: “station-identity”**

In Europe, the design of the local station which is often a part of the urban development project, is usually stressing very strongly the identity of its location and of the region. This vocabulary has been explored both at the conventional and HST stations.

**5.2 Conventional local stations**

Local stations are designed to give a convenient access to the city or the town. Such station is often identified with its surrounding. There are numerous examples of European local stations serving conventional railways, for example: the Nordpark Cable Railway stations (2007) in Switzerland, Station Leuven (2007) in Belgium, and Station Delft (2015) in the Netherlands.

- **Nordpark Cable Railway stations (2007)**
  The 1.8 km long Nordpark Cable Railway in Innsbruck, comprised of four new stations and a cable-stayed suspension bridge over the Inn River, connects the center of Innsbruck to the top of the mountain in less than half an hour. The stations were designed by architect Zaha Hadid (Zaha Hadid Architects). As a complete creations, the design for each station adapts to the specific site conditions at various altitudes, whilst maintaining the coherent
overall architectural language of fluidity due to their double-curvature glass structure. This approach was critical to the design for the railway, and demonstrates the seamless morphology of Hadid's most recent architecture as she pushes the boundaries of design and construction technology. These stations can be categorized as expressing the “identity” of their place – beautiful mountainous locations.

Starting at the underground Congress Station (Fig. 72) in the center of the city, the railway travels through a tunnel to Loewenhaus Station by the river. After crossing the Inn River on Hadid's suspension bridge, held by steel cables from concrete pylons, the car starts its steep ascend on the Nordkette Mountain side to Alpenzoo Station. The final station is at Hungerbur Station (Fig. 73) at Hungerburg village, 288 meters above Innsbruck, where passengers can join the cable car to the summit of the Seegrube Mountain. A high degree of flexibility enables the shell structures to adjust to various parameters whilst maintaining a coherent formal logic. Two contrasting elements "shell & shadow" generate each station's spatial quality, with lightweight organic roof structures of double-curvature glass "floating" on top of concrete plinths, creating an artificial landscape that describes the movement and circulation within. New production methods such as CNC milling and thermoforming guaranteed a very precise and automatic translation of the computer generated design into the built structure. The architects used state-of-the-art design and manufacturing technologies developed for the automotive industry to create the streamlined aesthetics of each station. Nordpark Cable Railway continues Hadid's quest for architecture of seamless fluidity, representing Zaha Hadid’s very latest contribution to the current global architectural discourse in digital design and construction.

Station Leuven (2007)
This station in Belgium serves about 26,000 passengers per day. The station has been remodeled for several years. In 1999, the Belgina Railways – NMBS (Nationale Maatschappij der Belgische Spoorwegen) arranged an architectural competition for the construction of a new platform covering for the Station Leuven. The winning project of the architects – Philippe Samyn and Partners has been a case study in which the appropriate integration of the surroundings, a minimal use of material, and an optimum comfort for travelers stands paramount. The station has a tunnel for pedestrians which passes underneath the station as well as an overhead bridge connecting platforms equipped with glass elevators. The canopy, which is a futuristic steel and glass structure, is covering all the platforms behind the historical station building built in 1875 in an Eclecticism style (Fig. 74). The original station was designed by architect Henri Fouquet. Historical station extends the identity of the city, while modern structure of the roof gives the contemporary dimension to the overall station. New structure is not visible from the frontal elevation (Fig. 75). Historical architecture and modern structure together serve as a visiting card for the Leuven city and expresses its “identity”.

Station Delft (2015)
The first train station in Delft, in the Netherlands, was built in 1847. Later it was redeveloped by Christiaan Posthumus Meyjes sr. and opened in 1885. In 1998 a historical building was restored and reused as a students’ dormitory. The works on the new station project were carried out since 2009 and a new building, with a new tunnel Willem van Oranjetunnel, were completed in 2015.
New station building located along the Westersingelgracht Canal is partly located above the ground and partly underground. The above-ground portion was designed by Mecanoo Architects in Delft. The station building has a simple form and a glass curtain wall, which is changing colors depend of the sunlight (Fig. 76). The underground part was designed by the Amsterdam firm Benthem Crouwel. The multilayered station has an entrance hall with a vaulted ceiling with slats on which a city map of Delft from 1877 is depicted. The hall is visible from the platforms (Fig. 77). The visual connection underlines the stylistic relations – the station has been designed totally, in similar style from the entrance to the platforms. The columns and walls are lined with broken tiles in a contemporary interpretation of the Delftware (Fig. 78). Between station concourse and the platforms in the tunnel is located a bicycle parking. The entrance to the station is on the side of the inner city (Westvest). The station is going to be integrated with the municipal office. Station, through its design with various local motifs is effectively capturing the “identity” of the city.

5.2.2 New High Speed Train stations

Many local stations in Europe are located on IC lines, or faster HST lines, serving TGV, Thalys, ICE, etc. The introduction of the HST was usually associated with the urban development of surrounding areas. It was important of the station building to serve as a “gate” and as an “identity” of the city and the whole region. Often expressive structures played an important role in emphasizing the modern image of the transportation facility. Selected examples of recent HST stations include: the TGV Méditerranée line station – the Gare d’Avignon TGV (2001), ICE station – Montabar Bahnhof (2002), and the Thalys station – Station Bruges (2009).

- **Gare d’Avignon TGV (2001)**
  The expansion of LGV lines to the south resulted in opening in 2001 of a new route – the LGV Méditerranée. Three new stations located in the Rhône valley – Valence, Avignon and Aix-en-Provence represent a “Mediterranean-style” TGV stations. From one side they are similar because they are easily recognized as a part of new LGV line and have brand products and uniform services of SNCF, from the other they are different because each station design was based on local context rather than repeating SNCF model. Landscape designers Desivgne & Dalnoky involved from the beginning in this project, helped to plan orderly various elements of each station – station buildings, drop-off and pick-up points, parking lots, access roads, bus stops, etc., and used local plants to arrange the surrounding. Magnolia trees and nettle trees were planted to suggest the large plantation region. Also the specifics of location was expressed through details and materials, including stone, wood and copper to provide the link with local soil and local colors.

Gare d’Avignon is one of two train stations in Avignon. The Gare d'Avignon-Centre is dedicated to local trains and is located in the city center, and the Gare d’Avignon TGV services the long distance and high speed train; the TGV. Station building was designed by the SNCF – architects Jean-Marie Duthilleul and Jean-François Blassel. The station archway building has the function of station hall and platform protection from the wind. The glass 340-m long roof is very expressive and its Gothic arch shape resembles a gothic cathedral (Fig. 79). The elevated 6.0 m above the ground and 400 m-long platform stands out in the landscape, emphasized by rows of magnolia trees parallel to station building. The station is representing the “identity” of its region.

- **Montabaur Bahnhof (2002)**
  It is a new station at the Köln-Frankfurt high-speed railway and on the Limburg–Siersbahn railway (Lower Westerwald Railway) in the German state of the Rheinland-Pfalz. It is conveniently located near the expressway and park & ride parking. The station is served by regional and long-distance passenger services and a freight traffic. The central bus station Montabaur was built nearby, as a result of the new ICE railway station, on the city side of the station forecourt. The urban design is the result of a competition in 1998. The first prize was awarded to architect Stefan Schmitz (Cologne Graf + Graf Architects). A steel structure of the roof has been technically determined and
aesthetically designed. It does not look fashionable but interesting and functional (Fig. 80). The structure gives the building a modern architectural image. The aim of the design was an easy and transparent construction that sets the special mark in the center of the station forecourt. Such transparent station is easy to understand by the users. The station building gives the location “identity” of a modernity and affluence.

- Station Brugge (2009)
The station is located in the UNESCO town of Bruges, Belgium, within a walking distance from the historic and commercial center. It serves about 15,000 passengers per day (2009). Since 2015, the station has been serving Thalys high speed service to Paris. This third Station Brugge from 1939, which is currently still in service, was designed by the architects Josse Van Kriekinge and Maurice Van Kriekinge, who had won the architectural competition. The building designed in modern classicism is protected as an architectural heritage (Fig. 81). There are noteworthy murals painted in 1939 by René De Pauw the ticket hall. In 1997 the modernist façade was thoroughly cleaned.

![Fig. 79 Gare d’Avinion TGV, Avignon (2001)](image1)
![Fig. 80 Montabaur Bahnhof, Germany (2002)](image2)

![Fig. 81 Station Brugge, Belgium (2009) – historical building](image3)
![Fig. 82 Station Brugge – new building](image4)

The development of the railway station since 2004 was a part the “Bruges St. Michiels” project commissioned by SNCB Holding that involved the construction of offices, underground parking and station entrance, as well as renovating the platforms that became accessible through the elevators and escalators, of tracks and underpass [23]. The most important part of the project has been a new multifunctional station building “Jacob van Maerlant Building” with the new entrance. The ambitious project adopted innovative technologies, for example for the 350 mm-long climate-protective façade made of special glass that also serves as a noise barrier and a dust screen. The 11 m-high bolted-glazing has been attached to a steel structure on a five meter high exposed concrete wall (Fig. 81). Structural design is an important part of a new building but the architecture and materials are predominant. New design is harmonized with historical building on the other side of the railroad – Sint-Michiels. The station with two buildings strongly reflects the complex “identity” of the city of Brugge.

6. Conclusion

In recent twenty five years, railway stations in Japan and in Europe along with the “station renaissance” have been transformed from standard facilities into modern multifunctional transportations hubs. Railway station became a central part of an urban development project, and being such, stations started to receive interesting, distinguished and modern forms. They began to represent their cities and regions. New types of train depots – “station-cities” and “station-towers” in Japan, as well as “station-complexes” in Europe – acquired new roles and new visual images, becoming the most representative buildings. Also the local stations play important roles of introducing the regions through the “station-gates” in Japan and “station-identities” in Europe.

The relationship between structures and architecture played part in shaping the overall image of the station. In some cases, structure determined the form of the building, in other cases architecture and details were prevailing over the
innovative structure. Being on the borderline between architecture and structure, recent railway stations display a wide range of types – from the cases of Berlin Hauptbahnhof and Gare de Liège Guillemins in Belgium, Station Leuven, Station Brugge, as well as the stations in Japan – Osaka, Asahikawa, Kōchi, and Tsuruga, where the role of a structure a paramount, to the cases, where the structure is subservient and the station has strong architectural expression (e.g., Nagoya, Shin-Tamana, Nagano, Jōetsu-miyōkō, Itoigawa, and Montabaur Bahnhof). Although the accent can be shifted, stations being on the borderline between structure and architecture – use both, combine both and their beauty relies on modern transformation of the archetype of a railway station into modern facility of the 21st century.

[i] “Kumamoto Artpolis” is an innovative urban planning and architecture project conducted in Kumamoto Prefecture since 1988. The project was an initiative of then governor Morihiro Hosokawa, a commissioner was at first Arata Isozaki and since 1997 Toyo Ito. Several other projects have been realized under this town planning method, for example: Kumamoto North Police Station (1990), Yatsushiro Municipal Museum (1991), Shirakawa Bridge Landscaping (1992), Kumamoto Prefectural Ancient Tomb Museum (1992), Ushibuka Haya Bridge (1997), Hikawa Dam Maintenance Facility (2001), Akishita Community Hall (2009), Kumamoto South Police Station (2011), etc.

References