Extending the algorithms of design procedures for new structures and urban spaces by research using architectural layout models and social surveys based on the example of new investment projects of the city of Zabrze

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Abstract. Upon the intense political and economic transformations of the early 1990s, the economic and spatial redefinition became necessary for a number of cities in Poland. Zabrze – a typically industrial city, located in the centre of Upper Silesian conurbation, due to the restructuring of the industry which mainly meant the fall and liquidation of mining and heavy industry correlated thereto - faced the necessity to change the functioning and – in consequence – the image based on new investment projects using the city material culture resources. The decision was made to transform Zabrze into a vibrant, post-industrial place, targeted at post-industrial tourism, developing academic and medical sciences centre with cardiology playing a special role therein. All components, recognised as the direction of the city sustained development, influenced the creation of the list of priority investment projects, which included: the reconstruction of Górnik Zabrze city stadium, revitalising the Main Key Heritage Drift and the erection of the new Hub to replace the present railway station. The investment decisions were subjected to consultation with the inhabitants of Zabrze. Furthermore, the publicity of city authorities intention related to the new investment projects and the population’s approval were to facilitate attracting strategic investors. The question was asked about the kind of advertising and visual techniques to be used to make the suggested new facilities most readable to the Zabrze community, so diversified by age, education and social origin. The choice fell on making several backlit architectural layout models of the new investment projects mentioned above, emphasising that close cooperation between the authors of the models and the designers of the new structures must be initiated, in order to enable up-to-date amendments and corrections to the approved solutions. At the same time, the exhibition of the finished models in places available to the general public was assumed and later accomplished, so that the local community could easily become familiar with the suggested new projects. Thus, it took a few years to create the layout model of the new Hub, presented at several meeting, the model of the Main Key Heritage Drift with accompanying facilities located in a special glass-case at the Wolności Square in the centre of Zabrze and the layout model of the new football stadium exhibited in Platan shopping centre and other buildings in the city centre at various events and meetings. It was also the major element of Zabrze stand at Real Expo Fair in Munich. The wide range of meetings and consultations has brought about, without limitation, a diametrical change of the Hub concept, changes in the facade colour range and the stadium auditorium seating as well as the change to the suggested landscaping of the area directly adjacent to the structure, acceptance of the formal-utility concept of the revitalised drift. The expansion of the communication platform between the city authorities and local community caused the increased interest in the possibility to affect the city policy and made the inhabitants aware of their shared responsibility for the development and future of Zabrze.
1. Introduction

The political transformations of numerous Central European countries in the 1980s and 1990s, in addition to the change of their political systems, significantly remodelled the economies of the entire Central and Eastern Europe. Furthermore, the global trends altering the economic structure of developed countries resulted in a dramatic restructuring of mining and heavy industry in numerous parts of the world. The main impact of the changes afflicted the urbanised areas that functioned therein, based on closely correlated mining and heavy industry. Upper and Lower Silesia were the regions of Poland that particularly suffered economically and socially due to the restructuring transformations, i.e. mass liquidation of mining and processing facilities. Zabrze, one of the leading cities at hard coal mining production within the Upper Silesian Industrial Basin, as an urban organism suffered the impact of industry reorganisation process effects particularly badly. The process of economic transformations that affected the city was rapid and included the industry sectors that constituted the foundation of the city functioning. In turn of the 20th and 21st century, Zabrze still being one of the major cities of the Upper Silesian conurbation, faced several challenges, such as structural transformations of some still functioning industrial works, gradual depopulation of the urban areas, related to the rapid reduction of jobs in industry and the necessity to find a new definition of its method of functioning and correlated new image and city marketing in the applicable capitalist and post-industrial economic conditions, within a relatively short time. The idea of using the existing urbanised resources and supplementing them with new investment projects of reconstruction of the post-industrial and sports facilities seemed to be the right direction of changing Zabrze as a modern city.

2. The spatial structure of the city areas

The Upper Silesian territory is characterised with a density of big industrialised cities, their limits so close to each other that it is difficult to notice movement from one city to another. Generally, the urban structure is continuous and the limits between the cities can only be seen thanks to the graphic signs showing their coats of arms. Zabrze, contrary to the neighbouring Gliwice and Bytom, is relatively young and not founded on the historical urban layout, which throughout centuries developed around the market square and adjacent central city areas. Originally it used to be a group of independent farming settlements dispersed around. Only the discovery of hard coal deposits and erection of mines plus the establishment of steelworks, glassworks, numerous factories, the coking plant as well as the situation of working men’s estates with accompanying infrastructure near the industrial works, with their specific form and layout, caused the functional and spatial merger of the areas, although belts of trees distinctly separating the city districts are visible until present [1]. Mainly the economic conditions and the tax regulations made Zabrze remain the largest village of Europe of that time. Eventually, as a result of the political and economic conditions, it was granted the city charter in 1922. After Poland had regained independence in 1918, the Plebiscite had been held, in spite of three Silesian Uprisings, Zabrze was left on the German side of the border until 1945. In the years 1919-1933, it was a vivid border city of the Weimar Republic, included in the development plans of the so-called Bytom-Zabrze-Gliwice Tricity, with all the related consequences [2], [3]. The time of war did not cause any significant devastation to the urban structure, except the destruction of the equipment of the industrial works mainly. After the war, the heavy and mining industries were reconstructed within a relatively short time and significantly expanded in the following years. The modernisation and expansion of various industrial production sectors, including electronic and medical ones, mainly fell in the 1960s and 1970s. In those years numerous housing estates were built in the central and suburban areas, which made Zabrze a city, largely merging the urbanised structures [4]. After that period the industry constituting the functional and economic and spatial backbone of the city dramatically deteriorated. The changes mentioned herein above followed afterwards.

3. The search for a new image of the city

The history of the areas now situated within the city limits of Zabrze affected the cultural heritage of the city. The population of Zabrze in the interwar period consisted of Poles, Germans and Jews. The years of World War II, the dislodging and exile of people defined as Germans after the war, such definition frequently wrong, which is being verified in the historical materials until present and the action of so-called family unification and mass emigration of a large part of the city population to the
Federal Republic of Germany in 1970s, which was of economic rather than national nature and the ongoing inflow of people from all over Poland seeking a well paid jobs with their relatively low qualifications until the end of 1970s were the factors that influenced the rich multicultural heritage of the city. The major element of the resources is the diversified structure of post-industrial development, preserved in a good technical condition, however, with a great potential for transformations and reconstruction useful in building the new image of Zabrze as a modern post-industrial city of Silesian conurbation. The main directions of urban development were marked out: the reconstruction and expansion of the base of academic facilities related to the establishment of new departments of Silesian University of Technology and Medical University of Silesia, as well as Katowice School of Technology, reconstruction and so-called “deep” modernisation of Górnik Zabrze Stadium – a sports club of laudable [5], long-term traditions and achievements and adaptation of a number of former vivid industrial heritage facilities to the post-industrial tourism purposes. The main structures selected to be adapted for tourist services are Guido Coal Mine, the Queen Luiza Mine Shaft, the Water Tower in Zamoyskiego Street, the Main Key Heritage Drift with a tourist centre and a number of minor post-mining structures [6], [7]. Zabrze is a city with good transportation links, because A1 and A4 Motorways pass nearby, the Drogowa Trasa Średnicowa [Diameter Roadrout] and Wrocław – Katowice railway line with branches into all the major transport directions cross the city centre. The Katowice-Pyrzowice International Airport is also situated near Zabrze. Wherever the tourist industry is developed, the matter of convenient transport access becomes the key objective to be achieved. Therefore the strategic task to build a modern Hub arose. All these measures are to create a new definition of the functioning and image of Zabrze.

4. Studies accomplished and research methods

The decisions concerning the new investment projects in Zabrze included supporting designs in the form of layout models of three projects: Reclamation of the Main Key Heritage Drift, reconstruction of the City Stadium and works on the concept of the New Hub. Each of the investment tasks included customised performance time, scope and form of the construction tasks in relation to the needs and expectations related to the specific architectural model of the specific structure. It was assumed that during the works on the models, regular consultations and meetings on the contractor’s premises would be held, attended by the investors and designers of the structure modelled in a miniature. The schedule of the meetings in each case was adapted to the mode of carrying out the design works and scope of marketing actions. The use of architectural models in the city promotion was considered at various meetings, exhibitions and international investment fairs, as well as in attempts to solicit strategic investors.

The scope of the first, a conceptual layout model comprised the reclamation design of the Main Key Heritage Drift [8]. The design assumed the construction of kilometres of diversified underground tourist routes adapted to various age groups. In the late 19th century the drift used to be one of the largest structures of this kind in Europe. It was ca. 14,5 km long and was used for the transport of extracted coal and the drainage of mining waters to the Klodnica Canal. The drift sight-seeing can be done partly on foot and partly on boats and mining floor railway. Numerous “junction” points were established along the underground tourist routes, including permanent and seasonal exhibitions on the topics related to the history of Zabrze and coal extraction. The routes are rich with interactive projects, connecting the newly erected tourist service building at the crossing of Karola Miarki and Jagiellońska streets with the „CARNALL” shaft in the „Queen Luiza” Mining Heritage Park and tourist service facilities in Sienkiewicza Street. During the reclamation works the conceptual layout model was displayed in a special showcase in Wolności Square – the main square of the City [6], (Figure 1), enabling the inhabitants to obtain information on the funding and target view of the investment project. There is also the model of the Water Tower in Zamoyskiego Street, under reconstruction at present, with target dedication to house a branch of the City Museum. The model has backlit and moving elements. The local media encourage the local people to share their opinions at various forums, to enable the participation in the project by means of social consultations. The first fragment of the drift was opened in 2017.
Figure 1. Conceptual layout model of reclaiming of Main Key Heritage Drift, highlighted, with mobile parts - the author of the model: Jerzy Pocisk-Dobrowolski

Another structure displayed in its target view by means of a backlit layout model is the City Stadium of Górnik Zabrze Sports Club, in 1:220 scale. The structure was subjected to so-called „deep modernisation”, which means the erection of new stands with roofs for the supporters, new heated turf and stadium facilities with supplementary service and commercial functions. Two stages of the reconstruction have been completed achieving a “C” shaped aerial view. At present, the stadium is used in its full scope. The third stage related to the reconstruction of the fourth stand with VIP seats, to close the structure into a full oval will be performed in the upcoming future. As a target, the stadium is to host 32 thousand supporters (Figure 2).

Figure 2. Backlit layout model of the City Football Stadium in its target version after completion of the three reconstruction stages, scale 1:220, the author of the architectural model: Jerzy Pocisk-Dobrowolski
During the design works the models served to test the layout and colours of seats as well as various suggestions for finishing the main entrance square. In the studies and tests on the colour range of the structure, the method of lightening the colours was applied according to the scale and adjusted to the extent of miniaturisation of the modelled fragments of the structure. The application of the method results from the fact that the same colour is perceived by the human eye differently when applied on a large surface and differently on a small test surface. The suggestions for the reconstruction were subjected to the consultations of the local community with particular consideration to the supporters’ opinion. The backlit layout model was displayed in “Platan” shopping centre, at some occasional meetings and it was the main exhibit promoting Zabrze at Real Expo international investment fair in Munich, 2012. The model was also to promote the share in a project funded by the European Union (Figure 3).

**Figure 3.** Backlit layout model of the City Football Stadium in its target version – another view, scale 1:220, the author of the architectural model: Jerzy Pocisk-Dobrowolski

The third backlit architectural model in 1:500 scale presented the concept of the new Hub, including the wide belt of the existing urban development. It was to check whether the form and cubage of the designed structure fit into the context of the existing city centre development. Its additional functions were to promote the project in a clear message to the local community showing its conceptual view. Furthermore, it was to support the search for a strategic investor. Throughout its creation, particular fragments were replaceable modules for testing the suggested various design solutions concerning the layout of the usable functions within the mall accompanying the parts dedicated to the railway and local bus/international coach stations and to test the look of the very form of the structure.

In all the cases the monitoring of various media and social platforms was carried out and the remarks, comments and suggestions gathered were analysed by various groups of experts and in some situations tested on the replaceable modules on the model. Eventually, the merged model was created in the form preliminarily accepted by the city authorities. The numerous discussions and specialist studies, as well as changing expectations, requirements and numerous controversies about the form and size of the group of buildings composing the planned structure, caused the suspension of the concept in the shape originally set. At present, the works on a totally different concept of the Hub are carried out with more care about the harmonious fitting the structure into the existing development and
much smaller, without the shopping mall, taking into the consideration significantly lower costs of such project performance (Figure 4).

![Figure 4. Town-planning model of the conception New Transit Hub in Zabrze – scale 1:500, the author of the architectural model: Jerzy Pocisk-Dobrowolski [4]](image)

5. Conclusions and research results
The rapid development of computer graphic techniques and 3D printing in the recent years has not brought about any reduction of demand for various layout models used as a support to the processes related to the design at the conceptual stage and throughout the performance of the executive projects. The simplicity of the message receipt by means of the model, concerning the look, dimensions and functional-usable layout of the miniaturised structures maintains the popularity of the 3D models. They enable multi-directional viewing of the suggested solutions for the design by groups of spectators who do not have to be specialists or hold any specific computer operation skills. It mainly concerns elderly people. Moreover, the common movement of a person viewing the model automatically enables watching it from a totally different perspective, while the graphic visualisation in most cases enables the perception of the message contained therein in the form of a single view (Figure 5).

![Figure 5. Visualisation of the City Stadium after reconstruction – reference: Stadion Miejski Sp. z o.o. [4, 5]](image)
The majority of the world’s leading design studios use the models efficiently as a tool of support in the designing process and at the stage of performing the structure. Scanning the models and the use of micro-cameras, including the transformation of the electronic file obtained in such a way, enables the professionals to enrich the content in the form of dynamic computer visualisation with some far more interesting pictures facilitating the analysis of the solutions evaluated. The application of the replaceable module system to the construction of the models and project performance in all the cases described above largely contributed to a significant reduction of the errors that are unavoidable at various performance stages of projects so complex. As a result, models were created presenting the target view of the new structures transforming the view of Zabrze and affecting its functioning as a vivid city. The same models were used for studies on the alternative solutions concerning the functional layout, visual information and the formal contents included in the concepts of the structures tested on the models (Figure 6). The secondary use of the layout models as elements supporting the perception of the suggested solution by the local communities of inhabitants puts this type of new investment process promotion within the group of highly effective marketing measures.

**Figure 6.** Layout model of the conception New Transit Hub in Zabrze with surroundings – scale 1:500, another view, the author of the architectural model: Jerzy Pocisk-Dobrowolski

6. Conclusions
The expansion of the algorithm of procedures at designing new structures and urban spaces with studies using architectural layout models appeared to be a reasonable measure supporting the right selections out of the suggested alternative investment solutions. Throughout the recent years, the growth of local patriotism and correlated increased interest of the local communities in the development plans of the cities being their small homelands has been recorded. The increased impact of opinion creating media on the investment activities in the cities generates the demand for building material forms of information to explain the local communities the new ideas concerning the city development in a clear and sometimes really literal and easy-to-perceive way. The layout models represent such spatial information and their multi-directional use throughout the very process of building them puts them within the group of effective research and medial tools. The new structures made and accepted by the inhabitants play an important role on the trail of Technical Historical Structures of the Province of Silesia, they improve the image of such cities as post-industrial Zabrze, influence the city development, create new jobs and add to the attractiveness and comfort of life in urban areas.
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