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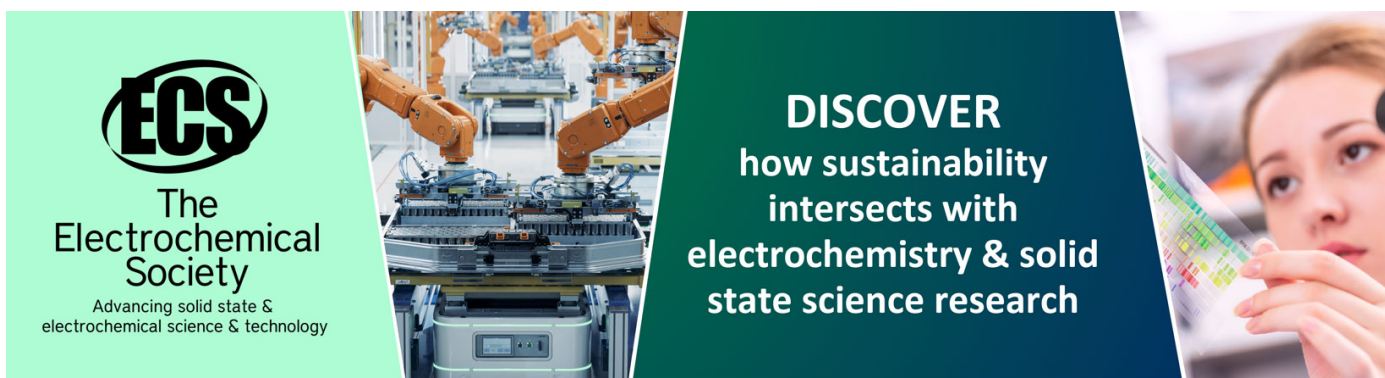
Eco-Strategies for Urban Space in Historic Cities

To cite this article: Izabela Kozłowska 2019 *IOP Conf. Ser.: Mater. Sci. Eng.* **471** 102031

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Eco-Strategies for Urban Space in Historic Cities

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Abstract. The paper deals with the devoted to ecological architectural projects undertaken in the areas of historic urban spaces. In many Polish and European cities, historic urban areas have been preserved, including many completed in the 19th century. They create a valuable cultural heritage, which is currently undergoing a process of revitalization, the aim of which is to transform degraded areas in social, architectural and economic terms. The first part of the papers defines the main eco-strategies used during revitalization activities in historic urban areas. A division has been made: a) permanent eco-strategy being an intervention into the historic structure of buildings introducing techniques and technologies using renewable energy sources, energy-saving and environment-friendly installations, and b) temporary eco-strategy involving the introduction of architectural and artistic facilities within public and semi-public spaces using ecological techniques and technologies. The second part presents examples of implemented actions in Polish and European cities, which focused on temporary eco-strategy in public and semi-public spaces. The conducted research suggests that revitalization programs are often long-term and often destroy the original, well-preserved structure of buildings, which should be protected and used as a cumulative "embodied energy" (energy and labour load invested in the construction of the building). The answer to these problems can be ecological project activities consisting of small spatial treatments, with minimal effort, which thanks to their creativity and originality ensure high efficiency. These activities combined with the limitation of a thorough modernization of a historic building substance can be ensured by a successful revitalization and restauration process.

1. Introduction

The paper deals with the devoted to ecological architectural projects undertaken in the areas of historic urban spaces. In many Polish and European cities, historic urban areas have been preserved, including many completed in the 19th century. They create a valuable cultural heritage currently undergoing a process of revitalization aimed at transforming degraded areas in social terms, architectural and economic. Revitalization understood in a broader context as a holistic issue should be based on the philosophy of sustainable development, whose components are: intergenerational social justice, economic development and ecological sustainability [1, 2]. This paper focuses on ecological aspects that aim to protect the natural environment in the existing historic cities. Such activities are part of the trend of sustainable urban regeneration / eco-revitalization [the author of this term is Marek Adam Wołoszyn].

In the case of historical cities, requirements regarding the protection of monuments are no less important. In this respect, doctrinal documents are in force: "The Venice Charter 1964" [3] and "Washington Charter 1987" [4]. The first one is devoted to conservation and restoration of monuments and sites and contains arrangements referring to this kind of activities. Such works can be part of the conducted revitalization, so the requirements in this regard should be respected. The Charter contains: how to use a historic object should not cause a change in the layout or decoration of the building, in the case of survival of the former surroundings any building, any demolition and any alteration that



could change the relationship of solids and colours, was banned, and actions restaurants should be conducted with respect for the former substance and elements that constitute authentic documents of the past (Articles 5, 6, 9) [3]. The second Charter refers to conservation of historic towns and urban areas. In this case, the records require before planning activities to develop plans indicating buildings and their groups for special protection, buildings protected under certain conditions, and those that can exceptionally be removed. According to the findings of "Washington Charter 1987" infrastructure should be adapted to the character of historic cities, and their adaptation to the needs of modern life requires the introduction or improvement of the necessary public facilities and installations. New buildings or reconstructions should, however, take into account the preservation of spatial layouts, plots, the scale of existing buildings, and contemporary elements should harmonize with the whole of historic cities (Articles 5, 8, 10) [4]. Records included in doctrinal documents are often difficult to reconcile with the requirements arising from the need to protect the environment and sustainable development.

The article is based on the analysis of examples selected by the author in the field of protection and revitalization of historical cities and ecological projects. The aim of the work is to develop eco-strategy typologies in the areas of historical cities and their assessment. Another goal is to indicate the optimal strategy that can be applied in historical city spaces.

In the area of research, historical areas were included, to which both old cities and historical 19th-century urban areas were included.

2. Type of eco-strategy in the urban spaces in the historic cities

The first part of the paper defines the main eco-strategies used during revitalization activities in historic urban areas. The division into two strategies was made due to their scope of influence:

- permanent eco-strategy,
- temporary eco-strategy.

2.1. Permanent eco-strategy

Permanent eco-strategy relies on intervention in the historic structure and substance of buildings introducing techniques and technologies using renewable energy sources, energy-saving and environmentally friendly installations. As part of this strategy, full revitalization can be separated as well as programs supporting revitalization activities.

Among the tools based on proecological postulates, the following project activities to improve environmental aspects can be specified [5, 6, 7]:

- the use of renewable materials that can be recycled,
- use of materials with low built-in energy, i.e. selection of building materials with the lowest possible energy value for their production,
- use of local materials,
- adaptation of external partitions as well as window and door carpentry to the needs resulting from local climatic conditions,
- use of the existing substance,
- reduction of energy use as a result of using a renewable energy system (solar, photovoltaic) and energy recovery system (heat pumps) taking into account local climatic conditions (in this respect, Mediterranean climate countries have different experiences compared to the cold climate of Northern Europe and the summer time) is a period of increased energy consumption for cooling air in buildings [8]),
- reduction of water use - watertight installations using rainwater and gray water for living purposes,
- introduction of waste segregation and composting of organic waste, reducing and minimizing (reduce) waste production using the principles of reconsumption (reuse) and recycling (recycle),
- improvement of the microclimate of the semi-public space as a result of the introduction of biologically active areas (green courtyards, elevations, roofs).

In the 1970s, actions taken in historical urban areas were "drastic" (especially in the 19th century areas), consisted of a total demolition of the quarters of outbuilding and the creation of an open, green, but also "nobody's" space. In the 90s of the last century, as a result of error analysis and eco-philosophy, introduced of the so-called mild revitalization model striving to preserve existing structures (the 12 commandments of gentle revitalization were developed during the revitalization of the Kreuzberg district in Berlin) [2].

Currently, projects implemented in historical spaces pay attention to ecological aspects, which should be an integral element of holistic urban planning and management of cultural heritage as well as social, economic and technical factors. One of the elements of the sustainable development of historical cities is the protection of the historic urban landscape as defined by UNESCO. There are looking for solutions combining the needs of climate protection against excessive gas emissions (Co2ol Bricks project) with proper protection of cultural heritage (Sustainable Historic Towns for Estonia, Finland, Latvia, Norway, Sweden) [9].

2.1.1. Full revitalization programs - examples

The presented examples of revitalization carried out in Berlin and Szczecin are considered as model programs taking into account ecological aspects.

The project of revitalization of block 103 in the Kreuzberg district of Berlin, realized in 1991, was the first model eco-revitalization carried out in the German capital. The program seeks to partially separate the whole team from the municipal power system, introducing individual infrastructure within flats encouraging savings and using the existing substance. Attempts have also been made to reduce energy use, such as the renewable energy system (solar panels), energy recovery system (heat pumps) and reducing water use by using watertight installations and using rainwater and gray water for living purposes. Separation of waste and composting of organic waste were introduced. The microclimate of the semi-public space was also improved as a result of the introduction of biologically active areas (courtyards, elevations, roofs) [7, 10]. In addition to photovoltaic conversion systems (photovoltaic panels), passive systems of photothermal conversion in the form of conservatory - greenhouse systems encasing the zone of balconies, staircases and loggias were used. As a result of revitalization work, it was possible to reduce greenhouse gas (GHG) emissions by reducing the heat demand by approximately 44%, and for electricity by 7.5%. In addition, the heating and energy needs were largely met by using solar energy (14-16%) and the local heat and power plant (around 56%). Drinking water consumption decreased by 20%, gray water drainage decreased by about a half. An important proecological element was the introduction of greenery for semi-public interiors (yard) with an area of 840 m², but also its location on walls and roofs, which increased the biologically active area by about 5000 m² [7].

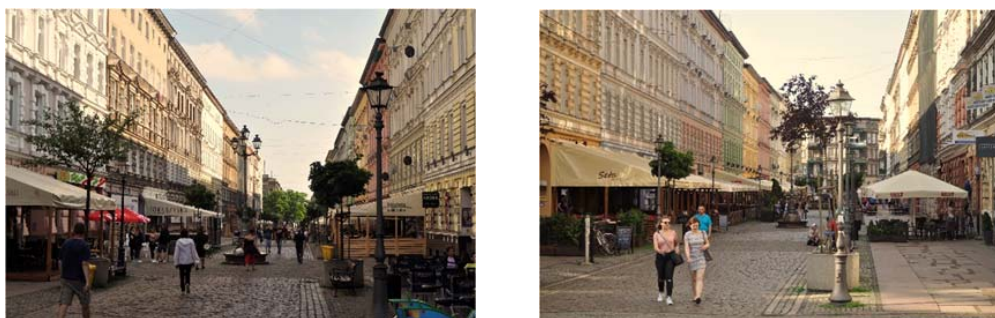


Figure 1. Pasaż Bogusława in Szczecin - pedestrian zone introduced as a result of revitalization of Szczecin quarters

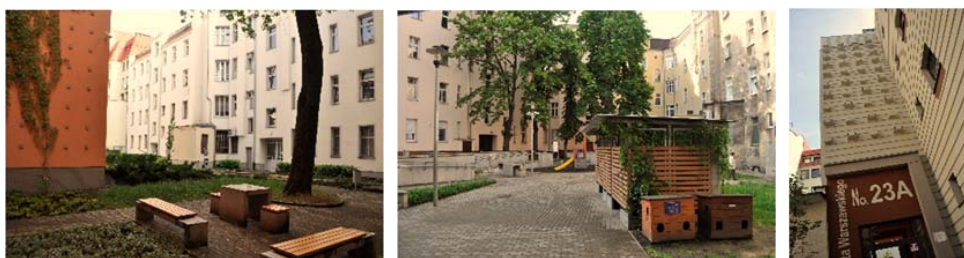


Figure 2. Semi-public interiors of the courts of Szczecin quarter No. 23

The quarter No. 27, so-called "turzyński" in Szczecin was the first revitalization program in Poland. As part of the renovation carried out in the years 1995-1999, the "Ecological renovation demonstration project" ("Projekt demonstracyjny renowacji ekologicznej") was implemented. The development of the assumptions and concepts of ecological renovation was entrusted to a scientific and research team composed of employees of the Szczecin University of Technology under the direction of prof. Associate. dr hab. Eng. arch. Marek Adam Wołoszyn. The project uses ecological solutions to reduce water and energy consumption, to obtain energy from renewable sources (solar and solar panels) and the use of building materials and technologies, including the method of environmental impact assessment of their entire life cycle - LCA Another Szczecin demonstration program was to initiate thermal modernization quarter no. 36 implemented in 2000-2004 as part of the "REGEN LINK Demonstration Project" ("Projektu Demonstracyjnego REGEN LINK"). The renovation process of this quarter focused on pro-ecological activities and improving the quality of life of tenement house residents. The measures taken were aimed at reducing pollution emitted to the environment (decommissioning of gas furnaces), using unconventional energy sources (using solar colls), reducing energy use (thermal modernization of buildings, replacing window frames with energy-efficient ones), increasing standards of premises (installation of central heating and hot running water) and improving the aesthetics of buildings and the environment as a result of repairs of the front elevations of tenement houses and the development of the interiors of the quarter. The revitalization of the quarter no. 23 was carried out as comprehensively as in the case of the pilot quarter No. 27. In 2012-2014, as part of the "Revitalization of RAZEM" ("Rewitalizacja RAZEM"), three projects were implemented. The interiors of the quarter were arranged and equipped with greenery, a playground for cats, nesting boxes for birds and containers for rainwater placed near gutters. The experience gained during the implementation of the pilot revitalization program of the quarter no. 27, 23 was used during subsequent works carried out in the downtown quarters No. 22, 33, 36 and 39 (from 2015), 40 (from 2012) (figure 1, 2). The planned area of revitalization activities covered a total of 56 quarters extending to 205 ha inhabited by approximately 50,000 inhabitants [2, 11]. From the whole project, in just 20 years, only 7 quarters have been realized in the form of comprehensive revitalization, which illustrates the scale of activities, their level of complexity and economic constraints affecting the progress of works.

2.1.2. Programs supporting revitalization activities – examples

In Szczecin, several programs were developed to support housing regeneration and tenants. They are: "Program of Small Improvements" ("Program Małych Ulepszeń"), "Program" Our House" ("Program „Nasz Dom”") and "Green Courts Szczecin" ("Zielone Podwórka Szczecina"). Introduced in 1994, the "Small Improvement Program" is addressed to tenants of municipal premises. As part of this program, subsidies are paid to municipal premises in the form of building a toilet, bathroom or kitchen together with the installation, changing the heating from traditional to gas, electric or district heating network. The second program implemented in 1998-2009 and addressed to apartment owners was to motivate them to carry out renovation of buildings. The last program "Green Courts Szczecin" introduced in 2008 financially supports the revitalization of courtyards and yards. In 2015, another program "Green Front Gardens Szczecin" was introduced ("Zielone Przedgródki Szczecina"). As part of the project, residential communities of tenement houses located along streets with historic suburbs received subsidies for their reconstruction while maintaining common aesthetic standards [11].

2.2. Temporary eco-strategy

This strategy consists in introducing architectural and artistic objects within public and semi-public spaces using ecological techniques and technologies. Due to their temporariness and mobility, these elements do not affect the spaces of historical cities. The resources of this strategy are diverse in scale and form. These include: small architecture, greenhouses, vertical and horizontal green walls, containers and pavilions with various functions (solar concealers, air purifiers, with green elements improving microclimate, collecting water, etc.), structures serving the fauna world (beehives, fissures for insects, birdhouses, cat houses).

2.2.1. Temporary eco-strategy tools

Objects classified as small architecture forms (bells, pergolas, objects for daily recreation, dry as well as sandpits, swings, garbage containers, bus shelters) are a typical elements of public space in cities. As temporary and mobile structures, they can enrich the cultural landscape of a historical city without affecting its historic structure. Among the small architecture, many objects are made of natural materials and use renewable energy to power.

An external city bench is a popular motif of design studies. It can be made of natural materials (wood) e.g. with holes of various sizes to fulfill the function of insect habitats (Eco Bench bench, Puzur Bureau), or can be equipped with a solar panel coupled with a seat and points for charging personal electrical equipment (Ecotap Solar system Bench, "Relax & Recharge"). The form of the bench often assumes a set of complex structures and platforms, also used for lying, combined with green rebates or lawns (Saturnia bench, Piba Marmi's Monocromo by Philippe Nigro). The ecological potential of small architecture can be demonstrated by another example - children's playground in Vienna's Museum of the Quarter (Woven Willow Kagome by PPAG Architects, in 2014 Architizer A + Awards in the category of pop-ups and temporary structures). The most extensive structures are adopted by the city pergola, which serve to shade particularly in the southern European countries (Barcelona, Lisbon).

Cities greenhouses are rather of character temporary or pop-ups structures and as purely formal activities at the interface with art have no impact on the enlargement or improvement of the ecosystem of green areas in the city. In urban interiors of old cities, often "tightly" built-up and devoid of green elements, they can influence of the public space quality improvement.

An example of such a tool for temporary ecostrategy can be LEGO Greenhouse by designer Sebastian Bergner – public installation displayed in front of the Coven Garden in London from 15 to 25 September 2011. Greenhouse was used transparent plastic brick with a natural environment growing inside [12].

Green roofs and walls (vertical greening system: green walls and green facade) introduction biodiversity into the urban environment, and they offer additional opportunities to format system of urban wildlife corridors. Green structures could be important element provide additional surfaces for "greening the grey" in the cities including in historical cities [13]. In addition, studies conducted on surface afforestation confirm the influence of such structures on the microclimate of the environment and buildings, for example by reducing the temperature on their surfaces (Shimizu Corporation's wall surface afforestation system "parabienta" indicates a temperature drop from 40 degrees to 30). Green roofs and walls are primarily elements of a permanent strategy and are used during the revitalization of historical urban areas (Berlin, Kreuzberg). A minimum roof area of 200 m² and a maximum slope not exceeding 2% are required for the use of the green roof next to the construction conditions. The impact of green structures on the ecosystem is not well recognized, and their number is relatively small in relation to the entire green urban resource [13, 14]. For example, the city of Paris (France) had only 44 ha of green roofs (1.4% of urban green spaces) in 2013, and 30 ha of green walls (less than 1% of urban green spaces) in 2016 [13, 14, 15]. In 2007, Zurich (Switzerland) had 87 ha of vegetated roofs [13, 16]. The flagship examples of the use of green walls are the works of Patrick Blanca, the precursor of the vertical garden system - "mur vegetal". His first green wall was CaixaForum - vertical garden in Madrid created in 2006-2007. This building is former Power Station from 1899, designed by Herzog & de Meuron. Installation is 24 meters high and contains 15,000 plants of 250 different species [12] (figure 3). Another implementation of Patrick Blanca is L'Oasis D'Aboukir (the Oasis of Aboukir) - a

green vertical garden founded on the wall of a nineteenth-century tenement house at the intersection of Aboukir Street and Petits Carreaux street in Paris in 2013.



Green wall layers: tubular steel frame – separates the vegetated surface from the building, plastic panel, woven material, water nutrient – drips from irrigation tubes at the top edge of the wall, two felt layers – act as a growing medium for the roots, plants – are inserted between two layers felt, gutter – along of bottom of the wall catches water that can be recycled.

Figure 3. CaixaForum - green wall, Madrid

Pavilions can possess different constructions and functions. They often have an attractive sculptural form, becoming 'works from the borderline' of art and architecture, which can be defined as architectural installations [17]. Their temporariness is a natural feature of these structures. Pavilions can be given ecological values, by using natural material, or using ecological technologies. Various tower structures with utility function can also be qualified for this type of objects. Towers are equipped with solar cells, air purifiers, green walls and roofs that improve microclimate, or water collectors. Examples of such structures are sculptural installations of Ecosistema Urbano erected on Ecoboulevard of Vallecas in Madrid. The towers have been given the form of "air trees" powered with photovoltaic cells that they produced water vapor. They also have a wind chimney that cools the air inside the structures. Installations also act as a stage for events organized in this place, creating a natural umbrella protecting against the sun [12]. The idea of such towers can be implemented on a smaller scale into the historical environment of the city. Another type of tower with only a technological function is Smog Free Tower by Daan Roosegaarde. The stand-alone device is powered by green energy and can filter up to 30,000 m³ of air within an hour [18].

2.2.2. Temporary eco-strategy - results

Sample conceptual projects prepared as part of student activities show the potential hidden in temporary structures and constructions. The first job is "Smog Pavilion" - a pavilion serving as an information tool about environmental threats, being also a machine for air purification (by: Patryk Grzeszczyk, tutor: Agnieszka Rek-Lipczyńska, the project was designed as part of the subject Psychology of Architecture and Perception of Composition (Psychologia Architektury i Percepcja Kompozycji) at the West Pomeranian University of Technology in Szczecin – WPUT Szczecin). The design of the pavilion is an ideological answer to the problem of many contemporary cities, which is associated with air pollution as a result of the emission of harmful dusts and gases formed in the process of inefficient fuel combustion during the use of cars, residential buildings or industrial facilities. The coating of the designed pavilion thanks to the use of photosensitive panels will signal the level of air pollution through the intensity of light. The object was designed as a structure consisting of three modules that can operate independently or in combination. The first module is a glazed cube with an interior composed of translucent membranes imitating the effect of polluted air. The second module is equipped with external light-sensitive panels reacting to air pollution. Inside this module with vertical green walls, Oxygent capsules are planned to ensure the inflow of fresh air. Inside the last module, a hologram system displaying information about the environment was designed. In addition, the walls of this pavilion can be equipped with an air-cleaning system similar to towers with a similar function. The modular design will ensure mobility and pavilion positioning in places requiring recognition in terms of air pollution, as well as its cleaning. In addition, the structures have an educational and information function devoted to the protection of the natural environment (figure 4,

5). All modules can be fed into renewable energy through concealers located on the surface of the roofs of the extreme modules. Smog Pavilion as a building object with a mobile, temporary character can be used in the space of old cities, monitoring the level of harmful air pollution not only for users, but also for the historic structures of urban development.



Figure 4. Ground floor plan, cross-sections and visualization of "Smog Pavilion"

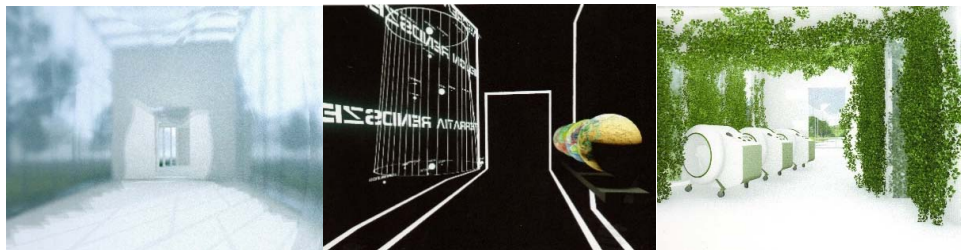


Figure 5. Interiors of "Smog Pavilion"

Another example of conceptual actions undertaken in historical urban areas is the work "Green Pergola". It envisages the introduction of green walls and a pergola in semi-public spaces (courtyard) of the Szczecin quarter (author: Klaudia Klimek, Paulian Bartkowska, tutor: Agnieszka Reklipczyńska, the project was designed as part of the subject Psychology of Architecture and Perception of Composition (Psychologia Architektury i Percepcja Kompozycji) at the West Pomeranian University of Technology in Szczecin – WPUT Szczecin). The work has designed seats and a honeycomb pergola with a filling of glass elements and photovoltaic panels that will provide the lighting of a temporary structure and the ability to top-up personal electronic equipment, such as a mobile phone or tablet. Lower parts of green walls can be used to grow vegetables for the needs of the local community (figure 6).



Figure 6. The situation of the "Green Pergola" installation-left, Pergolas and green, vertical walls - "Green Pergola"-right

3. Results and discussions

As a result of the conducted research, it was found that regeneration programs are often long-term and often destroy the original, well-preserved structure of buildings, which should be protected and used as a cumulative "energy resource" (energy and labour load invested in the construction of the building). The answer to these problems may be ecological project activities consisting of small spatial treatments, with minimal circulation, which thanks to their creativity and originality can ensure high efficiency. These activities, combined with limiting the thorough modernization of the historic building material, can be ensured by a successful revitalization process in historical cities. Temporary eco-strategy tools in spite of their temporary nature, contrary to the idea of sustainability of ecological solutions, can be an equal tool especially useful in the historical urban environment. Solutions referring to the temporary strategy do not interfere with the historic urban structure and are elements easily removable from this space. Such thinking about design in historical cities is also in line with the idea of protecting monuments and historical cities having their theoretical foundations in the entries "The Venice Charter 1964" and "Washington Charter 1987".

4. Conclusions

Contemporary revitalization activities undertaken in the areas of historical cities require finding a balance between the requirements resulting from sustainable development and environmental protection, and the protection of cultural heritage.

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