

# THE INFLUENCE OF ARCHITECTURAL DESIGN ON THE ECONOMIC EFFICIENCY OF NEW SHOPPING CENTRES IN TERMS OF FIRE SAFETY

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## Abstract

There are many ways to achieve a success of the development of a shopping centre, and one of the important aspects is the architectural design. The design has to be attractive, fascinating and comfortable for the visitors of the building. On the other hand, shopping centres are public buildings with high concentration of people and consequently very hazardous from the perspective of fire safety. Therefore the impact of architectural design on the fire safety design is substantial.

This paper aims to discuss the effective fire safety regulations in the Czech Republic and their application on the projects of new shopping centres. The particular case studies show the economic efficiency of the design.

## Keywords

economically effective design; fire safety; shopping centre

## Introduction

The retail market in the Czech Republic is growing every year by thousands of square meters, and it is mainly due to the development of new shopping centres. Most of them bring plenty of benefits for the locality, the citizens and the business, and all of them would like to be unique and fascinating for the clients.

However, every building of the shopping centre is a space with possible concentration of high number of people, and these buildings are considered to be *places with increased fire risk* according to the Czech law. Therefore a proper fire risk assessment has to be a part of every project design to detect which fire protection devices have to be installed, as well as their frequency and position in the building that minimizes the damage from the possible fire.

Suppose that the architectural design may bring an added value to the development project of the shopping centre, but in terms of fire safety the specialties in the design mean an augmentation of the investment costs. The aim of this research and the case study is to show if this hypothesis is true or false.

## Methodology

The qualitative research of the retail market in the Czech Republic during the last few years was used as the main approach to theoretical background of this study. The data were received from a well-known real estate consulting companies such as JLL, DTZ, and Cushman & Wakefield etc., which regularly monitor the current situation on the market. The legal background of the fire safety topic was briefly described and the main regulations were mentioned as an overview of the Czech legislation.

At the core of this paper is the case study which compares two development projects of the shopping centres in Prague, which were built and opened for public during the year 2014 – Quadrio and Lužiny. The data for the case study was received from the unnamed international retail chain that opened its shop in both of the shopping centers. The case study compares the history of the places, the construction process and the architectural design. All these aspects influenced the economic efficiency of the construction.

For evaluation of the economic efficiency of the architectural design, the fire safety system was chosen as a measuring scale. The fact that the architectural design brings certain value to the project was disregarded.

## Retail market in the Czech Republic

The retail market size is usually measured by gross leasable area (*"total floor area of a building, usually measured from its outside walls"* [1], from now on also as "GLA") of the retail space in sq m per 1,000 population. Figure 1 shows the current position of the Czech retail market with comparison to the other states of EU [2]. The Czech Republic is slightly below the EU average with over 220 sq m per 1,000 inhabitants.

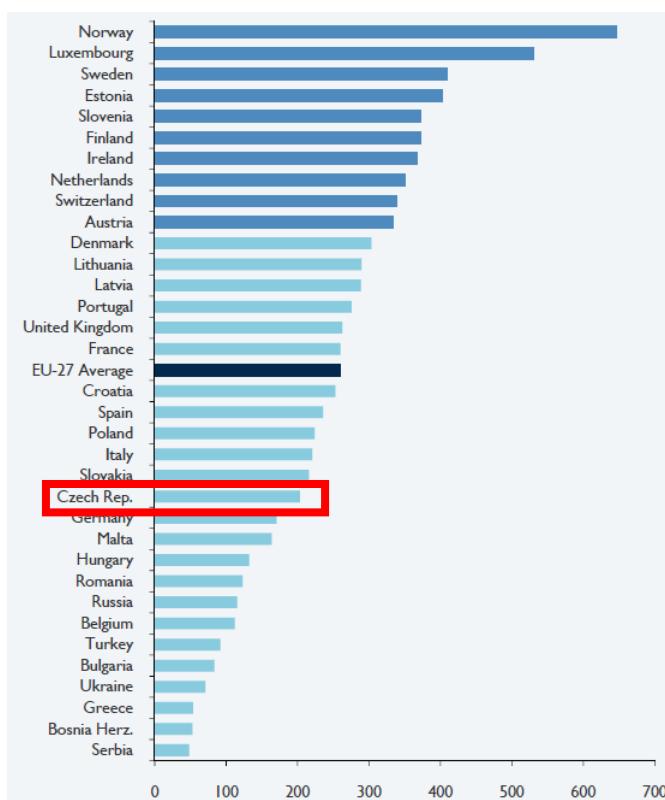


Figure 1: Shopping centres GLA (sq m) per 1,000 population - EU [2]

The amount of retail area is growing every year with the development of new shopping centres or expansion of the current ones. In the Figure 2, it is visible how the market is growing (years 2014 and 2015 are showed as a forecast). The biggest growth was registered in 2008 before the start of the economic recession.

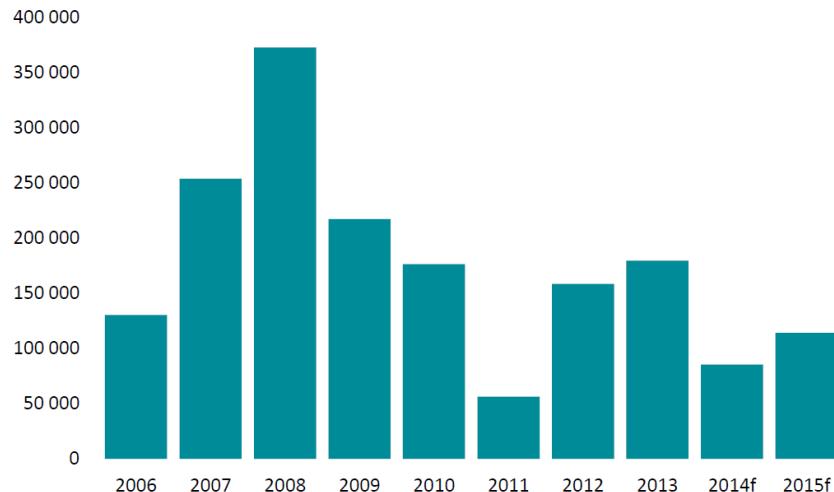


Figure 2: Annual retail supply (sq m) [3]

The distribution of the retail area (shopping centres) within the Czech Republic is shown in Figure 3. As expected, the higher density can be found in the big cities such as Prague, Brno, Ostrava but also Olomouc (because the newly opened large project Galerie Šantovka), Teplice (because of newly opened Galerie Teplice) and Liberec which is, for a long time now, the city with the highest density of modern shopping centres and retail parks in the Czech Republic with 1,773 sq m per 1,000 inhabitants. [4]

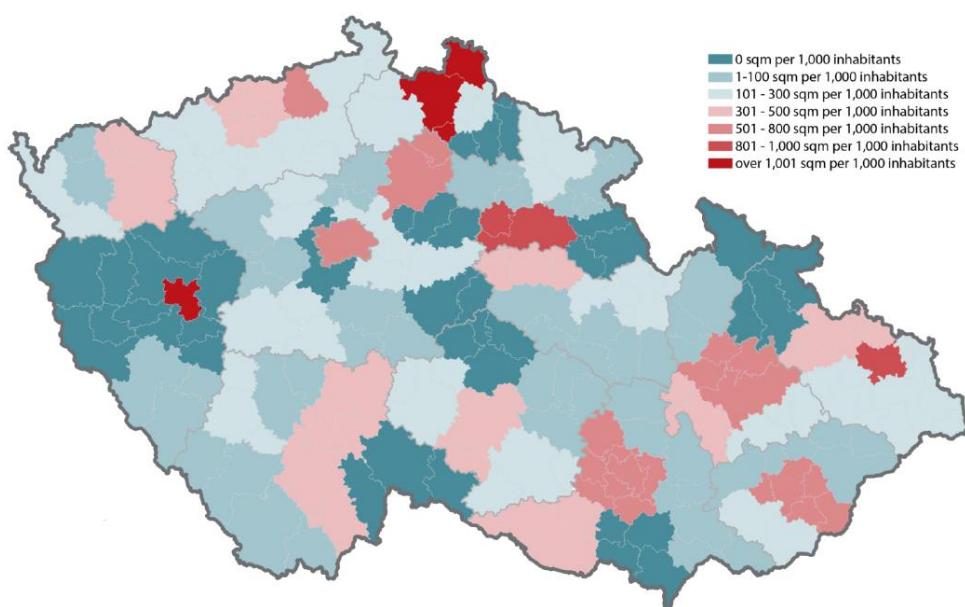


Figure 3: Retail density in the Czech Republic [4]

## Fire safety regulations

*The Act No. 133/1985 Coll., on Fire Protection as subsequently amended [5]* is the principal regulation on this topic in the Czech Republic. The law describes the general conditions and rules for fire protection, such as sorting the space into fire risk categories. Moreover it defines the system of fire protection for every space category.

The shopping centres are generally classified as places with increased fire risk which means more strict fire protection system and more frequent control and maintenance of the system by authorised persons. The employees in the shopping centres have to be trained regularly on this topic, using fire protection documentation.

*The implementing regulation No. 23/2008 Coll., on the technical requirements for the fire protection of buildings as subsequently amended [6]* describes the specific rules for design of the fire protection systems and equipment in the buildings, its construction and use.

*The implementation regulation No. 246/2001 Coll., on the determination of the condition of fire safety as subsequently amended [7]* sets up the specific ways to use and maintain the fire safety equipment and to create and update the fire safety documentation.

## Case study

The aim of this case study is to show the impact of the design on the fire protection system and related costs. Two shopping centres were chosen for comparison; intentionally the centres have a lot in common – Quadrio and Lužiny.

### Brief description of the centres

Both chosen shopping centres are in Prague. They were opened during the year 2014 in the area where small retail stands used to exist. Both centres are just above the metro station on the line B. The table 1 shows the other basic facts about both centres.

Table 1: A comparison of the chosen shopping centres

	Quadrio [8]	Lužiny [9]
photo		
district	Prague 1	Prague 13
location	city center	housing estate
opening	10/2014	5/2014
m2	8 500	16 000
supermarket	Billa	Billa
developer	CPI group	OC Lužiny s.r.o.
contractor	Metrostav a.s.	Syner s.r.o.

From the architectural point of view Quadrio is quite modern building with whole glass façade and Lužiny is a more conservative design with glass hall connecting two concrete blocks. Both centres were constructed by one main contractor, and the retail units inside the centres were built by tenants' contractors. Both centres wanted to keep the building consistent and unified. Therefor the architects prepared design manuals, and all tenants had to adopt the requirements of the manual into their design.

### **Fire safety system**

A Sprinkler system, an evacuation signal system, a fire signal system and emergency lighting are the basic systems for fire protection. They have to be used in every public building and have to be distributed into the building following exact rules defined by the law.

The fire safety system has to be designed for the whole building of the shopping centre and also separately for every tenant unit. The system's characteristic depends on the tenant's design and type of construction works. However, some generalization can be made. For example if the tenant wants to lower the ceiling, it is usually necessary to add another fire safety system (depending on used material).

Table 2 shows the comparison of the costs of fire safety systems at both mentioned shopping centres at one of the tenant's unit of almost the same size.

**Table 2: A comparison of the costs of fire safety systems**

	Quadrio		Lužiny	
size of the unit	22	m <sup>2</sup>	23,7	m <sup>2</sup>
sprinkler system	5 pieces	44 000 CZK	4 pieces	15 900 CZK
fire signal system	2 sensors	29 780 CZK	2 sensors	16 630 CZK
evacuation signal system	1 speaker	11 760 CZK	1 speaker	11 990 CZK
shop front ventilation system	7,9m	54 800 CZK	6,2m	33 950 CZK
special system	smoke roller	76 670 CZK		0 CZK
<b>total</b>		<b>217 010 CZK</b>		<b>78 470 CZK</b>

The figures from Table 2 show huge differences in costs of the fire safety system. The system in Quadrio costs about three times more than the system in Lužiny. What are the factors that influence the costs?

### **Causes of increase in costs**

The fire safety design in both aforementioned cases is almost the same. The big difference is the necessity to use smoke rollers in Quadrio, which significantly increased the total costs. This necessity was caused by the architect who designed the shop fronts four meters high in the whole centre and the fire safety designer who prescribed this protection for all units which do not have the shop front windows made from safety glass (which is almost more than twice as expensive as the regular window glass).

Another reason for different prices of the same system is the monopoly on the delivery and installation of the fire safety systems. The investor in cooperation with the main contractor determines the subcontractor who provides the systems into the whole building including tenants'units. This measure is taken for the security of the functionality of the system and the guarantee. The subcontractors are chosen on the basis of the tendering process, but the investor does not have to guarantee his good prices to the tenants as well. Thus the subcontractors could

offer lower prices to the investors and then catch up on their profit on the tenants' expenses. This may cause the big difference of the costs of the sprinkler system and fire safety system between both shopping centres.

## Conclusion and discussion details

This research brings forwards the description of the current retail market in the Czech Republic. The Czech Republic is slightly below the EU average size of retail area, but every year the gross leasable area is expanding. The biggest cities offer the greatest number of sq m of GLA per 1,000 inhabitants, with Liberec leading with GLA of 1,773 sq m per 1,000 inhabitants.

The fire safety protection is an important aspect in design and construction of the retail centres, and there is fine legal background for this topic in the Czech Republic.

The presented case study shows that the settled hypothesis was correct. It implies that the architectural design may bring an added value to the development project of the shopping centre, however in terms of fire safety the specialties in the design mean a significant augmentation of the investment costs.

This paper wanted to demonstrate the importance of the good architectural design which would take into the consideration other aspects of the construction, not just the appearance of the building. The research and the case study could be extended in the future to prove the conclusion on the wider sample or could bring other point of view into this topic.

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