Underground Public Space. Cracow's Tunnels of Fear?

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Abstract. The importance of the quality of public spaces increases with the inhabitants’ awareness. A well-designed place gives users a sense of security. Underpasses are a special type of urban space, which, despite relatively high implementation costs, are used quite often, especially in large cities. In recent years, Krakow underground passages have been called “fear tunnels”. However, not all of them cause a sense of danger. The aim of the research was to determine the factors that make the underground passage become user-friendly and do not create a sense of uncertainty? Underground passages located in various parts of the city and performing various functions were analysed. Underground public spaces have different shapes and dimensions. In the conducted research, it was analysed whether the technical parameters of the underpass - such as width and height have an impact on the user's sense of security. It was checked how the spaces in which no services exist are perceived and whether these spaces are available to all users. The aim of the research was to determine the elements affecting the reception and use of this special type of urban space. The analysis was carried out for ten underground passages located in various parts of Krakow. Out of these ten, five spaces of the most diverse character were selected for the performance. Underground transitions with different saturation with service functions, different number of users, different degree of adaptation for people with mobility difficulties and various aesthetic level were analysed. Areas with high saturation of service functions and located in places generating a large number of users were rated as the best. Spaces with a small number of services and with the proportions of a tunnel longer than sixty meters were rated as the worst, despite the good technical condition and facilities for people with mobility problems.

1. Introduction
The importance of the quality of public spaces increases with the inhabitants’ awareness. A well-functioning and decorated places gives users a sense of security [1,2]. Underpasses are a special type of urban spaces, which, despite relatively high implementation costs, are quite often used, especially in large cities. In recent years, Krakow underground passages have been called the “tunnels of fear” [3]. However, not all of them make an impression of being dangerous. It is puzzling what factors make the underground passages become user-friendly and do not create a sense of uncertainty? Does the location, proportions of space and its importance in the city structure [4] have a direct impact on the user’s sense of security?

2. Materials and methods
Underground passages are located in different parts of the city and have different functions. They have various shapes and dimensions. It is interesting whether the technical parameters of the underpasses – such as width and height have an impact on the user’s sense of security? How are the spaces in which
there are no services received? Are these spaces accessible to all users? The aim of the research was to
determine the elements affecting the reception and use of this special type of urban space. The analysis
was carried out for ten underground passages located in various parts of Krakow (Figure 1.).

![Figure 1](image.png)

Figure 1. Location of the analysed underground passages: 1-P.P. connecting the area around the Main
Railway Station with the areas around the market square; 2-P.P. connecting two sides of the Pawia Street
(MPK stops); 3- P.P. connecting two sides of A. Lubomirski Street; 4- P.P. connecting two sides of
Krasński Avenue (Jubilat department store); 5- P.P. connecting two sides of Konopnicka Street; 6- P.P.
connecting two sides of Zakopiańska Street (Sanctuary of Divine Mercy); 7- P.P. connecting two sides
of Na Zjeździe Street (at Bohaterów Getta square); 8- P.P. connecting two sides of Jana Pawła Avenue,
Kocmyrzowska Street and Pokoju Avenue (at the Czyżyński roundabout); 9- P.P. connecting the
Akademickie and Oświecenia estates; 10- P.P. connecting two sides of Brogi Street with Rakowicka
Street; Note: the underground passages selected for presentation are marked yellow.

The analyses included underground transitions with different saturation of associated functions,
different number of users, varying degrees of adaptation for people with mobility difficulties and various
aesthetic levels.

The first of the analysed locations was the passage linking the area around the Main Railway Station
with the areas around the market square (P.P.1). With reference to other examples, this crossing connects
the most prestigious and visited areas in the very centre of Krakow. The very location combining two places with high saturation of service functions, means that the number of users drops only late at night. The dimensions of the underground passage itself are about 50 m long by 10 m wide and about 3.5 m high (Figure 2) – in the narrowest point (the passage narrows in the middle part).

Figure 2. A view of the underground passage connecting the area at the Main Railway Station with the areas surrounding the Market Square. Photo by A. Ciepiela

The shape and layout of the passage in a very readable way “leads” the user from the Main Railway Station (or the nearby Krakow Gallery) towards the theatre of Juliusz Slowacki and the Main Market Square. Moving in these directions is possible thanks to slipways. A side, narrower tunnel extends from the main tunnel – allowing the passage towards the Westerplatte Street. On this side, accessibility for persons with mobility difficulties is ensured, apart from the stairs, by a passenger lift. In the space of the passage itself, as well as its “walls”, service points are located (souvenir shops, fruit, bread, clothing or footwear stalls), one can also buy railway tickets here. The variety of service points means that some users stop in the “passage”, instead of simply moving from one side to another. Despite the proximity, the next analysed space has a distinctly different character. The passage connecting two sides of Pawia Street (P.P.2.), acts primarily as a public transport stop (fast tram). The ability to go from one side of the street to the other is an additional element, not the main function of this space (Figure 3.). The ability to perform the function of a stop for collective transport – a fast tram – determines a significant amount of the entire space, but the proportions felt only using the passage in the form of a footbridge over the track (and not the stop located below) seem to be appropriate. About 40 m long, about 5 m wide and about 3 m high, it gives similar proportions as in P.P.1. Due to the sufficiently comfortable connection in the ground level, underground space is mainly used by public transport users, therefore the total number of people using this space is significantly smaller than in the previous case. The whole layout is simple and clear. Apart from the stairs, accessibility is also provided by personal lifts. There are no services accompanying the communication function (like a ticket kiosk).
The underground passage connecting the two sides of Rakowicka Street (P.P.3.) in terms of location is in a place similar to P.P.2.- it connects, on one side, the areas of the University of Economics and military units, and on the other, a complex of offices and hotel areas. The underground space has a simple layout (Figure 4.). Descent to the underground passage is made possible by a free passage under the busy A. Lubomirski Street, but also under the Rakowicka Street (which is intersected by A. Lubomirski Street).

Figure 3. Upper left corner – a view of the passage; bottom left – a view of the descent; on the right – a view of the descent to the platform – a stop. Photo by A. Ciepiela

Figure 4. A view of the passage connecting two sides of A. Lubomirski street. Photo by A. Ciepiela
While the layout of the passage itself is legible, the possibility of going out in different directions (on both sides of Rakowicka street) slightly disturbs this legibility. However, the exit labelling is satisfactory. The proportions of this space are similar to those discussed above – about 30 m long, 5 m wide and about 3 m high. As you can see in figure 4, there are service functions in the space (currently there are 3 points, not all premises are used). The number of users during the day is significant, which is undoubtedly related to the proximity of the University and office premises. Accessibility for persons with mobility difficulties is ensured by personal lifts and ramps. Another studied example was the underground passage connecting the two sides of Krasiński Avenue (near the Jubilat shopping centre, in the city centre – P.P.4), which is currently under renovation, which makes it difficult to refer to some elements of the analysis. However, one can see the proportions of space (similar to the examples described above), and a large number of users, associated primarily with the lack of an alternative passage, conveniently located in the field. The space is readable, one tunnel (before the renovation filled entirely with trade points). Accessibility for people with mobility difficulties prior to renovation was negligible. (Lack of passenger lift and quite steep ramps for wheelchairs). Then, an example (P.P.5) was analysed, connecting the two sides of Konopnicka Avenue. The passage has a clear layout and proportions similar to the above-mentioned cases. The space is not accessible to people with mobility difficulties, there is neither a lift nor a ramp. There is also no service function, and the location of the passage – among the predominant housing development – does not generate too many users (the proximity of public transport stops located on both sides of the street is an advantage). The underground passage which is only temporarily sufficient (in terms of throughput) for the number of users (P.P.6) is an interesting example. The passage connecting two sides of Zakopane Street, at the height of the Sanctuary of the Divine Mercy in Łagiewniki. The location of the passage is important in this case, because there is a public transport stop right next to it, from which it is closes to the Sanctuary. During important holidays or religious ceremonies, a large number of pilgrims practically block the possibility of passing through. In the period outside the abovementioned accidents, the space is definitely of a sufficient size. Accessibility can be assessed as good – on one side of Zakopane Street there are ramps, and a passenger lift on the other. The service function is missing in this space, and the closes environment (except for the selected periods of the year) does not generate too many users. The proportions of the space are slightly different from those discussed above (about 40 m in length, about 5,5 m in width and about 3 m in height).

The underground passage at the Bohaterów Getta Square (P.P.7 – figure 5), connecting two sides of Na Zjeździe Street have a similar character to passage no. (P.P. 3). However, the location and historical context of this place, as well as the greater number of service and commercial outlets located in the passage itself, make the number of users here larger than in the case of the P.P.3 passage.

Figure 5. On the left – a view of the underground passage connecting two sides of Na Zjeździe Street; on the right – a view of the public transport stop and a descent to the underground passage. Photo by A. Ciepiela
The proximity of the public transport stop is not without significance. The proportions of this space are similar to the aforementioned examples, and the availability for people with mobility difficulties is provided by personal lifts and a stairlift.

An example that definitely stands out from the others is the passage at Czyżyński roundabout (P.P.8) connecting two sides of Jana Pawła Avenue, Kocmyrzowska Street and Pokoju Avenue. The underground space has the shape of a square with eight exits located at the corners and approximately half of each side (figure 6).

![Figure 6. An orthophotomap with descents to the underground passage P.P.8 marked with red arrows](image-url)

The proportions of tunnels are overwhelming (figure 7), with a length of about 100 m, a width of about 6 m and a height of about 3 m. The most significant parameter here is the length of the tunnel. The idea is that there is space for a service space at each of the corners, but currently only one of four is functioning. Despite the markings at each exit, the vast space occupied by the underground passage is disorienting to the user, especially in combination with a uniform finish in all four tunnels.

![Figure 7. On the right – a view of the only operating service point; on the left – a view of one of the tunnels. Photo by A. Ciepiela](image-url)
Accessibility for persons with mobility difficulties is ensured by ramps and passenger lifts. The proximity of public transport stops, the “Czyżny” railway station, shopping centre, large workplace and housing estates, even if it generates a large number of users, it will not be felt with such a space of space.

Another example of the underground passage, which could be classified similarly to passages 5 and 6, i.e. those that do not have an accompanying (service) function, are passages 9 and 10. P.P. 9 connects a large housing estate (Oświecenia Estate) and a housing estate and areas of the Cracow University of Technology dorms. Near the passage there are public transport stops and a large shopping centre, a cinema and water park. The dimensions of the passage are approximately 70 m in length, 6 m in width and approximately 3 m in height. Appropriate distribution of relatively wide stairs and ramps offers a relatively easy access for both pedestrians and cyclists, or for parents with children in strollers.

Figure 8. A view of the passage connecting the Oświecenia estate and the Akademickie estate. Photo by A. Ciepiela

The space is well-lit, and three exits go out from the main tunnel (two ramps and stairs). Entering from the south side, the user can see a wall closing the tunnel, but because the stairs at the end are not roofed – one can easily determine where the exit is. From the north, one can immediately see the tunnel outlet (figure 8).

Passage no. 10 (P.P.10) stands out from the analysed examples with a complete maladjustment to the needs of people with mobility difficulties (figure 9).

Figure 9. On the left – a descent to the underground passage connecting Brogi Street with Rakowicka Street; on the right – a view of the tunnel. Photo by A. Ciepiela
In addition, its dimensions, although not significantly different from the dimensions of the above-discussed cases, give the impression that the tunnel is longer than it actually is (about 50 m in length, about 4 m in width and about 2.5 m in height). The passage connects the areas of not very intensive residential buildings with the outlet of Rakowicka street with a number of military units located nearby. Such an environment does not generate a significant number of users.

The results of the analyses carried out were developed and presented in the form of a table. (Table 1.)

### Table 1. The results of the studies carried out.

| No. of underground passage acc. to indications from Figure 1. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------------------------------------------------------------|---|---|---|---|---|---|---|---|---|----|
| Availability a                                             | 5 | 4 | 5 | 2 | 2 | 3 | 3 | 4 | 5 | 1  |
| Layout legibility b                                         | 5 | 5 | 5 | 5 | 5 | 4 | 3 | 5 | 5 | 5  |
| Space proportions c                                         | 5 | 4 | 4 | 5 | 2 | 3 | 5 | 1 | 5 | 1  |
| Labelling d                                                | 5 | 5 | 4 | - | 2 | 3 | 4 | 4 | 2 | 1  |
| Technical condition/aesthetics                              | 5 | 5 | 5 | - | 2 | 3 | 4 | 5 | 3 | 1  |
| Degree of service saturation                               | 5 | 2 | 3 | - | 1 | 1 | 3 | 2 | 1 | 1  |
| Number of users e                                           | 5 | 3 | 4 | 4 | 3 | 2 | 4 | 2 | 5 | 1  |
| Sense of security f                                         | 5 | 4 | 4 | 4 | 3 | 2 | 4 | 2 | 5 | 1  |
| Summary                                                    | 40| 32| 34| 20| 20| 22| 31| 23| 26| 12 |

a. Accessibility understood as accessibility for disabled people, with physical limitations, cyclists, people with small children;
b. Legibility of the spatial layout in terms of the number of exits, tunnels leaving from the main tunnel, visibility of the exit on the opposite side;
c. The ratio of the width to the length of the tunnel-passage;
d. Legibility of marking the exit directions from the tunnel;
e. The number of users recorded during observations;
f. According to data collected on the basis of surveys conducted during the observation.

### 3. Results and discussions

Summing up the results of the analysis, it can be concluded that the passage no. 1 proved to be the best, and successively passages no. 3, 2 and 7. All highly rated spaces combine a large number of users, similar proportions and the presence of an accompanying function (directly in the transition as well as in its surroundings). The passage with the smallest number of users and the lack of a service function generating a large number of users, both in the tunnel and in the immediate vicinity – passage no. 10 – was assessed as the worst, despite the simple layout and the lack of tunnels reaching the main corridor (figure 9). Steep stairs, lack of services located in the passage itself, a small number of users and a system of entrances located in a way that makes it impossible to see the opposite exit additionally deepen the sense of danger definitely felt here. Passage no. 9 is another passage, in which there are also no services. This space has completely different proportions than the previous one. It is three times wider than passage no. 10. Other proportions of space mean that the user does not feel overwhelmed (figure 8). Quite a large number of users (the passage connects a large multi-family housing estate on one side with a group of student houses and multi-family blocks on the other) works in favour of the perception of the space. Despite the high number of points collected during the evaluation, passage no. 2 is a completely different kind of space – the MPK stop is located there. The space is constantly monitored, the entrances clearly visible. However, it does not give the impression of a user-friendly place. Space 1 (figure 2) seems to be the most friendly, which is actually attended 24 hours a day. The services located in it make users constantly monitored – not only by monitoring, but by other users. The ramps and the
lift allow people with mobility difficulties to use the passage, and good proportions – the passage is relatively wide and short, and a large number of users make the place seem safe. The last passage can be simply described as strange – passage no. 8. This is the area located under the Czyżyński roundabout (figure 7). The corridors form a square under the ground, in the corners of which services can be located (the passage is relatively newly renovated and currently only one service point is operating there). Despite the wide corridors and – at least the theoretical presence of services – the place seems to arouse anxiety. The corridors are very long and marked in a way that does not fully facilitate orientation. All four corridors look very similar. It is worth paying attention to passage no. 4. Despite the lack of the possibility to assess all the analysed aspects, this space has collected almost twice as many points as P.P. 10, which turned out the worst.

4. Conclusions
After analysing the above spaces, the following conclusions arise. The proportions of tunnels are important, the length of the passage seems to be very important – the longer it is, the worse feelings it aroused in the user. The width of the tunnel of approx. 5-6 m seems to be comfortable, (with its more or less ten-fold length). The technical condition of the space itself is not as important as the presence of commercial and service outlets and what seems most important – a large number of users who have the greatest influence on whether the passage raises a sense of security or anxiety. The research shows that users feel the most comfortable around other people.

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