

# **Pedestrian Traffic and the Closed Inner Courtyards in the 21st Century**

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**Abstract:** In the significant part of the historical city centers can be found such buildings which having inner courtyards. In many cases these courtyards will be opened to the pedestrian traffic, which thanks to in the courtyards smaller shops, stores are created. But not just shops, but also depending on the size of the courtyard such another functions as playground, terrace, restaurant, ice cream shop, etc. also could be located in it. In the future more and more people will be living in cities, and one possible way the increase of open public spaces in the city centers the opening of the inner courtyard houses, primarily to the pedestrian traffic. Therefore this study is looking for the answer that an inner courtyard house how could join in to the historical city centers open public spaces network. How much are used in them can be found functions, and how much traffic have they.

**Keywords:** *inner courtyards, pedestrians, traffic, traffic counting, passageway, courtyard functions, traffic density, traffic performance, pedestrian characteristics, public open space, network*

## **1. Introduction**

With the pedestrian traffic related researches are mostly directing into the pedestrian accidents, and car conflict researches. Although there are other areas where it is worth to study the movement, and the habit of pedestrians. One of these is the closed inner courtyards which formation can't be made very regret (18-19<sup>th</sup> Century).

But what is actually a "closed inner courtyard"? We called so those buildings courtyards which are open during the day for the public traffic but at night will be closed. However these courtyards are usually provides shops, restaurants, etc. areas. Another specificity of the closed inner courtyards that on the surrounding buildings floors apartments can be found. So it can be said that such inner courtyards having buildings are unite the function of the private and public area. Because until the courtyard of the building is owned by the house and being managed until in the courtyard can be found shops, restaurants, etc are limited time open for the public traffic.

According to an English study made in 1999 increasing part of the world's population (currently 50%) lives in cities and that number will only grow in the future. In spite that

Europe's total population declines. On one hand is due to that into the Western countries cities coming increasing number foreign workers. However the cities having significant labor force absorption effect, so due to better living more and more people moves into there. Therefore the report highlights that the city's public open spaces will have particularly important role in the future from the aspect of society. Because that is the place where independently from gender, religion, age, nationality, etc. every social class can be found in a city. They can there relax, actively or passively recreating, fun having or even engage in dialogue. But not just from the foreigners or from the aspect of the different nationalities are important that but as the English study has also pointed from the aspect of the disabled and elderly people too. Because currently it the Western societies aging can be experienced and from the aspect of equal opportunity it is important that the disabled could also easily approaching the public open spaces.

In 2005 in Helsinki was held the „Forward Look in Urban Science” called international final conference which main topic was the future of the European sciences. On the conference was said an interesting presentation from another English study which was pointed on that thanks to the land privatization the use of the public open spaces changes. Because thanks to the more increasing number appearing private areas people are excluded from the former free used public open spaces. And this further strengthens the social conflicts because it creates on the private areas the “in remained” and on the public areas the “excluded” world.

According to the 1999 English study the public open spaces even should be function as a public space of democracy where the characteristics of single social groups, and the different cultures signs appearing. So everyone could express himself on the public open spaces which through they could easier integrate into the society the same way disabled people such as ethnic minorities or the rich and the disadvantaged people.

Against this background the second finding of the study was that it would be worth the open public spaces connecting as a network in the cities. This network would include parks, pedestrian streets, public open spaces, etc. But not just the existing public open spaces but also after revitalization at the present neglected smaller and larger parks, unused rail tracks, river banks, canals, etc. Because it was proved that in the city living people for they wealth definitely needs the connection with the green environment. In today's cities it could be increase the amount of the green areas if such “green corridors” would connect with each other the different squares, parks, pedestrian streets etc. However the study doesn't explain that in the case of the historical cities how could be working this process. And it is a question that the inner courtyards could be also a part of this network. Or would it be worthy it the city centres creating a completely different kind of public space network? All this what kind of importance has for the pedestrians? The article looking for answers to those questions.

## **2. The city centre's closed inner courtyards as the part of public space networks**

The historical city centres characteristic is that besides of the residential function, shops, restaurants, offices etc. can be found in them. These functions during in the 20<sup>th</sup> Century has begun significant expansion and complemented with office buildings, parking houses, hotels, Shopping centres, etc. This is mostly due to the Second World

War after most of the historical buildings were destroyed or due to the significant disrepair were demolished. So in many cases not just the city centres built density but also the population has significantly increased. Similar process took place also in one of Budapest district called “Erzsébetváros” which thanks to was formed the Gozsdu court (Figure 1.).

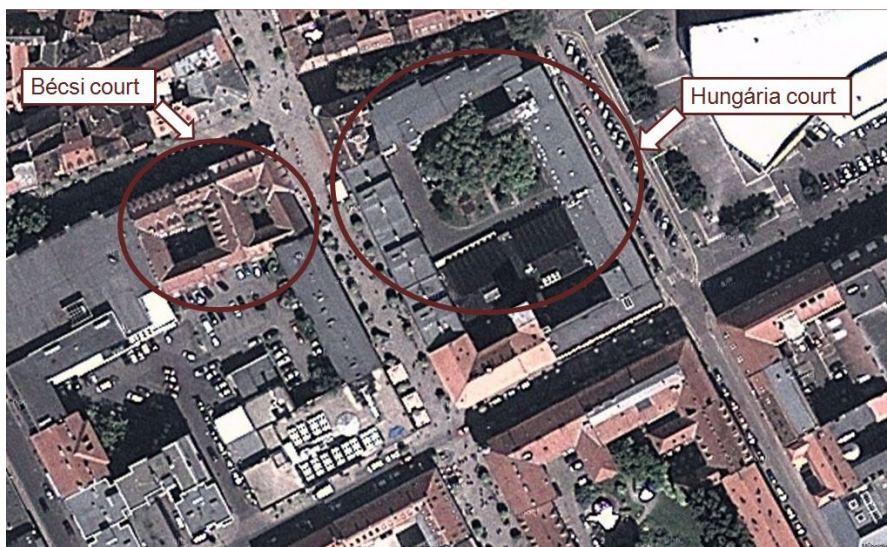


*Figure 1. The Gozsdu court*

In Budapest at the end of the 19<sup>th</sup> Century was on top the tenement house building which then the first then the Second World War has stopped in. Not has been made a significant change until the regime change. Namely from the 90s row appearing the newer commercial service or with administrative functions having buildings. In the case of Erzsébetváros that was the situation where thanks to the rental houses until then high density has continued to increase the newer office buildings, hotels, Shopping Malls, public institutions, etc. The situation has been further aggravated that this new buildings has filled in the gappy parts but with its ad hoc arrangement as an inclusion were enclosed into the urban texture.

Namely the characteristics of bunk tenement houses has come from that into the street front overlooking apartments were the civil apartments in the internal closed so called “gangos” courtyard sideway and behind the room and kitchen proletarians. So the biggest disadvantage of the courtyard apartments was that they have become lighting only from the courtyards side. Until the civil apartments also had from the street and the courtyard side windows. The “gangos” houses had become this kind of design in the 19<sup>th</sup> Century which was thanks to that in their place available former village houses parcels were built up. And the specificity of these parcels was that they have kept their former long and narrow filed shape which during the later land division only in cross direction could be further divided. So when the first tenement houses were built up towards in the greater benefit they have tried to develop apartments in them for all social classes. Thanks to this on the lots U form bunk houses were built which besides of the street front all side was close in the middle of the inner courtyard.

The leaders of Erzsébetváros into the 20<sup>th</sup> Century have realized the problem that in long term in order to the district development they must somehow loosen the previous high density. All this with the use of the district's endowments utilization, and with the ensure of the reconstruction by property without such a specific urban planning interventions like street openings. Besides of that it has to be ensure that into the district continued settling of the different shops, offices, etc. continues to strengthen the city centre function of the district. Therefore the municipality of the district in the middle of the 90s has announced their passageway housing program which was called Gozsgu gardening. The essence of the program was, that on the ground floor of the tenement houses passageways were opened which connecting with each other the formerly closed courtyards. So the building of the plots street front was still required however in the courtyards harmony with the neighbour buildings cross wings could be opened. With this the city organizer has been succeeded that the previous U shaped building was replaced by the L shape building pair, in which not just apartments but on the ground floor shops, offices, catering units etc. were placed. And thanks to the passageway housing courtyards loosened the former high density because they have begun functioning as an open public space.



*Figure 2. The Bécsei and the Hungária courts in Győr*

So in the case of Erzsébetváros the passageway housing has been functioning but it is questionable that outside such a capital city like Budapest elsewhere could be working this kind of development. Because as it could be seen in Erzsébetváros first of all it was therefore necessary the connection of the inner courtyards because the district built has become too dense as well it was needed the until then dark and closed tenement houses some kind of reconstruction which could according to the age every need meet in a city centre district. Therefore to answer this question it would be worth to study the Bécsei court in Győr (Figure 2.).

The Bécsei court can be found in the edge of the former castle wall surrounded city centre next to Fehérvári gate which was the south entrance of the city. The Arany János

Street which has once ran directly next to the castle wall, from the 18<sup>th</sup> Century has begun to infiltrate. Then one to two floor houses has been built which courtyard wings relied on the castle wall. The demolition of the castle walls has begun on the second half of the 19<sup>th</sup> Century, so the city has begun to increase also into south direction. No longer after that in the end of the 19<sup>th</sup> Century at the beginning of the 20<sup>th</sup> Century on the ground floor of the houses appeared to the city centre today also typical shops, banks, restaurants, etc. But during the second world war a lot of buildings has been destroyed in the city centre and after 1970 the ground floor houses were also demolished. In all three historicizing building has been left from the old building the Arany János Street 18, 20, and 22. From this three building the number 22 stands on the busiest pedestrian street of Győr, in the corner of the Baross and the Arany János Street. This three building was a separate house until the end of the 80s. Then they were renovated and the three building's courtyard was connected with passages similar to the Gozsdu court, then was born the present Bécsi court.

The Bécsi court can be divided into two large parts where between the 18<sup>th</sup> and the 20<sup>th</sup> houses part not just shops but coffee, ice cream shop, and a restaurant can be found. The restaurant has three entrances which from one can be found on the east side of the building and opens into the Baross Street. The north side into the Arany János Street until the south behind the Bécsi court can be found parking place. All three entrances will be closed by night and only next day morning will be opened. With this solution the Bécsi court works similar just like the shopping centres with the difference that in the courtyard apartments also can be found. However the courtyard functions as an open public space until the shopping centres Streets and Squares are private property.

Other specificity of the Bécsi court that not far away from it, into east direction can be found the Hungária court (2.figure) which though doesn't has gates which it would be closed at night, but also an inner courtyard. The Hungária court also differs from the Gozsdu, and the Bécsi court therein, that there is no shop, office, etc. on it. However on its south side it can be found a fast food restaurant and in the middle of the courtyard a smaller park with playground, benches, statues. This park has a quite big popularity which also due to the fact, that it ensures a direct corridor between the Baross Street and the Czuczor Gergely Street which has bicycle and passenger car traffic also. So its east-west way pedestrian traffic can be said significant of the Hungária court which has significant impact of the Bécsi court's traffic also. The two courtyard therefore on the one hand ensures connection between the largest pedestrian traffic Baross Street, the Czuczor Gergely Street and the Arany János Street. On the other hand in the Bécsi court can be found shops, coffee shop, ice cream shop, and in the Hungária court can be found park, playground, and fast food restaurant complement each other well. Therefore it can be said that both courtyard works well as a network in such a medium size city like Győr too. However it is worth study that concretely how much traffic has this to courtyard. And as well how use it the pedestrians what makes to them attractive.

All to answer this first of all it must be known the characteristics of the pedestrian's movement.

### 3. The characteristics of the pedestrians traffic

On the field of transport the pedestrian are those whom apply the most little rules which has its own disadvantages and advantages too. One of the greatest advantages of the pedestrians unlike to the vehicles that they are not bound to traffic lane. So they can choose free their speed, and the direction too, where they just want to go. However, just form this comes they vulnerability too, because they could anytime cross even a passenger car, bicycle, motorcycle, etc. way. And this in many cases leads to an accident.

The pedestrian at the same time to archive its aim always looks for the shortest and the most comfortable way. So unconsciously places before its safety the comfort. He doesn't likes bypass roads and the level differences (stairs, inclines, etc.) therefore if he can avoid them.

The other dominant element of the pedestrian traffic is the smallest distance keeping. Because the people during they traffic, always seeking of that, to keep they freedom of movement therefore according to the next and before them going they are trying to keep some smallest distances. However these distances can be different next to one way or two way traffic, pedestrian crossing point, stairs travelling on, as well as in the case of different speed.

In order to get more accurate picture from the pedestrian's movement, and behaviour, always under different groupings will be study it. All of these are needed because in the case of single groups significant differences cloud be experienced for example in the field of speed. The pedestrians can be grouped about the following aspects:

- pedestrian's age (old, young, children)
- pedestrian's gender (male, female)
- pedestrian's area use (targeted traffic, looking around, walking, etc.)
- pedestrian's area knowledge
- pedestrian's space requirements

Besides of grouping it is important also to study the physical space requirements of the pedestrians. But the space requirements of the people could be also different e.g. by gender or nation. In general the human body is often compared to an ellipse from above view, which two diameters is the shoulder width, and body thickness of the human. Based on this it can be said that the pedestrian's collisions zone is approximately 0,75 m<sup>2</sup>. However all to this must be counted also, that usually every pedestrian carries something with him, as well in many cases people are traveling in groups (e.g. pairs). But it should be not forget form the disabled people, and neither with the disabilities living people because in their cases can further increase the space requirement for example a wheelchair or a white cane. Therefore under the space requirement generally by the following aspects are distinguished the pedestrians:

- solo pedestrian
- pedestrian with packages, umbrella

- in group walkers (e.g. families, pairs, group of friends, etc.)
- walkers with stick, crutch
- with wheelchair travellers
- pedestrians with dog

So apparently several aspects affecting it also, that how the pedestrians traveling. But in any case it must be also study that for what purpose they doing this. However to this at present there is no unified methodology yet, because in many different ways can be grouped the goals of the walks. Similar to the space requirements this can be also different by areas, or even cultures. But if we want to group them perhaps it is worth by the following aspects:

- Commuters (Work, School)
- Shopping
- Profession Traffic
- Free time traffic

The current study deals with the inner passageway courtyards where under the listed criteria first of all the free time, and the shopping aimed traffic typical. All this is due in the courtyards can be found shops, restaurants, etc. However, because the inner courtyards also functioning as a square, beside of the above mentioned aspects must be taking into account another one, namely the uninterrupted position. In the inner courtyards similar to the squares there is not just passage traffic but also standing pedestrians too who are waiting for someone or staring a shop window. Therefore similar in the central mixed used areas found squares it must be taking into account by the scaling of the inner courtyards also the following values to accommodate the standing masses:

- undisturbed position: 1,2 m<sup>2</sup>/person
- strongly disturbed position: 0,7-0,9 m<sup>2</sup>/person
- crowded position: 0,2-0,3 m<sup>2</sup>/person

So in the movement of pedestrians many things must be study for which in the case of the inner courtyards more special aspects can be associated with. Based on this it is worth to determine the traffic density, performance and service level of the given inner courtyard. Because with the help of these it is determined that how much used the questioned inner courtyard, and its traffic services are appropriate.

In the paper studied and presented Bécsi court and Hungária court in Győr pedestrian's traffic study was also the goal that under the above mentioned aspects uncover how these two courtyards working. Therefore in both courtyard traffic counting has been made in 2011 and in 2012.

#### 4. The traffic of the „Bécsi court” and the „Hungária court”

In the study of the Bécsi court took place in August 2011 and the Hungária court in June 2012 in a given week on three different days and three different times. The three days were Monday, Wednesday, and Friday, and the chosen times a morning (from 9:00 to 10:00), an afternoon (from 13:00 to 14:00) and a late afternoon (from 16:00 to 17:00). By the dates selection it was an important aspect in the case of the morning that it should be not the morning rush hour period, because this role has received the late afternoon time when the after work pedestrian traffic was relevant. Each time points meaning one hour intervals in 15 minutes breakdowns. And in the selection of the three day was the most important aspect that it should be such days when probably it was the largest the traffic in the two courtyard.

In the case of both courtyards the pedestrians, the bicyclist, bench occupants and the dog walkers were also counted. Beside of that in each courtyard were such local functions which served as a benchmark of the courtyards traffic, and utilization. So in the case of the Bécsi court the users of the there can be found coffee terrace, and the number of the standing in line by the ice cream shop has been census. In the Hungária court can be found a smaller park with a playground and a fast food restaurant which terrace area is located in the south side of the courtyard, so there the users of these two functions were counted. Both courtyards have a terrace area, but during the counting only in the case of the Bécsi court have been succeeded in the adult and children category also counting to the table occupants.

Averaged on the three day measured data turns out that the Bécsi court has much more pedestrian traffic than the Hungária court (Figure 3.). In the Bécsi court average maximum 94 adult passes through of an quarter hour, but in the Hungária court only 56 people. In this difference presumably plays a serious role is that in the Bécsi court, in contrast to the Hungária court, smaller stores and shops also can be found. And these shops could be generating more traffic than in the Hungária court can be found fast food restaurant.

But in terms of the number of the children significant differences can be experienced between the two courtyards. Because until in the Bécsi court measured 15 minutes period never was more than 20 pedestrian children, until in the case of the Hungária court 36 people passed through it.

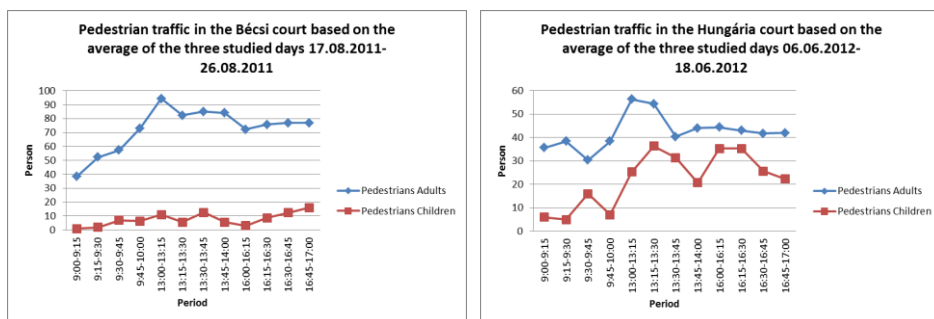


Figure 3. Pedestrian traffic in the Bécsi and the Hungária court based on the average of the three studied days

This difference can have several reasons, but probably it has a significant role in it, that in the Hungária court is a playground which is very popular among the children. The other reason is into the Hungária court opening fast food restaurant, which is mostly among the high school students has great popularity. During the location study it was observed, that the general and high school students mostly after the school education, from 13:00 pm were the most in the courtyard. But as it can be seen on the graph, after 16:00 pm gradually has begun to decrease their number. The traffic count of the studied days data separate considering also confirming this except Friday. Namely on this day after 16:00 pm has begun to grow the number of the children in the Hungária court. This reason is thanks again to the high school students who are at the beginning in the weekend starts going to the city centre to having fun.

In the case of both courtyard average between 13:00 and 13:15 turned on the most people. Interesting way this is true for each day of the study. The explanation of this maybe could be that in this period is lunch break, and so in the city centre workers than goes out or even back to their workplace. However the eight hour working time in the case of the most people ends at 16:00 o'clock, but after that wasn't as much traffic neither one of the courtyard as during in the last already mentioned quarter hour period.

In terms of the number of the bench and chair occupants can be already significant difference experienced between the two courtyards (Figure 4.). Maybe this is also thanks to that until in the Bécsi court due to its size chairs were placed as street furniture, until in the Hungária court still benches are available for the people who wants to relax.

The first conspicuous difference, that in the Bécsi court from the first measurement of the day with smaller fallbacks, but continuously has grown the number of the bench occupants. However all this is only true in the case of the adults, because the number the children showed much more moderate growth. As well as on the graph seems, there were time intervals when none child has been sitting on a chair. The Bécsi court on a Wednesday made traffic count for example in all only one child has sat down during the time of the study.

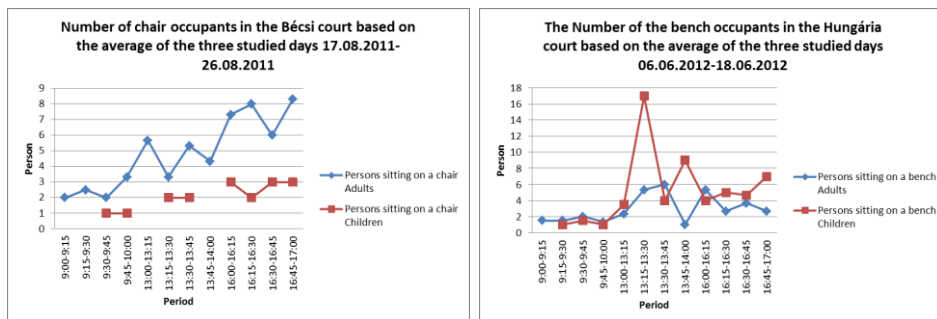


Figure 4. The number of the chair occupants in the Bécsi court, and the number of the bench occupants in the Hungária court based on the average of the three studied days

The Hungária court at first sight shows a quite interesting picture by the three days average. Namely in the morning hours nearly the same proportion have sitting down on the benches the adults, and also the young people. However on the study's Friday between 13:15 and 13:30 29 children had sat down which good presents also the graph's sharp increase. And in the afternoon hours, with one or two people, but the children were more on the benches.

In terms of the number of the adults under the three day average is true of both courtyards that neither of them has been sitting more than 10 people during in a quarter of an hour. But it is an important difference that until in a Bécsi court has continuously increased the number of the chair occupant adults, until in the case of the Hungária court the number of the bench occupants after a slight increase, has stagnated, than after 16:00 has begun to decline. This was true for the studied days separately also. However after 16:45 though slightly, but the number of the bench sitting children has begun to grow. It can be said from the average of the three day, that in the Hungária court an average of 3 adults, and 5 children had sit down in a quarter of an hour. And in the Bécsi court at the same time period an average of 5 adults and 2 children had sit down on a chair, in other words its broadly inverse the rate in the two courtyard.

What definitely should be noted in the case of the Hungária court, that two "peaks" can be observed at the bench sitting children and adults too. The first by the children was between 13:15 and 13:30, the second between 13:45 and 14:00. And by the adults between 13:30 and 13:45 and as well between 16:00 and 16:15. In the case of the children the two times coincide with the end of the last hour of the school, and by the adults, probably similar to the pedestrian traffic, the lunch break means the first time period, and the second the end of the working time. At the Bécsi court also can be observed after 13:00 hour two such "peak time", but as it could be seen in the graph the number of the chair occupants every day in the last quarter hour of the study was the highest.

As it were mentioned in the beginning of the chapter both courtyard has a terrace, which in the case of the Bécsi court belongs to a coffee shop, and in the Hungária court to a fast food restaurant. But as it were also mentioned only at the former has been succeeded separately by adults, and children study its "traffic".

The count of the terrace occupants was done therefore during the study, to see how much are they used as a public open space functions.

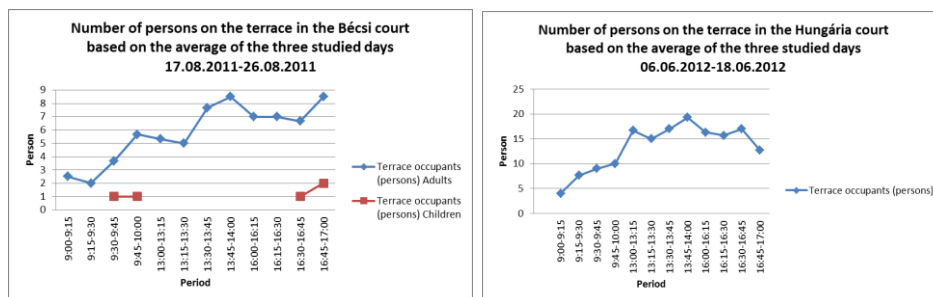


Figure 5. Number of persons on the terrace in the Bécsi and the Hungária court based on the average of the three studied days

What at first sight appears on the two graphs (Figure 5.), is that in the Hungária court can be found terrace area of the fast food restaurant has a significantly higher traffic, as the terrace area of the coffee shop has in the Bécsi court. In addition, the number of persons on the terrace though next to smaller fallbacks, but similar to the chair occupants shows an increasing trend. In contrast, in the Hungária court after between the 13:45 and 14:00 peak time has begun to decrease the traffic of the terrace.

The significant traffic difference of the terrace area both courtyards primarily comes from that proportionally the Hungária court is much larger, so there can be found fast food restaurant has also a significant size terrace. And the other reason is, which was during the on-site monitoring also perceptible, that the fast food restaurant had much higher traffic as the coffee shop. This is primarily thanks to that the fast food restaurant among the young generation (school, high school, university students) popular, and the coffee shop was mostly visited by the middle-aged and older people. This is supported by the fact that based on the three day average not more than two children hasn't sitting down to the terrace of the coffee shop. And as it can be seen on the graph too, together there is only such four quarter hour time period in which children were also stayed there.

The terrace area of the coffee shop according to the measured data more in the late afternoon early evening time can be very busy, and the fast food restaurant by the three major "peak time" in the lunch break, as well at the end of the working day, and the end of the school. Overall it can be said that on the terrace of the coffee shop in a quarter hour an average 6 adults and 1 children sits down, and to the terrace area of the fast food restaurant 13 people.

To Both courtyards specific, that not just pedestrians, but bicycles also ride on it. Therefore besides the pedestrian traffic, the bicyclist was also studied to determine, that how can this mean conflict situation between pedestrians and bicyclist.

What can be said of both courtyards, that none of them has more than 5 bicyclist ride in a quarter hour, which form the average of the three days is also good visible. Based on that in the Bécsi court in every quarter hour an average maximum two, and in the Hungária court 4 adults had cycled through (Figure 6.). With the number of the children the situation is different because in the Bécsi court much more less children had cycled, as in the Hungária court. In terms of the three day average that meant two children in every quarter hour in both courtyard, but as it can be seen also in the graph, there was a lot more such a time period too in the Bécsi court, when doesn't had cycled through it a child.

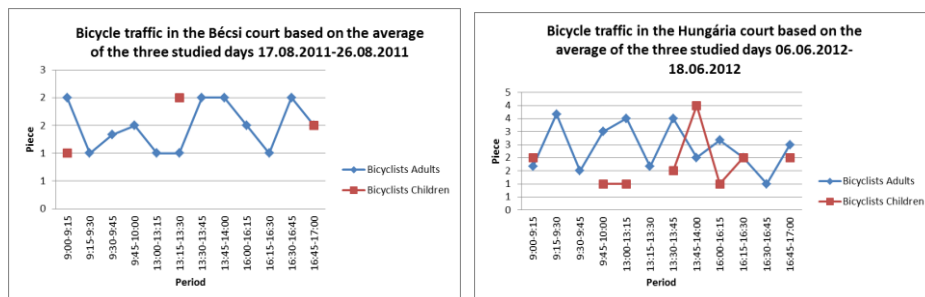


Figure 6. The bicycle traffic in the Bécsi and the Hungária court based on the average of the three studied days

In the case of the Hungária court has been more frequently drive through the children with bicycle mostly between 13:30 and 16:30 which “peak time” was between 13:45 and 14:00. This peak time has fall again at the end of the last hour of the school, and because the Hungária court is located between the Baross Gábor street the pedestrian street of Győr downtown and the Czuczor Gergely street on which painted bike lane also can be found, so many students walks through the courtyard into the direction of the city centre.

According to the Number of the bicyclist shows a very varied picture the Hungária court because as it can be seen also on the graph mostly it changes between 2 and 4 pieces until 16:00 hour, than it begins to decrease sharply, and in the last quarter hour jumps back to 3 pieces. Proportionally similar traffic can be observed in the Bécsi court also with the difference that in there mostly between 1 and 2 adult cyclist drives through in every quarter hour. So the bicyclist traffic not at all can be said significant either of the courtyards.

In both courtyards can be found more such additional functions which mostly generating pedestrian traffic. But during the study it would be impossible to study one by one each of them. This is especially true to the Bécsi court where several smaller shops, coffee shop, and a restaurant also can be found. Therefore in each courtyard just that function's traffic was studied which under the on-site observation had generated the largest traffic. So fell the choice in the case of the Bécsi court to the ice cream shop and in the Hungária court to the playground.

The ice cream shop of the Bécsi court can be said a quite popular, this is supported by among other things also, that under the average of the three day, an average of 19

people stands in row before it. But if we study more detailed the traffic of the ice cream shop it turns out that in the morning form 9:00 it shows continuous growth (Figure 7.). This process separately studied of each day, all of them was true. Most people always in the last quarter hour stood in line at the ice cream shop, which on one day had exceeded more than 40 people also. In addition it's clearly visible two larger "peak time" on the graph which from the first were between 13:00 and 13:15, the second between 13:45 and 14:00.

In the Hungária court the traffic of the playground hasn't shows such a clear picture as the ice cream shop in the Bécsi court. Because during the three day study it turned out, that the visitors of the courtyard uses quite varied the playground. But during of the three day it was also observed, that with more than 8 people stayed rarely in 15 minutes on the playground. Averaged the traffic of the three day it can be said that 6 people uses it in every quarter hour.

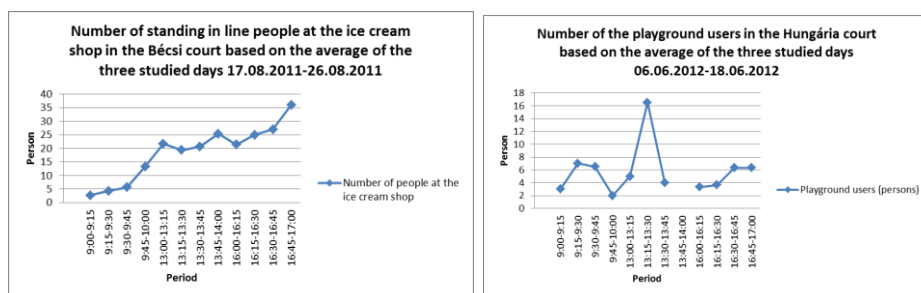


Figure 7. Number of the standing in line people at the ice cream shop in the Bécsi court and the number of the playground users in the Hungária court based on the average of the three studied days

As it can be seen on the graph there was such one time period between 13:15 and 13:30, when the number of the playground users was 17 people. This is thanks to that on Friday of the study in this quarter hour in a unique way 26 people has turned around on the playground. That is also therefore interesting because on the playground two swings can be found, so in contrast to the ice cream shop its capacity is much more limited. This is mainly due to among other also that usually more than 8 people weren't on the playground. However, it should be mentioned, that in front of the playground it can be found a bench on which usually the parents sit down until the children swing soaking. Therefore at the traffic study the bench occupants also have been included into the number of the playground users. So it can be said from the average of the three days received 6 people that during a quarter hour usually two 3 person family uses the playground. So the playground has a quite great popularity in the Hungária court.

The last study in both courtyards has studied the number of the dog walkers. All this was made because on a lot of open public space causes the dogs trouble for different reasons primarily thanks to the wrong behaviour of their owners. Namely the owners often don't comply for example to clean up the dog waste which however legislation provides for. And this in such a park where a lot of children also playing could be means a serious hygiene problem. But this is true also to the inner courtyard buildings where on a smaller "closed" area not only shops, but even ice cream shops, coffee

shops, and restaurants also could be. Or even a playground as also in the case of the Hungária court.

From the study of the two courtyard it turned out, that none of them are significant the number of the dog walkers. This is particularly true to the Hungária court where none of the studied days were walked more than one dog in a quarter hour (Figure 8.). However the Bécsi court already shows a little bit more varied picture but does not differ significantly from the Hungária garden. By the average of the three day in every quarter hour two dog walkers were in the Bécsi garden until in the Hungária garden only one. But as it can be seen in the graphs it was also more quarter hour time period when doesn't were walked a dog in none of the courtyards. And in the case of the Bécsi garden it is an additional curiosity that in the morning hour was "higher" the number of dog walkers, which was decrease at the early afternoon, than again from 13:45 it has begun to "increase". Under the on-site observation this is thanks to that in the courtyard and around it living mostly older people, who are kept a dog, then brought down walking their pets into the city center. However, it is important to note form the seen things, that only a few could hold a dog of those who living in the Bécsi garden.

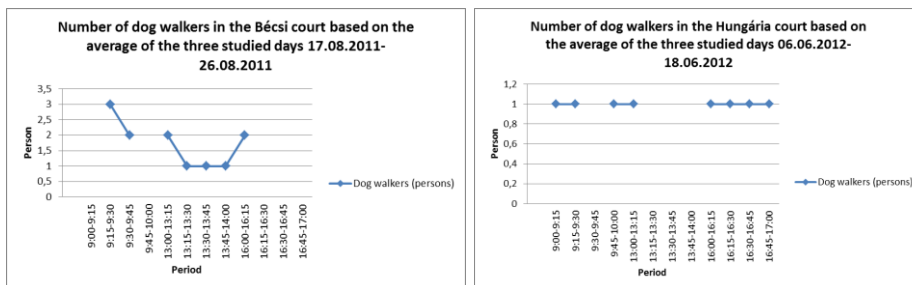


Figure 8. Number of the dog walkers in the Bécsi and the Hungária court based on the average of the three studied days

Summarized the traffic of the two courtyards the following can be concluded:

- The Bécsi court has more significant pedestrian traffic as the Hungária court
- On the Bécsi court much less children walking through as in the Hungária court
- In the Bécsi court the adults sitting down in significant number to the chairs, and in the Hungária court the children to the benches
- In the Hungária can be found terrace of the fast food restaurant has much higher traffic then the terrace of the coffee shop in the Bécsi court
- The difference between the two terraces traffic mainly comes from their size, the size of the two courtyards, and as well as from the generational age difference of the fast food restaurant and the coffee shop visitors
- In the Hungária court is more significant the bicycle traffic as in the Bécsi court

- The difference of the bicycle traffic mainly thanks to the location of the Hungária court and size difference of the two courtyard
- In the Bécsi court the ice cream shop has a significant traffic
- In the Hungária court the playground has a significant traffic
- The number of the dog walkers none of the courtyards are significant

So the traffic of the buildings with inner courtyard not only depends on their size, but from the therein included functions, the location of the courtyard and from the characteristics of each functions (size, type of service, amount, etc.).

As it can be seen in both courtyards the determining traffic was meant by the pedestrians. Therefore to determine that this traffic is how significant it must be known the traffic performance of both courtyards. Because with the help of these it is determinable that what kind the level of service of the two courtyards.

## 5. The Bécsi and the Hungária court pedestrian traffic performance

In the previous chapter it was also mentioned that the traffic study of the Bécsi and the Hungária court took three days, the former in August 2011 until the latter in June 2012. In both cases summarized and averaged the three days data it had managed to get the most important data from the traffic of the two courtyards.

In the Bécsi court an average 72 adult and 8 children turned around in every 15 minutes under the average of the three days (Table 1.). And the largest traffic in one of the studied quarter hour meant 114 adults, and 25 children. During the three days of the traffic counting in all 2606 adults and 273 children had walked through in the Bécsi court. From this, and from the data of the Table also clearly visible, that the pedestrian traffic is significant in the Bécsi court.

*Table 1. Traffic counting summary of the Bécsi court*

The total traffic counting data of the Bécsi court (17.08.2011-26.08.2011)										
Studied period	Pedestrians		Persons sitting on a chair		Persons sitting on a terrace		Bicyclists		Standing in line by the ice cream shop (Persons)	Dog walkers (Persons)
	Adults	Children	Adults	Children	Adults	Children	Adults	Children		
Maximum	114	25	12	5	14	2	4	2	48	3
Minimum	25	1	1	1	1	0	1	0	1	1
Mean	72	8	5	2	6	2	2	2	19	2
Sum	2606	273	170	28	175	5	30	6	667	16

In the Hungária court also the pedestrian traffic was dominant where one of the quarter hour 82 adults, and 62 children turned around on it (Table 2.). However during the three days an average of 42 adults and 22 children. Similarly way from the summarized data of the three days not only that turned out, that the pedestrian traffic is significant in the Hungária court, but in total 1526 adults and 799 children had walked on it during the time of the June study.

Table 2. Traffic counting summary of the Hungária court

The total traffic counting data of the Hungária court (06.06.2012-08.06.2012)									
Studied period	Pedestrians		Persons sitting on a bench		Bicyclists		Playground users (Persons)	Persons sitting on a terrace	Dog walkers (Persons)
	Adults	Children	Adults	Children	Adults	Children			
Maximum	82	62	8	29	6	4	26	33	1
Minimum	27	2	1	1	1	1	2	1	1
Mean	42	22	3	6	2	2	6	13	1
Sum	1526	799	89	116	68	17	136	481	10

Therefore with the help of the above data first the pedestrian traffic density has been determined. To get a more accurate picture of that how much is the actual traffic in both courtyard, therefore the maximal ( $d_{\max}$ ) and the average ( $d_{\text{átl}}$ ) traffic density has been determined with the help of the following formula:

$$d = \frac{F}{f}$$

Where:

$d$  – the pedestrian traffic density (person/m<sup>2</sup>)

$F$  – volume of the pedestrian traffic (person)

$f$  – the used surface (m<sup>2</sup>)

The area of both courtyards were with the help of the base map of Győr determined, which according the area of the Bécsi court 379,01 m<sup>2</sup>, and the area of the Hungária court 1716,26 m<sup>2</sup>. In the case of the Bécsi court the area includes the area of the passageways because there can be found the entrance of the shops also, and under the on-site observation the passageways had the same significant traffic as the courtyard itself.

During the determining of the traffic density the number of the adults and children has been added together also in the case of the maximal and average pedestrian traffic. The so obtained results include the Table 3.

Table 3. Pedestrian traffic density in the Bécsi and the Hungária court

Pedestrian traffic density of the Bécsi court	$d$ (person/m <sup>2</sup> )
Average traffic density ( $d_{\text{átl}}$ )	0,21
Maximal traffic density ( $d_{\max}$ )	0,37
Pedestrian traffic density of the Hungária court	$d$ (person/m <sup>2</sup> )
Average traffic density ( $d_{\text{átl}}$ )	0,04
Maximal traffic density ( $d_{\max}$ )	0,08

And the pedestrian traffic density calculation it was therefore necessary, that with the help of these getting the pedestrian performance of both courtyards busiest passageway. Because the pedestrian facilities traffic performance it shows that in given time unit how many people could pass through on its cross section. And the busiest passageway

in the case of both courtyards is into the Baross street opening (Figure 9.), which is the busiest pedestrian street of the downtown in Győr.



Figure 9. To the Baross street opening passageway of the Bécsi and the Hungária court

To the calculation of the pedestrian facilities performance besides of the traffic density it was needed also the pedestrian speed ( $v$ ), the useful width of the passageways ( $sz_h$ ), and to that given time period ( $t$ ) which shows how many pedestrians could go through the passageway.

During the time of the study not has been measured the speed of the pedestrians, therefore it was replaced during the calculation in the road management technical regulations "Design of the pedestrian traffic road facilities" document indicated pedestrian average speed which is  $v=1,34$  m/s.

The width of the Bécsi court's east passageway 3,25 m and the Hungária court's 4,81 m which data has been also with the help of the base map of Győr determined. During the study in 15 minutes time periods has been counted in both courtyards the pedestrians. Therefore at the counting of the passageways performance also that time period (900 s) has been replaced in the formula.

The performances of the two pedestrian passageways were with following formula determined:

$$K = v \times d \times sz_h \times t$$

Where:

$K$  – performance of some pedestrian facility (person)

$v$  – the pedestrian traffic speed (m/s)

$d$  – the pedestrian traffic density (person/m<sup>2</sup>)

$szh$  – useful width of the facility (m)

$t$  – the considered time interval (s)

From the obtained results turned out that the Bécsi court's eastern passageway average pedestrian performance in 15 minutes 827 person, the Hungária court's southwestern passageway 216 person. Counted with the maximal traffic density ( $d$  max) this result changed in the case of the Bécsi court for 1437 person and in the Hungária court for 487 person (Table 4).

*Table 4. The pedestrian performance of the Bécsi and Hungária court busiest passageway*

<b>Pedestrian performance of the Bécsi court's eastern passageway</b>	<b>K (person)</b>
The performance of the passageway by the average traffic density ( $d$ átl)	827
The performance of the passageway by the maximal traffic density ( $d$ max)	1437
<b>Pedestrian performance of the Hungária court's southwestern passageway</b>	<b>K (fő)</b>
The performance of the passageway by the average traffic density ( $d$ átl)	216
The performance of the passageway by the maximal traffic density ( $d$ max)	487

The results showing well that even in the case a small courtyard also as the Bécsi court an average more than 800 people could go through in a quarter hour its busiest passageway. But in the case of maximal traffic density also can in 15 minutes more than 1400 people walking through on the eastern passageway. And from this result well below during the on-site study measured distance, but even the maximal pedestrian traffic also.

Due from the sizes of the Hungária court it had much lower pedestrian traffic density, as the Bécsi court. This is mainly due to that even next to the maximal traffic density also only 487 people the pedestrian performance of the southwestern passageway. As it can be seen in the table also, its average performance is less than the half of the maximum (216 person).

However in the case of both courtyards it should be noted, that not just one, but they have several passageways too. In the Bécsi court for example in all three can be found, so by the obtained results next to maximal traffic also, in that direction walkers could comfortably walking through it. And in the Hungária court beside of the southwestern passageway another three provides an opportunity to approaching it.

So from the results it turned out that the two courtyards is capable to conducting the pedestrian traffic of the downtown Győr, and joining to that network. All this in such way, that the pedestrians could comfortably fit next to each other in the passageways, and in the courtyards too.

## 6. Summary

In the present paper studied Bécsi and Hungária court turned out that they are well-functioning, and "living" passageway housing courtyards, which having a significant

role in the downtown of Győr. In them can be found different functions are also quite popular and used. This proved in both courtyards done traffic counting also, from which significant differences turned out between the courtyards. Because as it can be seen the traffic of the courtyards not only depends on their size, but from in they can be found functions, and the location of the courtyard in the city. However in both courtyards the pedestrian traffic was determining, but as it can be seen from the traffic density, and the pedestrian performance calculation, this traffic can without obstacle passing through on them.

However the current study did not address yet such questions, that how affecting the traffic of the inner courtyard for example that surrounding streets traffic. Because the now presented Bécsi and Hungária court not only limited by the busiest pedestrian street of Győr, but it is located in one of the busiest area of the historical city center. But it is questionable what would happen than, when another part of the city center would be located these courtyards, or less busy street would be limit them. Or affecting this traffic in the nearby can be found bus stops, offices, shops, etc.

In the Bécsi court more smaller shops can be found besides of the previous chapters already mentioned ice cream and coffee shop. In the future in any case must be study, that in the passageway housing inner courtyards can be found shops how affecting the pedestrian traffic. Decrease or maybe increase it, depending on that how many can be found in them, or what kind of functions they having. This is true for such other functions as well as the chairs, benches, terraces, plants, fountains, etc. Because as the traffic counting data also proved the traffic of the Hungária court has been significantly affected by the there can be found fast food restaurant, which is mostly among the younger generation popular. Same way in the Bécsi court the ice cream shop had also great popularity, but the coffee shop's terrace already has been visited by the older generation. But it is questionable, that the other shops of the Bécsi court how much had affecting that the passers-by turned into there.

So in the field of the closed inner courtyards and the passageway housing courtyards exists many other research opportunities. And these areas should be in any cases study, because as it can be seen, in the future the cities can be found public open spaces will have an especially important role. In the case of the historical inner cities the inner courtyard making could be providing the best opportunity to the expansion of the public open spaces. So ensuring the sustainable urban development for the future generations.

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