7-12-2005

Classification of the Aesthetic Value of Urban Rivers

Ales Bisjak
University of Ljubljana

Abstracts of presentations given on Tuesday, 12 July 2005, in session 6 of the UCOWR conference.

Classification of the Aesthetic Value of Urban Rivers

Ales Bizjak
Institute for Water of the Republic of Slovenia
Hajdrihova 28 C, University of Ljubljana,
Faculty of Civil and Geodetic Engineering, Jamova 2
Ljubljana, Slovenia 1000
Ph: 00386-1-47-75-333
Fax: 00386-1-42-64-162
ales.bizjak@guest.arnes.si

Simon Rusjan
University of Ljubljana, Faculty of Civil and Geodetic Engineering, Slovenia
srusjan@fgg.uni-lj.si

Spela Lozar
University of Ljubljana, Faculty of Civil and Geodetic Engineering, Slovenia
spelaus@yahoo.com

1. INTRODUCTION

Environmental goals of the European Water Framework Directive (hereinafter called: WFD) (The European Parliament and the Council, 2000), adopted by the European Community in 2000, foresee the achievement of the Good Ecological Status of all surface water bodies by the year 2015. Goals should be achieved by the way of applying the measures, such as restoration or rehabilitation works. In the context of the modern care of the river environment, rivers in urban environment areas should be considered as a special category. European project URBEM (Urban River Basin Enhancement Methods) (http://www.urbem.net/), funded by the European Commission in the 5^{th} Framework Programme for the implementation of the WFD and developed in co-operation of partners from 5 EU countries (Great Britain, Germany, Austria, Portugal and Slovenia), has aimed to prepare a tool for the needs of municipal administration in the decision-making process in relation to renewal and rehabilitation schemes of urban corridors.

As a part of the project, the partner from Portugal has in co-operation with other partners in the project drawn up a draft method for a combined expert and survey assessment of the aesthetic value of urban rivers (URBEM, 2004). The aim of the method is to provide an assessment of the visual environment of urban rivers in order to facilitate decision-making when prioritising the approach to rehabilitation of urban rivers. In comparison to the existing methods for valuation of the hydromorphological state of rivers, which are based on the assessment of the anthropogenic alterations or ecological deficit of the hydromorphological process in the river corridor, the URBEM method provides an assessment of the river corridor in a wider sense: ecological, spatial and social.

In Slovenia, the method was tested on three urban rivers in the capital city of Ljubljana. In the course of testing, several strengths as well as weaknesses of the proposed method were identified.

2. THE METHOD

The aim of the method for the classification of the aesthetic value is to establish the value and potential of aesthetics of urban river reaches in order to identify the priorities and possible approaches to their rehabilitation or restoration (e.g. interventions into the aquatic environment, which would on one hand help mitigate water ecosystem degradation and on the other hand improve its ecological state). The draft method is based on three dimensions: »River«, »City«, and »People«, which are separately assessed and evaluated according to the state of viewpoints ("Fundamental viewpoints" and "Elementary viewpoints"), they consist of. Combined they provide a basis for the assessment of the aesthetic value of urban rivers (URBEM 2004).

Two main spatial units have been considered in the method: river corridor and riverfront. The river corridor is defined as the area that contains both sides of the stream with a width of approximately 500 m on each side, corresponding to about a 10-minute walking access to the water, rather than a landscape ecology category. Local and site-specific corrections to this theoretical limit are advisable. Another important area is the riverfront, i.e. the area between the river and the first line of buildings, including these buildings. The identification of the riverfront area is important from the aspect of relationship or interconnectedness between the river and the city.

The performances of the dimensions with respect to the "Fundamental" and "Elementary viewpoints" (Tables 1 to 3) are measured through the proposed indicators (descriptors) and standardized to the common scale of performance. Simple linear functions are used to convert real scales to a common scale that varies from 0 (the worst plausible level) to 100 (the best plausible level). The final result of the method is a profile of aesthetic performance for a selected river reach which enables a further analysis of overall performance of the river reach or an investigation of performance of selected dimensions.

2.1 Dimension "River"

The dimension "River" is delineated by the "Fundamental viewpoints": River Morphology, Biological Components and Natural and Technological Hazards, with the corresponding s "Elementary viewpoints". The viewpoints of dimension "River" are given in Table 1.

Table 1: Dimension »River«

Fundamental viewpoint	Elementary viewpoint	Code
River Typology*	Basin size	**R1**
	Stream order	**R2**
	River width	**R3**
	Valley morphology	**R4**
River Morphology	Degree of disturbance of the natural dynamics	**R5**
	Sinuosity	**R6**
	Bank shape	**R7**
	Presence of hydromorphological elements in the channel	**R8**
Biological Components	Biological diversity	**R9**
	Presence of riparian vegetation in the river banks	**R10**
	Width of riparian vegetation	**R11**
	Presence of different type of vegetation species	**R12**
Natural and Technological Hazards	Flood vulnerability	**R13**
	Bank erosion and landslide risk	**R14**

*Fundamental viewpoint »River Typology« does not influence the aesthetic performance of the river.

2.2 Dimension »City«

The dimension "City" is characterized by the "Fundamental viewpoints": Urban Space Quality, Cultural Heritage, Activities, Accessibility and Pollution. Within the dimension "City" the relationship between the built urban space with the water body is identified; the viewpoints are shown in Table 2.

Table 2: Dimension »City«

Fundamental viewpoint	Elementary viewpoint		Code
Urban Space Quality	Visual Permeability	Visual contact	**C1**
		Depth of views	**C2**
		Width of views	**C3**
	Density of landmarks		**C4**
	Built space quality		**C5**
	Public utility of riverfront		**C6**
	Intensity of construction		**C7**
Cultural Heritage	Cultural heritage		**C8**
Activities	Diversity of uses		**C9**
	Attractiveness of riverfront		**C10**
Accessibility	River crossings	Bridges	**C11**
		Use of bridges	**C12**
	Surface of parking		**C13**
	Public transport		**C14**
	Walkways and bikeways		**C15**
	Level of disruption		**C16**
	Anchorage places		**C17**
	Use of river by boats		**C18**
Pollution	Pollution		**C19**

2.3 Dimension »People«

The dimension "People" is characterized by these fundamental viewpoints: Public Perception, Place Identity and Restorative Capacity.

Table 3: Dimension »People«

Fundamental viewpoint	Elementary viewpoint		Code
Public Perception	In relation to the River	Aesthetic	**P1**
		Water	**P2**
		Biodiversity	**P3**
		Flood risk	**P4**
		Pollution	**P5**
	In relation to the City	Urban quality	**P6**
		Accessibility	**P7**
		Security infrastructure	**P8**
	Relation People-River	Relax	**P9**
		Attachment	**P10**
Place Identity	Continuity		**P11**
	Self-esteem		**P12**
	Self-efficacy		**P13**
	Distinctiveness		**P14**
Restorative Capacity	Being away		**P15**
	Fascination		**P16**
	Extent		**P17**
	Compatibility		**P18**

3. CASE STUDIES

3.1 The Ljubljanica River (study reach 2,600 m)

The catchment area of the Ljubljanica River comprises 785.9 km^2. According to the Strahler stream ordering system, it is a 3^{rd} order stream. The average width of the active cross section and the average bankful width range is between 20–200 m. The valley morphology type is asymmetric.

The Ljubljanica River study area includes a large part of the old city centre of Ljubljana with a high density of buildings. Numerous spatial activities and uses connected with the Ljubljanica River have been developed in the areas around the river. The river has been used as an important transport line, port, entertainment area, market place, and also as a conduit for sewer and refuse. To reduce the flood risk, a diversion channel was excavated in the period from 1772 to 1780 between the Castle hill and the hill of Golovec according to the plan of a Jesuit, Gabriel Gruber. In the 19^{th} century, the Ljubljanica River and surrounding areas provided a continuously attractive social space. Later, the regulation and deepening of the Ljubljanica River channel was carried out in the reach of the river through the Ljubljana city centre. The image of the river changed drastically between 1913 and 1918, when banks on the river section through the city were heavily reinforced with high concrete walls. The plan for regulation was developed by engineer Alfred Keller. The natural Ljubljanica River channel was transformed into a ditch, which alienated the river body from the city life. The monotony of the river channel regulation was changed by architect Jože Plečnik in the 1920's and 1930's (Figures 1–2).

Figure 1: The Ljubljanica River through the city center

Figure 2: The Ljubljanica River study area

3.2 The Mali Graben River (study reach 3,750 m)

The catchment area of the Mali Graben River comprises 154.3 km^2. According to the Strahler stream ordering system, the section of the Mali Graben is a stream of 1st order. The average width of the active cross section and the average bankful width are in the range of 5–20 m. In terms of morphology type, the stream is a broad floodplain along most of the course. Although the Mali Graben was intensively regulated, mainly to assure the conveyance of a discharge up to 170 m^3/s, the hydraulic conductivity is not sufficient. Therefore, the surrounding areas are often flooded.

In the past, the course of the Mali Graben was situated apart from the urban area of the city of Ljubljana. Due to the fast development of the city that eventually grew into an important cultural, political and economic regional centre, the Mali Graben became the boundary between the managed urban space and the green urban space on the periphery. The densely built-up areas are located mostly to the north of the river, directed towards the city centre. During the last two decades, the urbanization spread to the right bank of the Mali Graben. As anticipated, these areas of Ljubljana will face further building expansion (Figures 3–4).

Figure 3: The Mali Graben River

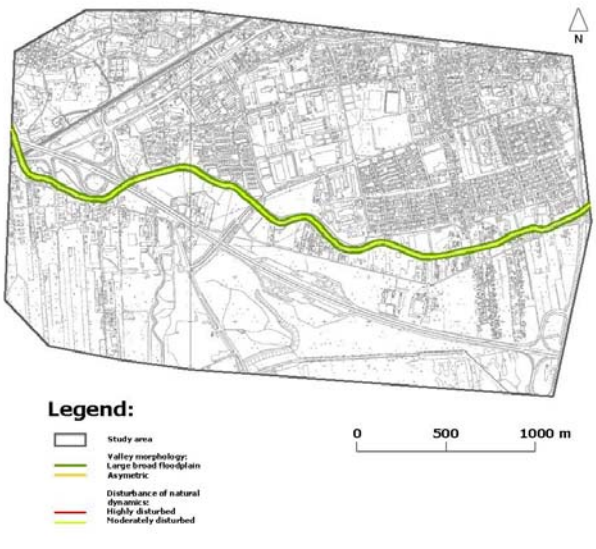


Figure 4: The Mali Graben River study area

3.3 The Glinscica Stream (study reach 2,150 m)

The catchment area of the Glinscica Stream comprises 19.3 km^2, according to the Strahler stream ordering system, the Glinscica is a 1st order stream. The average width of the active cross section and the average bankful width are classified in class 0–5 m. In terms of morphology, the valley profile type is mainly a large broad floodplain, except at the joint of the Glinscica corridor with the slopes of the Rožnik hill. In the downstream part of the study area, the river corridor is more densely urbanised.

The Glinscica Stream has its source under the northeastern slopes of Toško čelo and at Podutik passes into the plain area of the Ljubljana Plain. The topography of the basin is comprised of a hilly area to the east and west and a plain area that spreads out in the southern part. The relief of the Glinscica drainage basin is versatile, comprising hilly headwater areas as well as plains. The precipitation watershed area of the Glinscica comprises 17.4 km^2. The position of the runoff within the urban area is determined by the removal of rainfall water by way of a sewage system, thus the orographic barrier fails to coincide with the Glinscica drainage. The total drainage area of the Glinscica up to its outlet into the Gradaščica is somewhat bigger and comprises 19.3 km^2 of the catchment area. There are an estimated 38 % of urban areas, that is 6.6 km^2 (Figures 5–6).

Figure 5: The Glinscica Stream

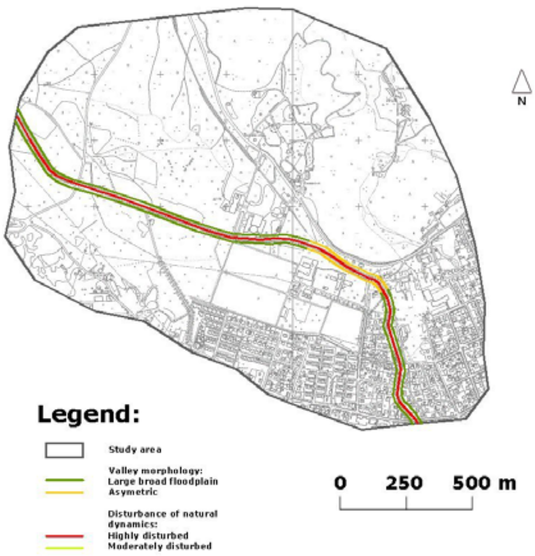
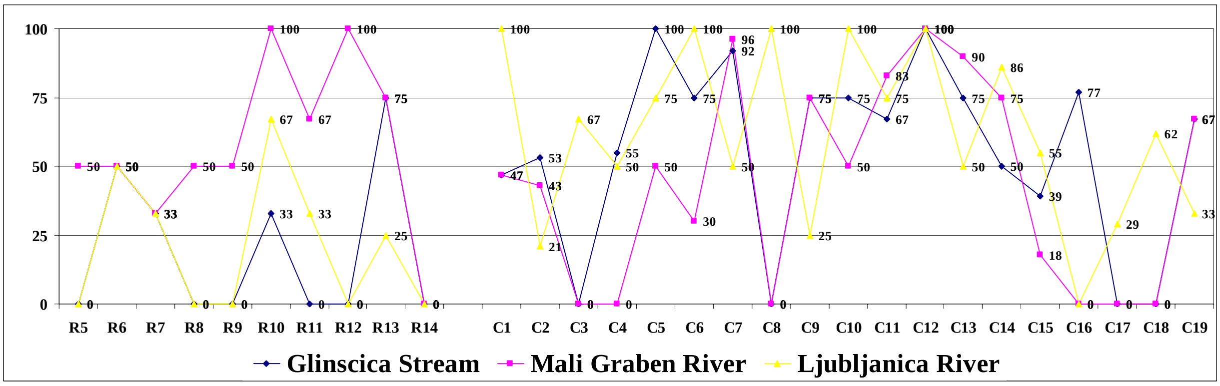


Figure 6: The Glinscica Stream study area

4. RESULTS

The results of the application of the method in three test reaches on the Ljubljanica River, Mali Graben River and Glinscica Stream are shown in Graph 1. In the continuation the performance of the test reaches with consideration to dimensions of »River« and »City« is discussed. The performance of the dimension "People" has not yet been evaluated for all three case studies, thus it is not included in this paper.



Graph 1: Profile of aesthetical performance for the Ljubljanica River, the Mali Graben River and the Glinscica Stream (100–best, 0–worst; R-dimension "River"; C-dimension "City")

4.1 River morphology (viewpoints R5–R8)

The degree of the disturbance of natural dynamic processes in the Ljubljanica River corridor is high due to the high building density in the city centre (Figure 3). The river channel was deepened several times, the banks are reinforced with almost vertical concrete walls. On short subsections, the banks are grassed above the concrete walls. In the study reach, some individual trees and lines of trees are present on the top of the banks. Inside the narrow city centre, the riparian vegetation is completely absent. The local sinuosity of the river was diminished with the regulation works. Along the entire study reach, the cross section is of trapezoidal shape with unchanged slope and bank arrangements. The hydro-morphological elements of the natural river channels (runs, pools, riffles, weirs, asymmetric cross sections) were removed from the stream channel during the regulation works in the 19th century. The average performance of the fundamental viewpoint "River Morphology" for the Ljubljanica River is 20.8 %.

The degree of disturbance of natural dynamic processes on the Mali Graben is high in the upper reach of the study area, where the river corridor is disconnected by the traffic infrastructure (Figure 5). In the lower, maintained and managed study area, the degree of disturbance is moderate. The bottom of the river is natural, the banks are technically arranged, however, they are densely grassed and covered in riparian vegetation. The index of sinuosity of the stream is 1.15, calculated according to the method proposed; the local sinuosity is further diminished due to past regulations. Characteristic of the entire study reach is the trapezoidal cross section with steady slope and bank formation. The hydro-morphological elements (runs, pools, riffles, rocks, weirs) were partly removed from the channel. During the restoration works in the 1980's several weirs were built into the channel, which changed the morphological structure of the channel bottom (emergence of pools) and the river course structure. The average performance of the fundamental viewpoint “River Morphology” for the Mali Graben River is 45.8 %.

The degree of the disturbance of natural dynamic processes in the Stream Glinscica corridor is high and remains mainly unchanged along the entire study reach (Figure 6). The bottom of the Glinscica Stream channel is paved with concrete plates, the river banks are technically arranged and grassed. The index of sinuosity of the stream, calculated according to the proposed method, is 1.13. The local sinuosity of the Glinscica channel is further diminished due to past regulations. Along the entire study reach, the cross section is of trapezoidal shape with unchanged slope and bank arrangements. The hydromorphological elements of the natural river channels (runs, pools, riffles, weirs, asymmetric cross sections) were removed from the stream channel during the regulation work. The average performance of the fundamental viewpoint “River Morphology” for the Glinscica Stream is 20.8 %.

4.2 Biological components (viewpoints R9–R12)

The Ljubljanica River corridor has undergone intensive regulation works combined with the development of the urban tissue in the entire study reach. In some subsections, buildings were situated right next to the river channel. As mentioned, the riparian vegetation mainly includes sparse trees; only short subsections of the river channel are partly shaded. The width of the riparian vegetation is in a range of 0–12 m. The variety of species of the riparian and aquatic vegetation is very low. The average performance of the fundamental viewpoint “Biological components” for the Ljubljanica River is 25 %.

Even though the river corridor of the Mali Graben River has undergone intensive regulations, the riparian vegetation on the study reach remained well developed, ranging in a width of 12–20 m. During the vegetation period the channel is strongly overgrown and shaded (Figure 4). The variety of species (aquatic, amphibian and terrestrial vegetation) is high. The average performance of the fundamental viewpoint “Biological components” for the Mali Graben River is 79.3 %.

The biological diversity of the Glinscica Stream corridor was highly disturbed during the regulations (Figure 7). The riparian vegetation was almost entirely removed. In the downstream section of the study reach, the banks have slowly become overgrown with vegetation, which is advancing from the private gardens along the Glinscica channel. The variety of species of riparian and aquatic vegetation is low. The average performance of the fundamental viewpoint “Biological components” for the Glinscica Stream is 8.3 %.

4.3 Natural and technological hazards (viewpoints R13–R14)

Flood vulnerability of the surrounding urban areas in the study area was high in the past. Intensive regulations of the Ljubljanica River channel (widening of the cross section, deepening, introduction of the water barrier) and the excavation of the Gruber channel (diversion of the water away from the city centre) have diminished the flood vulnerability. We estimate that the area of a 100-year flood event spreads over 25 % of the urbanised part of the river corridor. Bank erosion processes and landslide risks are not present in the study reach. The average performance of the fundamental viewpoint “Natural and technological hazards” for the Ljubljanica River is 12.5 % (performance is measured in reversed scale).

Flood vulnerability of the urban areas in the Mali Graben River corridor is high. It has been estimated that more than 75 % of river corridor areas are 100-year flood events. No bank erosion processes and landslide risks have been identified. The average performance of the fundamental viewpoint “Natural and technological hazards” for the Mali Graben River is 37.5 % (performance is measured in reversed scale).

Flood vulnerability of the urban areas in the Glinscica Stream corridor is high. We estimate that the area of a 100-year flood event spreads over 75 % of the urbanised part of the river corridor. There are no bank erosion processes and landslide risks present in the study reach. The average performance of the fundamental viewpoint “Natural and technological hazards” for the Glinscica Stream is 37.5 % (performance is measured in reversed scale).

4.4 Urban space quality (viewpoints C1–C7)

The visual permeability of the urban space along the Ljubljanica river is characterised by longitudinally and transversally oriented visual axes, which were designed in detail. The linear density of the visual intersections is 11 visual intersections / km of river length. The average length of a visual axis is 100 m. An important landmark in the study area is the tower of the Ljubljana castle on top of Castle hill. High quality constructions (residential, business and commercial) with developed sewage and rainwater drainage system are characteristic. The rainfall runoff from the urban area drains directly into the Ljubljanica River. Poor quality constructions are to be found in some areas of the old city centre where several old buildings require reconstruction. Footpaths are arranged along the entire study reach on both sides of the river channel. The green system of the city of Ljubljana is especially well developed in the upper part of the study reach (area called Trnovski pristan), before the river enters the narrow city centre in the middle part of the study reach. In the downstream part of the study area, traffic and parking surfaces prevail along the channel. The average performance of the fundamental viewpoint “Urban space quality” for the Ljubljanica River is 66.1 %.

The built-up area on the left bank of the Mali graben River is characterised by urban visual axes. The linear density of the visual intersections is 4 visual intersections per km^1 of river length. The average length of the visual axis is 200 m. There are no typical belvederes in the study area, nor any landscape points. Characteristic of the study area on the left bank of the Mali Graben and to the north, is quality housing in private ownership and commercial areas in the central part of the study reach with proper public utility infrastructure. The rainfall runoff is diverted into the river. Individual buildings with poor quality public utility infrastructure spread mostly on the right bank of the Mali Graben and in the area south of the river. Poor quality urban environment is also in the upper part of the study area with a dense traffic network. The Path around Ljubljana as an important element of the urban design runs parallel to the left bank of the Mali Graben and adds to the amenity value of the area. In general, the state of the green system within the study area is good. The average performance of the fundamental viewpoint “Urban space quality” for the Mali Graben River is 38 %.

The urban and suburban space along the Glinscica Stream is characterised by long and wide visual axes of open, mainly non-urbanised areas in the upper part of the study reach. In a more densely urbanised lower part of the study reach, the urban visual axes are narrower and shorter. The linear density of the visual intersections is 4 visual intersections / km of river length. The average length of the visual axes is 250 m. There are no typical belvederes in the study area, the buildings of the Biotechnical Faculty and the Department of Biology feature as landscape points (landmarks). For the downstream section of the study reach, quality residential housing in private ownership with good sanitary conditions is characteristic. The sewage system is well developed. The rainfall runoff is diverted into the Glinscica channel through the surface water drainage system. The upper part of the study area is rural, the meadows along the stream are in private ownership. The path around the city of Ljubljana as an important part of the urban design is in public property. In the study area, the state of the green system is good. The average performance of the fundamental viewpoint “Urban space quality” for the Glinscica Stream is 60.3 %.

4.5 Cultural heritage (viewpoint C8)

In the part of the old city centre, which is directly connected with the Ljubljanica River, the cultural heritage is extremely abundant and attractive. It draws numerous inhabitants of Ljubljana, daily commuters and tourists every day and all year long, especially in the summer time. Cultural heritage undoubtedly contributes to extremely high aesthetic value of the study area Performance of the fundamental viewpoint “Cultural heritage” for the Ljubljanica River is 100 %.

There is no element of cultural heritage present within the river corridors of the Mali Graben River and the Glinscica Stream, therefore the performance is 0 %.

4.6 Activities on the riverfront (viewpoints C9–C10)

In the upstream part of the Ljubljanica River study area, a partially urbanized use of the riverfront area prevails. The green system of the city of Ljubljana is well arranged and enables access to the Ljubljanica River water body. In the area of the city centre, there is a diversity of urban activities with predominantly urbanized use of riverfront. The attractiveness of the entire study area is high due to numerous possibilities of spatial uses and activities (footpaths, bikeways, cultural and social events, tourist activities). The performance of the fundamental viewpoint “Activities on the riverfront“ for the Ljubljanica River is 62.5 %.

Urban activities prevail in the upper study area of the Mali Graben River. The lower study area is an open suburban space with an abundance of green areas. The amenity value of the riparian areas is highest on the left bank and to the north of the river due to the characteristically high residential quality and recreational possibilities (footpaths, bikeways), and the Path around the city of Ljubljana. The quality of the riverfront areas is poor in the upper part of the study area due to the traffic network, and on the right bank in the area to the south. The performance of the fundamental viewpoint “Activities on the riverfront” for the Mali Graben River is 62.5 %.

In the lower part of the Glinscica Stream study area, urban activities prevail. The upper part of the study area is open suburban space with the dominance of green area. The attractiveness of the riverfront area is high in the lower, more densely urbanised area, and also in the upper, open suburban area due to the quality of the residential area and recreational possibilities (footpaths, bikeways, ZOO, botanical gardens, river crossings, path around the city of Ljubljana). The performance of the fundamental viewpoint “Activities on the riverfront” for the Glinscica Stream is 75 %.

4.7 Accessibility (viewpoints C11–C18)

There are 9 river crossings in the study area of the Ljubljanica River (six for automobile traffic and three for pedestrians and cyclists). The network of public transport lines is well developed. Tourist navigation with boats of all sizes is organised on the river. The performance of the fundamental viewpoint “Accessibility” for the Ljubljanica River is 57.1 %.

Out of 10 river crossings along the Mali Graben River study area, 7 are intended for automobile traffic, 1 for rail traffic, 2 for pedestrians and cyclists. Well-maintained footpaths and bikeways are characteristic for the area north to the river. The bridges of the south by-pass, rail, Tržaška Road, Cesta v Mestni log Road and Barjanska Road are the most disruptive elements in the river corridor. With regard to the size of the Mali Graben, the navigaton on the river is not possible, also there are no anchorage points. The performance of the fundamental viewpoint "Accessibility" for the Mali Graben River is 45.8 %.

In the Glinscica Stream study area, there are 6 river crossings (two bridges for automobile traffic and 4 for pedestrians and cyclists). Near the Biotechnical Faculty, parking lots are arranged next to the Glinscica channel. The public traffic route passes along Cesta na Brdo Street and crosses the Glinscica channel in the lower part of the study reach. In the upper part of the study reach, there is a well-planned arrangement of footpaths and bikeways along the Glinscica channel. The most disruptive elements in the river corridor are bridges on Cesta na Brdo Street and Brdnikova Street in the uppermost and lowermost sections of the study reach. Because of the size of the Glinscica Stream channel, navigation on the river is not possible and there are no anchorage points. The performance of the fundamental viewpoint "Accessibility" for the Glinscica Stream is 51 %.

4.8 Pollution (viewpoint C19)

The Ljubljanica River is moderately polluted with litter and other pollutants, which are deposited in the channel because of the weak river flow. The water has a dark blue to green colour, it is not transparent and it has no odour. The performance of the fundamental viewpoint "Pollution" for the Ljubljanica River is 33 %.

Within the study reach, the Mali Graben is partly polluted with litter and other pollutants (occlusion of alluvial waste material because of the intensive riparian vegetation); the water is transparent and has no colour or unpleasant odour. The performance of the fundamental viewpoint "Pollution" for the Mali Graben River is 67 %.

In the study reach, the Glinscica Stream is not polluted with litter and other pollutants, the water has no specific colour and odour. The performance of the fundamental viewpoint "Pollution" for the Glinscica Stream is 67 %.

5. DISCUSSION

According to the results of the application of the method in the test case studies, shown in Tables 4 and 5, the performance of the dimension "River" has proven best for the Mali Graben River, however the method has indicated a similarly poor state for the Ljubljanica River as well as for the Glinscica Stream. In pursuing the environmental goals of the WFD by the year 2015, the results of the method have suggested that the Ljubljanica River and Glinscica stream should be prioritized in terms of rehabilitation and renewal works. However, the designation of the probable status of a heavily modified water body actually applies only to the Glinsica stream, but not to the Ljubljanica River.

In terms of dimension "City" the method yields the highest rating for the Ljubljanica River, followed by the Glinščica stream and the Mali Graben River. From the aspect of improving the living environment of inhabitants and other users of space, the Mali Graben River should be prioritized for an adequate urban upgrading and connection of the river corridor and built-up urban tissue.

Based on the expert study and field assessment of the status and comparison of test study reaches it can be established that the results of the application of the method reveal a good response of the method. The values of dimensions "River" and "City" as well as single "Fundamental viewpoints" for dimensions "River" (River Morphology, Biological Components, Natural and Technological hazards) and "City" (Urban Space Quality, Cultural Heritage, Activities, Accessibility, Pollution) provide an objective assessment of the status of test river reaches.

However, it should be emphasised that the overall assessment of the dimensions "River" and "City", which is similar for all three rivers, cannot be regarded as a relevant indicator of status, since it contains the assessment of the ecological status of the river corridor and spatial integrity of the urban tissue and river corridor, which are not comparable values of the urban environment. In this manner, the results of the method have shown that the aesthetic value cannot be equivalent with its hydromorphological status. Accordingly, a hydromorphologically heavily modified test reach of the Ljubljanica through the city centre can have high aesthetic value.

Table 4: Average performance values of fundamental viewpoints of the three case studies in Ljubljana

Fundamental viewpoint	Average Performance Ljubljanica River [%]	Average Performance Mali Graben River [%]	Average Performance Glinscica Stream [%]
Dimension "River"			
River Morphology	20.8	45.8	20.8
Biological Components	25.0	79.3	8.3
N & T Hazards	12.5	37.5	37.5
Dimension "City"			
Urban Space Quality	66.1	38.0	60.3
Cultural Heritage	100.0	0.0	0.0
Activities	62.5	62.5	75.0
Accessibility	57.1	45.8	51.0
Pollution	33.0	67.0	67.0

Table 5: Average performance values of dimensions "River" and "City" of the three case studies in Ljubljana

Dimension	Average Performance Ljubljanica River [%]	Average Performance Mali Graben River [%]	Average Performance Glinscica Stream [%]
River	20.8	57.5	19.1
City	62.0	43.4	55.1
Overall	47.8	48.2	42.7

Besides the expert review of the adequacy of assessments of the status of dimensions "River" and "City", we provide some further conclusions. When applying the method, the influence of subjectivity of corresponding viewpoints should be considered (dimension: »City«), where the degree of aesthetic value of a specific viewpoint in a concrete area is established on the basis of expert assessment (e.g. most fitting number of potential river crossings in the area, appropriate density of landmarks). Having this in mind, the accuracy and repeatability (robustness of the method) should be checked. In addition, the method cannot be applied in a simple manner: several data are required, which are often not available for the area (e.g. intensity of construction, number of people that use the bridges daily etc.).

The aesthetic value is undoubtedly an important element in the process of renewal and rehabilitation of rivers, certainly, it is the element that is usually noticed first (Shannon et al. 1995, Ortolano 1997). Urban rivers are particular from at least two points of view: narrowness of the river corridor inside the urban tissue and also a variety of uses inside the urban river corridor for everyday and leisure activities of city population (Bizjak and Mikoš 2001, Mikoš and Kavčič 1998, Perspektiven 1994, 2002). That is the reason why the determination of urban river corridors, which should be prioritised for the implementation of revitalisation or rehabilitation measures, also requires the analysis of the aesthetic value and aesthetic potential of urban rivers.

6. CONCLUSION

The application of the method for classification of the aesthetic value of three test rivers in Slovenia has raised some theoretical dilemmas and has also shown certain problems in terms of practical application of the method. In our opinion, the method offers a good basis for further research in the field of assessment of aesthetic value of urban rivers and streams. From the view of further optimisation of work procedures and methodological processes, some recommendations and comments should be considered. This could be done through the involvement of the existing methods for the analysis of the quality of the visual environment and established procedures for restoration or rehabilitation of urban rivers and streams in combination with the experiences gained through practical realisation of such projects.

7. ACKNOWLEDGEMENTS

The research was funded as part of EU 5th Framework URBEM project. The authors wish to thank anonymous reviewers for their valuable comments.

8. REFERENCES

Bizjak, A. and Mikoš, M. 2001. Obnova ali rehabilitacija koridorjev mestnih vodotokov (Restoration or rehabilitation of urban river corridors), Ljubljana: *Urbani izziv*, 2(12): 51 – 57 (In Slovenian, with English abstract)

Bizjak, A. and Mikoš, M. 2003. Slovenska in evropska pravna določila varstva in obnove rečnih koridorjev (Slovenian and European legal provisions of protection and restoration of river corridors), Ljubljana: *Urbani izziv*, 1(14), 41–50 (in Slovenian, with English abstract).

Mikoš, M. and Kavčič, I. 1998. Majhni vodotoki v mestnem okolju – njihova revitalizacija (Small watercourses in an urban environment – their revitalisation), Ljubljana: *Gradbeni vestnik*, 8–9–10(47): 186–195 (in Slovenian, with English abstract).

Ortolano, L. 1997. *Environmental Regulation and Impact Assessment*, Chicester: John Wiley & Sons Ltd, p. 470–487

Perspektiven. 1994. *Wasserbau*, Thematic issue, Vienna: Perspektiven, 4(1994), 88 p.

Perspektiven. 2002. *Neues Leben am Wienfluss*, Thematic issue, Vienna: Perspektiven, 12(1994), 112 p.

Shannon, S., Smardon, R. and Knudson, M. 1995. Using visual assessment as a foundation for greenway planning in the St. Lawrence River Valley, *Landscape and Urban Planning*, 33, p. 357–371

The European Parliament and the Council. 2000. *Directive of the European Parliament and of the Council establishing a framework for Community action in the field of water policy,* Brussels: European Commission, 62 p., 11 annexes

URBEM 2004. Classification of the aesthetic value of Jardas Stream – application of the methodology to the study area, Deliverable 4-3, Urban River Enhancement Methods, Lisbon: Work Package 4, April 2004, 114 p.

For additional information see:

http://ksh.fgg.uni-lj.si
http://ksh.fgg.uni-lj.si/urbemdatasi/
http://www.urbem.net/