

Habitats fragmented by transportation infrastructure connected again by green bridges and culverts: examples of wildlife passages in Austria, Belgium, France, Germany, Switzerland and Poland

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Abstract. Against the background of well projected ecological passages in Europe, the work presents a critical assessment of 5 passages built specifically for wild animals over the A-4 highway in the Opolskie province. The structures, put into use in the year 2000, do not comply with the requirements because they are too narrow and not appropriately incorporated into the landscape. The lack of planted trees and shrubs discourages animals (like e.g. deer) from taking advantage of them and crossing the highway.

Key words: A-4 highway, Poland, fauna passages, using

1. Introduction

Poland is a country in which in general the natural landscape, forests, meadows, pastures, and marshy and peat-bog areas have been preserved. Proof of this is, among other things, the richness of birds and other wildlife. We currently have approx. 40 thousand pairs of storks. Every third stork of the world census lives in Poland. According to the Central Statistical Office census from 2005, the number of wild animals as of March 31, 2005 was: 13,115 fallow deer; 3,896 elk; 1,684 mouflon; 140,700 red deer; 691,600 roe deer; 173,500 wild boar; 201,200 fox; 475,400 hare. We therefore have a lot to protect. Wildlife is the natural wealth of nature and, as men do, animals have the right to live; therefore, we need to do all we can to preserve this wealth for generations to come.

However, roads, fast train lines, and in particular highways – due to the fact that there is very dense traffic there and that they are fenced – are an impassable barrier for wild animals.

Fauna have traveled hundreds of kilometers for years on well-known migration routes located in ecological corridors. Cutting these migration routes with highways and motor ways, as well as with fast train lines makes the migration of wildlife that cannot live normally in a too-small area impossible (Fig. 1).

Due to fragmentation of the landscape and contact being broken between remote and unrelated populations, animals are forced to exist on isolated patches of land and cannot migrate. Mating between genetically unrelated populations is impossible, and the lack of a broad gene pool results in their gradual degeneration, weakening their inborn resistance to diseases, which in the end leads to populations' gradual extinction.

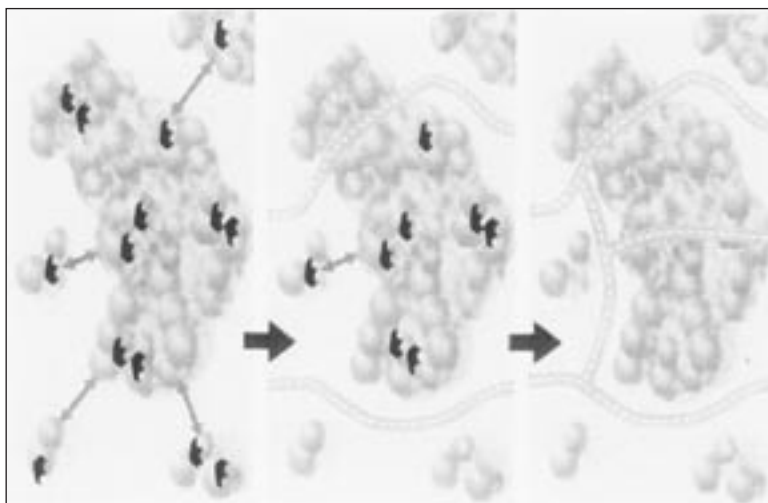


Fig. 1. Fragmentation of the landscape with roads and highways of dense traffic eliminates wildlife that cannot live in a too-small area from the environment (IENE, 2000)

2. The existing and planned network of highways in Poland

Currently in Poland we have fragments (sections) of highway of the total length of 398 km. The latest projects from the year 2002 provide that by 2010 we will have built 1,586 km of highways and we will have in total approx. 2,000 km. This is the necessary minimum. The network of motor ways (express roads) will also be modernised and extended.

Highways, due to their high technical requirements, brutally cut through the environment and are usually fenced; they are, therefore, an impassable barrier for wild fauna. The planned network of highways and modernised motor ways will fragment the migration routes of wild animals. The most seriously endangered by habitat fragmentation will be elks, which move from the rich habitats of the northeast regions of Poland towards the western border of the country, from where, across the River Odra, they go to Germany and south to Czech and to Slovakia. These routes are also traveled by deer and wolves, and these migrations take place in both directions.

3. The condition of wildlife overpasses over the A-4 highway in the Opole region

The A-4 highway on the segment in the Opolskie Voivodeship runs for 89 km, 32 km of which run across forest areas rich in wildlife: red deer, fallow deer, roe deer, wild boar, hare, and fox. Periodically, elks traverse these areas. On this section, five bridges were constructed, designed especially for wildlife.

The designs of the bridges were prepared by TRANSPROJEKT from Kraków. The bridges are too narrow (10-12 meters) and their surfaces, even of those serving exclusively for animals, were to be cobbled. As ordered by ATMOTERM Sp. z o.o. under the supervision of the author, an evaluation of the bridge designs was performed in the Agricultural University of Kraków. Due to the richness of wildlife and their migration, also including elks, the University proposed bridges 70 meters wide, but due to the cost, the designs were not modified but accepted, changing only the concrete bricks which were to be on the surface to soil and grass, as well as trees and bushes.

Seeing during the discussion that the designers and road planners lacked understanding, the author wrote to *Łowca Polski* an alarming article entitled “*Autostrady i zwierzyna. – Czy tylko au-*

tostrada opolska będzie zabójcza dla zwierząt?” [‘Highways and wildlife – Will only the Opolska highway be deadly to animals?’] (Curzydło 1998).

In order to make clearer the problems related to the design, construction, and functioning of green bridges and culverts, as well as to submit the outcome of research in this area in Poland, the author, from 7th to 10th September 1999, organised the International Seminar in the Agricultural University’s Congress Centre in Kraków (Curzydło 1999). The seminar was attended, among others, by: V. Keller (Switzerland), B. Georgil, U. Tegothof and M. Kilka (Germany), A.A.G. Piepers (The Netherlands), and F. H. Voelk (Austria). They gave very interesting lectures and presented films from video cameras installed on the bridges and culverts. All the lectures were printed out in 450 copies and distributed to the participants of the Seminar.

The first day was designed for learning about the bridges and their location in field. The specialists from abroad were critical about the width of the bridges and the concrete containers. Trees and bushes need to be planted directly in the appropriate soil laid on the surface of the bridges. The bridges, in order to be effective in particular for larger mammals (red deer, elk) should be at least 50 meters wide. At the beginning of the 1980’s in Western Europe, narrow bridges were built (8-15 meters), but now, based on experience gained, they are no longer that narrow.

Wild animals are claustrophobic and do not enter narrow and fenced bridges. The surface of bridges, as well as the so-called ‘funnels’, need to be planted with guiding trees and bushes that encourage the animals to cross the bridge.

[It should be noted that as a result of the organisation of the International Seminar in Kraków in 1999, Vägverket – Swedish National Road Administration, in agreement with the General Directorate of National Roads and Highways, and in connection with experience in the field of fragmentation of habitats and infrastructure development, Józef Curzydło was appointed to the position of the National Coordinator for Poland and Joanna Zaifryd was appointed to the position of Sub-Coordinator (Vägverket nomination of March 8, 2000)].

When driving on A-4 from Wrocław toward Gliwice, we encounter in the Opolskie Voivodeship five bridges built especially for wild fauna. Visually, from the road they look excellent. The first bridge with open-work fence is at km 217.7 (Fig. 2). Unfortunately, this beautiful and structurally solid bridge is not accepted by wildlife, the proof of which is the complete lack of traces of migration of fauna (Fig. 3). Animals emerging from the forest (Fig. 4) do not see any trees on the other side of the bridge, only some building structures that limit their free flight, and due to the fact that they are claustrophobic, they do not use these ‘green’ bridges. The situation could change if the so-called “funnels” and the surface of the bridges are planted with vegetation guiding strips, which the author has called for for many years (Curzydło 2002; Curzydło J. & Curzydło M. 2002).

When we travel from Wrocław to Gliwice, we can see the third fenced bridge at km 230.3. A fragment of the bridge surface is presented in picture, which was taken in spring 2000 (Fig. 5). As the author predicted, junipers withered and the bushes of broom will wither ‘later’. Now, only weeds grow there, as can be seen in picture (Fig. 6).



Fig. 2. A bridge with an open-work fence at km 217.7, situated amidst forests. ‘Funnels’ are not planted with trees or bushes



Fig. 3. Wild fauna does not use this bridge



Fig 4. The bridge at km 228.5. Animals do not use this bridge



Fig. 5. A fragment of surface of the bridge with containers and withered junipers. The broom will need more time to wither



Fig 6. The same fragment of the bridge surface presented in Fig. 5.
In order to precisely weigh the soil and the lower layer of fine filtering stones, the contents of container 1 were taken out and weighed

As can be seen in photographs (Fig. 2-6), as well as the ones presented in the study done in the year 2004 as ordered by the General Directorate of State Forests (Curzydło i in. 2006), and in publication in *Magazyn Autostrady* (Curzydło i in. 2001), it is indeed very difficult to comprehend why TRANSPROJEKT from Kraków thought up such a strange management of the “greenery” of the surface of the bridges and the access paths to them, the so-called “funnels.” At the edges of the bridges, heavy concrete containers were designed, 2x1 m in size and 1 m high. They were filled with soil, and juniper and broom were planted inside. As foreseen in 1999, the juniper and broom

withered and now only weeds grow there. There are no guiding paths to the so-called 'funnels'. The designs also envisaged paving the surface of the bridges with concrete bricks – even on bridges in forests, designed exclusively for wildlife. The only critical remarks of the author that was accepted was that concrete bricks be replaced with a layer of soil and grass.

As is presented in photography (Fig. 6), soil with small stones was taken out from one of the containers and weighed. The weight was 2.6 tonnes x 44 containers = 104 tonnes. Under the soil, at the bottom of the container, there is a layer of approx. 15-20 cm of small stones. Their weight is 0.848 ton x 44 containers = 37 tonnes, which means that the total load of only soil and filtering stones = 141 tonnes. This is a tremendous load for the bridge, to which we should also add the weight of the empty concrete containers, which, considering the fact that it is heavily reinforced concrete, must weigh twice as much as the soil and small stones. Instead of these unfortunate containers (which in addition narrow the surface of the bridge), a thicker layer of soil should be laid, which the author has long petitioned for (Curzydło 2002; Curzydło J. & Curzydło M. 2002). In the authoring study 'Design and preparatory works for the modernisation of the wildlife overpass over the A-4 highway near Prószków Forest Inspectorate' (Curzydło i in. 2006), it was proposed that fragments of these ineffective containers be cut off and removed together with their contents, and in their place a layer of 60-70 cm acidic soil from the surrounding forest should be laid down, and in this soil forest trees should be planted (the same species as in the surrounding forest). The modernisation pertains not only to the bridge at km 230.32, but to the other four bridges within the Opolskie Voivodeship as well.

The conclusion of the description of the functioning of wildlife bridges over the A-4 highway should also include positive facts. The two most recently built bridges in the Gliwice region (within the Silesian Voivodeship) are 32 meters wide, without these unfortunate concrete containers and with smoother and elongated funnels. The layer of soil laid on the bridge surface is approximately 40 cm thick and on it grow noble grasses, shamrock, and clover. These tasty plants attract animals, who use these bridges, as when they come out of the forest as a result of smoother funnels, they see tops of trees at the other side of the bridge and are thus encouraged to cross. The planting on the surface of bridges and funnels is, however, poor (crooked, weak). They were planted with forest trees, i.a. spruce, pine, linden, birch, berberis, and euonymus.

When we discuss wildlife bridges in the Wielkopolskie Voivodeship, at the Konin- Września section of the A-2, they are 32 meters wide, but again with these unfortunate (although lower) containers. Unfortunately, they have not been planted with trees or bushes.

There is a relatively good bridge, 33 meters wide, in the Poznań region in the Wielkopolski National Park over road no. 5 Leszno-Poznań. Funnels are smooth, planted with trees, as is the surface of the bridge. Animals use this bridge (Figs. 7 and 8).



Fig. 7. A bridge in the Wielkopolski National Park over road no. 5 (photo by J. Konopka)



Fig. 8. Both the surface of the bridge and the so-called 'funnels' have been planted with spruce and pine (photo by J. Konopka)



Fig 9. Belgium. A bridge over the highway between Brussels and Luxemburg in a forested region. It is only 8 meters wide, but very well managed. The bridge surface is leveled with the surrounding forest. Roe deer use this bridge



Fig 10. Germany. Road B31. One of several wildlife bridges, 33 meters wide. The road surface near the bridge was lowered



Fig. 11. Switzerland. One of the new bridges over highway N7. It is 200 meters wide. This is a super-comfortable bridge in a flat area, but the roadways of the highway were lowered. The level of the bridge is similar to the level of the surrounding forest

4. Wildlife bridges and culverts in some European countries

Wildlife bridges and culverts I have described in detail together with photographic documentation in some publications (e.g. Curzydło 2002; Curzydło J. & Curzydło M. 2002; Curzydło & Polak 2004; Curzydło i in. 2006). Moreover, the detailed description of wildlife passages together with photos was

presented in the report on the results of research for Scientific Research Committee (the authoring project No. 6PO4G06715). In this article We present just a few examples (Figs. 9, 10 and 11).

5. Conclusions

The five bridges constructed and commissioned in the year 2000, built especially for wild fauna in the Opolskie Voivodeship over the A-4 highway do not perform the functions designed for them. The bridges are too narrow, but their most serious fault is the complete lack of management of planting of trees and bushes, which encourage and guide animals to cross the passage. Animals, including red deer, wander along the fence and stop in the lower parts of the so-called funnels, but because they are claustrophobic they fear to enter the bridge, because they see some barriers (palings, a fence), and because they see no trees or free space on the other side of the bridge, they do not enter the bridge. An exception is the bridge at km 230.3, near Prószków. The access to the bridge, the so-called 'funnels', are more elongated and smoother; therefore, animals coming out of the forest see tree tops on the other side of the bridge and are slowly starting to cross the bridge.

It is indeed hard to understand the origin of the idea of heavy concrete containers by the designers from TRANSPROJEKT in Kraków. Despite fierce criticism from the author in 1998 (Curzydło 1998) and from specialists during the International Seminar from 7th to 10th September 1999, neither designers nor road builders participating in this seminar accepted any of the critical remarks or proposals.

It should be regretted that following the construction of these 'white elephants', neither the contractor nor the road builders took any interest in what happened to the junipers or brooms planted in containers, or in the shrubs and trees planted on the so-called 'funnels'. They just withered.

The question is where the contractors deposited the surface layer of valuable humus stripped from a 30 km forest section of the highway. Both the containers and the so-called 'funnels' were filled with poor alkaline chalky clay soil, in which tree vegetation will not grow.

There is an urgent need for repeated management of vegetation of both the so-called 'funnels' and the surface of bridges. Heavy concrete containers need to be removed and in their place good soil should be placed – acidic humus from the surrounding forest and trees should be planted there, as is envisaged in the project submitted on November 15, 2004, prepared by AR (Agricultural University) of Kraków for the General Directorate of State Forests.

When we drive on the A-4 highway towards Wrocław, we encounter two good wildlife bridges, 32 meters wide and without these unfortunate containers and with 'better soil', a mix of good grasses with papilionaceous plants, as well as trees and bushes planted directly in the ground. It is still surprising that the road builders spent millions on the construction of the bridge but planted sickly and already partially withering trees. Why did they not spend just a few thousand zlotys on planting trees?

Our country is at last starting more intensively the delayed construction of highways as well as wildlife bridges. Road planners should cooperate with foresters, environmentalists, and hunters.

There are numerous dissertations supported by the results of research, conducted in Western Europe (among other places) under the supervision of the Swiss Ornithology Institute SEMPY (the renowned specialist Dr. Verena Keller, Hans Peter Pfister, and others: A.A. Piepers, Udo Tegohtof, Bertram Georgii, Friedrich H. Voelk, and others).

Since 1990, there have been many research papers prepared regarding conflicts between wildlife and roads (including 'Environnement Faune construction de routes et trafic'. Copyright: SBF 1995). Recently, two volumes of results of research were published in COST Action 341 and COST 341 (2003). The results of this research were presented at the International Conference 'Influence of transport infrastructure on the nature' in Poznań (2006).

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