

Dealing with bats: monitoring of the mitigation process and the effectiveness

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Abstract. The article draws the attention to the significance of monitoring for effectiveness of mitigating means used in case of natural habitats fragmentation caused by transport infrastructure. A problem was illustrated on the example of activities taken in Holland in connection with the construction of road N296 and N297, which threatened, among others, populations of 3 species of bats.

Key words: road, bats, mitigation, compensation, ecoduct, ecombiduct, monitoring, Netherlands

Since the seventies the Netherlands has taken several measures to counteract the fragmentation of habitats. In spite of the strict protection of bats (EU Habitat Directive) there has been only recently some serious attention for the effectiveness of infrastructure on bats. In the Province of Limburg some new infrastructural projects among them the building of the N296 and N297 (Fig. 1), are the first projects in the Netherlands in which mitigation and compensation measures for bats are implemented on a large and innovative scale.

The first step in the process of protection measures was a field research. This field research showed that in case of the N296 and the N297 the Daubenton's bat (*Myotis daubentoni*), the Common pipistrelle (*Pipistrellus pipistrellus*) and the Serotine (*Eptesicus serotinus*) use the habitat within the sphere of influence of these (new) roads (Figs. 2 and 3).

After the analyses of the flyways and hunting ways (there were no maternity places), the mitigation and compensation measures were determined.

Because of the construction of both roads, trees had to be cut, through which forage area of bats disappeared and flyways of bats were interrupted (Fig. 4). In the new situation flyways are being restored with the planting of trees. On the roads that lose their function after finishing the N296, the asphalt will be removed and trees will replace the asphalt (Fig. 5). As a result the living area of the bats will increase with about 12,000 m² after the road is realized.

With the project N297 a tree zone of 2.5 ha was planted as a compensation of the lost of ca. 4300m² hunting/forage area. With the construction of the N297, a bridge was heightened in a way that flyways of Daubenton's bat will not be disturbed. On a other interrupted flyway trees of 6 metre high were planted to restore this flyway. An exceptional mitigation measure which is implemented is the construction of a so-called ecombiduct (Fig. 6). This ecombiduct is situated on a former flyway of bats which is interrupted by the new road (Fig. 7).

The ecombiduct is in fact a combination of a (in this case small) ecoduct and a badger tunnel (ø 40 centimetre). It's dimensions are 3 metres width and it reaches 42 metres. On this ecombiduct a 2.5 metres high hedgerow will be planted especially for the bats to restore the flyway. These hedges can also be used by other species like birds and insects as habitat and as orientation. The ecombiduct will also be useful for other wildlife, such as amphibians, reptiles and small mammals.

Also unique for this concept is the tunnel in the surface of the crossover. In this way animals have the choice to cross the road safely through the tunnel or over the ecombiduct. The tunnel can be very useful especially for animals that fear the traffic lights and the traffic noise. Two big pools on both sides of the ecombiduct have been realized intended to stimulate the use of the passage and to attract bats such as Daubenton's bat which hunt for the insects on and above the water.

The last step in the process is the monitoring. This monitoring already started during the constructing of the road. The results validated the forecasting that the flyways and huntingways of the bats were affected. Monitoring proves also the evidence of flyways and underlines the necessary of a license. Another advantage of monitoring during the construction phase is the possibility of fine-tuning of the recommendations of the researcher with the contractor. In this way ad hoc measures are possible. In this case for example the lighting of the construction site was adapted in a way that bats were not impeded by the light during their hunting.

Meanwhile some other new infrastructural projects have been prepared. The acquired experience with the N296 and N297 has now been applied in these projects and in some cases optimized. For example a new kind of street light has been introduced, because it has been proved that the standard street lights affect some bats. This new lamp limits the dispersing of light. At the same time these new kind of street lights supports the policy of reducing the light nuisance.

This year and next years the monitoring program will be continued to find out whether the mitigation measures for the bats and the other animals will be successful and were implemented in a correct way. The first results are anyway encouraging. At this moment foxes, stoats, mice, rabbits use the ecombiduct already and the pools have already attracted some Daubenton's bats. Also some Noctules (*Nyctalus noctula*) were located, a bat specie which was never found before in this area. After the hedgerow will be planted on the ecombiduct, the monitoring will focus on this section to verify if the former flyway of bats will be restored.

Monitoring appears to be an indispensable instrument to verify the function of compensation and mitigation measures. It can contribute to an optimization of the function and so in some cases to adaptations of these measures. In this way it can justify the choice of compensation and mitigation measures such as fauna passages. Last but not least it's therefore also important to communicate the results to insiders (scientists, officials and politicians) and to the people living in the neighbourhood.

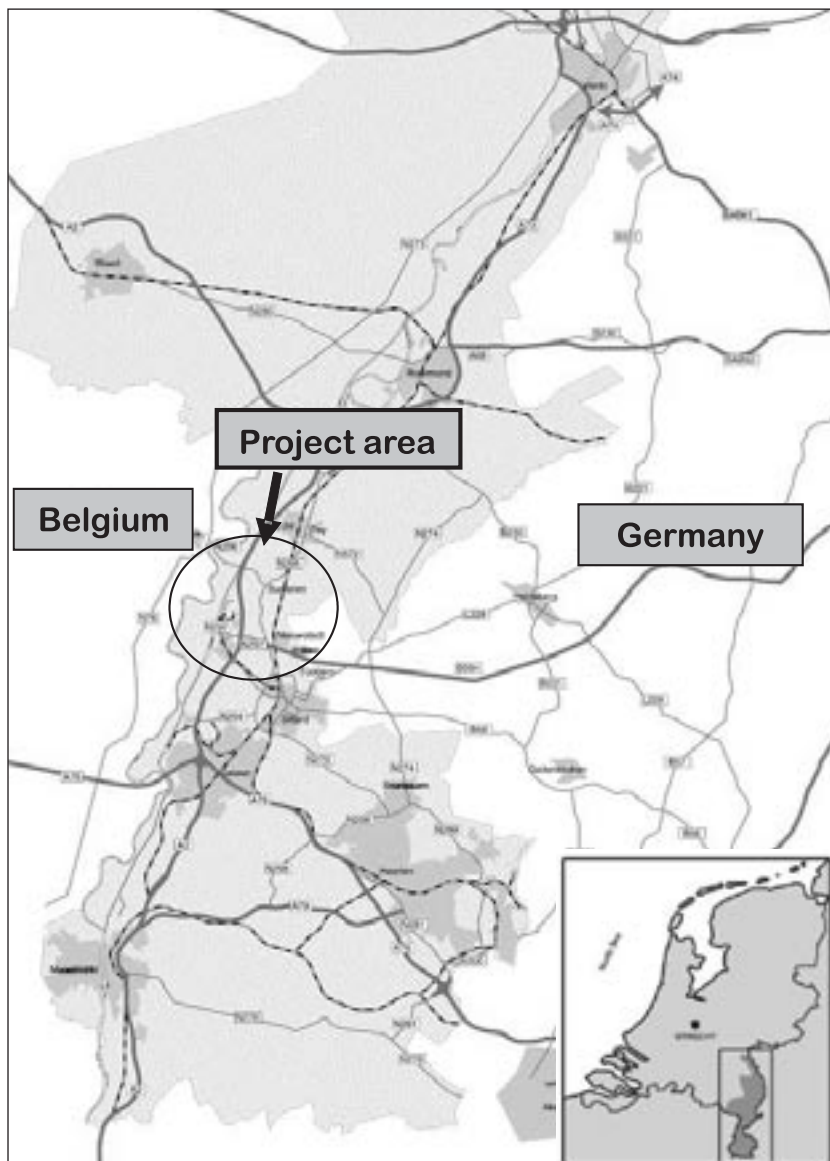


Fig. 1. Project area of the roads N296 and N297

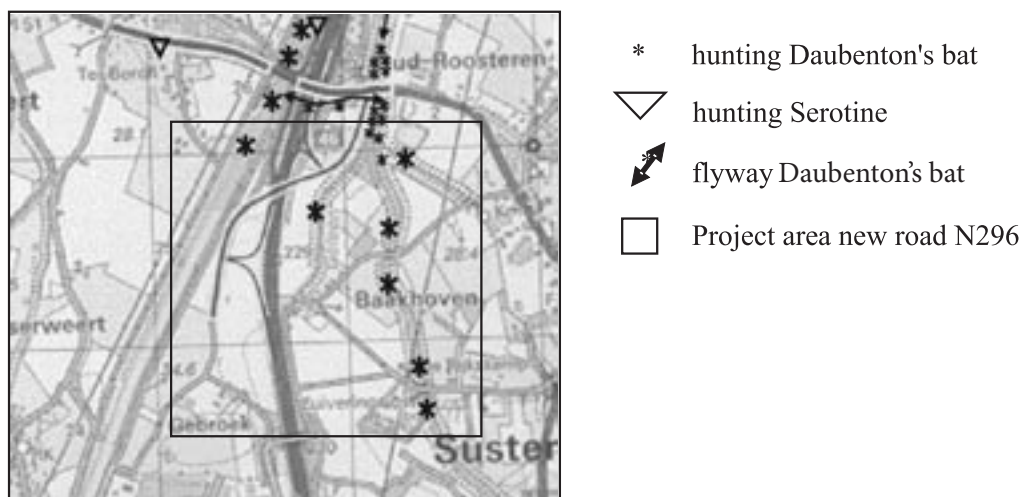


Fig. 2. One of the results of the field research in case of the N296



Fig. 3. Impression of the habitat and the flyway of bats near the planned N296



Fig. 4. Cutting of trees



Fig. 5. Planting on roads which lose their functions



Fig. 6. The ecombiduct is a combination of a (in this case small) ecoduct and a badger tunnel

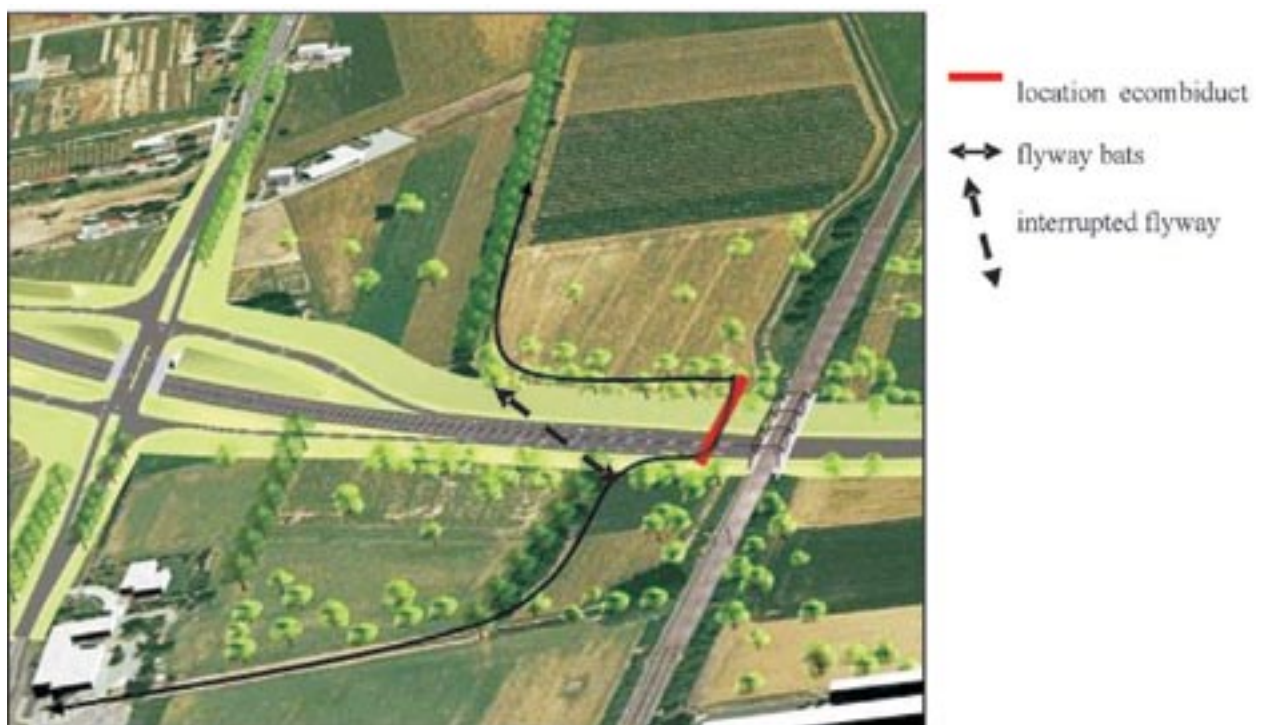


Fig. 7. The ecombiduct is situated on a former flyway of bats which is interrupted by the new road