

# Research on Measures and Improvement of Fragmented Ecological Protection in Road Construction

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## ABSTRACT

With the continuous improvement of road construction, roads run through wildlife protected areas and areas of wildlife distributions have become more and more often. It cuts full landscape and broke the habitat of the wildlife which caused wild animals with high risk when they are passing through the broken partial region to another. It also makes the construction of the road leads to the crushing of animals habitats, plant and animal populations may become isolated at the same time. This study will explore measures to protect the surrounding ecological environment in the process of road construction. After reviewing other researches, it can be concluded that the best way is to build a wildlife corridor. And we can make it better by combining it with an infrared field monitor. We can have human assistance and adopt the law to strengthen the protection measures. We can also slow down the roadbed, limiting the speed of vehicle travel through the road section. Other measures, such as wildlife warning signs with legal effects on both sides of the road, will have a greater impact on wildlife protection. This study will consider the most appropriate solutions for the current situation, providing feasibility recommendations for wildlife protection in highway construction, which will provide a reference for the road design and construction departments and also for the animal protection organizations.

**Keywords:** *wildlife corridor, road construction, wildlife protection*

## 1. INTRODUCTION

The background of this research is that human and animal harmonious development has always been a great question worthy of concern. People should all follow the principles of green construction and the principles of humanity and environmental peaceful development when conducting the engineering implementation and construction. The current development of road in various countries is growing and rapid, and the economic speed in the surrounding area is continuously promoted. Even though it brings a lot of benefits to human beings, it also causes huge damage to the surrounding environment and animals, especially to the animals that live near it. The isolation caused by roads hinders the movement of wild animals and the exchange of genes between species, putting great pressure on them to survive.[1] In order to reduce the impact of highways on Wildlife, ecologists propose the establishment of Wildlife corridors, which connect

fragmented patches of habitat and provide continuity among communities, species and ecosystems.[2]

Therefore, it is the key content of this paper to ensure the safety of animals while satisfying the development of roads. And for now the most useful and important measures adopted by wildlife protection in the process of highway construction are to establish a wildlife corridor to solve the problems of environmental separation, habitat breaking, and other issues as much as possible. At the same time, foreign countries, especially in Germany, the United States, Switzerland and other countries, their wildlife corridors have a long history. From the 1950s, some ecologists and civil organizations in the 1960s began to pay attention to the effects of roads and railways on wildlife habitats and direct damage to their lives. [3] For example, in 1994, the world's first wildlife passage was established for the first time on the Route 46 in Florida. The domestic current situation is still in its infancy, has attracted the attention of a large number of scholars and

has gradually improved. In 2005, some researchers conducted a preliminary study on wildlife protection in the construction of the Qinghai-Tibet Railway.[3] By reading and checking other references, we want to understand the geological conditions and terrain conditions in the area where the road will be built, to understand the habits of the local animals, and to find the most suitable wildlife corridor in the area. What kind of wildlife corridor should be built to better guide animals to pass, rather than just play a decorative role with no practical value. And what auxiliary facilities can be added on the basis of animal channels to better help animals to pass through, and whether we can use mobile phones to further help wild animals to pass safely on the road. We predict that the development direction of the future road will develop and progress together with the animal corridor, so as to achieve rapid development on both sides. At the same time, with the popularization of mobile phones, almost everyone has a mobile phone, so we suggest that the phone be combined with navigation and infrared monitoring devices to carry out voice reminders in the process of navigation, so as to further improve the vigilance of drivers in road driving. This paper will consider the most appropriate solutions for the current situation, providing feasibility recommendations for wildlife protection in highway construction, which provide reference for the road design and construction departments and also for the animal protection organizations and make a great contribution to animal protection.

## **2. THE IMPACT OF ROAD CONSTRUCTION ON THE SURROUNDING ENVIRONMENT**

### ***2.1. Effects of animals and plants during road construction***

#### ***2.1.1. Noise interference to animals***

There will be a lot of noise generation and giant machinery, which will have an effect on animals that are sensitive to sound or timid with their physiological functions and to a certain extent it will mix up their ability of judgement. It means that they will have an impact on their living. Since the time to build the road is long, the noise will last for a certain period of time, and it will even affect their breeding and give up the original living environment. And for migration species, it will be really hard for them to pass a road segment that is still under construction with a great noise.

#### ***2.1.2. Vegetation reduction destroys local biodiversity***

During the road construction, there is a need for a large amount of surface area to be excavated. There is a

large number of vegetation to be destroyed, especially in some fragile ecological environments, such as the domestic Heilongjiang, Northeast China due to the cold and frozen soil environment, etc., caused the local ecological environment is very fragile. Decomposition and damage caused by the frozen soil environment during the road construction process, leading to changes in soil physicochemical properties and caused deterioration of vegetation survival, further exacerbating soil loss, resulting in surface vegetation degradation. [4]

#### ***2.1.3. People in construction have a serious impact on animals (hunting)***

During the construction process, due to there isn't any clear laws and regulations in some regions, it didn't point out clearly that Hunting wild animals are forbidden, or because of the construction of road workers do not have a high degree, or understand the law so well, so sometimes it can't help that they will do wrong things like trying to hunt up the wild animals around them. It will affect the local animals directly.

### ***2.2. Effects on animals and plants after the completion of highway construction***

Animal migration generally refers to the behavior of movement from one area or habitat to another.

It is well known that animals migrate over a certain distance for reasons of reproduction, foraging, climate change, etc., rather than being fixed in a single area, they usually migrate along areas near water where food is abundant.[5]

During the migration, it is very dangerous for them to cross the road to reach another region or habitat, especially for mammals that need to migrate because the road did nearly no influence on the migration of birds, fish and insects. Mammals are usually not in the form of an individual in the migration process but a group, which means that the time that needs to cross the road, and the uncertain coefficient will greatly increase.

## **3. THE PROTECTION MEASURES FOR THE IMPACT OF ROAD CONSTRUCTION ON THE SURROUNDING ENVIRONMENT**

### ***3.1. Protection of animals and plants during road construction***

In the construction process we can set the sound barrier around to block the propagation of noise, and try to avoid passing through an animal distribution intensive area and a large amount of vegetation in the road design construct. At the same time, the position of

the wildlife corridors should be reserved in the design chart.

### 3.2. Protection of plants after the completion of the road construction

After the road construction is completed, noise barriers should be set up on both sides of the road under feasible conditions. If a large area of plants is destroyed, manual rescue should be carried out. We can use the field infrared monitor to monitor the nearby animals. With the development of the network, we can use the combination of mobile phones and infrared monitors to further improve protective measures against wild animals crossing the road. There are very few wild animals in the general urban area. And generally when leaving the city, people tend to choose to employ map navigation to guide the way. We can use satellite positioning combined with infrared monitors. When people pass by the road with wild animals on the side of the road, they can be reminded to slow down and pay attention to the surroundings through voice broadcast, which can better prevent the time of harming animals. And in the season of wild animal migration, we can call on volunteers to help stop vehicles to make the road better and safer for animals, and animal migration will not stop due to continuous traffic.

### 3.3. Build wildlife corridors

#### 3.3.1. Introduction to Wildlife Corridor



Figure 1 A wild animal appeared near the culvert



Figure 2 G575 culverts connect mountain forests and grasslands in Xinjiang, China

According to the animal's habits, the corridor can be mainly divided into three types. The first kind we can call is tunnel or pipes, the second one is overpass and the third one is underpass. Depending on the corridor size, it can be divided into a large one and a small one. The small corridor refers to a passage of diameter or height of less than 1.5 m, mainly including amphibian underground tunnel and a variety of ecological culvert (ECO-PIPES) also ECO-culverts. The large corridor refers to a passage of diameter or height greater than 1.5 m, including two types of overpass and underpass, mainly designed for large mammals and various types of animals.[6]

Culverts are primarily designed for small animals, such as small mammals or two-toed reptiles. When the road passes through wetlands, rivers, etc., in order to protect the amphibious and crawling wild animals in this area, culverts can be set up to reduce the free migration of wild animals. Culverts are small in size and generally made of smooth metal or plastic. The bottom of the culvert is laid with gravel, vegetation, etc., which is conducive to guiding animal migration.

The upper-span wildlife corridor is mainly built for large-scale wildlife, forming a mode of getting on and off the beast, also known as the green bridge. The car is lower, so the animal cannot see the multiple of the traffic flow, so the animal will feel less nervous, but it can also ensure that the animal has a wide field of vision. There will be a lot of vegetation around it, and there will be tree shadows. This can not only improve the safety of animals, but also effectively reduce traffic noise. At the same time, it also satisfies the characteristics that mammals do not like to drill holes.

The Underwear Wildlife Gallery is for medium-sized wildlife. It can use local terrain bridges to build roads, thereby avoiding the environment of the animals below. And underwater wildlife corridors can avoid the intersection of traffic and animals, allowing animals to pass this section safely. The animal's field of view should be guaranteed during the design process, making sure it is wide enough.

### 3.3.2. Factors affecting animal corridors

Clevenge[7] suggests that the factors influencing the animal's use of the passage mainly include: design characteristics of the passage (such as the size, location and type of the passage), characteristics of the surrounding landscape, and the degree of human interference in the vicinity. Generally, it takes several years for the artificially constructed animal passage to adapt to wildlife.[8]Yin Bao method [9] and other researchers have studied the Qinghai-Tibet railway and highway and found that animals mainly use bridge channel to cross the railway and highway, and cement square channel and Qingshuihe bridge are rarely used. It is believed that the main reason why the cement channel can not be utilized is that the height and length of the channel are not enough. Meanwhile, ungulates have a large field of vision, and small channels may be avoided by ungulates as predation risk sources. Therefore, the negative effects of these factors should be fully considered when constructing wildlife passage.

### 3.3.3. Method for increasing the utilization rate of corridors

Once these passages are in place, we need to help animals understand and adapt to this new structure, so that they know that they can use this passage to navigate the dangerous path and reach the opposite side safely. This needs to help them build trust in the channel. We can grow the same plants to increase their sense of security and lure them through, or we can lure them with food to slowly approach and become familiar with it until acceptance. And with some animals, you can use scent to guide them, attracting them to approach and pass. Elsewhere, we can put barriers in place to help them form memories just by going through the corridors, preventing the animals from hitting the road again.

### 3.3.4. Additional measures to assist animals in the wildlife corridor

Road kills have been increasing as many roads do not have corresponding wildlife corridors. Some roads only have culverts that only reptiles can pass through, and mammals can only pass by luck. Therefore, a separate large wildlife corridor needs to be established during the construction process. When there are a small number of wild animals, in order to save costs, it can be considered not to build a wild animal corridor, but try to make the road ensure the vision of the vehicle driver, set up speed limit signs, and set up wild animal signs on both sides to remind drivers. At the same time, strengthening the rigor of laws and regulations and increasing punishment can make people pay more attention to this issue. Today, when the law is highly popular, education and publicity work can accelerate people's awareness of the seriousness of the problem. At

the same time, we can use infrared monitors for monitoring and early warning, and map software for real-time reminders and broadcasts. For example, during the migration season of Tibetan antelopes, some volunteers can also intercept vehicles so that the antelopes can pass safely.

## 4. CONCLUSION

This study will explore measures to protect the surrounding ecological environment in the process of road construction. And the following conclusions can be listed as below. First, the impact of noise on wildlife needs to be addressed. To address this impact, the anti-noise screen can be built during road construction. To isolate the noise to reduce the impact on the surrounding environment and wild animals, after the completion of the construction. Workers should try to find the best way to achieve the noise reduction from the vehicles that pass everyday. To avoid excessive noise affecting the behavior of wildlife. Secondly, wildlife corridors should be built absolutely where geological and economic conditions permit. Especially when the road is passing through an area with high concentrations of wildlife, we should try to build suitable corridors for the animals to pass from one side to another. It's necessary to make efforts to restore the damaged vegetation at the same time. Third, if there is no condition to build the wildlife corridor, workers or managers can do other things to reduce the possibility of road kill event, such as building a smooth road, setting the deceleration sign, and cooperating with an infrared monitor and other auxiliary operations. Human volunteers also need to help during the peak migration season. However, this research also contains many omissions in the research process, which need to be further strengthened. For example, the combination of navigation and field infrared monitor is not implemented at now. It needs to make many more efforts and time to come out. The future should take advantage of the convenience of the Internet and the general improvement of people's quality to live a reasonable and harmonious life with wild animals sharing the earth. which also provides reference for the road design and construction departments and also for the animal protection organizations.

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