

Road Deterioration on Delfin Huergo Street, in Paraná: Ecological Pavement and Implementation of Parking Lots

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Summary— This presentation is based in Paraná, which is the capital city of the province of Entre Ríos, the largest and most populated city in the province. The city is characterized by its streets with abundant traffic. Due to this traffic, the streets of this city deteriorate very easily. The purpose of this work is to describe and address the problem of road deterioration on Delfín Huergo Street, which is located next to the premises of the National Technological University, Paraná Regional School of Engineering. The use of ecological pavement and the implementation of parking lots on this street as a solution are also analyzed. To achieve this purpose, this work follows this order. First, the problem is contextualized and then addressed, as well as its causes and consequences are highlighted. Secondly, a solution to the problem will be addressed and its strengths and weaknesses will also be raised.

Keywords: road deterioration, ecological pavement, parking lots implementation, sustainable construction

Resumen—Esta presentación tiene como sede la ciudad de Paraná, capital de la provincia de Entre Ríos, la cual es la ciudad más grande y poblada de la provincia. La ciudad se caracteriza por sus calles con abundante tránsito. Debido a este tráfico las calles de esta ciudad se deterioran con mucha facilidad. El presente trabajo tiene como objetivo describir y abordar la problemática del deterioro vial de la calle Delfín Huergo, la cual se ubica al lado de la NTU PRS. También se analiza el uso de pavimento ecológico y la implementación de estacionamientos en esta calle como solución. Para lograr este propósito, este trabajo sigue este orden. Primero se contextualiza el problema y luego se aborda, así como se resaltan sus causas y consecuencias. En segundo lugar, se abordará una solución al problema y también se plantearán sus fortalezas y debilidades.

Palabras clave: deterioro vial, pavimento ecológico, implementación de estacionamientos, construcción sustentable

I. INTRODUCTION

This presentation is based in the city of Paraná and capital of the province of Entre Ríos, the largest and most populous city in the province. It has a total area of 4,974 km² and a population of 391,696 inhabitants.

The city is characterized by its streets with abundant traffic. According to the municipal transit area there is approximately one car every 3,5 inhabitants, so the streets of the city deteriorate very easily, and it is usually normal to hear it nicknamed, informally speaking, as the "city of potholes".

The purpose of this work is to describe and address the problem of road deterioration on Delfin Huergo street, which is located next to the NTU PRS, where the subject English I is offered. It also analyzes the use of ecological pavement and the implementation of parking lots on this street.

To achieve this purpose, this work follows this order. First, it is contextualized so that the problem can then be addressed; as well as this, its causes and consequences are highlighted. Second, a solution to the problem is going to be addressed and its strengths and weaknesses are also going to be raised. This project is expected to contribute to the analysis of the use of ecological materials in civil works to deal with road deterioration issues.

II. PROBLEM DEFINITION AND ANALYSIS: DAMAGED ROADS ON DELFIN HUERGO STREET

As stated in the introduction, there is a road deterioration problem on Delfin Huergo street, in Paraná. To understand this problem, it is first necessary to describe its context.

A. Description of the Context

The city of Paraná is located on the banks of the Paraná River as shown in Fig. 1. This city has very good views thanks to its coastal promenade that overlooks the river. In addition, it has several universities, making it a city with a great academic offer.

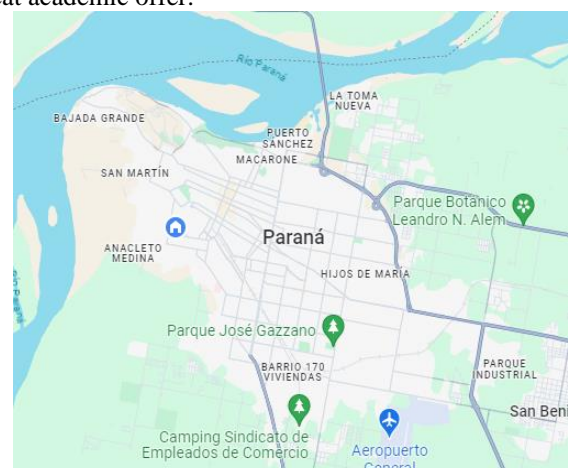


Fig. 1. Paraná City Map

The city is divided by its municipality into five large units according to their areas. The areas are the central, the west, the southeast, the northeast and the southern areas. Fig. 2 shows each unit differentiated by colors.

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Fig. 2. Units of the city of Paraná.

Within the northeast area, at 1033 Almafuerte Street, the NTU PRS is located. This is a school of engineering, which offers three career paths. They are Civil Engineering, Electromechanical and Electronics Engineering. Due to its large capacity for both students and teaching and non-teaching staff, it has a parking lot that connects with Delfin Huergo Street, as it can be seen in Fig. 3.



Fig. 3. Entrance to the UTN parking lot.

As can be seen in Fig. 4, cars park in the parking area of Delfin Huergo street. Also, due to its large circulation of vehicles by people who go to the school, this street is very deteriorated with large potholes that, on rainy days, are covered with water and are not visible, so circulation is affected. Fig. 5 shows the potholes with water.



Fig. 4. Delfin Huergo Street.



Fig. 5. Potholes with water.

As the pictures show, this street is heavily used every day and it is not in good conditions. By driving on this road, people are at risk of having problems with both the car and their safety.

B. Problem Statement

In general, the cracking and deterioration of the pavement in the city of Paraná is a frequent and complex problem that greatly affects the road infrastructure. In this project, emphasis will be placed on Delfin Huergo Street, where the NTU PRS parking lot entrance is located. Many people attend NTU PRS by car so this traffic causes pavement deterioration and a shortage of parking spaces on Delfin Huergo Street.

C. Description of Scenes that Help Picture the Problematic Situation:

The deterioration of the road and the lack of parking spaces on Delfin Huergo Street in the city of Paraná is something that NTU PRS students and staff are used to living with. There are many scenes that can help understand the problematic situation that students and staff who work at school experience every day.

Fig. 6. shows one of the deepest potholes, which is located just outside the entrance to the NTU PRS. If people drive over it without spotting it, they could damage their vehicles.

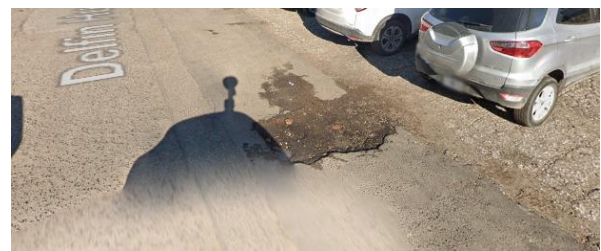


Fig. 6. Deepest pothole on Delfin Huergo street

The lack of parking spaces on Delfin Huergo Street is a recurring problem on this road. The strong need for a lot of vehicles to park causes drivers to park in places where there is dirt, which can stagnate on rainy days, as shown in Fig. 7.

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Fig. 7. Parking on a rainy day on Delfin Huergo Street

On rainy days the problems increase because the potholes are covered with water, and it is very difficult to see them, as shown in Fig. 8. This causes difficulty when driving on this street and could lead to a road accident.



Fig. 8. Potholes covered with water

D. Identification and analysis of causes or factors that give rise to the problem

There are different factors that contribute to the daily increase of the problem. Among them, this work highlights three of them.

The main cause of this negative situation is the high circulation of vehicles. This street, which leads to a main avenue in the city of Paraná, usually has a higher circulation than other streets.

A further cause is related to the lack of investment in pavement in the city's streets. The paving and maintenance of Delfin Huergo Street is very important since it is a busy street and it is located next to the NTU PRS, where many people attend.

Lack of investment in parking is another cause of the problem. The NTU PRS parking lot has few spaces compared to the number of students and staff, so the majority of them park their vehicles on Delfin Huergo Street. This situation worsens when it rains, since the NTU PRS parking lot is closed on those days due to its lack of pavement.

E. Identification and Description of the Consequences

There are many consequences related to the deterioration and lack of parking space on Delfin Huergo Street. However, three main consequences are considered, which directly impact the daily lives of people who live and circulate on this street.

The main consequence of this situation is that the large circulation of vehicles can cause accidents. It is a street with many potholes so people make difficult maneuvers to avoid them, which can cause accidents.

Another consequence of this situation has to do with the fact that vehicles can suffer breakdowns when circulating on Delfin Huergo Street. The pavement is in very bad condition. It has many deep potholes, and it is difficult to avoid them with cars. Furthermore, on rainy days this consequence is the most important since the potholes are covered with water, remaining invisible and worsening the situation.

Some of the NTU PRS students and staff must park their vehicles on the street, which also lacks good lightning, so they have no security. Furthermore, on rainy days, cars are parked and stuck in the mud.

III. THE WAY FORWARD; ECOLOGICAL PAVEMENT

The problem of road deterioration in the streets of Paraná, more precisely on Delfin Huergo Street is very important to be solved as soon as possible, because it can lead to serious consequences. Below, a solution for this problem with sustainable characteristics will be presented.

A. Problem Approach

The proposed solution consists in implementing ecological pavement for the repaving of Delfin Huergo Street. The ecological pavement consists of the addition of recycled polymers to asphalt to improve its mechanical properties. In this case, the incorporation of high-density polyethylene was chosen.

Next, the characteristics of the sustainable material, the asphalt binder and the asphalt mixture will be detailed, and then the stages of the process will be described.

1. Sustainable material (High Density Polyethylene):

The sustainable material used in this project is the polymer called high-density polyethylene from recycled bins. This is green in color and appears in the form of lentils as Fig. 9 shows. Its size is approximately 4 mm, and its average density is 0.930 kg/dm^3 .



Fig. 9. High-density polyethylene

2. The asphalt binder:

The asphalt used must meet certain characteristics. Casaux et al. express in [1] that "CA20 type asphalt" is used, shown in Fig.10. This material meets certain viscosity

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properties according to the IRAM-IAPG 6835:2002 standard.
Then high-density polyethylene is added to this material.



Fig.10. CA20 type asphalt

3. The asphalt mixture:

For the mixture, the asphalt is preheated to 170° and the recycled material from drums is incorporated in a proportion of 3% of the total asphalt. It is then mixed until obtaining a shiny and uniform asphalt with an appearance that is similar to that shown in Fig. 11.



Fig.11. Appearance of CA20 binder modified with recycled plastic

The process has different steps. Below these steps will be mentioned in detail.

Process steps:

Step 1: Demolition and removal of existing pavement

The existing pavement layer on the street must be demolished. In addition, any waste remaining on the surface of Delfín Huergo Street must be removed.

Step 2: Preparation of sub-base and base

The surface must be compacted with a roller as shown in Fig.12 to achieve good leveling. Then a layer of gravel should be added, thus forming the sub-base followed by a layer of a finer material such as crush gravel. It is important to clarify that both layers must be compacted since they are the support of the asphalt.



Fig.12. Roller that compacts the surface

Step 3: Asphalt placement

For this step, the ecological asphalt must be transported at a temperature between 140° C and 170° C. It is placed on the surface and then compacted.

After completing this process, a uniform pavement is obtained. An example of this is seen in Fig. 13. In addition, a pavement with better mechanical characteristics is obtained.



Fig. 13. Example of finished pavement

B. Strengths and Weaknesses of the Proposal

The solution to the paving problem on Delfín Huergo Street has more positive than negative aspects. One of the most positive aspects of this solution is the implementation of recycled materials, turning the product into an ecological product. Another important advantage is the long lifespan of the street when this product is used and it also requires little maintenance over time. Last but not least, using recycled asphalt reduces costs by 10% to 25%.

On the other hand, this project has two main weaknesses. First of all, the use of this type of mixture requires better care in managing temperatures compared to a conventional one. In the second place, the quality of this pavement, being composed of recycled materials, may vary, which may generate different results in the final pavement. In addition, we must clarify that since it is a new product, it is not known how it copes with wear and tear and daily use.

IV. CONCLUSION

The problem of potholes and road deterioration in the city of Paraná is one of the most recurring problems of this city. This presentation highlights this problem on Delfín Huergo Street as well as the lack of parking spaces and proposes an ecological solution. In addition, it promotes the use of recycled materials such as polymers, thus helping to conserve the environment and reduce pollution.

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The present project is a skills integration activity in Inglés I at Universidad Tecnológica Nacional, Facultad Regional Paraná, carried out by EFL engineering students. The yearlong project requires students to delve into a problem in the city where they live and to address it by means of a simple project in English. Should the reader have any questions regarding this work, please contact Graciela Yugdar Tófaló, Senior Lecturer, at gyugdar@frp.utn.edu.ar.