

Road Improvement: Reconditioning of Gutierrez Street in Paraná

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Summary— Paraná is a city located in Entre Ríos, Argentina, and it has many problems related to its streets. There are problems like bad lighting, poor use of space, the lack of traffic lights, and potholes. Gutierrez Street, which is a crucial artery for the city, has too many potholes that put people at risk for serious inconvenience and safety issues. The aim of this presentation is to address the potholes problem on Gutierrez Street in Paraná. The solution to this problem is to recondition the infrastructure of the road. The presentation is organized as follows. First, the problem is defined by providing information about the context where the problem is located, the description of the problem and the most specific areas where the problem is most visible. Secondly, the analysis of the problem is conducted. In this part, the causes and consequences of the problem are discussed. Thirdly, a possible solution for the problem is described as well as the advantages and disadvantages of this solution are addressed. The work's impact on Paraná can be significant. The city has a lot of street problems which lead to inconvenience and safety issues. This presentation addresses the pothole problem with an innovative road infrastructure reconditioning solution that can be replicated in other areas of the city. This solution aims to improve transportation infrastructure, safety and residents' quality of life.

Keywords: heavy traffic, potholes, roads, road safety

Resumen— Paraná es una ciudad ubicada en Entre Ríos, Argentina, y tiene muchos problemas relacionados con sus calles. Hay problemas como mala iluminación, mal uso del espacio, falta de semáforos, y pozos. Calle Gutiérrez, la cual es una arteria crucial para la ciudad, tiene demasiados pozos que ponen a las personas en riesgo de sufrir graves inconvenientes y problemas de seguridad. El objetivo de esta presentación es abordar el problema de los pozos sobre calle Gutiérrez en Paraná. La solución a este problema es reacondicionar la infraestructura de. La presentación está organizada de la siguiente manera. En primer lugar, se define el problema proporcionando información sobre el contexto donde está ubicado el problema, la descripción del problema y las áreas más específicas donde el problema es más visible. En segundo lugar, se analiza el problema. En esta parte se discuten las causas y consecuencias del problema. En tercer lugar, se describe una posible solución para el problema, así también como las ventajas y desventajas de esta solución. El impacto de este trabajo puede ser significativo en Paraná. La ciudad tiene muchos problemas en las calles que derivan en inconvenientes y problemas de seguridad. Esta presentación aborda el problema de los pozos con una innovadora solución de reacondicionamiento de infraestructura de esta calle que puede ser replicada en otras áreas de la ciudad. Esta solución pretende mejorar la infraestructura de transporte, la seguridad y la calidad de vida de los residentes.

Palabras clave: tráfico pesado, pozos, calles, seguridad vial

I. INTRODUCTION

Paraná is a city located in Entre Ríos, Argentina, and it has many problems related to its streets. There are problems like bad lighting, poor use of space, the lack of traffic lights, and potholes.

Gutierrez Street in particular, has too many potholes, which put people at risk for serious inconvenience and safety issues. This presentation shows the critical pothole issue that affects this vital street, which is a crucial artery for the city.

The aim of this presentation is to address the potholes problem on Gutierrez Street in Paraná. The solution to this problem is to recondition the infrastructure of the road.

The presentation is organized as follows. First, the problem is defined by providing information about the context where the problem is located, the description of the problem and the most specific areas where the problem is most visible. Secondly, the analysis of the problem is conducted. In this part, the causes and consequences of the problem are discussed. Thirdly, a possible solution for the problem is described as well as the advantages and disadvantages of this solution are addressed.

The work's impact on Paraná can be significant. The city has a lot of street problems which lead to inconvenience and safety issues. This presentation addresses the pothole problem on Gutierrez Street with an innovative road infrastructure reconditioning solution that can be replicated in other areas of the city. This solution aims to improve transportation infrastructure, safety and residents' quality of life.

II. PROBLEM DEFINITION AND ANALYSIS

A. Description of the Context

Gutiérrez Street is an important road that is in Paraná in San Agustín neighbourhood. The neighbourhood is in the western part of the city. Gutierrez Street runs from Los Talas Street to Emilio Carafa Street, which are marked in green (Fig.1). It is important because there are a lot of streets connected through this road and it has some important landmarks.

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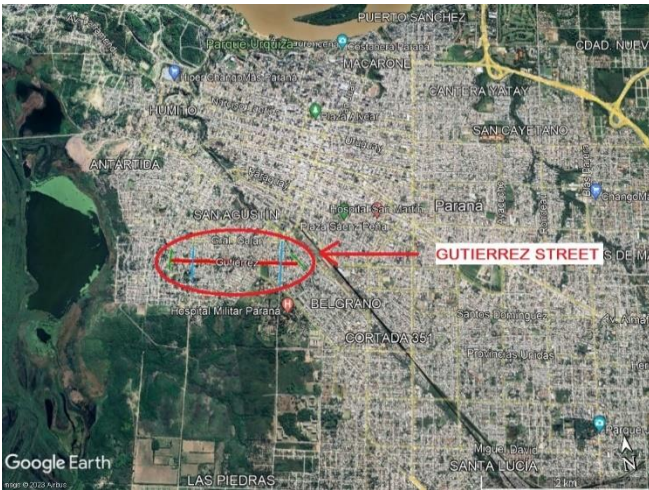


Fig. 1. Gutierrez Street highlighted on the map of Paraná (Image from Google Earth).

This street runs through a large part of San Agustín neighbourhood, and it is quite busy during the day. This street is important because a lot of people drive through it every day, as it serves as a vital connection between the houses and the workplaces of the citizens.

In this street, there are a lot of different shops and bus stops. Also, it is intersected by other important streets like Ejército Avenue and Selva de Montiel Street, which are marked in blue (Fig.1).

On the eastern side of the road, there is a roundabout which connects two unnamed streets with Street 257 and Gutierrez Street. Moving towards Gutierrez Street and Ejército Avenue, you can find Ejército Avenue Athletic Club (Fig. 2), which is one of the most prominent landmarks in the area.

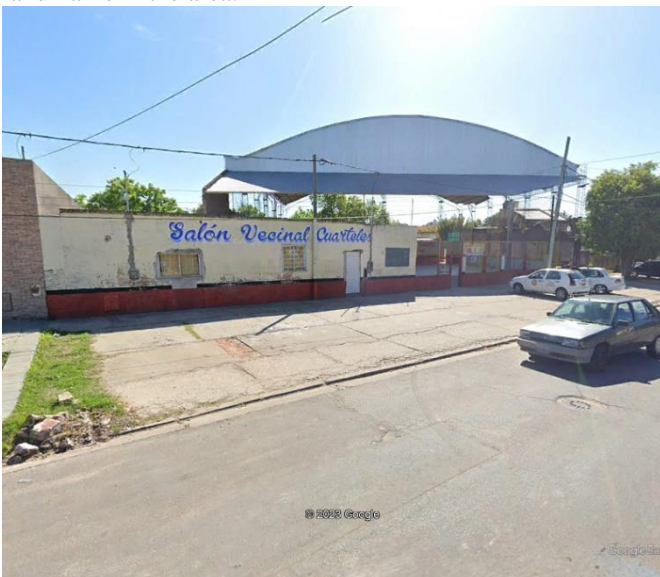


Fig. 2. Ejército Avenue Athletic Club.

There are three points of interest at the corner of Ejército Avenue and Gutiérrez Street. These are Tuki (Fig. 3), which is an electromechanical workshop, and a beverage distributor. In the corner next to the beverage distributor, you can find Mundo Muebles (Fig. 4), which is a furniture shop.



Fig. 3. Electromechanical workshop at the intersection of Ejercito Avenue and Gutierrez Street.

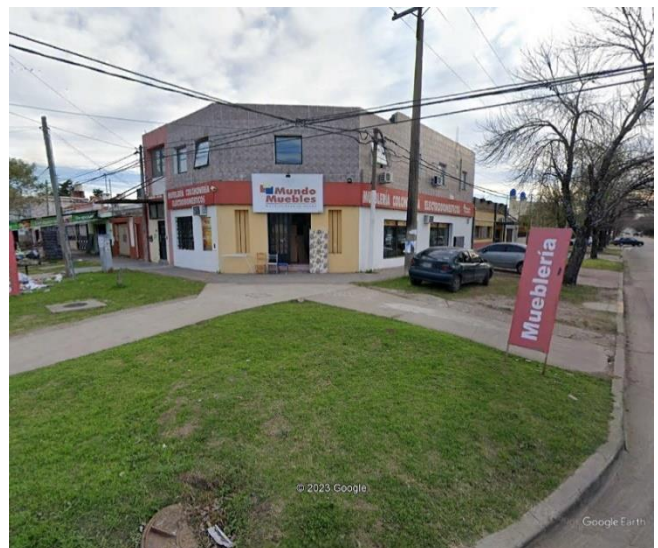


Fig. 4. Mundo Muebles furniture store.

In the next blocks, there are other important landmarks in the area. There is a nursery, a mechanical workshop (Fig.6), and a radio broadcasting station (Fig.7). In the middle of the stretch there is a veterinary clinic (Fig.8), a butcher shop (Fig.10), a pantry (Fig.9), and a gym.

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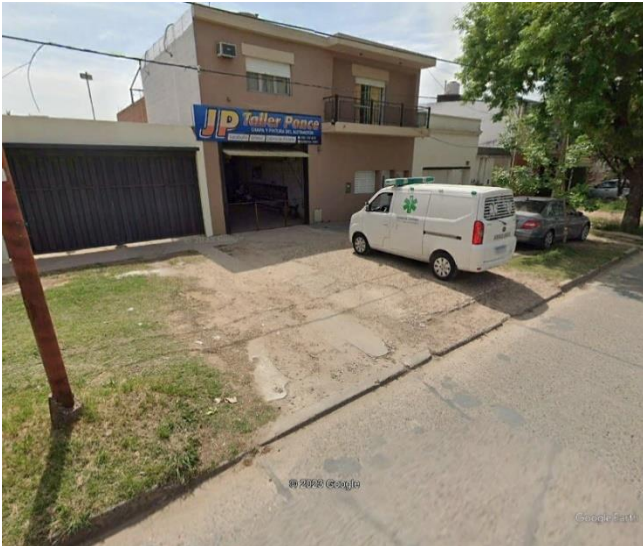


Fig. 6. The mechanical workshop and the nursery.



Fig. 9. The pantry.



Fig. 7. The radio broadcasting station.

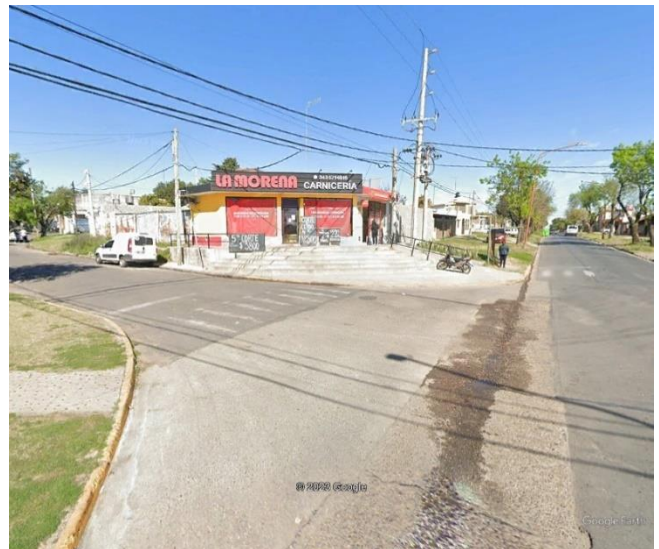


Fig. 10. The butcher shop.

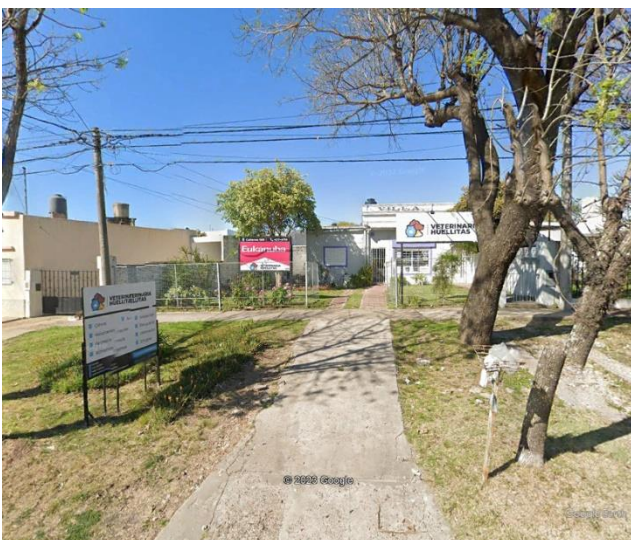


Fig. 8. Veterinary clinic.

At the end of the street in the west, there is an Adventist Church (Fig.11), a greengrocery, and an Asian supermarket which is on Selva de Montiel Street. This last part of the road is a residential area compared to the other parts because there are fewer shops.

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Fig. 11. Adventist Church.



Fig. 10. Pothole at the intersection of Coronel Martinez Street.

Fig. 11. Pothole at the corner of Virasoro Street.

Gutierrez Street is a very important road because it has shops and workshops. The people walk along Gutierrez Street or drive across it with their cars, so this street needs to be in good and accessible condition.

B. Problem Statement

The main problem on Gutierrez Street is its condition, which is not good because there are a lot of potholes. The potholes are getting bigger and deeper so this makes the problem more dangerous to the people who ride through this road every day. This danger increases during the night because the street is dark in some parts. These potholes are widespread along the street. Consequently, this is an infrastructure problem.

C. Description of Scenes that Help Picture the Problematic Situation

These two pictures below show potholes which are found on Gutierrez Street. The first one is at the intersection of Coronel Martinez Street (Fig. 10). This pothole is very deep because many cars drive over it. The second picture is at the corner of Virasoro and Gutierrez Streets (Fig. 11). In this pothole there is a patch, but it has sunken because there is heavy traffic at this intersection. At night, this street is very dark so these two potholes are dangerous to the cars.

The next picture shows one of the central points of Gutierrez Street, between Virasoro and Piran Streets (Fig. 12). In this image, the problem is more visible because there is a large pothole, and the problem is marked by the lines that surround it. This pothole will be deeper and larger if the problem is not solved on time. The solution for this problem is not a patch because the underlying structure is experiencing failure, so it requires a structural reconstruction.



Fig. 12. Central Gutierrez Street, between Virasoro and Piran Streets.

There is another pothole located within a storm drain (Fig. 13). In this case, the depth is more evident. If cars drive over it, these could damage the storm drain because of their wheels' impact.



Fig. 13. Storm drain in Gutierrez Street.

D. Identification and Analysis of Causes or Factors that Give Rise to the Problem.

There are different factors that contribute to the problem's daily increase. The main cause of this increase is the lack of maintenance on the street, but there are three more important causes which can be solved if the government decides to recondition the street.

The first of these three causes is the type of soil in Paraná, which is clay, so it makes the ground less solid. This area needs a soil study to make a structure with the necessary properties.

Another cause is the heavy traffic because the street was initially built for lighter traffic. This heavy traffic load places more stress on the road than it was originally constructed to handle, resulting in road damage and sinking in some parts. The heavy traffic has increased in the last years because the street's location is a business area and there are bus stops along the street.

The last cause of this problem is the poor quality of the street structure, which was rebuilt in 2014. The street needs reconditioning considering its early deterioration, which exacerbates the problem.

E. Identification and Description of the Consequences

There are a lot of consequences related to the potholes on Gutierrez Street. However, three main consequences, which have a direct impact on the daily lives of people who live and go along the street, are considered.

The first one is the danger of damaging vehicles. Potholes on Gutierrez Street are so big and deep that they can cause damage to vehicles such as flat tires, bent rims, suspension damage, among other problems. People who pass over a pothole can not only damage their vehicles but also cause traffic accidents.

Safety risk is a second consequence. Potholes are more dangerous at night because this street does not have a good lightning system and does not have traffic lights, which can lead to faster driving speeds and an increased risk of accidents when encountering potholes.

Another consequence of potholes is the increase in the structural problems. Potholes are the result of a bad road structure or an excessive stress on the infrastructure. If these issues are not addressed on time, they can further deteriorate the infrastructure.

III. THE WAY FORWARD

A. Problem Approach

The solution proposed for addressing the issue of potholes on Gutierrez Street is quite simple, based primarily on the heavy traffic in this street, which is one of the principal causes of this problem. The solution involves reconstructing the road but, in this case, it is crucial to change the method of construction to improve the quality of this street.

This improvement project promotes the replacement of the existing pavement by a more robust and

rigid pavement. Figure 14 shows this method of design, which is called Method AASHTO 93 [1], is described in the corresponding method manual.

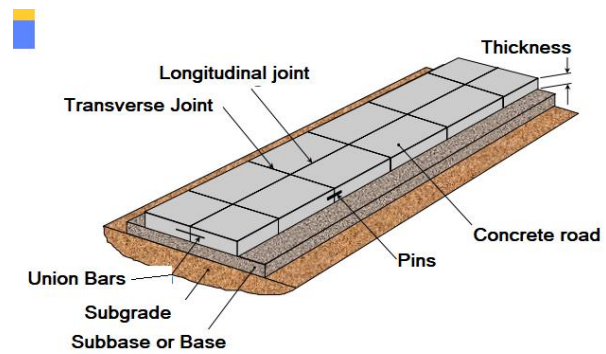


Fig. 14. Structural package. [2]

In relation to the application of this rigid pavement, there are a few steps to follow for the correct execution of the project. The steps below ensure the correct execution of the method.

- Old road removal

In this first step, the existing pavement is removed using special machines. All the debris generated by the removal is carried to a construction waste recycling plant, where it can be recycled into rubbish and other possible materials. This step may last throughout the entire road reconstruction process because it takes time to remove the old construction, but during the removal the workers begin constructing the new pavement.

- Determination of subgrade soil

The determination of the subgrade is essential for this project because it substantially affects the behaviour and durability of the pavement. The subgrade needs to be composed of fine soils or soils capable of suspending loads. The pavement of concrete does not require elevated subgrades resistance, but a reasonably uniform support without abrupt changes in bearing capacity.

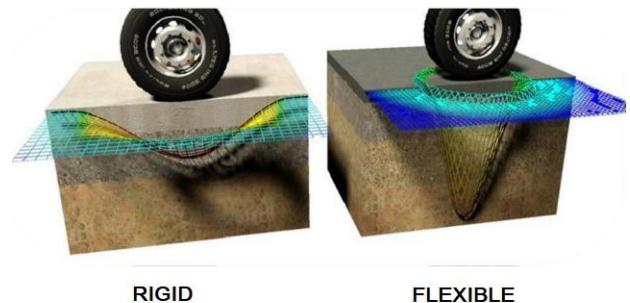


Fig. 15. Subgrade behaviour: rigid pavement vs. flexible pavement. [2]

- Construction of subbase or base

The construction of the base makes a big improvement in the pavement because this base increases the erosion resistance of the pavement. Therefore, as it can be observed

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in Figure 15, it is essential to construct a rigid base. This base is made up of cement that is applied in sections on top of the subgrade. In addition, the base can be constructed at the same time as the old road is removed.

- Concrete Road

In this final step, the base is finished and it should be ready to receive the concrete pavement. This pavement is prefabricated with a rectangular section, and it is connected using union bars. Furthermore, these blocks of concrete have pins that evenly distribute charges among them (Fig. 16).

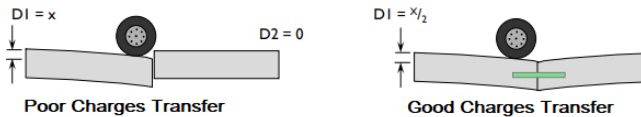


Fig. 16.Charges transfer. [2]

B. Strengths and Weaknesses of the Proposal

This solution has more positive aspects than negative aspects. One of the most positive aspects of this solution is the long useful life of the street when using this method. Moreover, it demands low maintenance over time. Furthermore, it promotes the use of local materials, contributing to sustainability, and enhances load transfer, which ensures a more robust road structure.

On the other side, this project has two main weaknesses. One of the negative aspects is the work time required for the project, since first the old road must be removed. Also, another problem that this project faces is the

economic cost because it needs highly skilled workers and time compared to traditional road construction methods.

IV. CONCLUSION

In conclusion, it is evident that the road condition on Gutierrez Street is one of its most important problems, therefore it should be resolved before more problems occur. This pothole problem is generated by the poor inversion and low investment of new technologies and methods.

People need a solution because they should not be more attentive to avoid potholes than to drive correctly. This situation causes many accidents, such as crashes due to avoiding a well, flat tires, and parts of cars breaking. The driving security is very important to transport and progress of society because many people die in traffic accidents.

The steps outlined in this project present a complete method, including evaluations and considerations, cost and time analyses to minimize them, and warn people in advance of the problems that this project could bring. In these cases, despite the project weaknesses, the solution described would maximize the useful life of the road, reducing future costs.

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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.