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Proposal of infrastructure in Baluartes Circuit Avenue, between the San Juan Baluarte and the Santa Rosa Baluarte as a promoter of tourism development and social welfare in Campeche, Mexico

Propuesta de infraestructura en la Avenida Circuito Baluartes, entre el Baluarte San Juan y el Baluarte Santa Rosa como promotora del desarrollo turístico y bienestar social en Campeche, México

BARRERA-LAO, Francisco†*, CRUZ-Y-CRUZ, Andrea, PALEMÓN-ARCOS, Leonardo, QUIJANO-GARCÍA, Román and MEDINA-BLUM, Fernando

Universidad Autónoma de Campeche. Facultad de Ingeniería y Contaduría. Campeche. México
Universidad Autónoma del Carmen. Facultad de Ingeniería. Campeche. México

ID 1st Author: *Francisco, Barrera-Lao* / **ORC ID**: 0000-0001-5144-8305

ID 1st Coauthor: *Andrea, Cruz-y-Cruz* / **ORC ID**: 0000-0001-8861-1276

ID 2nd Coauthor: *Leonardo, Palemón-Arcos* / **ORC ID**: 0000-0001-9743-0434

ID 3er Coauthor: *Román, Quijano-García* / **ORC ID**: 0000-0001-7316-1997, **Researcher ID Thomson**: G: 6014-2018

ID 4th Coauthor: *Fernando, Medina-Blum* / **ORC ID**: 0000-0001-6532-0871, **Researcher ID Thomson**: M-1632-2017

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Abstract

The Regulating Plan of Campeche in 1952, constituted one of the first formal projects of rules and regulations for the city, whose principals were based on sustainability and modern urbanism. Through the same, three fundamental points were developed: a) zoning of the areas according to their use, b) regeneration of housing areas and c) structuring of a road communication system. Over time, the historic center of the city and in particular the Circuito Baluartes avenue, have presented a series of constant changes in its road infrastructure due to the increased vehicular and demographic flow of the population that affects the tourist influx in the city that It has the denomination of Cultural Patrimony of the Humanity granted by the UNESCO. Based on the above, the reorganization of the circulation is proposed, through the relocation of pedestrian crossings, the diagnosis of signage and pavement, as well as the construction of a public parking lot that helps to decongest local traffic and allows tourism to access greater ease to the bulwark. To formulate the diagnosis and the subsequent proposal of parking in the road environment, a methodology was developed that considered a detailed inspection of the area under study in a visual manner, accompanied by photographs of existing problems to support the approach, obtaining a more analytical description. In this way, different proposals of the area under study were obtained and analyzed, which allowed choosing the most viable option that would be adapted to the current needs of the area without affecting the existing landscape architecture and adhering to the norms and laws in force..

Urbanization, Planning, Social project, Cultural Heritage

Resumen

El Plan Regulador de Campeche en 1952, constituyó uno de los primeros proyectos formales de reglas y ordenamientos para la ciudad, cuyos principios se basaban en la sustentabilidad y urbanismo moderno. Mediante el mismo, se desarrollaron tres puntos fundamentales: a) zonificación de las áreas según su uso, b) regeneración de zonas habitacionales y c) estructuración de un sistema vial de comunicación. A través del tiempo, el centro histórico de la ciudad y en particular la avenida Circuito Baluartes, han presentado una serie de cambios constantes en su infraestructura vial debido al incremento del flujo vehicular y demográfico de la población que afecta la afluencia turística en la ciudad que cuenta con la denominación de Patrimonio Cultural de la Humanidad otorgado por la UNESCO. Con base a lo anterior se propone el reordenamiento de la circulación, mediante la reubicación de pasos peatonales, el diagnóstico de la señalización y del pavimento, además de la construcción de un estacionamiento público que coadyuve a descongestionar el tránsito local y permita al turismo acceder con mayor facilidad al baluarte. Para formular el diagnóstico y la posterior propuesta del estacionamiento en el entorno vial, se desarrolló una metodología que consideró una inspección detallada del área en estudio de manera visual, acompañado de fotografías de los problemas existentes para sustentar el planteamiento, obteniendo una descripción más analítica. De esta manera, se obtuvieron y analizaron diferentes opciones para el área en estudio, que permitieron elegir la más viable y que se adecuara a las necesidades actuales de la zona sin afectar la arquitectura del paisaje existente y apegada a las normas y leyes vigentes.

Urbanización, Planeación, Proyecto social, Patrimonio cultural

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* Correspondence to Author (fjbarrer@uacam.mx)
† Researcher contributing first Author.

Introduction

San Francisco de Campeche is a city located on the shores of the Gulf of Mexico, being famous for being one of the few walled cities of America that still preserve its fortified historical heritage that surrounds the Historic Center, it is formed by a hexagon with eight bastions originally united by wall canvases.

In its natural evolution, the city has modernized, an example of this is that during the state governorship from 1943 to 1949, public policies were generated that had the objective of expanding the city geographically, by filling land reclaimed from the sea, where a new, different city would be developed, with modern buildings according to the architectural image of the city.

The sixth government report of the period mentioned above, mentioned that "the new Campeche, so controversial, is there, with its buildings, facing the sea, which encourages new projections and open doors for progress" (El Expreso de Campeche, 20 July 2014), with this, came the transformation of the municipality of Campeche, building new roads and paving roads, which significantly improved communication between different areas of the city.

When the construction of road infrastructure was carried out, it began to implement systems and lines of electric power, telephone and telegraph, potable water and sewerage.

The proposals of the Regulatory Plan were based on a mixture of trends of development and growth of the city, (Novedades de Campeche, 2006), which in turn were divided into three:

- Circulation Areas. They formed a network that communicated the city with the new residential areas, due to this and its dimensions the road implementation of the "Herrey System" of continuous circulation was proposed, which gave life to the Baluartes Circuit, surrounding the city center, which resolved the connection between the historical center and its adjacent areas, allowing to delimit and isolate the center of the rest of the city.
- Work areas. It includes the areas of growth both on the mainland and on land reclaimed from the sea, these areas of work are divided into zones, which are: commercial, farm and industrial; all the zones would be communicated by means of the railroad and highway, which helped to classify the roads and therefore the first roadway was constructed to divert the heavy traffic of the city.

Areas to inhabit. This type consisted of each household having basic services.

With the above, it was possible to implement the "New Campeche", which would be the social and economic future for the state of Campeche opening the way to sustainability (Castellanos and Novelo, 2002).

In 2003, Circuito Baluartes avenue presented another appearance, which gave it a touch of modernity, with a fairly wide central ridge, reduced sidewalks and returns on the avenue that could cause sporadic vehicular traffic accidents, however, with the reconstruction of a part of the wall and the construction of the Mega drainage in the whole stretch, included from the Baluarte de Santa Rosa to the Baluarte de San Juan, in 2014 the complementary works of this artery began. A new line was formed where the central ridge disappeared to give life to a new road next to the wall that would become a green area and where the Shooting Range was housed, it should be noted that it was on the side of the Baluarte de San Juan; the installation of street lighting, signage, pedestrian crossings, wider sidewalks and ridges were modernized, as well as the change and creation of some roads, having as objective the mobility of both vehicle traffic and pedestrians throughout the Baluartes Circuit where for a while, urban transport no longer circulated.

From 2003 to 2017 this section of the circuit has not presented any modification, as it was delivered the work, in 2014, except that public transport returned to resume its routes along this avenue and is currently implemented the change of colors in the fringes of the sidewalk, which comprises from the Campeche Arena, where drivers can no longer park, which exacerbated the few parking spaces that exist in the first square of the city.

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Historical background

The city of San Francisco de Campeche is located in the south of the Gulf of Mexico, for many years it was attacked and plundered by invaders since it was rich in different varieties of products (Trujillo, 2009), in addition to being strategically located, which it was recognized as the main port of the peninsula for more than three centuries (Piña, 1987).

Because of the continuous attacks of the pirates, the governor Francisco de Bazán, recommended in 1658, the coastal wall of Campeche to the King of Spain. Peraza, (2000) mentions that Francisco Bazán makes the first uprising of the town, noting the most important buildings and fortifications, including the neighborhoods of San Francisco, Santa Ana and San Román, locating the Plaza Mayor in the center of the complex. In 1662, the Governor Campero made a call to the King of Spain to remind him of the need to improve and strengthen the fortifications. However, it is not until a year later, in 1663, when the Governor Juan Francisco de Esquivel poses a method to distribute the buildings in an organized way and thus be able to save space to regulate the growth of the town, with the sole purpose of unifying it in a smaller space (Figure 1), (Peraza, 2000, p.103)

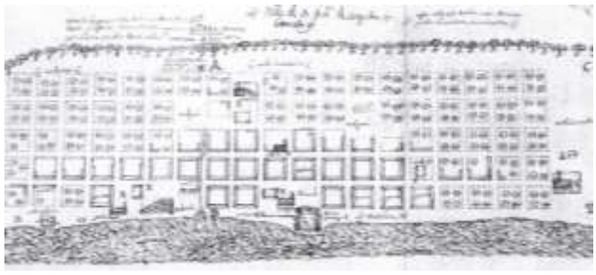

Figure 1 Plan of Campeche ordered by the governor Francisco de Esquivel in 1663, made in the second evolutionary period.
Source: Morales, F. (2004). Campeche, fortified historic center World Heritage of Mexico

In 1680, Don Antonio de Layseca y Alvarado, governor of the province, sent the proposal to wall the town of Martín de la Torre (Figure 2). His proposal was to build a wall with eight medium bastions, separated by the distance of a musket shot between each one, adapting in this way to the human resources that were counted for the defense. The proposal was accepted by the Crown, but due to lack of money and the death of the captain, the work was not carried out.

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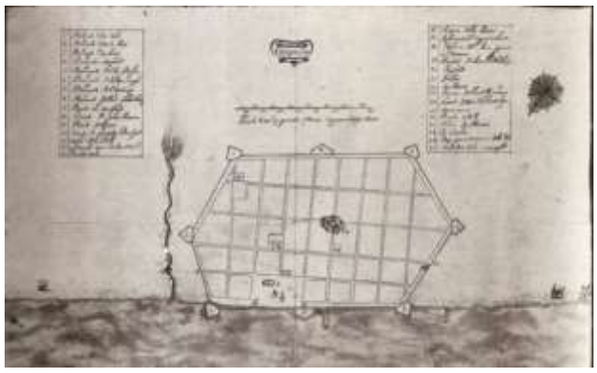

Figure 2 Final project for the walling of the village, by Jaime Franck in 1680
Source: Antochiw (2007). The first fortifications of the Villa and Port of San Francisco de Campeche

The Villa, he told himself, would be safe to wall it; it would avoid infinity of expenses and anxieties to the province; it would benefit the whole country, because this port was an important refuge for the boats in need of repair and for being there the best shipyard in America; would have a positive effect on the increase in the collection of real rights, since it would protect trade that would return to its past of splendor.

Layseca's proposal on Martin de la Torre's plan was approved by the Board of War of the Council of the Indies, after listening to the considerations of the Marquis de la Granja and Enrique Enríquez advisers, that the work was completed in two years projected by the engineer.

However, the works were carried out with great slowness (...) (Álvarez, 2015, pp. 51-52), it was decided to wall in January 1686 the Villa, with a defensive system comprised of an irregular polygon of eight sides, with a bastion in each vertex and four doors that communicated with the outside, for then, the project of the walls was in charge of sergeant major Pedro Osorio de Cervantes. (Pacheco, 2008, page 38), In the year 1704, the last Baluarte, the Baluarte de Santiago, was finished, the polygon being completely closed (Secretariat of Culture of the State of Campeche, 2017).

The walled city has the following bastions:

- **Baluarte de San Carlos.** It is the first bulwark of the fortification system, it is located on 8th Street, next to the current Chamber of Deputies in the Historic Center.

- **Baluarte de Santa Rosa.** Built at the end of the 18th century, it was the first of the 8 bastions to be completed for protection against pirate attacks.

  It is located on the Baluartes Circuit at 14th Street in the Historic Center and owes its name to the dedication of the first sanctified American: Rosa de Lima, whose cult was widespread among the Creoles of the Colony during the seventeenth century.

- **Baluarte de San Juan**. Built in the year of 1698 as the defensive system of the Puerta de Tierra, it is located on the Baluartes Circuit on 65th Street, the Historical Center.

- **Baluarte de San Francisco**. Built at the end of the seventeenth century, between the years 1686 and 1690, this Baluarte guarded the Puerta de Tierra on its left side and joins said Puerta, it is located in the Baluartes Circuit on 57th Street, in the Historic Center.

- **Baluarte de San Pedro**. It was the sixth Baluarte to be built at the end of the 17th century, it is located on Avenida Circuito Baluartes on Avenida Gobernadores.

- **Baluarte de Santiago**. It was demolished and partially rebuilt, its reconstruction took place in the 50s of the twentieth century, was similar to that of San Carlos, nowadays it has the function of being a botanical garden that receives the name of Xmuch -haltún, it is located on Avenida Circuito Baluartes on Calle 8 of the Historic Center.

- **Baluarte de Nuestra Señora de la Soledad**. It was built in the year of 1690, connected with the Puerta de Mar and the Baluarte de Santiago, located in the Historic Center, between 8th Street and 57th Street.

- **Baluarte de San José**. It is the eighth bulwark and received this name in honor of the husband of the virgin and father terrain of Christ, the demolition of it was made in the first decades of the twentieth century.

  Currently the space is occupied by Justo Sierra Méndez primary school. Was one of the two dismantled bastions, for the apparent progress of the city of San Francisco de Campeche. It was at an approximate distance of 277 meters from the Baluarte de San Pedro.

The Baluarte de Santa Rosa has as a special feature access through a courtyard at street level. It is around 227 meters. of the bastion of San Carlos, occupying an area of 1,157.45 square meters with 31.54 meters. in its fronts and 15.35 meters. on its flanks. In 1766 it had 11 iron cannons of different calibers. As quarters had the body of the guard, another more built in the eighteenth century under the ramp and two vaults for gunpowder and ammunition that surrounded the courtyard with its cistern. By 1690, there were the bastions of San Carlos, San Juan, San Francisco, San Pedro, San Jose, La Soledad, Santiago and Santa Rosa. Shortly thereafter, in 1704, the eight bastions with their respective were seven curtains had already completed three to four feet high (Figure 3). However, there were not any steps, parapets, or sentry boxes in the bastions. (Peraza, 2000, pp. 103-104)

Figure 3 Sketch of the walled area of Campeche towards the year 1705
Source: Recovered from https://unmundoporrecorrer.wordpress.com/2014/04/11/campeche-y-uxmal-research-of-an-pasado

When the importance of the walled city ceased to exist, as piracy on the high seas declined with the passage of time, at the beginning and during the 20th century (Figure 4), the demolition tasks of some of the walls' canvases began. and of some bastions for various purposes, all in favor of "modernity" then in force.

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Figure 4 View of San Francisco de Campeche, the sea reached the edge of the belt of walls that separated it from the sea
Source: Piña, R. (1987). Campeche during the colonial period

The San Francisco, ran with the fortune of only being divided into two sectors to make way for the tram that at that time was used as a means of transport and was not destroyed in its entirety, as those of Santiago and San José el Bajo. For the years 1910 and 1915 Mr. Salvador Dondé, owner of the tram, asked the City Council, the demolition of the canvases of walls that comprise the Bastion of Santa Rosa to the Bastion of San Juan (Viadal, 2008).

The surroundings of the historic center are formed by a fortified system that acquired the shape of an irregular hexagon with eight bastions, joined by canvases of walls of 6 meters high by 2.50 meters wide, various monuments housed in roundabouts, streets with a length of 7.00 meters wide, sidewalks of 2.00 meters wide, underground electrical and telephone installations, this not to affect the urban landscape of the historic center, as well as the traditional dwellings with Spanish colonial architecture that are part of the first picture of the city, which they make the perfect set to catalog it as a historical heritage (Gutiérrez y Rivero, 2015). Only in this municipality is 1.81 km², decreed as an area of historical monuments, on November 24, 1986, later in December 1999 it was declared a World Heritage Site by the United Nations Educational Organization, Science and Culture, UNESCO (López, 2004).

Macro and micro location

Circuito Baluartes Avenue is located southwest of Mexico, in the State of Campeche (Figure 5); It is located in the southwest of the Yucatan Peninsula, southeast of the Mexican Republic.

It limits to the north with the state of Yucatan, to the south with the state of Tabasco and the Republic of Guatemala, to the east with the state of Quintana Roo and Belize, and to the west with the Bay of Campeche in the Gulf of Mexico. It has a total area of 56,858.84 km^2 (INEGI, 2016), which is equivalent to approximately 2.9% of the national territory. Politically the state of Campeche is currently divided into thirteen municipalities: Calkiní, Calakmul, Campeche, Candelaria, Dzitbalché, Escárcega, Hecelchakán, Tenabo, Hopelchén, Champoton, Carmen, Palizada and Seybaplaya.

Figure 5 Macro location of the Santa Rosa Bastion
Source: Google Maps (2017). Satelital image

Within the State, Circuito Baluartes avenue is located in the municipality that bears the name Campeche and that in maya means: Place of snakes and ticks; comes from the Maya Kim = snake, Pech = tick. This is one of the thirteen municipalities of the State of Campeche; its municipal head is called Campeche and San Francisco de Campeche, it is the capital of the same state. It has a total area of 3,410.6 km^2, equivalent to 6% of the total territory of the state of Campeche.

This limits to the North with the municipality of Tenabo; to the East and Southwest with Hopelchén; to the south with Seybaplaya and Champoton and to the west with the Gulf of Mexico. (Gio, 1996, p.15) (Figure 6).

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Figure 6 Micro location of the Santa Rosa Bastion
Source: Google Maps (2017). Satelital image

With a population of 220,389 inhabitants according to the 2010 Population and Housing Census (INEGI, 2010), it is the most populated city in the state.

Geographically San Francisco de Campeche is located between parallels 19º51'00 "of north latitude and between meridians 90º31'59" of west longitude. It is located to the Northwest to 387 kms of the City of Villahermosa; 177 km southwest of Mérida and southeast 1,127 km from Mexico City. The city has a maximum altitude of 100 meters. above sea level.

The study area includes the Baluartes Circuit Av., Starting from the Baluarte de Santa Rosa and ending at the Baluarte de San Juan with the junction to Av. Adolfo López Mateos and 67th Street in the city center. The streets surrounding this artery are: Talamantes street in the neighborhood of San Román, the street Pedro Moreno del Barrio mentioned above, the street 14 or Moctezuma, as well as the street 67 both belonging to the Colonia Centro. The stretch has a total extension of 10,302.37 ml, with a total width of 45.00 ml, (Figure 7).

Figure 7 Current status of Baluartes Circuit Av., Baluarte de San Juan section - Baluarte de Santa Rosa, as of 09/20/2017
Source: Google Earth (2017)

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Description of the problem

The Historic Centers are living settlements, spaces with the opportunity to grow, the development of these, totally changes the way of life of the individuals that inhabit the place and of those who travel daily through its streets, that is, the elements that make up the image urban, such as: streets, sidewalks, parks, houses, green areas, etc.

Currently, the Historic Center faces the problem of road congestion, both in its streets and its main avenues and an urban transport system that has not been modernized according to population growth.

Such is the case of av. Circuit Baluartes, in the stretch Baluarte de San Juan - Baluarte de Santa Rosa and vice versa, located in the city of San Francisco de Campeche, where pathologies that have been increasing over time, affecting motorists and pedestrians that daily are forced to transit through this area, coupled with this problem, is the difficult access to the Bastion of Santa Rosa and which affects domestic and foreign tourism as they cannot enter the walled area easily, this is due to the influx of existing vehicles and the lack of safety measures that help the pedestrian and motorists to interact without being affected, that is to say that there is a system of comfort between both.

Over time, the urban sprawl of the city has been increasing, leading to the construction of new avenues, streets and parking spaces, such as the streets 67 and Talamantes that are in the vicinity of the Baluarte. The increase of the population and the vehicular park brings as a consequence problem of: traffic congestion, pollution, lack of parking, inoperative road systems, the construction of new roads, among others, that can be perceived at present. The current deterioration in the infrastructure of urban pavements presents four important aspects, such as: the loss of service capacity, the economic effects of deferring maintenance, operating costs derived from the current state and the action of heavy vehicles (Ferro, 2008).

Problems derived from roads are more evident in the so-called heritage cities because they were never foreseen for automobiles (Ferro, 2008), which is aggravated by the growth of the population.

The aforementioned leads to plan a road reordering of the area that is adapted to current needs, since the current road infrastructure does not fulfill the necessary functions: pedestrian crossings are poorly located so they are inoperative for pedestrians, the returns that are around the Baluarte de Santa Rosa cause problems of road congestion, pollution, lack of parking, roads and inoperative road systems; Among the main affectations are: narrow streets in the first square of the city, road signs are inadequate and insufficient, poorly located pedestrian passages, central ridges of different types not uniform to the urban image of the site, ignorance of poisonous vegetation planted, inefficient lighting, insufficient placement of ramps for the disabled, among others coupled with this, is the current deterioration that the pavement infrastructure presents, having loss of the service capacity with which it must comply, for which there must be an urban mobility that facilitates the daily life of all passers-by. the problem is derived from the lack of promotion by the competent authority since there is no whereabouts or parking in which they can descend and access the Baluarte, coupled with this we can mention the difficult access to the site, because it is not counted with an adequate road system where it does not endanger the integrity of the people who visit it.

In the last decades, different adaptations were made in the Baluarte de Santa Rosa - Baluarte de San Juan section, where, for example, the closure of 14th Street before Moctezuma intersected the Av. Circuito Baluartes, it was a parking place and served to descend and access the Baluarte de Santa Rosa with great security, however, this altered the traffic in the area to stop being useful space, so they decided to close the road space.

Justification

The roads in heritage cities are similar to those of any contemporary city: problems of traffic congestion, pollution, lack of parking, roads and inoperative road systems, among other things; from which the fact that the appearance of the automobile transformed the cities is confirmed. The problems arising from the road, are exacerbated or become more evident in the so-called heritage cities because they were never foreseen for automobiles. (Ferro, 2008).

The west sector of the municipality of Campeche presents human settlements regulated by the supply and demand of urban growth, also concentrates commercial, educational, bureaucratic activity and the most important urban equipment.

Here is the Walled Enclosure, recognized today by UNESCO as a Cultural Heritage of Humanity. (IET, 2016). Narrow streets in the first square of the city, existing roads with inadequate signage and that adapt to the type of road; pedestrian steps poorly located with problems to cross by the pedestrian; central ridge of different types, (which affect the uniformity and urban image of the site) and part of the existing vegetation are a danger to the general population since some are poisonous which can cause health problems.

Regarding lighting is a vital factor, since an area of historical monuments must have quality lighting allowing a better image at night, in the case of the walled wall it is deteriorated; the placement of ramps for the disabled is an important issue and even more so in a tourist area such as the center of the city, these are essential for the person who needs to ascend or descend from the sidewalk, and those near the Bastions do not have a ramp that allows adequate mobility.

In recent years in the city of Campeche the different strategies aimed at the rescue and conservation of the Historical Heritage have been noted and have resulted in the visit of a large number of tourists from different countries and who want to know the cultural and architectural wealth of state.

The need to carry out this project arises over time and to the demand of society since the areas surrounding the Santa Rosa Bastion have undergone significant changes, and require modernization and maintenance of its infrastructure and urban equipment, for which, it is intended to thoroughly analyze its road infrastructure, in order to have a detailed diagnosis and in the future implement actions to meet current needs, without losing the original touch of the urban image.

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This project aims to offer a tool to government institutions and interest groups (schools, chambers, private initiative), which require executing a physical intervention with a proposal that allows them to establish dissemination strategies to the spaces that the State has to visit, adhering to the corresponding norms and laws.

Theoretical framework

In recent years, the Historic Center of the city of Campeche has undergone various changes in its urban image, especially in the section of the Baluarte de Santa Rosa to the Baluarte de San Juan; currently the roads of the av. Circuit Baluartes have paved asphalt (flexible pavement), except for the interior of the Historic Center, which uses hydraulic concrete (rigid pavement); also in different points of the study area, it can be observed that there are different models of central ridging, which affects the uniformity of the urban landscape of the site; the road signs that exist in the section are: preventive, restrictive, and tourist and service which impart information, necessary, to users who transit through the area.

Over the years, the demographic increase of the population and the arrival of tourists have been increasing, causing the placement of pedestrian crossings, allowing crossing safely the street and where the pedestrian has the right of way.

The green areas have also evolved in recent years, have been planted different types of trees and ornamental plants, such as bougainvillea, royal palm, areca palm among others, further extending the vegetation. Torres, Ramírez and Garzón (2014) assure that it is one of the aspects least treated in the landscape studies of the city and its implications in the construction of the urban heritage image, especially its historical centers, is the pavement:

Public roads are important, as they allow access to significant places; so, they are a variable that conditions a prominent part of the public space, which helps to set the functions and the urban image of a city. The pavement influences the urban image of the historic cities, since they are part of its heritage value and are capable of renewing the cultural image of the city.

According to Curiel (2008) the road and transport reorganization consists in the extension of sidewalks, a non-polluting transport system (trams and bicycles) within a Historic Center, multimodal stops in the periphery of the Center, regulation of concessions, routes and schedules of the operation of the pedicabs, strict application and revision of the Traffic Regulations referring to loading and unloading.

As well as prohibition of parking on the streets, adaptation of sidewalks to facilitate the transit of people with special needs:

Having an adequate road reordering in World Heritage areas is of vital importance, since pedestrians and people with different disabilities can travel without so much risk in these areas.

The road reordering is combined with the type of building that is around, improving the urban image, but without losing its original context. Cerezo (2012) affirms:

An important element and starting point for the realization of the project, is the type of order to be adopted for transit: the road network, with all the aspects related to it, sidewalks, parking lots, etc., in conjunction with the buildings. In order to achieve an adequate order of the road network it is necessary to be informed of the hierarchy of the roads, and the capacity of the same. (p.18).

The rehabilitation process must seek a balance between conserving heritage without musealizing (sic) the city, inducing its abandonment, and providing its resident population with opportunities to improve their conditions and quality of life and contribute to their development. (p.321). Serna (2016) affirms:

The rehabilitation of historic centers today is important, since part of the history of a city is preserved, intervening in the pathologies found, improving their conditions and adapting to the current urban landscape which is developing historic centers (Petzet and Ziesemer, 2004).

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Methodology

Due to the high demand in recent years for better roads, as a consequence of the growing vehicle fleet in the city, the historic center is of vital importance as the main thoroughfare for both citizens and tourists.

Regarding the study of the roads surrounding the Santa Rosa bastion, a diagnosis was made mainly in the area identified as the Baluartes Circuit, since this Monument is located on this road.

As well as the influx of the streets 14, 12, 16 and Av. Adolfo López Mateos (Figure 8).

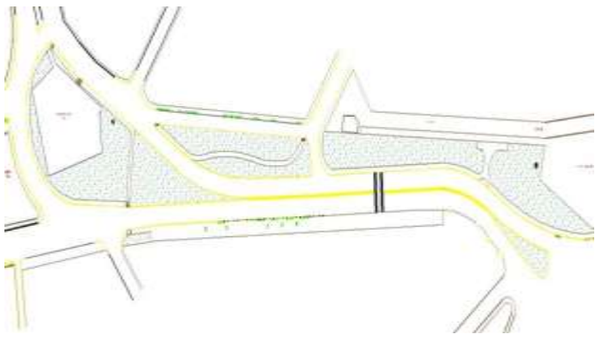

Figure 8 *Current study section of the area*
Source: Own elaboration (2018)

This project considers the road diagnosis of the Baluartes Circuit, and for this the following studies were carried out:

1. Geometric survey Secretariat of Communications and Transportation (SCT). (2016). Highway Geometric Project Manual.
2. Vehicle gauging
3. Survey of road infrastructure
4. Speed study.

1 Hypotheses raised

Central hypothesis

With a road reordering that adapts to traffic, visits would increase significantly and safely without altering the current traffic of vehicles.

Secondary hypotheses

1. Roads operating at a Service Level between A and B, characterized by a free and fluid circulation with stability at high speed, 10 years ago, now operate at levels between C and D or E that varies in range of a stable circulation, unstable and forced respectively, in hours of maximum demand (EIT, 2016).
2. The deterioration that can currently be felt in the infrastructure of urban pavements, presents four important aspects, such as: the loss of service capacity of the pavements, the economic effects of deferring maintenance, operating costs derived from the state of the pavements, and the action of heavy vehicles (Ferro, 2008).
3. The great road problems in the heritage cities, is due to the fact that they did not foresee the natural growth of the population, which resulted in the saturation of the spaces of community benefit, exceeding the levels of vehicular operability in a sustainable and sustainable way..

Results

1 Geometric survey

The Geometric Survey refers to the horizontal geometry of the roadways that make up the area in which the Santa Rosa Bastion is located. For this, satellite photography was used, as well as the manual survey of the area under study. With this, a scale map was finally developed that serves as the basis for the subsequent studies that will lead to improvement proposals (Figure 9).

Figure 9 Current geometry of the parking area that intends to intervene
Source: Own elaboration (2018)

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2 Vehicle gauges

Vehicle gauges allow accounting and classifying the vehicles that transit the roads. To do this, the methodology established by the Ministry of Communications and Transportation (SCT, 2016) was used through the manual for the realization of vehicle gauging, formulated by the Mexican Institute of Transportation. For the study, a manual capacity was developed, which consists of the accounting and visual classification by the personnel trained for this purpose.

For the elaboration of the vehicular gauges, it was decided to place three gauging stations Balán, (2015):

1. Av. Adolfo López Mateos with Circuito Baluartes.

2. Calle 10-B junction with Circuito Baluartes.

3. Av. Circuito Baluartes in front of the Santa Rosa Bastion.

To carry out the study, the vehicle classification that will be applied in the counts as shown in Table 1 was previously defined:

Vehicle type	Description
A	Automobiles, Van, PickUp, Vans
B	Minibuses, School bus, Staff, Foreign
C1	2 and 3 axle cargo trucks, Turn over
C2	Tractor trucks (tractor with one or two trailers)
D	Motorcycles, bicycles and tricycles

Table 1 Vehicle Classification for the Capacity
Source: Vehicle Gauging Study Faculty of Engineering of the Autonomous University of Campeche (2018)

Due to the increase in road infrastructure, it was also necessary to analyze the flow in the roundabouts that surround the first square, since it is necessary to know how busy they are at different times of the day (Transportation Research Board, Highway Capacity Manual, 2000). The present work is based on a quantitative and qualitative investigation of the vehicle fleet that circled the roundabout "Adolfo López Mateos" taking place on November 30, 2018, from 9:00 am to 10:00:00 am; 11:00 am-12:00pm; and from 6:00 pm to 7:00 pm (Table 2 and Figure 10).

Vehicle type	Type A	Type B	Type C1	Type C2	Type D
TOTAL	4582	389	51	5	721

Table 2 Data obtained in Station 4.
Source: Vehicle Gauging Study Faculty of Engineering of the Autonomous University of Campeche (2018)

Figure 10 Current photograph of the proposed parking area
Source: Own elaboration (2018)

Stations 1, 2, 3, and 4 were established to carry out this methodology, which were in strategic places and with ample visibility, which allowed a correct observation of the area, always taking into account the necessary safety equipment.

The quick counting of vehicles was done in blocks of 5 in 5, with 4 vertical lines and a diagonal, this facilitated the final count. Next, the satellite image of the location of the stations is shown, (Figure 11):

Figure 11 Location of the stations on the Adolfo López Mateos roundabout, whose coordinates were: station 1 (19.840116, -90.537880); station 2 (19.840044, -90.538202); station 3 (19,839626, -90,538,204); station 4 (19.839821, -90.537735). Google
Source: Google Earth

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The vehicle with the highest frequency in the gauging results in the four stations was type "A" with a total flow of 3,367, secondly type "D" with a vehicular flow of 702 and third type "B" With a total flow of 413 see (Table 3 and Figure 12), it is observed that there is very little frequency of vehicles type C1 and C2 given that it is an area where it is difficult for the heavy vehicle to drive through the road and would represent a problem of circulation for the other units.

Vehicle Types	A	B	C1	C2	D
Station 1	112	139	5	0	273
Station 2	175	47	3	1	27
Station 3	1119	93	9	1	234
Station 4	961	134	16	0	168
Sums per column	**3367**	**413**	**33**	**2**	**702**

Table 3 Results of the type of vehicle according to traffic on the road
Source: Vehicle Gauging Study Faculty of Engineering of the Autonomous University of Campeche (2018)

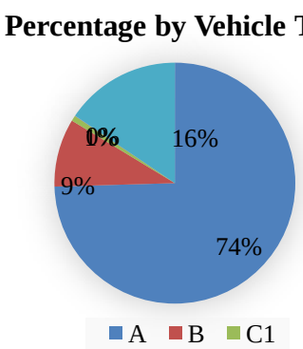

Figure 12 Graph of percentage representation of each segment of the vehicle classification (A, B, C1, C2, D)
Source: Vehicle Gauging Study Faculty of Engineering of the Autonomous University of Campeche (2018)

In the results shown in Table 3, it is observed that the vehicles with the highest frequency are those of type A, D and B, this indicates that the vehicle with the greatest presence in the vehicle flow is the particular compact type, followed by those that they are not necessarily vehicles but they have a recurring presence in the road such as motorcycles and bicycles; finally, type B vehicles (public transport) such as buses and cargo trucks that also transit the area, (Figure 13).

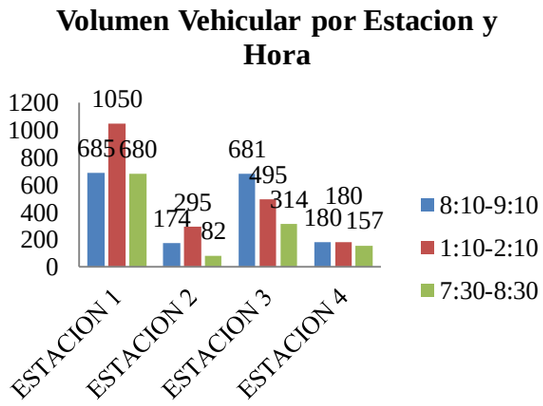

Figure 13 Vehicle volume
Source: Vehicle Gauging Study Faculty of Engineering of the Autonomous University of Campeche (2018)

According to the results obtained; it can be determined that, of the three observation periods, from 12:00 pm to 1:00 pm. there is the greatest vehicular flow in all three directions, with cars and trucks being the vehicles with the most traffic (Table 4).

Hour	Aforo 1	Aforo 2	Aforo 3
8:00 a 9:00	865	326	631
12:00 a 13:00	1088	359	740
18:00 a 19:00	889	288	562

Table 4 Result of vehicular flow by stations
Source: Vehicle Gauging Study Faculty of Engineering of the Autonomous University of Campeche (2018)

With these results it is possible to establish the need to build a public parking lot in the surrounding area of the Circuito Baluartes avenue, a few meters from the Santa Rosa Bastion, (Figure 14).

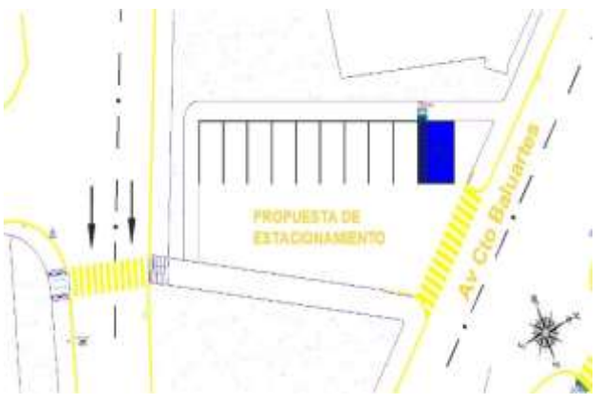

Figure 14 Public parking proposal for the Santa Rosa monument area
Source: Own elaboration (2018)

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The parking consists of 9 drawers for vehicle type (A), since these represent 70% to 80% of vehicles that pass through the Baluartes Circuit area, and a drawer for the disabled, by current regulations.

Conclusions

1. Pedestrian safety is minimal, since there are no well-marked signs that indicate to the driver the decrease in speed or the pedestrian crossing.

2. Mobility for people with disabilities is very limited or almost nil, because there are no adequate ramps, especially for the change of sidewalks.

3. To improve the parking service for tourists or local public, a study is required to create a space that allows to accommodate a truck with tourist ticket, in order to increase visits to the Santa Rosa Bastion....

4. The geometry is not available for the displacement of a truck with tourist passage that can enter 67th Street, because the speed with which it circulates is 30 km / hr. and we have a 70% percentage of light vehicles (type "A")

5. The hour of maximum vehicular flow has a schedule of 13 a.m. to 4 p.m.

6. Both drivers and pedestrians show little road culture.

7. To replace the existing signaling and comply with NOM-SCT-2016, a more detailed study is required.

8. Carry out a study of pedestrian capacity, in order to make the appropriate adjustments for mobility, empowering people with disabilities (example: adequate ramps, widths of bench, etc.).

9. In order to improve the urban image of the place, a thorough study of the placement of the street furniture is required, in order to rid the sidewalks, improve the lighting and the use of the surrounding green areas.

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Annexes

Proposal for parking.

Panoramic view No. 1.

Figure 16 Proposal for parking
Source: Own (2018)

Panoramic view No. 2

Figure 17 Proposal for parking
Source: Own (2018)

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Panoramic view No. 3

Figure 18 Proposal for parking
Source: Own (2018)

Panoramic view No. 4

Figure 19 Proposal for parking
Source: Own (2018)

Panoramic view No. 5

Figure 20 Proposal for parking
Source: Own (2018)

Panoramic view No. 6

Figure 21 Proposal for parking
Source: Own (2018)

Panoramic view No. 7

Figure 22 Proposal for parking
Source: Own (2018)

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