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# Sustainable Public Transport Service Adapted for People with Disabilities and Reduced Mobility in the Municipality of León, Guanajuato, Mexico

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**Citation:** Colmenero-Fonseca, F.; Fonce-Segura, C.D.; Guzmán-Ramírez, A.; Flores-García, M. Sustainable Public Transport Service Adapted for People with Disabilities and Reduced Mobility in the Municipality of León, Guanajuato, Mexico. *Sustainability* **2021**, *13*, 7471. <https://doi.org/10.3390/su13137471>

Academic Editor: Carmen Lizarraga

Received: 1 March 2021

Accepted: 5 April 2021

Published: 5 July 2021

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**Abstract:** Urban mobility makes it possible to incorporate new perspectives that make it possible to question and problematize the way in which social links and relations between city dwellers are shaped. In this way, mobility constitutes an increasingly massive, recurrent, and complex social practice, strongly conditioned by the existing levels of inequality and particularly those that entail processes of social exclusion. In the present research, the efficiency of the modality of adapted public transportation for people with disabilities in the city of León, Guanajuato, Mexico, which came into operation in 2012, receiving the 2019 Building Equality Award from the International Center for the Promotion of Human Rights and United Nations Educational, Scientific and Cultural Organization (UNESCO), is analyzed. The management, design, and implementation of Inclusive Urban Transportation (TUI), demonstrated how the articulation of actors (public, private, and civil society) are of vital importance for the success of the project. In this sense, it is important to count on the permanent participation of focus groups that identify and understand the real needs of users with reduced mobility. The results achieved allow establishing an evaluation that contributes to detect and mitigate the conditions of vulnerability, risk, and segregation of people with disabilities.

**Keywords:** sustainable transportation; universal accessibility; urban mobility; resilience

## 1. Introduction

Accessible and inclusive transportation is one of the main tools for the independence and social participation of people with disabilities, whether transitory or permanent. Mobility plays an increasingly important role in the quality of life and personal development of citizens and constitutes an essential element of that active independence that allows all categories of workers and consumers to contribute to society, reducing the dependence of vulnerable people. According to [1] from the point of view of the individual, mobility makes at least three obvious contributions to a good quality of life for all citizens: (a) It offers possibilities to a wide range of family, social, cultural, educational, and occupational activities that would otherwise be closed; (b) It promotes mental and physical health, which in turn tends to improve the quality of life and prolong the length of life; (c) It enables people with reduced mobility to be more visible to the local community and thus promotes a favorable change in the perception of them towards society and of society towards them.

Urban mobility issues are important to the lives of people with disabilities, this being the most important concern at the local level when considering the integration of such

a community into the city's transportation system [2]. Accessible transportation enables people with disabilities to live independent lives and therefore means having transportation services that go where and when one wants to travel, being informed about the services, knowing how to use them, being able to use them, and having the means to pay for them.

In some states of the Republic, universal accessibility has been considered as a right in their mobility law; but only in a few cities have specific actions been carried out in their rules or regulations that recognize the needs of different vulnerable groups, such as seats for people of small size and signage in Braille language and next stop sound equipment; but unfortunately, in many cases these rules are not rigorously enforced, or in any case, the units that have this equipment are not representative in the universe of units circulating in a city.

In the case of the city of Leon Guanajuato, actions have been taken to improve mobility in public transportation, with an integral and inclusive vision (elimination of barriers, transportation units, and exclusive routes), so that its service model is being replicated in other cities in the state; under the premise of building citizenship generating the necessary equity and equal opportunities for all.

This mobility program (Transporte Urbano Incluyente (TUI)) has improved the quality of life of many families, because a few years ago it was impossible to imagine that people with disabilities could use public transportation to go to school, work, or recreation centers.

## 2. The City of Leon, Guanajuato

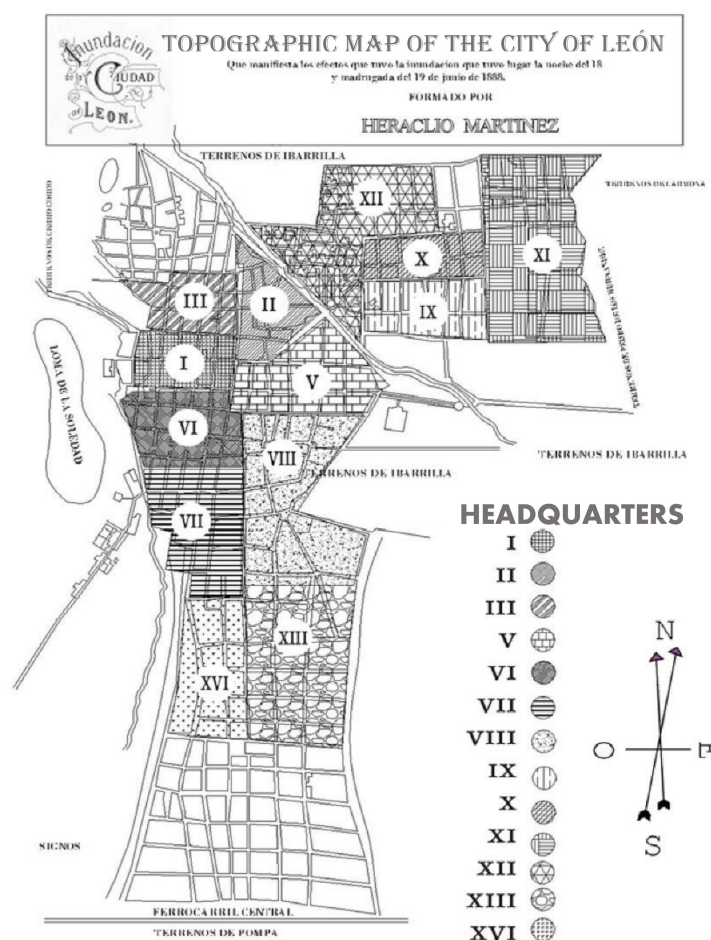
The first armed Spanish presence in the territory of the future Mayor's Office of Leon dates from 2 February 1530, when Nuño de Guzman and his Tarascan allies forded the Lerma through Conguripo, calling it "Our Lady's" river.

Its agricultural and cattle colonization began in 1546, with ranches granted by the Governor of Nueva Galicia, Vázquez de Coronado to the Spaniards Rodrigo de Vázquez and Juan de Jasso. The Chichimecas, upon being invaded, maintained a state of war against the Spaniards. Faced with this situation, the Spaniards asked the viceroyalty authorities to found a larger town for better protection. This is how Juan Bautista de Orozco founded the town of León on 20 January 1576, laying out the layout of the town and installing its first town hall, fulfilling the order of Viceroy Martín Enríquez de Almanza on 12 December 1575, that it be founded in the Valley of Our Lady. The settlement was named Villa de León, place of origin of the Viceroy, and was located between the Machihues and Mariche streams [3] by order of Viceroy Martín Enríquez de Almaza, with the purpose of creating a defense against Chichimeca attacks. In 1580, it was elevated to the category of Alcaldía Mayor, separating it from Guanajuato and had jurisdiction in the current municipality of León [4].

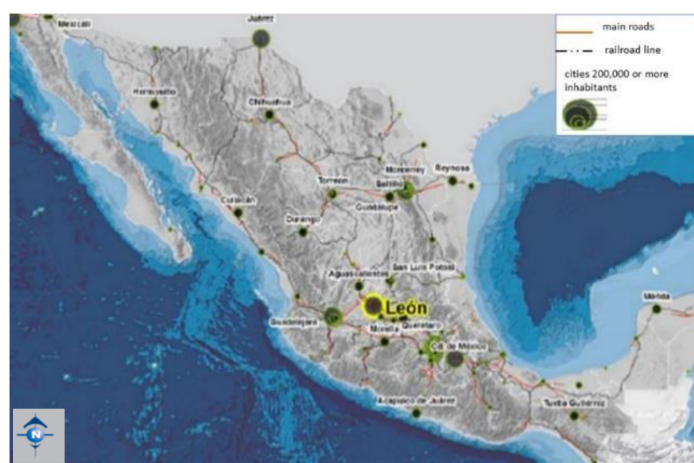
From 1576 to 1780, the Bajío was characterized by the development of handicraft industry, textiles, and cotton factories [5] In the 20th century, shoemaking and tanneries increased. As Miño explains, "the weavers of the Bajío were, between 1793 and 1801, distributed in the towns of their region (Figure 1) without ever presenting the degree of concentration and movement that occurred, for example, in Puebla or Guadalajara" [6]

### 2.1. Temporal and Spatial Delimitation

The municipality of León is part of the National Urban System and is located in a region known as the Mexican Bajío, which includes 107 municipalities in four states (Querétaro, Guanajuato, Michoacán, and Jalisco), characterized mainly by valleys, plains, and hills, and which has become an area of great national importance as one of the country's main trade routes (Figure 2) It stands out for its good location, considered as one of the urban, commercial, and service poles of the western region of the country, strategically connected by federal highway 45D coming from San Juan del Río, Querétaro, and federal highway 45 (Ixmiquilpan-Zacatecas and the Mexico-Ciudad Juárez railroad route [7]).



**Figure 1.** Delimitation of the city's barracks. Formed by Heraclio Jiménez. Source: Historical Archives Municipality of León. Digitalization elaborated by Mtra. Architect Teresa L. Martínez. [6].

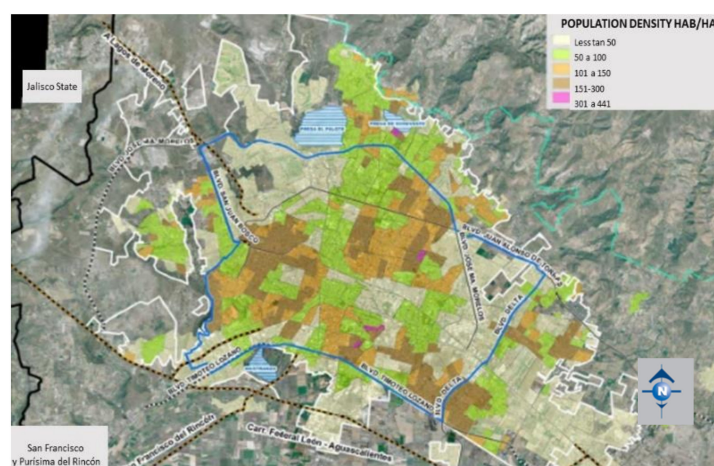


**Figure 2.** Urban growth of the city of León. Prepared by Municipal Planning Institute (IMPLAN) [7].

## 2.2. Growth and Expansion of the City and the Urban and Suburban Public Transportation Service

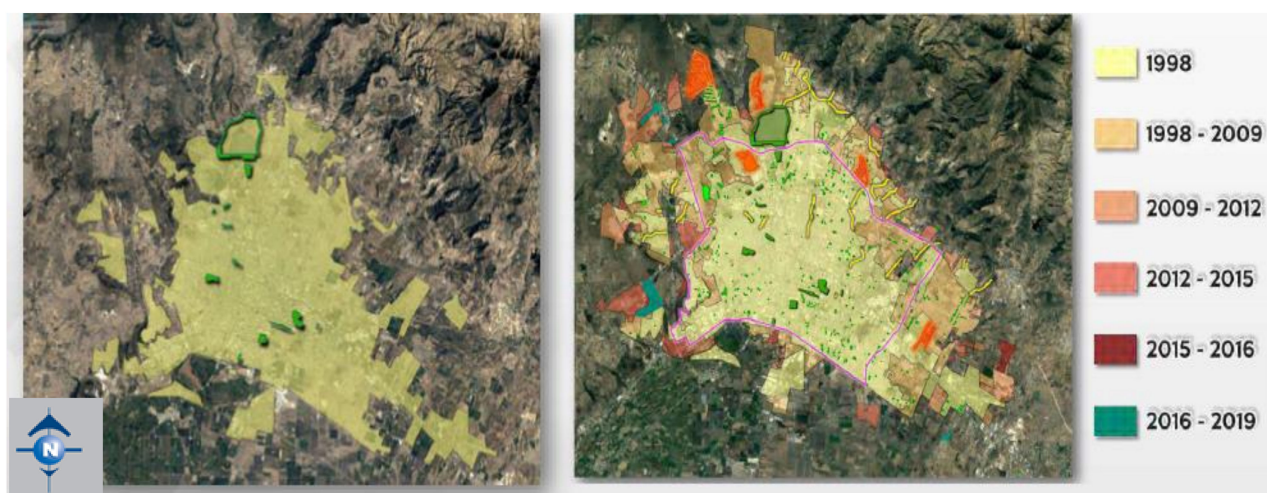
Following the great economic development, the city of León, Gto, the urban area expanded by 72.56% (9662 hectares) in 21 years and the population grew 43.4%; 44% of the city presented an urban density below 50 hab/ha (Figure 3) [7].





**Figure 3.** “50-100” Urban growth of the city of León. In 21 years, the urban area expanded by 72.56% (9662 hectares) and the population grew by 43.4%. Source: Municipal Development Plan Municipal Program for Urban Development and Ecological and Territorial Planning. [7].

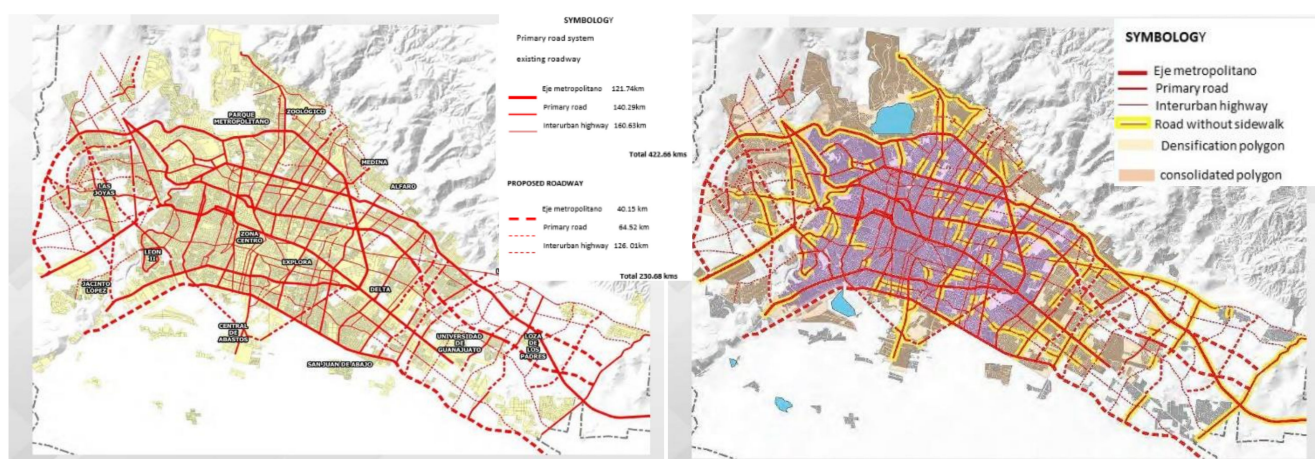
Sixty-five percent of the population occupies the first contour, in an area of 48%. This means that 35% of the rest of the population occupies 52% of the surface in “suburban” conditions, in a diffuse way. This surface area occupied by the 2nd contour due to diffuse urban growth means that for every 2 hectares of urban land, there is approximately 1 hectare of diffuse urban growth (Figure 4)



**Figure 4.** Urban density of the city of León; 44% of the city had an urban density below 50 inhabitants/ha. 2019:61.17 inhabitants per density. Source: Municipal Development Plan. PMDUOET. Municipal Program for Urban Development and Ecological and Territorial Planning. [7].

Among the 20 main strategic development problems [7] of the city of León are the following: Urban expansion of low densities and deficit in infrastructure (Figure 5), equipment, and public spaces, which generates a growing number of empty spaces; deficiency in infrastructure and imbalance between different modes of mobility, which privileges private transportation over non-motorized mobility and public transportation; high rates of failure, educational lag, and dropout; and lack of strategies for the rescue and preservation of the tangible and intangible cultural heritage of the municipality.





**Figure 5.** Mobility. Primary road system (60.71 km 2015–2019) and sidewalks (sidewalk deficit 128.24 km). Source: Municipal Development Plan. PMDUOET. Municipal Program for Urban Development and Ecological and Territorial Planning, 2019. [7].

### 3. Contexts of Inequality from the Disability Perspective

The research is approached from the perspective of disability based on the identification of conditions of poverty, mobility, and inequality, which contribute to fewer opportunities for adequate human development, greater possibilities of exposure to risks, and fewer possibilities of accessing a dignified life. Therefore, the following dimensions are proposed.

#### 3.1. Disability and Poverty

Several studies have identified that in the relationship between disability and poverty, a relationship of a bilateral nature, poverty can increase the risk of disability and vice versa [8]. [9] The report notes the frequency with which the understanding of disability is dismissed because of its deprivation from the world, noting not only its higher prevalence among the poor but also among the underserved population, the author points out several obstacles such as higher cost of living, lower income, and lower earning capacity. [10] Has documented the economic impact of the of disability in the gross domestic product (GDP) for middle-income countries, where Mexico was classified, an impact of between \$902 and \$3154 dollars of annual global loss due to the disability condition of each person in this situation.

In Mexico, studies such as those of [11] allow us to observe the dissimilarity in the participation in economic activities between persons with disabilities and persons without disabilities, being, among persons with disabilities with multiple impairments and cognitive impairments those with the lowest levels of participation, 29.7% and 13.8% respectively. The differences between the economic participation of persons with and without disabilities observe important differences, while 7 out of 10 persons without disabilities were economically active in 2018, only 4 out of 10 were economically active for persons with disabilities.

The differences between income recipients with and without disabilities documented in the National Household Income and Expenditure Survey Encuesta Nacional de Ingresos y Gastos en el Hogar [12] how that the average monthly income for people without disabilities was \$324.4, while the average for people with disabilities was \$198.8; the range of variation in this group was between \$195.5 to \$107.8, the last places being occupied, coinciding with the Solis study, by people with difficulties related to multiple and mental impairments, such as difficulties in self-care or paying attention to learning simple things.

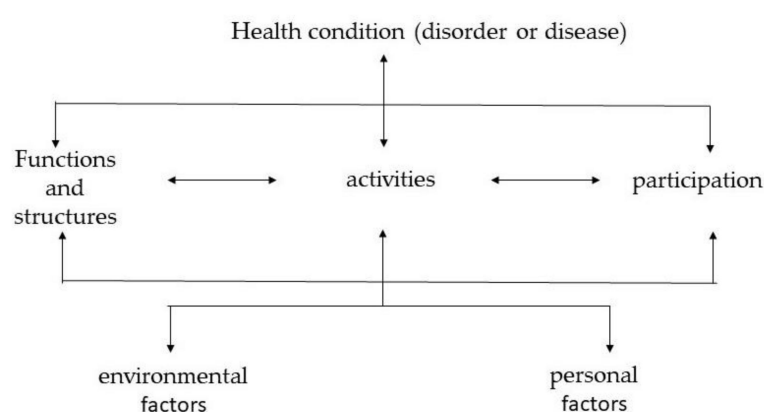
The basic food basket for 2018 was estimated by the National Council for the Evaluation of Social Development Policy CONEVAL, at \$157.4 and \$101.8 for urban and rural localities respectively [13]. It is worth mentioning that the calculation of the basic basket does not include differentiated considerations for people with and without disabilities.

Studies such as Metts allow concluding that this is higher for households where people with disabilities live, and that its value is also related to the intensity in the limitations caused by people's impairments.

For 2018, in Mexico 48.6% of people with disabilities were in poverty, 38.8% of which were in moderate poverty and 9.8% in extreme poverty. In contrast for the population without disabilities, the percentage of poverty was 41.4%, 34.1% and 7.3% for moderate and extreme poverty respectively. It can be seen how in Mexico that the aspects pointed out by Sen for people with disabilities related to income are manifested in a concrete manner and can be considered as contributing conditions for a higher prevalence of poverty in the population with this condition.

### 3.2. Disability and Mobility

The WHO defines disability as all limitations in activity and restrictions in participation as a result of impairments, within the framework of interactions between the individual and his or her environmental and personal contextual factors [14], it is proposed in the International Classification of Disability Functioning and Health ICF (Figure 6) to assess disability in two parts with two components each. These components have interactions explained in the following scheme:



**Figure 6.** Conceptual scheme of disability proposed from the International Classification of Disability Functioning and Health (ICF) from [14].

The assessment of the different areas of facilitation or barrier identifies a greater or lesser capacity for participation, which aspires to be full and effective, on equal terms with the rest of the population [15], an aspect that can be related to the Capabilities Approach [16] and its focus on the achievement of the exercise of substantive freedom [15]. Transportation in the context of the International Classification of Functioning, of Functioning, Disability and Health (ICF) IPC is identified in the Environmental Factors component, in the Services, systems, and policies domain, and specifically with code e540 services, systems, and policies for transportation. From the Capabilities Approach, public transport is encompassed within the social/political-economic conditions as a tool to choose a specific operation. Nussbam proposes among its central capabilities the physical integrity, which includes, among other aspects, the ability to move freely from one place to another [16]. From both approaches, limiting mobility, due to the absence of public transportation for people with disabilities, is a restriction for the achievement of either effective participation or the exercise of substantive freedom, particularly when the person has greater limitations as a result of his or her impairments and the transportation service presents insurmountable barriers. Just as for the rest of the population, access to resources in the territory can be considered as the main objective of mobility; mobility is a fundamental element for accessing the world and its resources [17]. The most common barriers in public transportation faced by people with disabilities are the lack of effective programs, barriers in transportation units, physical and information barriers, discontinuity in the transportation chain, accessibility in

pedestrian routes, as well as lack of staff awareness [8]. In Mexico, according to the results of the National Survey of Discrimination (ENADIS), 25.1% of people with disabilities stated having experienced discrimination in at least one social sphere, the spaces where discrimination was perceived to be greater were medical services, the street, or public transport and the family.

### 3.3. Disability and Inequality

Inequality has been studied and measured mainly in terms of economic income by analyzing the distribution of wealth in society. In urban areas, it has been analyzed in terms of the distribution of income and employment, understood as containers of inequality. However, in recent years there has been a shift in the understanding of inequality based solely on the structural class location of individuals within an economic order, to the extent that it does not consider power relations that are not only class-based but can also be attributed to gender, ethnicity, culture, religion, or sexuality identities and even with vulnerable groups [18].

It is important to achieve the inclusion of all vulnerable groups such as the elderly and people with disabilities and to avoid the continued existence of inequalities towards these groups. In this sense, inequality becomes a mechanism of exclusion, while inequality refers to the process of inequitable positioning, distribution and appropriation of social, political, economic, and cultural resources among the members of a society, incorporating not only material resources but also immaterial and intangible resources such as time, power, and freedom. Social exclusion refers to the limitations of access and participation to these resources, which limits the possibilities that certain members of society have to participate in the dynamics and processes of development existing in it, generating breaks in social cohesion [19]. The multidimensional nature of social exclusion is also manifested in the differentiated and unequal access to means and mechanisms of daily urban mobility, and consequently, to the goods, products, and material and symbolic services available within an urban society.

Every day, urban mobility makes it possible to incorporate new perspectives that make it possible to question and problematize the way in which social ties and relations between city dwellers are shaped. Thus, urban daily mobility is an increasingly massive, recurrent, and complex social practice, strongly conditioned by the high levels of inequality existing in the city. For this reason, the study of strategies and experiences of urban daily mobility provides a critical approach to the analysis of urban social relations, particularly those involving processes of social exclusion. This study allows for a critical analysis of the way the city is thought, planned, and managed, because mobility affects various aspects of daily life, in terms of how to move or how to settle, what can be taken and what is conditioned, and who can move freely and who does so in a restricted manner [20].

## 4. Need for an Inclusive Public Transportation System for León

As mentioned above, a gap has been identified in the programs associated with urban transportation systems not only in the city of León, but also in other cities, which is seen as an area of opportunity to develop those local and municipal actions that in parallel contribute to sustainable, efficient, and above all inclusive mobility for all, so it is relevant and important to highlight those aspects that influence in increasing the conditions of disability of people in the city. In this sense, the implementation of an Inclusive Urban Transport project such as Inclusive Urban Transportation (IÜT) TUI has given very interesting results articulating strategic actors and the community, which represents valuable opportunities in the development of local inclusion strategies.

Currently, the transportation system in the city of Leon is conceived under an Integrated Transportation System (ITS) network. In accordance with the Sustainable Development Goals (SDG) 2030 particularly goal 11, as well as the contribution to the development of people with disabilities in the State of Guanajuato, this project carried out in the municipality of Leon, Guanajuato is shown as a model to follow among the states that make up



the Mexican Republic. According to data from the 2010 Population and Housing Census, in León there are 48,642 people with disabilities, equivalent to 3.4%; through the Tui service, there have been 18,206 services granted during a year of operation, including a restricted service due to the pandemic situation as of March 2020, with 8 units distributed in 16 routes. In contrast, at the end of 2018, 40,642 services were reported with a vehicle fleet of 118 units. The need is identified for a state fund to support the operations covered by the municipalities and complementary to the Federal, Public Transportation Accessibility Fund for Persons with Disabilities (FOTRADIS). Municipal investment, to which operational routes are added in the municipalities of Tarimoro and recently Uriangato. While these projects can be considered as affirmative actions, in terms of the legal framework against discrimination in the Entity, the strategies, projects, and actions derived from the PMDUPET in the municipalities will be the key tool for the achievement of the vision set out in the PED 2040, ODS2030, particularly goal 11, as well as the contribution to the development of persons with disabilities in the State of Guanajuato.

*Adapted Public Transportation Services for People with Disabilities and Reduced Mobility in the Municipality of León*

Before implementing the Inclusive Public Transportation service, the municipality requested that it be carried out by the transportation concessionaires; however, this was not authorized by the Guanajuato Institute for People with Disabilities (INGUDIS), so the municipality had to spend close to one million pesos to implement it. (Table 1)

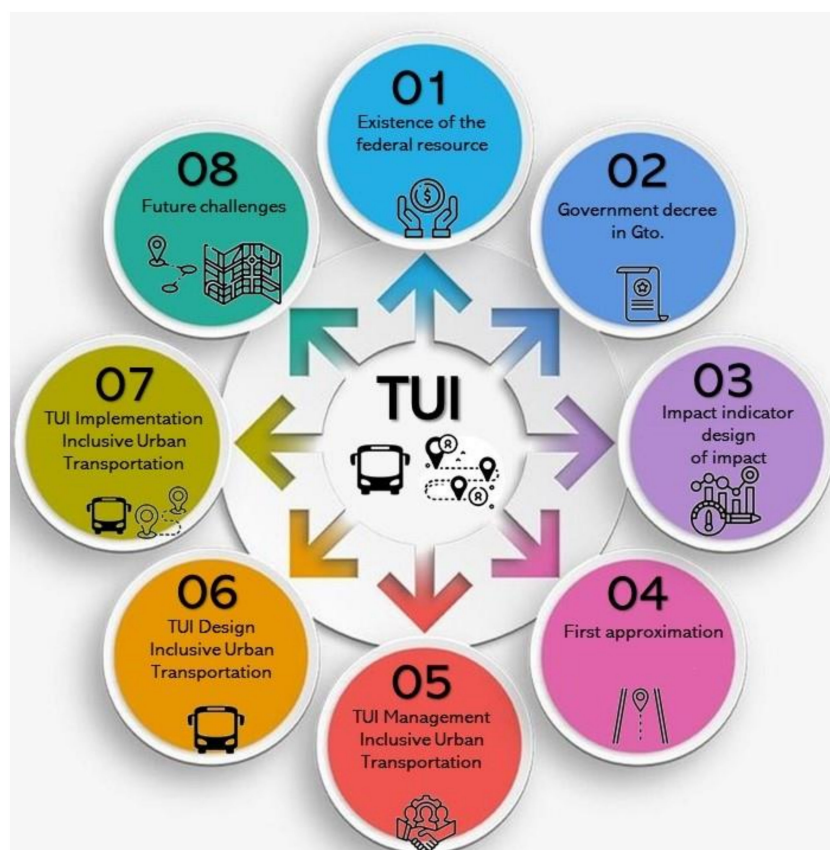
**Table 1.** Chronological background of the project, 2021 chronology of events according to year and feature of institutionalism.

Year	Scope of Institutionalality	Event
2011–2020	Resources	Federal resources are programmed for public transportation and accessibility in the specific context of disability.
2012	Laws	In the state of Guanajuato, the modality of Public Transportation adapted for Persons with Disabilities is established by decree.
2016	Laws	The modality is transferred to the Mobility Law of the State of Guanajuato and its Municipalities, being a transportation modality with a wide range of operations.
2015–2016	Evaluation instruments	A process is designed to use an indicator to assess the impact of the service coverage of the Adapted Public Transportation Network operated by the Municipal Integral Family Development (DIF) Systems.
2016	Articulation mechanisms	Installation of the first service configured as a route in the municipality of Tarimoro, we observe, among other aspects, a 100% increase in the impact of use.
2017	Articulation mechanisms	Dialogue begins with the Transportation and Mobility Department of León and the idea of installing a system of peripheral routes to the terminals of the SIT trunk routes is defined.
2018	Legal framework, articulation mechanisms, agencies, resourcing.	A service goal is programmed as a goal in the 2018–24 municipal public administration program, including the creation of an administrative unit within the General Directorate of Mobility for its operation, and the strategy is designed in conjunction with the Municipal DIF System, for the design of routes, definition of program beneficiaries, and training of operators.
2019	Legal framework, articulation mechanisms, agencies, resourcing.	In July 2019, the service will be inaugurated; in December, an additional route will be added to the 16 routes initially installed.

## 5. Methodology: Phases of the TUI\_ Inclusive Urban Transport Mode

The TUI (Figure 7) Inclusive Urban Transportation model is made up of seven phases that have been gradually articulated in sequential order to mitigate the conditions of

vulnerability associated with disability and public transportation, starting with the availability of resources, the regulatory framework, design of impact indicators, first approach, management, design and implementation of the TUI, as well as its monitoring for future challenges, which are shown in the following chart.



**Figure 7.** Phases of the TUI (Inclusive Urban Transport) implemented in the city of León Guanajuato. Own elaboration, 2021. Source: Adapted Public Transportation Services for people with disabilities and reduced mobility in the municipalities of León and Celaya.

#### 5.1. Phase 1. Management and Disposition of Federal Resources

**Resource endowment.** As part of the Ramo 23, Previsiones Salariales y Económicas, it is part of the budgetary policy tools destined to the attention of obligations of the Federal Government which are not carried out directly by dependencies or entities [21] in the year 2011 that the Fund for Accessibility in Public Transportation for Persons with Disabilities is published, which remains until the year 2020, except for the year 2015 in which it is published as Fund for Accessibility for Persons with Disabilities. Table 2 shows, according to data from the Expenditure Observatory of the Ministry of Finance, in the approved amount in dollars disposed throughout the years that the fund existed, said amount was distributed proportionally according to the known percentage of people with disabilities in each federal entity; in 2018, 853,588 dollars were allocated to Guanajuato. A part of this resource was destined to the acquisition of 14 adapted vehicles, of which 8 were destined to the municipality of León.

**Table 2.** Resources approved 1 2 3 from Ramo 23 for the fiscal years of existence of the Fund for Accessibility to distribute in the 32 states of the country.

Year	Fund	
	Public Transportation Accessibility Fund for Persons with Disabilities Fund for Accessibility in Public Transportation for Persons with Disabilities FOATD	Fund for Accessibility for Persons with Disabilities FOAP
2011	31,726,160	
2012	20,549,214	
2013	26,068,822	
2014	26,068,822	
2015		37,080,572
2016	34,797,747	
2017	24,447,346	
2018	26,068,822	
2019	20,123,379	
2020	19,555,538	

<sup>1</sup> Source: <https://nptp.hacienda.gob.mx/programas/jsp/programas/fichaPrograma.jsp?id%20=%2023U075> (accessed on 20 February 2021), <sup>2</sup> values deflated according to the National Consumer Price Index, INEGI, as of 2018 source [https://www.inegi.org.mx/app/tabulados/default.aspx?nc%20=%20ca55\\_2018](https://www.inegi.org.mx/app/tabulados/default.aspx?nc%20=%20ca55_2018) (accessed on 20 February 2021), <sup>3</sup> values in dollars, exchange rate as of September 2018, Developed by: Fonce, C. 2021.

### 5.2. Phase 2. Governmental Regulatory Decree (in Force)

Adjustments in the Regulations. The modality of Adapted Public Transportation for Persons with Disabilities and Reduced Mobility was created from the governmental decree 203, published in April 2012. At that time, it was established as a modality to be operated exclusively by government entities. In 2016, with the publication of the Mobility Law of the State of Guanajuato and its Municipalities, the possibility of having concessions of this nature operated by public or private instances was concretized. The particularity of this modality is the flexibility of use to which the units can be destined, they can cover areas of other modalities, such as personnel transportation, tourist transportation, transportation with route or without route, urban and foreign. The objective of this is to facilitate the implementation of transportation projects of any kind as long as these are intended for people with disabilities and include the necessary technical adjustments to fulfill this function.

### 5.3. Phase 3. Impact Indicator Design

Measurement instruments. During 2016, in the Annual Work Program (AWP) of the State Committee of Statistical and Geographic Information of the State of Guanajuato

(CEIEG), the Impact Indicator of coverage in the municipalities of the units of the Adapted Public Transport Network for Persons with Disabilities is developed. The indicator is based on the results of work performed reported monthly by each agency of the 46 municipalities operating the units. The indicator (P) is defined as the ratio between the total number of people who receive a transfer service reported in the logbook (Ub) and the product of available seats according to the vehicles operated by each municipality, and is expressed by the following formula:

$$P = \frac{Ub}{(Pd)30}(100)$$

In 2017, the CEIG's PAT included quarterly documentation of the impact of vehicle use in the different municipalities including usage data documented in logs since 2015. Among other aspects, the impact of the first municipality that formally installed a fixed route operation, the municipality of Tarimoro, was observed in May 2016. Among other aspects, in addition to a significant increase in the percentage of impact, the Hellen Keller education center, focused on minors with disabilities, went from an enrollment of 37 students in the 2015–2016 cycle to 71 in the 2017–2018 cycle.

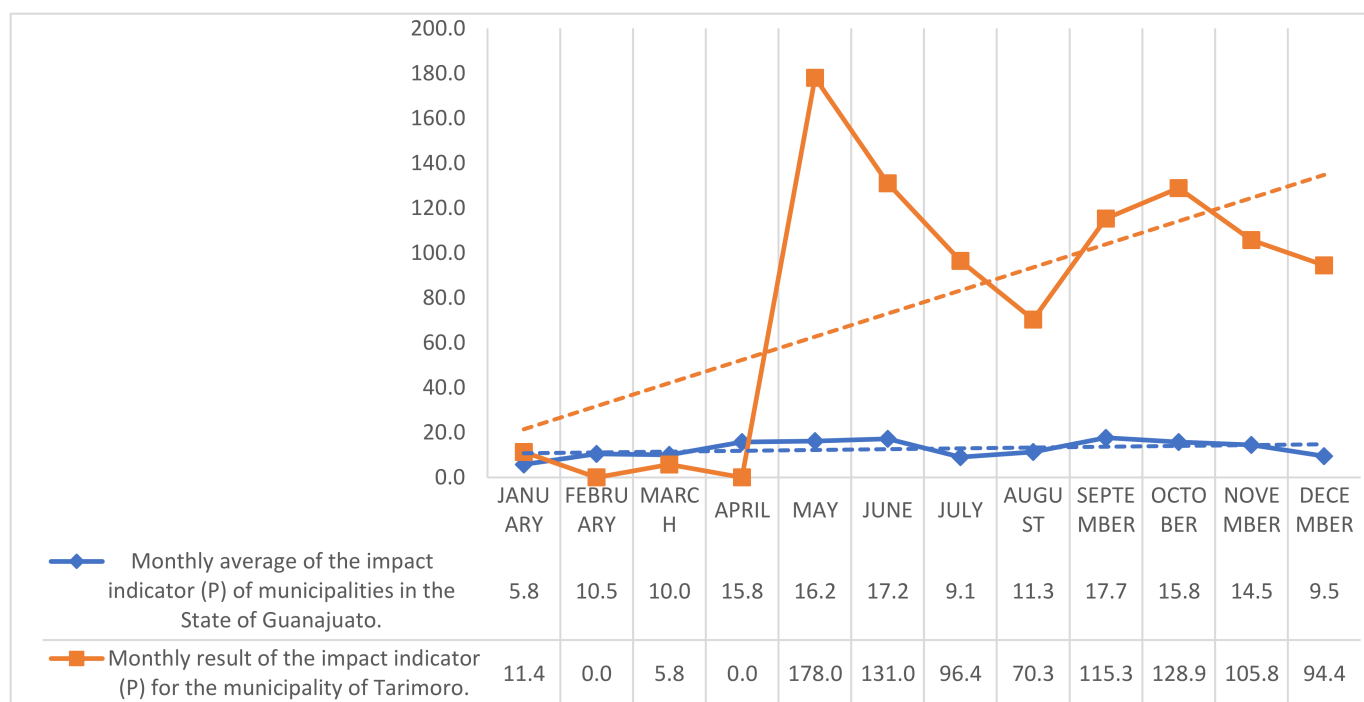


#### 5.4. Phase 4. First Approach to the Case Study

The investment projects of each fiscal year to exercise the Fund for Accessibility in Public Transportation for Persons with Disabilities FOATD required a project documentation made in the previous fiscal year. In 2017, we have the first approaches with the General Directorate of Mobility of the municipality of León to raise the installation of units system, which is conceptualized to function as feeder units with routes intended to operate around the terminals of the trunk routes of the trunk routes where Bus Rapid Transit BRT type buses operate.

#### 5.5. Phase 5. Inclusive Urban Transport Management (TUI)

Management of the so-called. Inclusive Urban Transportation TUI. The 2010 Population and Housing Census estimated a population in the city of León de los Aldama of 1,238,962 people, of which 41,445 were people with disabilities. The coverage of the SIT integrated transportation system is accessible only on trunk routes. A goal of transfer services is proposed in the municipal government program 2018–2024, to be operated through a government company scheme within the General Directorate of the Municipality (Figure 8).



**Figure 8.** Measurement instruments of the Annual Work Program PAT of the State Committee for Statistical and Geographic Information of the State of Guanajuato, CEIEG. Source: Own elaboration 2020.

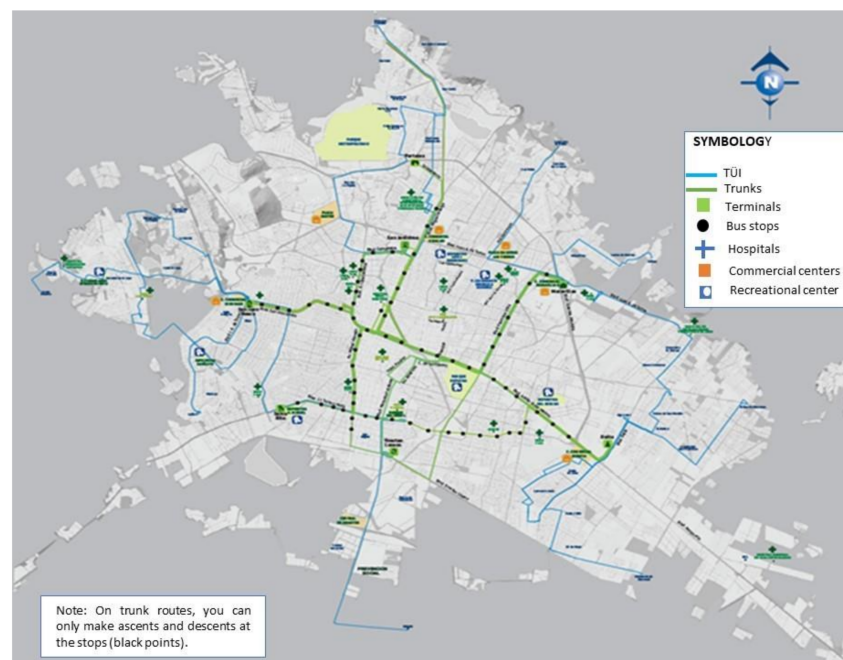
#### 5.6. Phase 6. Inclusive Urban Transportation Design

The map shows the design of the TUI routes and how these are articulated to the trunk lines where BRT units operate with accessible stops. The organizational structure of the General Directorate of Mobility is transformed to have a team of operators and administrative monitoring of the vehicle fleet, i.e., a government administrative unit is formed to provide the service. It is worth mentioning that these services have no cost for the user or their companions and just present the credential of the National Registry of Persons with Disabilities, which can be processed in the offices of the Municipal System for Integral Development of the Family (SMDIF), also free of charge. The SMDIF is a decentralized agency of the municipal government that provides social assistance and rehabilitation services to people with disabilities and other population groups such as the

elderly. The addresses of the users of the services in the different SMDIF centers were an input for the conformation of the routes; among other aspects, the SMDIF participates in the training of the personnel destined to operate the units in the matter of treatment and attention to people with disabilities, given the long experience in the matter.

#### 5.7. Phase 7. Implementation of Inclusive Urban Transportation

In July 2019 the TUI (Figure 9) services are inaugurated with 16 routes in which 8 vehicles operate from Monday to Saturday from 7:30 to 16:30 h. The van type units are equipped with a lifting platform and the possibility of transporting wheelchair users. A communication campaign is conducted to publicize the service among the population, consisting of posters in the transport system, large posters in different parts of the city, printing and distribution of information brochures, as well as the provision of the number of citizen attention. In December of the same year, another route was installed to facilitate access to the Regional General Hospital, which was relocated from its previous location in the center of the city to the northeastern part of the city. The cost of the service on the TUI routes is free; people must cover the fare, with a preferential rate for people with disabilities, if the trip is required to be through the trunk routes.



**Figure 9.** Inclusive Public Transportation Routes in the municipality of León Gto. Source: <https://leon.gob.mx/leon/tui/tui-troncales.pdf> (accessed on 15 April 2021) [21].

#### 5.8. Phase 8. Future Results and Challenges

The greatest future challenge lies in providing accessible services, according to the principles of universal design available to the entire population, although actions such as the TUI contribute as affirmative actions to address gaps in the long term the possibility of accessing transportation services to exercise personal mobility should be generally available to all people. The federal fund from which the resources for the acquisition of new vehicles came from did not continue in fiscal year 2021; currently, the resources for the operation are entirely covered by the municipal government. If the demand increases to a point where more units are required, it is important to propose a resource participation scheme, at least with the participation of the state government and desirably also of the federal government for its attention. Currently, despite the fact that the productivity of the units is notably higher than the state average, the number of users is lower than expected, and a study is needed to identify the causes of this circumstance. In the city of León, there

has been a sustained policy of promoting cycling mobility, with an extensive network of bicycle lanes and roads with preferential cycling mobility, an aspect that is reflected in the presence of bicycles in private homes censused during the Population and Housing Census 2020, the average in towns in Mexico with more than one million inhabitants is 20; 17%, while for the city of León, it is 30.69%. It is relevant to promote cycling mobility for people with disabilities, particularly wheelchair users, since the tricycle as a technical aid is identified by the World Health Organization (WHO) as one of the 50 priority technical aids in the world for people with disabilities.

## 6. Discussion

As shown in the methodological design, the management, design, and implementation of TUI Inclusive Urban Transport shows the articulation of actors as agents of vital importance for the success of the project. According to the diagnosis of Accessibility of BRT systems in Mexico, published in 2016, accessibility elements are usually integrated in isolation, without having a comprehensive planning that considers the concepts from the initial phase. It is very important to have the permanent participation of focus groups that identify from their own or close experience the real needs of users with reduced mobility [22]. The initial implementation of Inclusive Urban Transport to the current BTR routes in the municipality of León, should be made visible as the beginning of an integral system model of adaptation to current and future public transport, which although it has been visualized with high possibilities of replicability to other municipalities in the country, frequent monitoring should be carried out to ensure its proper adaptation to the current systems of motorized and non-motorized mobility in conjunction with other transport routes in other sectors of the city. Among the indicators that can evaluate the accessibility index in public transportation are the potential opportunities available to an individual or a group of individuals, the possibilities of individuals to participate in one or more activities, the purposes of trips based on activities, the ability to reach a place from various origins, among others, highlighting priority concepts such as mode of transportation, location, social groups, and associated activity [23]. Low-income populations suffer from measurable deficits: nutrition, health, education, housing, and job opportunities, which invariably correlate with deficits in mobility [24].

For [23] inequalities in the distribution of public infrastructure services for mobility can contribute to the production and reproduction of social inequalities and high levels of exclusion in cities [25]. Thus, the deficiency in public transportation impacts on longer trips and consequently longer travel times, higher costs, and an increase in risk situations such as pollution, traffic accidents, and now contagions [24], not to mention that these possibilities are drastically reduced when user conditions involve reduced mobility. Spatial distribution correlated with the location of services such as education are aspects that open opportunities in development plans for an improvement in their efficiency, which would imply a greater coverage to people's demands. These demands, through the data collection carried out in the case study, have particularly shown the scarce attention to the most vulnerable sectors in some areas of the city.

Emphasizing the context of the Global Agenda for Sustainable Development, specifically SDG11, under the concept of urban and community resilience, there are some emerging initiatives from COVID-19, which raise the need to develop projects that are associated with urban dynamics issues from the perspective of urban and human geography in conjunction with transportation engineering, sociodemographic aspects, and adaptations to different lifestyles from an ethnographic and anthropological perspective, where urban resilience precisely represents that survival of urban fabrics where the most vulnerable groups try to resist the impacts of crises [26,27]. Thus, urban resilience should consider aspects such as financial resources and adequate infrastructure, which contribute significantly to recovery efforts for human health and well-being [28]. In this case, the study of City of León is an example of real actions for the construction of inclusive scenarios with equal opportunities for all.



It is relevant to mention the integration of the public transport service route through the operation of an administrative unit of municipal government, this strategy is unusual, at least in the state of Guanajuato, since such services are usually concessioned and operated by private individuals under the regulatory provisions established in the state and the municipality itself. The provision of public resources for the implementation of a service that may not be economically profitable for the private initiative to operate shows the social commitment of the public administration in the municipality.

## 7. Conclusions

The absence of opportunities for access to adequate urban transportation results in fewer possibilities for the most disadvantaged, i.e., among the main strategic development problems identified in the [7] is the excessive urban sprawl, which inevitably implies low densities with infrastructure and service deficits, as well as deficiencies in mobility modes, since public transportation is usually the only alternative to connect with the centralities, and usually other trips are made to get there. Thus, we can affirm that there is indeed a direct relationship between disability and poverty, since current programs do not have the required scope, there is no adequate access to information, and mobility plans do not integrate accessibility aspects from an integral perspective, which denotes a lack of awareness. According to this study, people emphasized that the greatest areas of discrimination were those associated with medical services, public transportation, and public space, as well as family environments. Thus, we find ourselves with scenarios in urban peripheral areas with high concentration of low or no income, without services and with high density, which generates greater possibilities of social segregation, difficulties in access to housing and health, among others. Traditional methods of planning, urban transportation, and mobility in the city are based on demand and efficiency, without considering social or spatial equity [29] in addition to not integrating analysis and evaluation tools of indicators that assess accessibility levels from multiple dimensions such as a geographical context and distribution of services or planning at the urban system level. Transportation provides the means to access essential opportunities for participation in society, such as employment, education, commerce, and social activities, thus linking lack of mobility with social disadvantage and exclusion [30].

### 7.1. Public Policies Associated with Mobility with a Social Approach

Inequalities generate high rates of marginalization of the most vulnerable sectors of the population, so that public policies with a social approach have the possibility of mitigating these effects related not only to urban mobility, but should also include environmental, social, health and, of course, sociodemographic aspects [31]. Concern about the social consequences of mobility has led to a significant increase in research exploring the links between transport, poverty, welfare and sustainability [30]. If we stress the importance of adapting global agendas to a local scale such as municipalities, the TUI model represents the possibility of integrating aspects of sustainability, efficiency and inclusive mobility, contributing to a possible public policy that favors an increase in the levels of equity and integration of vulnerable groups to urban life, integrating motives of mobility culture, exercising the essential aspects of the guarantees of the right to the city.

Martha Nussbaum [16] considers that the idea of equality raised in the social contract implicitly considers a condition of physical and mental equality between individuals for whom such contract entails reciprocal advantages for participation in society. In Mexico, the constitutional reform on human rights means a change of focus for the construction of policies by which there is no room for the exclusion of any person and in cases such as the present study, it means that the implementation of actions by their nature can be considered as part of the transition process triggered by the aforementioned reform.

## 7.2. Future Lines of Development

- Develop innovative methodologies that contribute to strengthen the proposal of strategic plans associated with transportation and urban mobility, from the perspective of equality and inclusion, to promote better opportunities for the less favored.
- The replicability of the operational model in other municipalities in the country, with high possibilities of contributing to the fulfillment of SDGs: SDG 11: Resilient cities and communities, SDG 3: health and well-being, and SDG 10: reduction of inequalities.
- Development and implementation of protocols for management, care, and implementation of the model in risk areas in the city, where people in vulnerable conditions are concentrated in greater proportion.
- Reflect within the constitutional regulatory frameworks the relevance and need to create an inter-institutional model focused on actions of rights and equality, which in turn, constantly promotes the culture of inclusion.

**Author Contributions:** Conceptualization, F.C.-F. and C.D.F.-S.; Data curation, F.C.-F. and C.D.F.-S.; Formal analysis, F.C.-F. and C.D.F.-S.; Funding acquisition, F.C.-F., M.F.-G., A.G.-R., Municipality of Leon; Investigation, All authors.; Methodology, F.C.-F. and C.D.F.-S.; Project administration, C.D.F.-S., Municipality of Leon; Resources, F.C.-F. and C.D.F.-S.; Supervision, F.C.-F.; Validation, F.C.-F., C.D.F.-S. and M.F.-G.; Visualization, F.C.-F., C.D.F.-S., M.F.-G.; Writing—original draft, F.C.-F.; Writing—review and editing, F.C.-F. and M.F.-G. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research was funded by Presupuesto de egresos de la Federación para el Ejercicio Fiscal 2018, anexos 21 y 21.1, correspondientes al Ramo General 23 Provisiones Salariales y Económicas y Administración del Ayuntamiento de Leon 2018-2021. (Leon, Gto. México). Federation of Colleges of Architects of the Mexican Republic.

**Institutional Review Board Statement:** Not applicable. This research uses the conceptualization of disability proposed by the World Health Organization, based on the International Classification of Functioning, Disability and Health (ICF). This conceptualization contemplates components of the person and his/her context. The present research did not address medical aspects of people; the object of study is focused on the policy, system and transport service, which together are part of the environmental factors of disability. Due to the situation described, the present research is outside the object of the Helsinki declaration, since it does not inquire about medical conditions, human material or identifiable information of specific persons.

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** The data presented in this study are available upon request to the corresponding author. The data are publicly available on the access to information page of the municipality of Leon, Gto.

**Acknowledgments:** We gratefully thank Alma Cristina Rodríguez Vallejo, Director of the Municipal System for Integral Family Development (Sistema Municipal de Desarrollo Integral de Familia). To Engineer Enrique Moreno, General Director of Mobility, Municipality of León, Gto. for providing data on the TUI routes. We also thank ITESO's Reduced Mobility and Senior Citizens Laboratory for their support and the reviewers for their contribution and professional and suggestive guidance, which have been of great help. Alma Cristina Rodríguez Vallejo and Enrique Moreno agree that their names should appear in the acknowledgements and Natasa Miladinovic, Assistant Editor the reviewers for their contribution of professional guidance and suggestions.

**Conflicts of Interest:** The authors declare no conflict of interest.

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