



Article

Citizens' Perceptions in Relation to Transport Systems and Infrastructures: A Nationwide Study in the Dominican Republic

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Abstract: One of the challenges currently faced by emerging countries is to get their citizens to decide to use sustainable transport for their regular trips, in order to reduce the current vehicular pollution rates. The objective of this descriptive research is to examine the perceptions of Dominicans regarding the state of the country's transport systems and road infrastructure. For this purpose, a nationwide survey procedure was performed. This cross-sectional research used the data retrieved from a sample of 1260 citizens aged over 18, proportional in gender, age, habitat, and province of the Dominican Republic. The results showed how Dominicans believe that, compared to other road features, pedestrian roads and public transport vehicles remain in a very poor condition. Further, citizens report to be more interested about the improvement of road infrastructures than in the implementation of any other set of measures performed to promote sustainable road mobility, including those related with alternative transport means. Finally, this study claims for the need of fostering educational, communicative and participative actions and measures aimed at increasing the value given to sustainable transportation, and the relevance of integrate potential structural and vehicular improvements with those related to human behavior in mobility.

Keywords: perception; mobility; road safety; cities; infrastructures; Dominican Republic



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1. Introduction

Given the recently released Sustainable Development Goals (SDGs), many governmental authorities around the world are developing action plans to encourage sustainable transport as an essential part of their regional development plans [1]. In brief, it is a fact that the present and future of cities is bound to be greener [2]. Therefore, it is necessary to reduce the pollution rates produced by the high concentrations of vehicles on the roads [3,4]. One of the main measures in this regard is the implementation of actions to improve mobility in cities and, thus, avoid traffic jams [5,6].

Over the last two decades, transport mobility problems have turned in a particularly concerning phenomenon worldwide, but especially in emerging countries, whose resources and capability remain more limited to face several problems present in many spheres, including those other than mobility [7]. The idiosyncrasies of these countries exacerbate this situation due to several factors [8]. On the one hand, the existing infrastructures are deficient, and there is a lack of technological systems [9,10]. Further, technical reports frequently show how inadequately constructed sidewalks and roads with obstacles hinder the flow of traffic, endangering users' urban trips. In addition, on many occasions, public roads are not prepared or adapted to the needs of city dwellers [11]. Dangerous road scenes occur due to the lack of traffic lights, pedestrian crossings or level crossings in areas with a high concentration of population and frequency of travel. Thus, poor planning of road

construction has a direct impact on the road safety of citizens [12]. On the other hand, another aspect that should be emphasized is that the quality of public transport service is not optimal because of the condition of vehicles and the planning of transport routes [13].

All these elements modify the way citizens move around. In fact, many studies indicate that a large number of people do not commute on foot or use a bicycle because their towns and cities do not have an efficient infrastructure for this purpose, even though these would be their preferred modes of transportation [14].

Some recent studies have been systematically showing how, in addition to socio-economic factors, there are other issues greatly influencing the quality of infrastructure of countries. These factors include, e.g., the region's size, tourism density, the degree of urbanization and motorization, and government strategies [15,16]. In the particular case of the Dominican Republic, the large annual volume of tourists is, in fact, one of the reasons that have allowed the wider development of the road network, as well as the conditions and coverage of public transport services [9].

However, perceptions in these regards may vary among users, especially when compared to objective data. Indeed, users' perceptions of road infrastructures also tend to substantially differ across countries. Azik et al. (2021) found that road systems tend to be positively evaluated in Russia and Estonia, highlighting its adequacy for pedestrians and cyclists, while Turkish citizens stated that the infrastructural adequacy for driving in their country was rather *unsafe* for users [17]. Similarly, a study performed in the UK reported that sidewalk and traffic conditions were commonly perceived barriers to pedestrians and key factors in the choice of travel route [18]. In other research conducted in the United States, citizens perceived an improvement in road conditions compared to two decades ago, even though not to a very extensive extent. Still, most respondents agreed with a moderate tax increase to improve the road infrastructure in their area [19]. Overall, all these studies show how important it is for the population to have adequate and safe road networks in constant development [20].

1.1. Study Area

The situation in the Dominican Republic is framed within the aforementioned particularities. The country has 4,842,367 private vehicles registered in its national vehicle fleet as of 2020, representing an increase of 4.5% over the previous year [21]. This number of vehicles, together with the state of the road infrastructure, has an impact on the country's mobility problems and its high accident rate, which is one of the highest in the world [22]. Although the Dominican Republic has multiple means of public transport, the quality of these means that citizens choose to travel by private car or motorcycle [23]. The public transport supply is mainly composed of motorcycles, cabs, and urban buses, although there are also metro and metropolitan buses in the major cities of Santo Domingo and Santiago [24].

Additionally, in recent years national and local authorities have tried to promote sustainable transport through communication campaigns, but they have not been assessed as very effective [25]. Data from 2018 indicate that only 21% travel by foot regularly, 36% by public transport, and less than 1% make regular trips by bicycle [26].

In regard to economic settings, most trade in the Dominican Republic is carried out by land transport, with the country's road network being the main facilitator of the distribution of goods and services [27]. In addition, the existing literature in the field generally agrees on the importance of counting on adequate development and maintenance actions of roads, routes, and public transport vehicles, given that all them constitute potential engines to invigorate many other important dynamics of the country's economy, including tourism and regional development [28].

1.2. Objectives

The present study aims to examine the perceptions of the population of the Dominican Republic regarding the state of their road infrastructure, public transport, and the degree to which they believe their cities are prepared for the travel needs of their citizens. In addition, opinions regarding future measures that the government plans to implement were also analyzed, in order to assess the degree of peoples’ predisposition to partake in such changes, and to suggest some practical guidelines for transport-related policymakers in the region.

2. Materials and Methods

2.1. Participants

This study analyzed the information provided by a nationwide sample of $n = 1260$ Dominican Republic residents from different cities of the country. It was a completely voluntary and anonymous process and corresponded to the main features of the general Dominican population. According to the ONE census (National Statistics Office of Dominican Republic), the sample distribution was proportional to the population by gender, age (over 18), habitat, and province [18] (Table 1 and Figure 1). If we assume a degree of confidence of 99 percent, a maximum margin of error of 5 percent ($=0.05$), and a beta of 0.20, which allows for an 80 percent power, the minimum sample size should be around $n = 680$ (Table 1).

Table 1. Sociodemographic data of the sample.

| Feature | Category | Total | | Male | | Female | |
|---------------------------------|--------------|----------|-------|----------|-------|----------|-------|
| | | <i>n</i> | % | <i>n</i> | % | <i>n</i> | % |
| Age range | 18–24 | 260 | 20.6% | 136 | 21.6% | 124 | 19.7% |
| | 25–34 | 311 | 24.7% | 146 | 23.2% | 165 | 26.2% |
| | 35–49 | 366 | 29.0% | 193 | 30.6% | 173 | 27.5% |
| | 50–64 | 221 | 17.5% | 108 | 17.1% | 113 | 17.9% |
| | >65 | 102 | 8.1% | 57 | 17.1% | 55 | 8.7% |
| | Total | 1260 | 100% | 630 | 100% | 630 | 100% |
| Do you drive a motor vehicle? | Yes | 580 | 46.0% | 458 | 72.7% | 122 | 19.4% |
| | No | 680 | 54.0% | 172 | 27.3% | 508 | 80.6% |
| | Total | 1260 | 100% | 630 | 100% | 630 | 100% |
| Do you have a driver’s license? | Yes | 273 | 21.7% | 244 | 38.7% | 29 | 4.6% |
| | No | 987 | 78.7% | 386 | 61.3% | 601 | 95.4% |
| | Total | 1260 | 100% | 630 | 100% | 630 | 100% |
| Do you normally drive? | Yes | 470 | 37.3% | 392 | 62.2% | 78 | 12.4% |
| | No | 790 | 62.7% | 238 | 37.8% | 552 | 87.6% |
| | Total | 1260 | 100% | 630 | 100% | 630 | 100% |
| Type of driver | Professional | 202 | 35.1% | 190 | 41.5% | 12 | 9.8% |
| | Private | 373 | 64.9% | 264 | 57.6% | 109 | 89.3% |
| | Total | 685 | 100% | 454 | 100% | 121 | 100% |

2.2. Design, Procedure and Instruments

The data used in this study came from the Dominican Republic’s National Survey on Mobility, which was conducted in 2019 [29]. The questionnaire covered topics such as institutional knowledge and traffic rules, public transportation, private transportation, on-foot movements, bike use, ITS systems and measures, and the variables studied in this study. It is a first-of-its-kind questionnaire in Latin America, where such comprehensive instruments had never been used. It was first administered in 2018 to examine the situation in the country and detect changes in the way Dominicans move as a result of INTRANT’s different programs.

and all preceding considerations, participants gave their informed consent to participate in the study. It is important to remark that the administration of personal information was carried out in compliance with current data protection regulations and ethical standards (including their full anonymity and the blinding of any potential identification information, except for generic demographic features), as it was also explained to each one of the participants before starting the survey.

3. Results

The general perception of Dominicans is that their country does not have streets sufficiently prepared for walking (M = 5.20; SD = 3.69). Such assessment is determined by the state of the roads and the road infrastructures linked to pedestrian displacements. Figure 2 shows the scores given to various specific aspects of public roads in the Dominican Republic. The perception that there are few places to cross the street (M = 4.78; SD = 3.57), the short green time at traffic lights when pedestrians are crossing (M = 4.67; SD = 3.78), and the lack of separation between pedestrians and other road users, particularly with vehicles on the road (M = 4.98; SD = 3.61) stand out among them. In addition, citizens point out the low level of safety they perceive when walking (M = 4.59; SD = 3.69). This situation has repercussions for pedestrians, who relatively frequently have to avoid certain streets due to the danger they perceive (M = 6.15; SD = 3.94), as well as having to change sidewalks because of parked vehicles or other obstacles in the road (M = 6.38; SD = 3.88).

Infrastructures

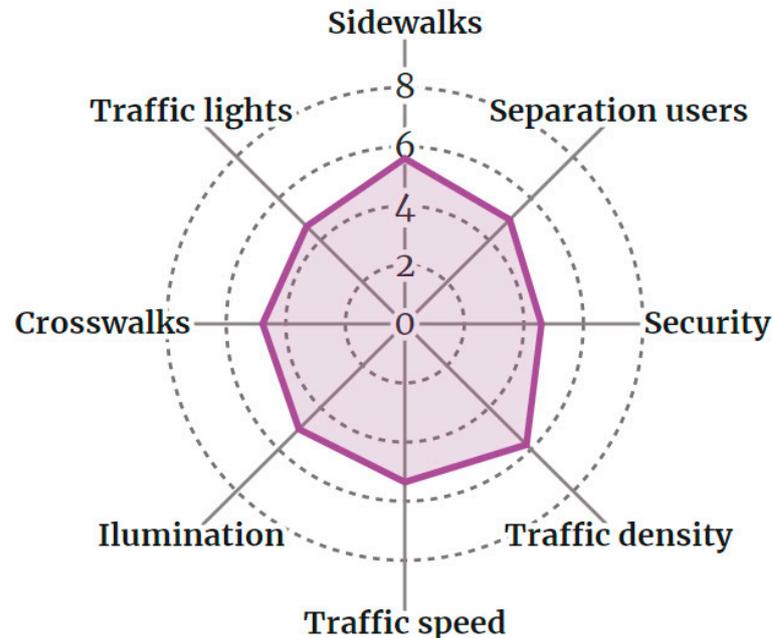


Figure 2. Assessment of roadway features by Dominican pedestrians.

The evaluation of public transport is relatively positive, especially in relation to accessibility (M = 7.08; SD = 3.19) and frequency (M = 6.99; SD = 3.08). However, there are some aspects that present insufficient scores. Especially comfort (M = 5.11; SD = 3.56), price (M = 6.27; SD = 3.40), and cleanliness (M = 5.42; SD = 3.67) (see Figure 3).

Public Transport

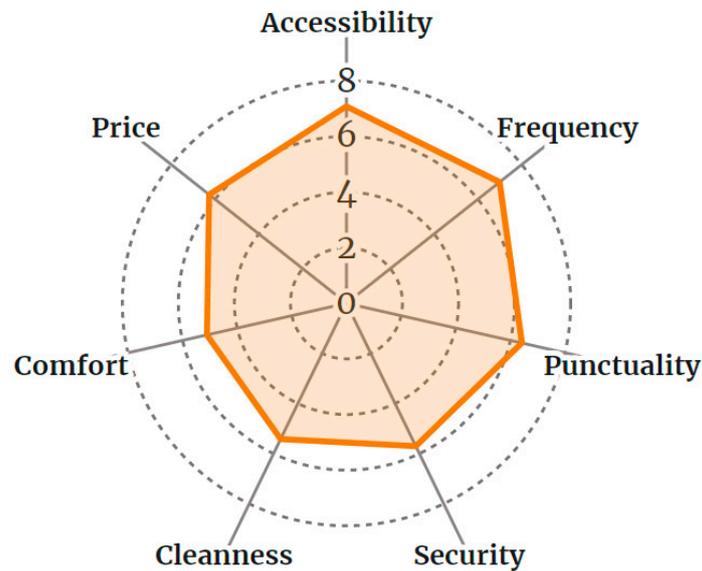


Figure 3. Assessment of public transportation conditions in the Dominican Republic.

In general, there was observed a favorable predisposition towards the possible new measures that could be adopted by the Dominican government in terms of road mobility, as none of them were rated, on average, below 7.5 out of 10 possible points (see Figure 4). The improvement of public transport priority ($M = 8.93$; $SD = 2.03$), the improvement of sidewalks for pedestrians ($M = 8.92$; $SD = 2.24$), and the improvement of roads, highways, and connectors ($M = 8.85$; $SD = 2.24$) stand out over the other possible issues presented in relation to transportation system features. In other words, this shows how, overall, there is a perceived priority for improving road conditions and traffic infrastructure over other more educational or transportation planning measures over other relevant issues, such as transport cleanness (especially if the impact of the current COVID-19 pandemic is considered) and transport security.

It should be also noted that most of the measures were more highly rated by women than by men. However, there were only significant differences between these two groups in a total of four items, all of them related to public transport. Therefore, it was determined that females are more willing than males to adopt measures that encourage shared transport, allow greater priority to be given to public transportation, generate specific routes for public transport, and improve modal interchange between different modes of transport. Although there were no significant differences between provinces, there were differences according to habitat. Some measures showed differences between people with a driver’s license and those without one. However, given the characteristics of Dominican citizens, it is curious that there were no such significant differences between regular and nonregular drivers. Table 2 presents the mean comparison test scores and significance levels of all the variables analyzed.

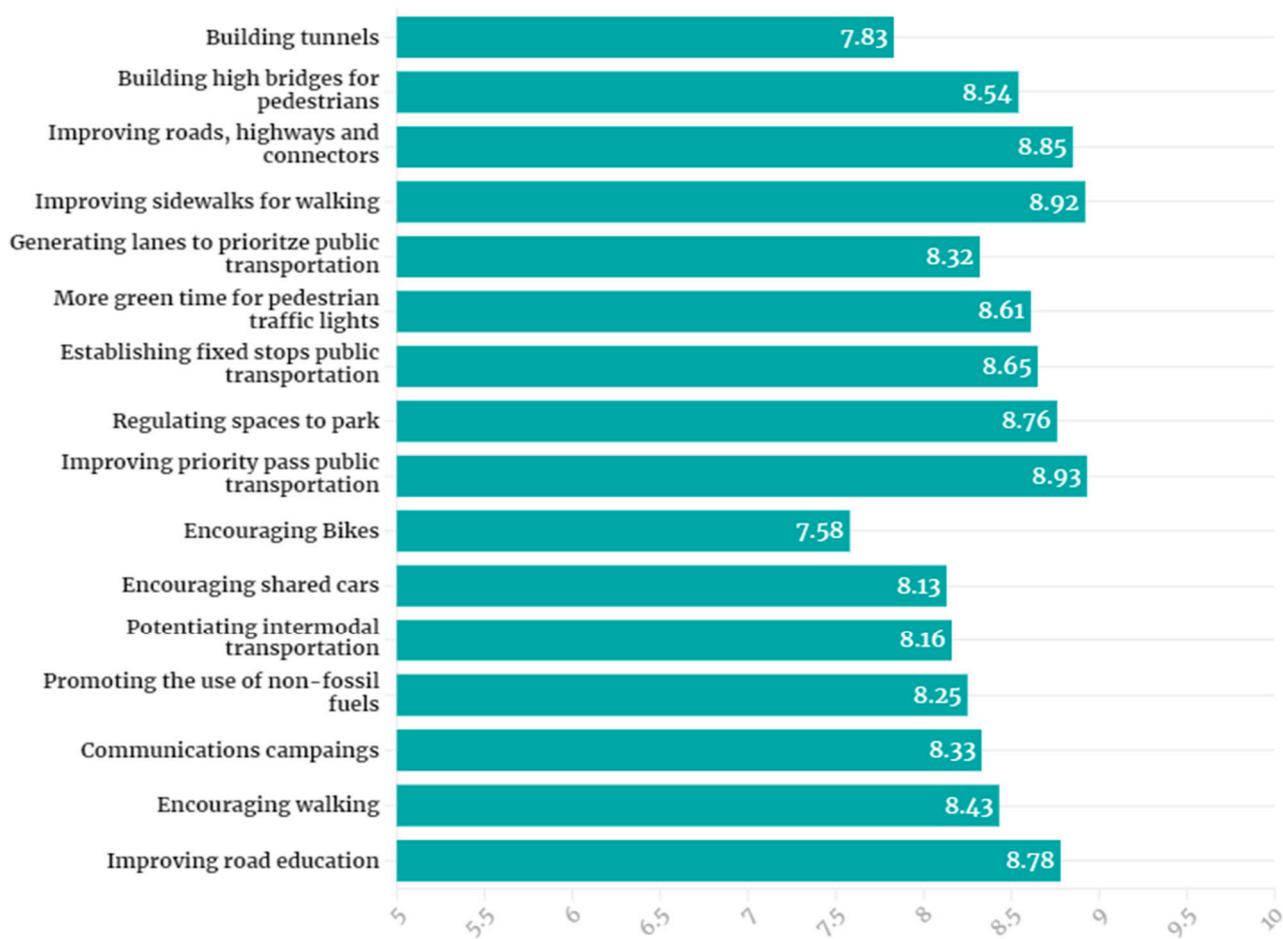


Figure 4. Assessment of future mobility measures by Dominican citizens.

Table 2. Differences in the assessment of mobility measures according to citizens' genders.

| Mobility Measures and Improvements | Gender | | | | | | ANOVA |
|--|-----------------|------|------|--------|------|------|------------------------------|
| | Male | | | Female | | | |
| | n | M | SD | n | M | SD | |
| Generating lanes to prioritize public transportation * | 620 | 8.14 | 2.58 | 614 | 8.51 | 2.30 | F(1,1233) = 6.924; p = 0.009 |
| Improving priority pass public transportation * | 625 | 8.76 | 2.21 | 626 | 9.10 | 1.82 | F(1,1250) = 8.832; p = 0.003 |
| Encouraging shared cars * | 604 | 7.95 | 2.67 | 595 | 8.31 | 2.43 | F(1,1198) = 6.058; p = 0.014 |
| Potentiating intermodal transportation * | 610 | 8.03 | 2.43 | 302 | 8.30 | 2.44 | F(1,1211) = 3.804; p = 0.050 |
| | Habitat | | | | | | ANOVA |
| | Urban | | | Rural | | | |
| | n | M | SD | n | M | SD | |
| Building tunnels * | 1020 | 8.01 | 3.10 | 226 | 7.04 | 3.50 | F(1,1245) = 17.423; p < 0.01 |
| Generating lanes to prioritize public transportation * | 1012 | 8.40 | 2.41 | 222 | 7.99 | 2.61 | F(1,1232) = 5.158; p = 0.023 |
| Establishing fixed stops public transportation * | 1021 | 8.72 | 2.39 | 229 | 8.31 | 2.50 | F(1,1248) = 5.465; p = 0.020 |
| Regulating spaces to park * | 1023 | 8.83 | 2.23 | 228 | 8.48 | 2.37 | F(1,1249) = 4.323; p = 0.038 |
| Communications campaigns * | 1021 | 8.41 | 2.52 | 228 | 7.98 | 2.66 | F(1,1247) = 5.320; p = 0.021 |
| | Driving License | | | | | | ANOVA |
| | Yes | | | No | | | |
| | n | M | SD | n | M | SD | |
| Building tunnels * | 272 | 8.28 | 2.68 | 974 | 7.71 | 3.31 | F(1,1245) = 6.782; p = 0.009 |
| Regulating spaces to park * | 272 | 9.01 | 1.93 | 979 | 8.69 | 2.34 | F(1,1249) = 4.187; p = 0.041 |
| Promoting the use of non-fossil fuels * | 269 | 8.57 | 2.21 | 967 | 8.16 | 2.65 | F(1,1235) = 5.309; p = 0.021 |
| Encouraging walking * | 270 | 8.82 | 2.04 | 977 | 8.32 | 2.77 | F(1,1245) = 7.623; p = 0.006 |

* All study variable comparisons appended in the table correspond to significant differences (p < 0.050).

4. Discussion

This manuscript aims to examine the perceptions of the citizens of the Dominican Republic regarding the state of the national road infrastructure and transport vehicles. This is a first approximation of the travel needs of Dominicans, which has direct practical implications for the development of future measures affecting road construction and transportation mobility planning in the country.

There is a general perception that the state of the roads is not entirely adequate. Respondents are clearly dissatisfied with the road conditions, which even forces them to change some of their routes. The proximity to vehicles, the density and speed of traffic, and the obstacles on the sidewalks are some of the problems pedestrians have in their daily lives. Additionally, this is a problem that not only affects mobility and travel, but also has direct repercussions on the road safety of users [30,31]. Factors such as the absence of pedestrian infrastructure [32], poor lighting [33], or the type of street [34] are linked to road accidents. In addition, it has been proven that walking on a street in poor conditions affects pedestrians and makes them more prone to jaywalking or other risky behaviors [35].

This situation undoubtedly makes pedestrians in emerging countries, where pedestrian protection is less developed, particularly vulnerable [36–38]. Data indicate that more than 40% of the annual deaths caused by traffic accidents involve pedestrians in Asia, Africa, and the Caribbean. In comparison, this figure is less than 20% in Europe and the United States [39]. Therefore, it is necessary to develop actions specifically aimed at the protection and safety of pedestrians [40,41]. In fact, one of the measures most highly valued by Dominicans is the improvement of sidewalks as well as roads. In any case, and until an increase in the quality of these road infrastructures is designed and implemented, pedestrians should be aware of the risks of the road and try to protect themselves to the best of their ability [42]. Avoiding being distracted by a phone and being aware of the road circumstances can be crucial to prevent a crash [43].

In this sense, a second group harmed by road conditions is the cyclists. In the Dominican Republic, they are a tremendously reduced road group. In fact, the latest data indicate that only 1% use bicycles on a daily basis [25]. In countries such as Denmark, the United Kingdom, or Australia, infrastructure improvement for cyclists led to a substantial increase in this type of user [44,45]. Therefore, it is very likely that the Dominican Republic would substantially increase its cycling population if appropriate actions are taken.

It is important to promote walking and cycling to reduce pollution rates and increase the sustainability of the country [46]. In addition to this, citizens should also be encouraged to use public transport [47]. The vehicular circumstances and conditions in which the public transport fleet of many emerging countries is in, among other factors, cause citizens to tend not to use them as much as desirable [48]. In these places, public transport tends to have poorer planning and service [49,50]. In particular, the Dominican Republic has several transportation systems but with poorly defined routes that are not adapted to the needs of citizens [51]. In fact, the most commonly used public means of transport are urban buses and motorcycle cabs, which generally do not have established stops but pick up passengers at points of high passenger density that are not defined in the metropolitan bus routes [52]. This leads to some road chaos, traffic jams, and mobility problems [53].

In this sense, it is not surprising that measures focused on improving public transport routes are among the most highly valued. In addition, it should be noted that these types of actions are the ones in which the most significant differences are found according to gender, with females being the ones who prioritize them the most. This is logical given the dynamics of displacement in the country, where there are practically no women drivers [25]. Therefore, they especially demand conditions that are more appropriate to the characteristics of their trips [27].

The lack of safety perceived by users is another element to be mentioned. For both on foot and public transport, security is poorly rated. In these scenarios, robberies, violent actions, or harassment can occur, which also determines the consumption level of public transport services [54,55]. This is undoubtedly an important problem, as it indicates that

improving road infrastructure conditions may not be enough to change travel dynamics [56]. Not feeling safe and comfortable is sufficient motivation to avoid traveling in the area or vehicle that causes such insecurity [57].

This context is especially important with women [58]. Figures indicate that public roads, and more specifically, public transport, are areas where harassment situations frequently occur [59–61]. In addition, they have the problem that, even if they do not want to use any particular transport, they are often forced to do so because they have no other travel options [62]. This occurs especially in countries such as the Dominican Republic, where it is very rare to find women drivers [25]. Harassment in transportation is a common phenomenon worldwide, so in recent years specific actions have been developed to reduce the insecurity of female users [63]: from basic measures such as the installation of security cameras [64] or education and social awareness campaigns [65] to major actions such as “pink” vehicles or cars for females only [66], or specific mobile applications [67].

In short, if the authorities intend to change the dynamics of travel of Dominicans in favor of more sustainable mobility, concrete actions must be developed to improve road infrastructure and the conditions of public vehicles [68]. Only this way will it be possible to initiate a change that increases walking, cycling, and public transport in the country [69].

5. Conclusions

After analyzing the perceptions of Dominican users regarding the conditions of their country’s transportation and infrastructure, the results of this study allow to describe a considerably low valuation of these key transport-related spheres.

On the other hand, citizens tend to support the implementation of new measures to improve these conditions, in order to adapt them to their actual needs. In this regard, these measures should be aimed at improving the public transport fleet, as well as planning routes that meet the needs of the population. In addition, it is necessary to improve the condition of sidewalks and pedestrian walkways, in order to both enhance walkability and active transport, thus fostering sustainable mobility.

The results of this study may be of great use to the authorities of the Dominican Republic and other emerging countries with similar contexts and characteristics [9]. This is the first step before the planning, design, and implementation of concrete actions to improve mobility and, consequently, the pollution levels produced by the large number of trips in private transport.

Author Contributions: For this study, F.A., S.A.U. and M.F. conceived and designed the research, and performed the data collection; S.A.U. and M.F. analyzed the data; F.A. and S.A.U. contributed with reagents/materials/analysis tools; M.F., B.C. and S.A.U. wrote and revised the paper. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Ethics Committee of Research in Social Sciences in Health” from the University Institute on Traffic and Road Safety of the University of Valencia (Spain) (protocol code HE000125101, approved on 25 October 2019).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data will be available upon reasonable request to the corresponding author.

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