

“Park And Ride”, A Traffic Congestion Solution At Public University Congregations: A Case Study Of University Of Ghana.

Author

Abstract

University of Ghana has run the free park and ride bus shuttle service over the past five years continuously. At the 2022 congregation, a survey was conducted at the various parking terminals on campus to solicit inputs from respondents who were both students and guest, to find their views on the free park and ride transport service.

The survey sought to find the level of satisfaction of the park and ride (P&R) service regarding promptness, comfort, timeliness, convenience, and in what way the service contributed to reducing traffic congestion on the route.

Analysis of the responses showed that most respondents felt the service was satisfactory, convenient, prompt and contributed to reducing traffic congestion along the route to the venue and back to the parking terminals. It was found that there was no statistical association between age, sex, educational level, the type of vehicle guest owned and drove to the university.

It was observed that a longer travel time was associated with a decrease in the level of satisfaction. With respect to the time taken to move from terminal to venue and from the venue back to the parking terminals, it was found that a higher delay time was associated with a reduction in the level of satisfaction.

There was however a statistical association between the travel time from the parking terminals to and from the congregation venue by both graduating students and guests and the level of satisfaction. In conclusion it is expected that public universities will adapt the park and ride model to help reduce traffic congestion on various campuses.

Keywords: *Park and ride, congregation, transportation, services, shuttle, congestion*

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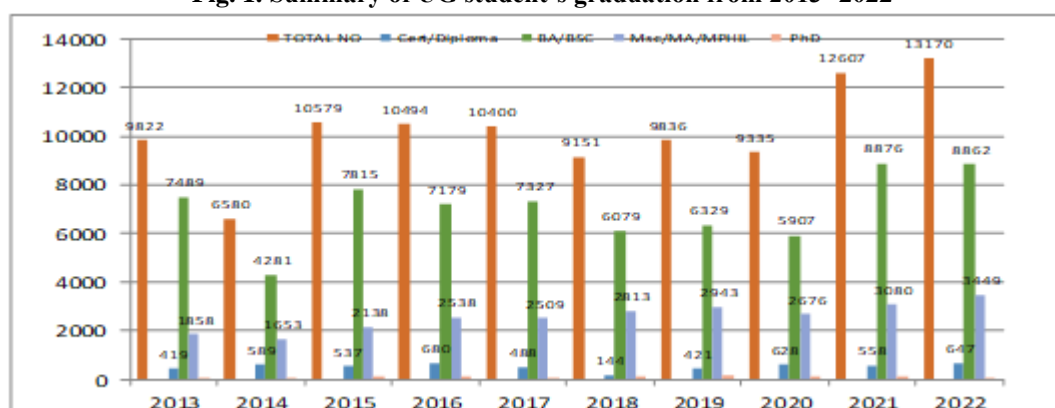
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I. Introduction

Public universities continue to enroll large numbers of students yearly. It is not surprising that congregations attract very large numbers of participants, being faculty, students, guests, friends, and family. This huge number of people moving to a specific venue often causes both human and vehicular traffic congestion. Various interventions such as separating graduation dates and time, selecting different venues for graduations and organizing virtual graduation ceremonies, have yielded some results and have been able to reduce the traffic situations on campuses, however it is worth considering an intermodal, transport pooling arrangement such as the park and ride, to further reduce vehicular congestion on campuses during congregations.

Since its establishment, the University of Ghana has over the years graduated several thousands of students, in many fields of study yearly. The initiative to introduce free Senior high school education by the government of Ghana in 2017, has also contributed to an increase in the total enrolment of students at public universities, few years after its introduction. This increase has had a direct impact on the number of students graduating from these universities yearly. For instance, according to the Institution Research and Planning Office (IRPO), a directorate of the University of Ghana, in 2021 and 2022 the University of Ghana graduated a total number of 12,607 and 13,170 students respectfully, compared with year 2013 and 2014 where the total number of graduating students were 9,822 and 6,580 respectfully. It also appears that unlike the past years, where the university recorded, more males graduating as compared to females, there is now a gender parity in number of graduates as seen in the 2021 and 2022 numbers shown in Table 1.

Fig. 1. Summary of UG student’s graduation from 2013- 2022



Source: UG IRPO Directorate, 2022

Table 1. Summary of male and female graduands from 2013-2022

Year	TOTAL	MALE	FEMALE	Year	TOTAL	MALE	FEMALE
2013	9822	5813	4009	2018	9151	4938	4213
2014	6580	3690	2890	2019	9836	5079	4757
2015	10579	5815	4764	2020	9335	4540	4795
2016	10494	5780	4714	2021	12607	6004	6603
2017	10400	5533	4867	2022	13170	6505	6665

Source: UG IRPO Directorate, 2022

Graduation ceremonies are very memorable and joyful occasions for all graduating students and family members. It therefore attracts a lot of people to these ceremonies thereby creating a huge human and vehicular traffic congestion. Even if five percent of the graduands invited two guests each and arrived on campus with personal vehicles and drove to the venue, this number will certainly create a big security challenge and huge traffic congestion along the routes, other adjoining roads and at the congregation venues.

There have been instances where instead of driving for 15-20 minutes, it has taken over two hours for guests and graduands to drive down from the Great Hall at University of Ghana to the main gate, approximately 3.8km apart, due to traffic congestion. To solve congestion challenges University of Ghana has divided the congregation ceremonies into various days and times, as well as run morning and afternoon sessions. Another alternative to reduce the congestion has been to organize congregations by colleges at different locations on campus. These have reduced the congestion but not entirely solved it, hence the need to consider the option of vehicle pooling strategies such as “park and ride” on campuses. During the covid 19 period, many universities ceased in-person congregations and used various online systems for graduations. Virtual congregations eliminated congestion at congregation venues, however graduands missed the normal fun and joy of in-person celebration and socializing.

To reduce heavy traffic congestion on the day of congregation, the University of Ghana has over the past few years introduced a free “park and ride” arrangement, using mainly buses owned or assigned to the university’s colleges and departments, to convey graduating students and their guests to the congregation venues and back to the designated car parking areas after the ceremony, thereby reducing or eliminating the usual congestions. Only graduating students are allowed entry to the congregation venues (Great Hall) or (Cedi Conference Centre) and its vicinity. Family and friends of graduating students have the option to follow the proceedings by watching them on provided TV screen or online. No individual graduation parties are allowed on lawns and on any other open spaces on campus after the ceremony. Special arrangements are made for students to collect their certificates and submit their gowns later after the congregation. All these interventions have helped reduce the congestion on campus during congregations.

Park and Ride (P&R) arrangements have been introduced in many universities all over the world, including the University of Northampton and University of Sheffield. For instance, since 2018, the University of Northampton has operated a P&R facility for staff, students, and visitors (University of Northampton, 2022).

P&R service is a transportation arrangement offered in connection with public transport, allowing users to drive their private cars to a parking facility, park the cars and ride on board a provided mass public

transport system for the main part of the journey (Tennøy et al., 2020). A park and ride system are also an intermodal transportation connection between private and public transport and considered as one fundamental element in transport planning (Ortega et al., 2020).

Being an intermodal transport system, P&R is designed to encourage students, guests, and occupants of various private vehicles park their vehicles at a distance away from event centers on campus and complete the rest of the journey using a pool of an alternative public transportation arrangement to their destinations. The integrated transport nature of the P&R operation allows users of private vehicles park and use bigger public vehicles to and from their destinations.

Some of the problems often experienced at congregations, convocations and several other events that attract a large crowd is vehicular traffic congestion, due to lots of private vehicles being sent to these venues. Other problems include delays in commencing various sessions of the congregation due to traffic congestion, huge vehicle and crowd control challenges at venues and not forgetting noise, air and environmental pollution.

The P&R transport service can offer several benefits to students, staff, and the overall community. Some of the key advantages include reduction in traffic congestion, by encouraging students and staff to park their vehicles at a central location and then use a shuttle service to reach their destination on campus. The number of vehicles plying campus roads during the period can be significantly reduced, leading to smoother traffic flow, less noise, and less pollution.

P&R may have a few disadvantages being reduction of green space, damage to environmentally sensitive sites, poor accessibility for those without a vehicle and those with mobility disability or impairments. The Free P&R operations of the university, also comes at a cost, since one must consider the cost of hiring and bus operations, remuneration to staff, fueling, wear and tire. However, in the long run, the benefits of operating the P&R transport system far outweighs the demerits of cost (T. A. Litman, 2017).

The objective of this paper is to find out if the P&R service that is currently being operated during UG congregations has contributed to reducing vehicular congestion on campus and how satisfied graduating students and guest are with the innovative P&R services on University of Ghana campus during congregations. Therefore, the research questions were:

1. How has the park and ride contributed to reduction in the time it took to travel to the venue and back and reducing traffic congestion on the route.?
2. In what way was the park and ride services satisfactory or not satisfactory to graduating students and guests.?
3. Is there an association between age, sex, educational level, the type of vehicles guest or students owned and drove personally to the university congregations.?

II. Theoretical Perspectives On Transport Mode Choice

Many transport choice theories and models exist. Some aim at finding the determinants and factors influencing travellers' mode choice. Operational theories are used as a guide to understand the mode choice process and actions to change choices (Schneider, 2013). For instance, the theory of Unplanned Travel Decisions (UTD) explains that the nature of one's trip or travel decision may change substantially depending upon new information, constraints, disparities between anticipated and actual situations (Hwang, 2011). In other words, travel behaviour may not be precise or follow a definite plan. Rather, it is highly influenced and dependent on the circumstances or current situation at the time of decision-making with reference to substantial changes between anticipated and actual situations.

The author argues that, in as much as travel decision may be influenced by circumstances and situations, the proposition by Hwang, (2011) is limited because there is still an element of certainty or planning and travel behaviour that may not change with changing situations and circumstances. Therefore, the Theory of Planned Behaviour (TPB) emphasizes that social behaviour of people can control or modify the original intention of a traveller and it can also influence the actual travel mode choice (Bamberg & Schmidt, 1998) (Lee & Moudon, 2016).

If travel behaviour can be planned, then one must consider human behaviour or travel expectations. Some human behaviour is repetitive and therefore routine and makes it possible to plan movement and transport choices. The routine nature of travel leads us to the theory of Routine Mode Choice Decisions (RMCD) which is relevant and explains that broad mode shift choices are likely to occur in communities and this requires a comprehensive approach that improves alternative mode attractiveness by following the five-mode choice steps to form habits.

These include the awareness and availability step where transport modes are viewed as a possible choice for travel. The second step is the basic safety and security awareness stage. The next step is the convenience and cost stage, followed by the enjoyment of access and the situational tradeoff between modes stage. Lastly, the habit stage that reinforces previous choices and closes the decision process loop.

Therefore, lifestyle decisions may be associated with changing transport mode choice habits over some time, (Bowman & Ben-Akiva, 2001). For this reason, it is necessary to analyze the travel displacements

according to three interacting aspects being spatial, social and perspective approaches respectfully (Muro-Rodríguez, Perez-Jiménez, & Gutiérrez-Broncano, 2017).

Another theory that seeks to find reasons for choice of travel mode is the Utilitarian Theory (UT). The theory is built on the supposition that individual choice of transport mode is utilitarian, in that standard measures of individual trip utility are subject to chance errors describable by the normal distribution error function and that the deviations result from predictable influences. It, therefore, states that people make rational decisions to maximize their personal interest or benefits and minimize their cost (McFadden, 1974; (Ni et al., 2015). Efforts are being made to integrate utilitarian factors into psychological mode choice theories, (Klößner, 2013).

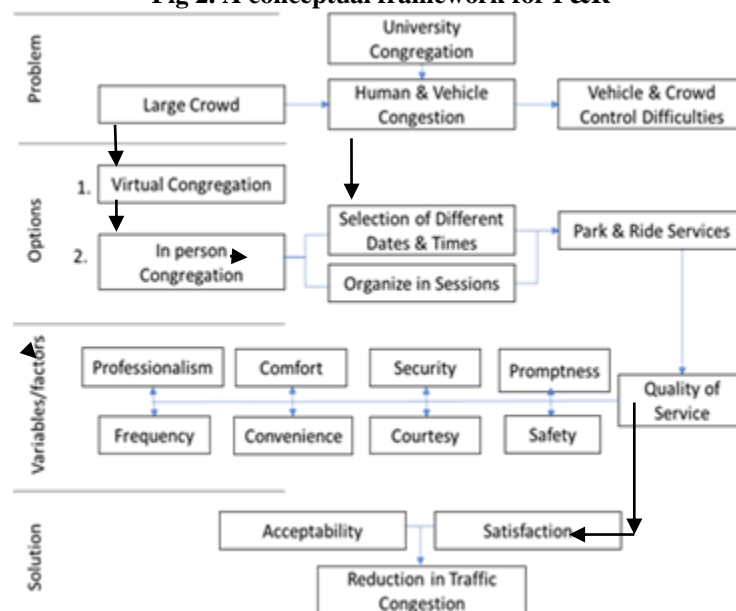
As explained locally by Oteng-Ababio & Agyemang, (2012) rational beings or trip-makers select among various transport alternatives, the ones which are most likely to render them the maximum utility. “The utility to be derived from different transport modes is reflected in the preferences and lifestyle options that trip-makers undertake” (Agyemang, 2013, p. 27 ; Agyemang, 2015).

Trip makers will naturally not sacrifice their comfort and the perceived utility for park & ride trips, unless they can appreciate the benefits, they will derive from it. Hence the need to explain the benefits to users for it to be successful.

P&R systems have been used in many regions and have been able to reduce or eliminate traffic jams and establish parking spaces in urban centers (Qin et al., 2022). P&R is considered a model of choice in that, it allows travellers using private vehicles to select a public transport service and ease congestion on our roads (Moeinaddini et al., 2014).

Contextual issues

Fig 2. A conceptual framework for P&R

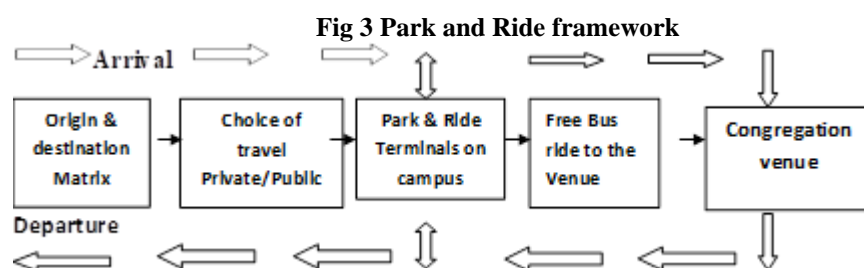


Conceptual framework. Source: Authors draft from research and literature, 2023

Fig 2. Shows the problem, options, variables and solution to reducing traffic congestion at Public university ceremonies. Public university congregations often attract a large crowd of people, being students, staff, guests, family, and friends. This results in huge human and vehicular congestion on campus that requires crowd and vehicle control arrangements. Various solutions and initiatives such as virtual congregation, selection of different days and times for colleges, or organizing the congregation in sessions such as morning, afternoon, and evening sessions. In as much as these P&R services have the potential to reduce congestion, there is a good justification to implement a P&R bus service alongside these arrangements. When P&R is acceptable and satisfactory, it has the potential to eliminate heavy traffic congestion along the route and at the venue. Even though P&R has the advantage of reducing vehicular traffic congestion if it is acceptable and satisfactory, its success depends on factors or variables such as promptness or timeliness of the services, security, and safety of potential passengers on buses, courtesy of operators, frequency of the service comfort and convenience of the service.

Its disadvantage is that it comes at a high cost to the institution in terms of operating cost of the buses i.e. Renumeration to staff or operators, high fuel, lubricants and maintenance and repairs cost of vehicles. For

instance, for a day shuttle operation of 4,000 guests and students a minimum of 9 buses is needed to operate the P&R service and each vehicle will consume approximately 75-65 litres of diesel each. Allowances to each staff may range from GHC 700.00 to 500.00 daily. So some institutions charge a token for the service to defray some of the cost.



Source: Authors draft from research and literature, 2023

III. Methods

University of Ghana has operated the P&R arrangement for over five years to support reduce traffic congestions at the venues of congregation ceremonies. Depending on the number buses, drivers, and volunteers explain the P& R arrangement on board the buses to guests and students of graduands and the number of guests officially invited the university makes available several.

Five private car parking clusters are established at the peripheries of the university entry gates. These parking clusters are manned by UG security officers, who ensure that there is no unauthorized entry to the congregation venues by private vehicles but ensure that private vehicles park at the assigned car parks are secured and safe. These shuttle buses are broadly labelled with the name of the car parks on each side, using colour codes to enable easy identification by guests. These buses shuttle graduands and guests without carriage of the usual food and drinks to the venue. The route for each car park to the destination is planned to enable shuttle buses move from these parking terminals along the shortest routes possible to the congregation venue at an interval of 10-15 minutes each and return immediately to pick up the next batch. The arrangement is reversed from the congregation venue to the specific parking terminal when the congregation event is over for passengers to drive out their private vehicles through the university gates.

At the May 2022 congregation, at University of Ghana, Legon campus, a questionnaire was designed and administered conveniently on board the buses to guests and students who boarded the buses to the congregation venue and from the congregation venue back to the private vehicle parks for each day of congregation. The aim of the questions was to find out how they rated the service in terms of satisfaction. The questions are also aimed at finding out the challenges encountered and how best these challenges could be improved in future. Other information that was solicited included how long it took to move from the car park to the destination and back via the buses, whether the driver drove safely, and volunteers were cautious and polite. It also sought to find the level of agreement or disagreement to the promptness, convenience, comfort and professionalism of security and staff that offered the P&R services

In all approximately 890 respondents were received. This was made up of 412 students and 478 guest from various backgrounds. The questionnaire was sorted and analyzed using Statistic software for data analysis, STATA version 14.1

Research Design and Setting

Methods used to collect data.

Data Collection:

Prior to the commencement of the congregation, a park and ride planning team was set up to plan and discuss the parking clusters, the route and the number of buses needed based on the number of expected graduating student and guests. The following parking terminal located at the periphery of the university campus was identified to transport students and guests to the Great Hall and any other congregation centers. The four main parking terminals and parking clusters were:

- Terminal (1) Coded Red: UG Guest Centre Carpark
- Terminal (2) Coded Yellow: Ecobank/ Republic bank Carpark
- Terminal (3) Coded Green: Institute of African Studies Carpark
- Terminal (4) Coded Blue: School of Law/International House/IAS Carpark

Selected university owned buses were labeled with their respective terminal numbers and marked with colour codes to help guests and students identify them. The buses provided shuttle services in closed time movement schedules between 10 to 20 minutes from the designated car parks to the UG Great Hall, where the congregation was held. The shuttle service targeted graduands and their guests who had their specially designed invitation cards. Volunteers from the University were deployed on the buses to act as guides and to communicate the message and objective of 'park and ride' to the graduands and their guests. The volunteers and the bus drivers wore clothes with the same colour code as their carparks, for easy identification. Student volunteers were also engaged to assist the UG security staff with directional services, car parking arrangement and security services.

A survey questionnaire was designed and was randomly administered to both graduating students and their guest attending the UG congregation each day. For all five days of the congregation and all sessions (morning and afternoon sessions), graduands and guest of students were selected and given randomly survey forms to fill as they sat in the shuttle buses before and after the congregation ceremony, as they waited to be driven from or back to their respective parking terminals.

The filled forms were collected the same day by the assigned shuttle bus volunteers on board each of these buses and submitted for data analysis.

Research problem.

Public universities have very large enrolments and therefore a very large number of people attending the congregations. The traditional arrangements allow all students and guests to move to congregation venues with private vehicles. This has consistently created the problem of vehicular and human congestion, environmental pollution, delays in commencing the programme and other sessions of the congregation due to traffic.

There are various ways to reduce congestion at congregations. These may include organizing virtual congregations, which was successful during the COVID 19 period, others include breaking down the number of graduands into colleges and spreading the congregation ceremony over a period or days. Since congregations are large social events that attract family and friends, the preferred choice has always been in person celebrations hence the need to introduce park and ride services to reduce vehicle traffic congestion at these venues.

IV. Analysis

Graduating students and guests who used the shuttle bus services, evaluated the P&R shuttle service. The quantitative and qualitative method of the study sought to find from respondents how the P&R service offered at the university congregations was evaluated in terms of general satisfaction, comfort, convenient, promptness and timeliness.

The analysis of the survey data sought to find how the P&R service contributed towards reducing traffic congestion on the route, how professional the drivers and security personnel were in terms of safety and security of passengers and vehicles. Finally, how the service could be improved in the future.

A model was further developed to analyze the level of satisfaction of the P&R services using the time it took for the buses to get to the congregation venue and the time it took the buses to leave to go back to the parking terminals.

V. Results And Findings

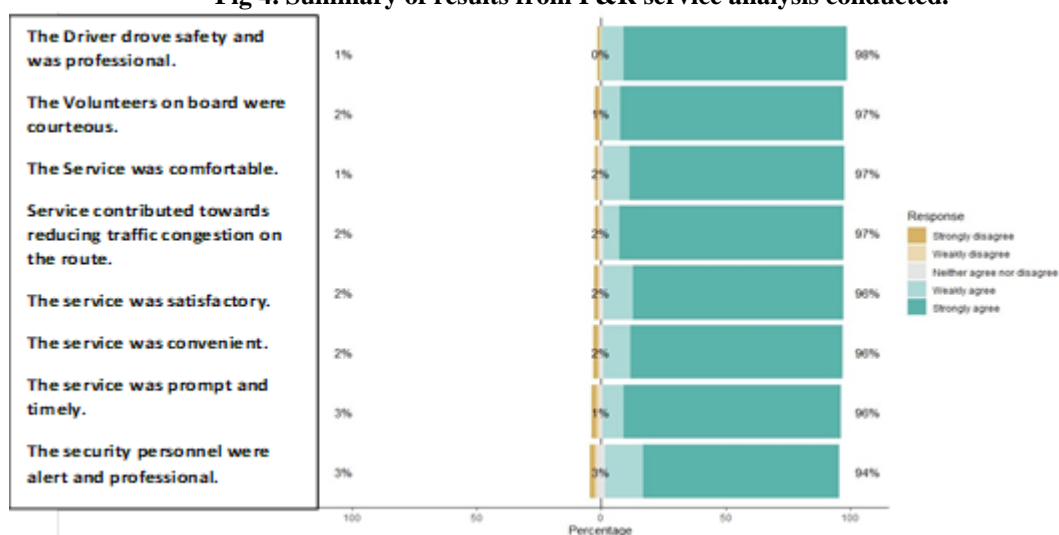
The first and second research questions of this paper are:

- 1.How has the park and ride contributed to the reduction in the time it took to travel to the venue and back and reducing traffic congestion on the route.?
- 2.In what way was the park and ride services satisfactory or not satisfactory to graduating students and guests?

The results and findings are summarized in fig 4 below. It shows the measurement of the level of agreement or disagreement to the following statements:

The driver drove safely and was professional, the volunteers on board were courteous, the service was comfortable, service contributed to reducing traffic congestion on the route, the service was satisfactory, service was convenient, service was prompt and timely and security personnel were alert and professional.

Fig 4. Summary of results from P&R service analysis conducted.



Source: Analysis from survey questionnaire 2022.

The results of the analysis on the survey conducted showed that 98% of respondents strongly agreed that the drivers who drove buses on the P & R shuttle service drove the buses safely and professionally. 97% of respondents strongly agreed that the volunteers on board the buses were courteous. 97% of respondent strongly agreed that the service was comfortable, 97% strongly agreed that the service contributed to reducing road traffic congestion along the routes. Then 96% strongly agreed that the service was satisfactory, 96% strongly agreed that the service was convenient, 96% strongly agreed that the service was prompt and timely and lastly 94% strongly agreed that the assigned security personnel were alert and professional.

In finding answers to the research questions and objectives, graduating student and guest evaluated the P&R service, answers from the quantitative survey questionnaire were analyzed. The findings showed that both students and visiting guests felt the P&R services was very satisfactory in reducing traffic congestion.

A model was developed using graduating students as the reference variable to find the level of satisfaction of the service using the time it took for the buses to get to the congregation venue and the time it took the buses to leave back to the parking terminals.

Comparing passengers who indicated that it took 5-15 mins to those who indicated 16-30 mins (-0.19) and more than 30 mins (0.35) respectively, it was observed that a longer travel time was associated with a decrease in the level of satisfaction.

With respect to the time taken to return from the venue back to the parking terminals, those who indicated it took above 30 mins were significantly different from those who indicated it took 5-15 mins. A higher delay time was associated with a reduction i.e. (-0.25) in the level of satisfaction.

It was found that there was no statistical association between age, sex, educational level, the type of vehicle guest owned and drove to the university. There was however a statistical association between the travel time from the parking terminals to and from the congregation venue by both graduating students and guests and the level of satisfaction.

VI.Conclusion / Recommendations

Conclusion

The objective of this paper was to find out if the P&R service that is being operated during UG congregations has contributed to reducing vehicular congestion on campus and how satisfied graduating students and guests are with the innovative P&R services at University of Ghana campus during congregations.

Therefore, the first research questions was: How has the park and ride contributed to reduction in the time it took to travel to the venue and back and reducing traffic congestion on the route.?

It was found that a longer travel time was associated with a decrease in the level of satisfaction. With respect to the time taken to return from the venue back to the parking terminals, It was found that a higher delay time was associated with a reduction i.e (-0.25) in the level of satisfaction.

There was therefore a statistical association between the travel time from the parking terminals to and from the congregation venue by both graduating students and guests and the level of satisfaction.

The second research question was: In what way was the park and ride services satisfactory or not satisfactory to graduating students and guests.?

It was found that respondents strongly agreed that the drivers who drove buses on the P&R shuttle service drove the buses safely and professionally. They strongly agreed that the volunteers on board the buses were courteous. They strongly agreed that the service was comfortable, and strongly agreed that the service contributed to reducing road traffic congestion along the routes. Respondents again strongly agreed that the service was satisfactory, and strongly agreed that the service was convenient, and was prompt and timely. Respondents finally strongly agreed that the assigned security personnel to the P&R service were alert and professional.

The third research question was: Is there an association between age, sex, educational level, to the type of vehicle guest or students owned and drove personally to the university congregations.?

The model developed to test the association of these variables found that there was no statistical association between age, sex, educational level, the type of vehicle guest owned and drove to the university during congregations.

VII. Recommendations

P&R has many benefits, and it includes reducing vehicular traffic congestion, vehicular pollution, reduced the stress of travelling to destinations on campuses, improves security and safety, offers a much faster and cheaper alternative to travel better than driving personal vehicles to large congregation venues. It however, requires well designed and well sited car parks that provides intrinsic aesthetic recreational benefits on university campuses.

P&R may have a few disadvantages being reduction of green space, damage to environmentally sensitive sites, poor accessibility for those without a vehicle and those with mobility disability or impairments. However, special buses designed to carry the mobile disabled or visually impaired may be introduced to meet their special needs in the future.

Finally, for campus P&R services to be successful and satisfactory, the university needs to sustain the convenience, frequency, timeliness, and comfort of all who patronize the service on university campuses.

Declaration of interests

The author declares that he has no known competing financial interest or personal relationships that could have appeared to influence the work reported in this paper.

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