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Measuring the success of the Great Western Greenway in Ireland

Gerard Deenihan
Department of Civil, Structural and Environmental Engineering
Trinity College Dublin
Dublin 2
Ireland
Tel: +353 1 8962537
Fax: +353 1 6773072
Email: deenihag@tcd.ie

Brian Caulfield*
Department of Civil, Structural and Environmental Engineering
Trinity College Dublin
Dublin 2
Ireland
Tel: +353 1 8962534
Fax: +353 1 6773072
Email: brian.caulfield@tcd.ie

Dermot O'Dwyer
Department of Civil, Structural and Environmental Engineering
Trinity College Dublin
Dublin 2
Ireland
Tel: +353 1 8962532
Fax: +353 1 6773072
Email: dwodwyer@tcd.ie

*Corresponding Author

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*Manuscript (remove anything that identifies authors)
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1 ABSTRACT

This paper analyses the usage of a pilot Greenway (cycle way) in a rural environment in Ireland. The path is 42 km long and has several settlements along the route. Usage of the path is established by means of automatic counters located along the route. Usage patterns are analysed in relation to a number of weather variables and hours of the day. An economic analysis of tourists cycling along the Greenway was conducted to determine, the quantity of tourists needed to pay for the path is estimated and the payback period. In terms of increased tourist expenditure to the area, the facility brings approximately €405,000 from non-domestic tourists and €737,000 from domestic tourists annually, giving the facility has a payback period of 6 years.

2 INTRODUCTION AND BACKGROUND

In 2009, Ireland's first National Cycling Policy Framework was adopted. The specific objectives were to promote the development of walking and cycling in Ireland. One objective was to "*Provide designated rural signed cycle networks providing especially for visitors and recreational cycling*" (Smarter Travel Office, 2009). One such project is the Great Western Greenway (GWG) in a rural area of north west of Ireland. The first phase of this project, an 18 km route from Newport to Mulranny was opened in April 2010. This phase was deemed a "huge success" (Fáilte Ireland, Smarter Travel Office 2010) and a €3.5 million package was agreed to expand the route to 42 km. The 42 km route is currently the longest off-road cycling and walking trail in the republic of Ireland.

In 2009, it is estimated that cycling tourists spent €97 million while in Ireland (Fáilte Ireland, 2009). The majority of the cyclists that were surveyed were just satisfied with cycling in Ireland, however; 12% of those surveyed were either dissatisfied or very dissatisfied. With investments in infrastructure like the GWG it is hoped to increase the percentage of cyclist tourists that are satisfied with cycling in Ireland. This in turn may lead to an increase in expenditure from this category of tourist and also increase sustainable travel patterns within the area. Lamont (2009) claims that there has been relationship between cycling and tourism since the 1890s, but it is only in recent years that these areas are being researched academically. It is important that research be carried out in these areas, as a lack of knowledge leads to misleading conclusions when categories of tourists are not defined properly. This can cause falsification, exaggeration, and an understatement of facts when it comes to analysis of certain cycling groups. Burkart and Medlik (1981) also state why it's important that research into tourism be carried out. It is necessary for three specific reasons. They are as follows:

- To evaluate the value and significance of tourism to a particular area,
- To use in the design and planning of infrastructure and service for tourists, and
- Plan and create effective marketing campaigns.

Several similar projects of this nature are currently under consideration in Ireland and this paper was undertaken to identify the potential success of these schemes. Figure 1 shows an illustration of a section of the GWG. This paper analyses counter data in relation to weather parameters and also evaluates the benefits users of the GWG bring to the area. The GWG benefits locals in that it caters for safe sustainable travel in the area and also provides a leisure/fitness route.

Figure 1 Image of the GWG

Figure 2 illustrates the location of the GWG in a national and local context. The left map indicates the location of the county in which the GWG is located. The middle map indicates the area surrounding the GWG in regard to the county. The right map displays the route of the GWG in green and the parallel Primary road is indicated in red. The routes are illustrated in the context of the surrounding area. Settlements along the route are indicated in black. The GWG traverses 10 electoral wards and from the 2006 census of Ireland statistics, the population density in each electoral ward is known. These are indicated by the purple dots with each dot representing one resident. Other roads in the area are displayed in green. It can be seen that the population in the eastern and southern sections is denser than the western sections.

The population in the area surrounding the GWG from the 2006 Census is 4,967 (Central Statistics Office, 2007). These statistics are presented in Table 1. These Census figures were compiled in 2006, four years before the first phase of the GWG opened. Table 1 indicates that there are more males in the area than females, the car is the predominant means of transport, the age group '35 – 49 years' is the largest age group and 45.5% of household have two cars.

Figure 2 Maps containing location of GWG

Table 1 2006 Census statistics for the area around the GWG

3 LITERATURE REVIEW

Cycling and tourism has been examined in many ways. The literature shows studies that consider recreational and sports tourism. Research into sports tourism has mainly focused on hallmark events where people travelling for sports tourism are spectators. These hallmark events mainly consist of sporting tournaments that range in size from small scale (local sports teams competing), medium scale, (national sporting leagues in a country), to large scale (Olympic Games, World Championships). Hinch and Higham (2011) demonstrate that sports tourism is composed of three main areas. These are as follows:

- Hallmark events
- Health and Fitness
- Outdoor recreation

Hallmark events are extensively analysed in Hinch and Higham (2011). Hinch and Higham (2011) state that outdoor recreation is, "an area that is inextricably linked to sport tourism" and that "One of the most dynamic components of outdoor recreation is adventure tourism". Ritchie (1998) found that globally, cycling for leisure, recreation and tourism has been re-emerging since the 1990s and that the relevant cycling industries' interest in the area at the time was scarce. It was found that there was not any demand related literature in relation cycle tourism. In order for this area of tourism to grow appropriately and contribute to the economic and social well being of a rural area, the demand and supply side of cycle tourism needs to be further researched and fully understood. Lamont (2009) examines literature, both at an academic level and a government level, from around the world that analyses cycling tourism. It was found that defining cycling as a “strictly recreational phenomenon may be overly restrictive”. This paper defines tourist cycling as:

- Persons who travel away from their home region, of which active or passive participation in cycling is the main purpose for that trip, and
- Persons who travel for the purposes of engaging in competitive cycling, and those who travel to observe cycling events.

To maximise the value for the investments in these outdoor recreation and adventure tourist schemes it is important to look at research into the areas of cycle infrastructure planning and cyclist forecasting. Porter et al (1999) reviewed existing methods for forecasting cyclists and pedestrians. The paper looks at the various methodologies and factors that are implicit in modelling cycling trips of non-automised transport. The relationships between various factors were interpreted, and knowing these factors, non-motorised trip making could be determined. It summarised that there appeared to be a shortage of methods that were widely usable and that technical resources were limited. Levitte (1999) focused on cycle demand analysis in the Greater Toronto Area. This research found that cycle trails in the vicinity of schools, universities, shopping and employment centres were the most popular and successful facilities. This paper also concluded that multinomial regression models can be used to predict future demand by factoring changes in conditions from creating off-road routes.

Stinson and Bhat (2003) determined the variables, which affect a cyclist’s route choice from analysis of commuter cyclists using a stated preference survey. The paper concluded that the six most important factors in order of importance were lower travels times, road classification, types of cycle infrastructure, barriers between motorists and cyclists, pavement quality, and fewer intersections. These qualities varied from commuter to commuter. The main causes of the variances were a commuter’s age, and residential location. Caulfield et al (2012) also examined factors that impact upon individuals’ decision to cycle. The results concur with those published in Stinson and Bhat (2003) in that the provision of segregated cyclist infrastructure had the biggest impact upon the decision to cycle. Morris (2004) showed that there is an increase in the percentage of residents cycling for a “transportation trip” who live within one half mile of an urban cycle trail. This paper outlined factors influencing cycle commute rates on trails. This paper differed to Stinson and Bhat’s (2003) analysis and identified many other externalities such as competing facilities, numbers using a facility, land use around facility and access points of the facility. These variables vary for different categories of users. In order to understand the variable for tourist related cycling, it was important see how these trips are influenced. Downward et al (2009) further added to the cycle tourism literature determining the economic impact of sports tourism by looking at the economic impact of a cycle network in North East England. It was found that for leisure and tourist related cycling, expenditure and duration of trip had the largest affect on trip length. Duration did not directly affect expenditure and different route characteristics for this category of cyclists. Income and, if the users were in a group, group size, were key determinants in sports tourism expenditure. It was found that when planning infrastructure that targets tourists and leisure users, it is important that the infrastructure cater for longer trips.

Several studies have looked at methods to increase cycling. Stinson and Bhat (2004) determined that the most important factors affecting cycle commuting by means of an internet based survey. The results indicate that the most effective policy to increase cycling was to increase cycle parking at employment facilities. Cyclist training and education would also be an easy method of increasing cycling. Birk and Geller (2005) investigated the increase in cycling in Portland, Oregon over a thirteen-year period during which there were extensive improvements to cycling infrastructure. The paper shows that there was a 210% increase in cycling over the time period and a clear correlation between improvements in the cycle network and increases in the usage of the facilities. Berridge (2012) investigated cycling in London, preceding and succeeding the Tour de France Grand Depart in 2007. It found that a series of policies and investments led to a large increase in cycling, increasing 72% between 2000 and 2006. One of the investments was in bicycle parking, adding 40,000 new bicycle parking spaces on streets, at train stations and the introduction of super cycling highways and greenways.

A number of international case studies have been published on the benefits of greenways. Richardson (2006) examined the results of intercept surveys on Switzerland's National cycle network over a three-year period. The surveys gathered information at sixteen random locations around the network. Temperature, rainfall and cyclist numbers were noted over a period of time at these locations and for certain times of the year every year for three years. This research concluded that there are about 7.2 million day trips on the network and 350,000 overnight trips annually on the network. Other benefits of investing in cycling infrastructure are the improvement in the international and national image of a location. In 1999, Sustrans published a report on cycling tourism in the United Kingdom. Sustrans is a UK charity that endeavours to make sustainable travel by foot, bicycle and public transport more attractive. Sustrans (1999) found that cycle tourism was worth £695 million to the UK economy annually. The Sustrans report found that it was important to develop cycle tourism as:

- Cycle tourism is positive at generating local trade and offers business opportunities, particularly in rural areas,
- It is an environmentally sustainable form of tourism with minimal impact on the environment and can help reduce traffic congestion,
- It utilises existing facilities and often under-used facilities such as quiet laneways, and canal towpaths, and
- It can provide a use for disused railway lines.

Wray (2009) looked at how methods and ideas from community and network policy, and issues/problem management can be used to understand the activities of stakeholders, corporations and governments. It was found that there was no sustained network for tourism planning and management initiatives for Byron Bay in Eastern Australia. There was not any transfer of knowledge from one network to another. Another project in Australia is the Munda Biddi trail. The GWG is similar in to the Munda Biddi Trail in Western Australia. The Munda Biddi trail is presently 1,000km long (Munda Biddi Foundation, 2012). The trail is in a predominantly rural location and passes through several small towns. It is constructed along forest tracks and disused railway lines. The trail enjoys 21,000 visitors annually; the majority stay for three days along the route. This leads to a demand for accommodation, cycle hire, food and transport in the towns located along the route. It is estimated that in 2013, the Munda Biddi Trail will bring AUD$13 million into the South West and Great Southern communities of Australia.

4 METHODOLOGY

4.1 User data counters along GWG

During construction of the GWG, several automatic bicycle counters were installed along the route. The two counters were located adjacent to the settlements of Achill and Mulranny and are approximately 12 km apart. This data is used in conjunction with local weather data. Rainfall, mean wind speed, and mean temperature measurements were retrieved from an automatic Irish Meteorological Service weather station located in Newport. Sunshine hours were recorded in an Irish Meteorological Service Weather observatory located in Belmullet, approximately 35 km away from the locations of the counters. The various weather parameters and the user figures can be correlated to determine relationships allow predictions of usage along the path according to weather forecasts. Regression analysis was performed on the data allowing conclusions on the effects of weather on usage to be determined. This regression analysis was similar to the analysis performed by Levitte (1999).

The bicycle counters are based on radar technology and record time, date, speed, and direction of the cyclist passing. The device operates by measuring the length of a passing object. The device is able to split larger objects into several shorter objects. For instance, if several cyclists pass at the same time, the software can determine from the length recorded how many cyclists are in the group. If the cyclists are in a group, side by side, the whole mass of the group will be longer than one cyclist. The device has been calibrated from extensive studies of cyclist groupings to determine the quantity of cyclists that would be in a measured group. This is not 100% accurate and may vary for certain conditions. Accuracy is high with recorded speed being accurate to +/-3% and length measurement of passing objects being accurate to +/- 20% (Sierzega, 2012). The data recorded allowed many observations to be carried out such as average daily usage, average hourly day profiles, weekend and weekly usage. The data alone reveals many patterns and noteworthy observations.

A multinomial logit regression model was estimated in this research. The choice variable examined in the model was the usage of the GWG. As explained later in the text, the usage was split into four levels. These levels were split with an even distribution of the data across the four levels (quartiles). The four levels were low, low-medium, medium-high, and high. The model estimated examined the impact of the weather parameters, temperature, rainfall, and wind on the usage of the path. Each weather parameter was split into four sub-categories, each representing a quarter of the total for that parameter. This relationship can be viewed in equation (1). The model takes the following functional form:

$$\text{logit}(p) = \log \frac{p}{1-p} = \alpha + \beta I + e \qquad (1)$$

where p is the probability that event Y occurs (decision to use the GWG), βI is the set of weather parameters, and *e* is a random error term. Table 5 details each of the weather parameters estimated and the resultant model.

5 COUNTER DATA RESULTS AND ANALYSIS

The data from one of the cycle counters can be viewed in the charts in Figure 3. External factors such as weather, time of the year, and days of the week were investigated as to how they impact upon usage of the greenway. Over the period recorded, there were several national holidays, and periods of good and poor weather. These external factors were noted and the relationships between usage and these factors were observed. The information contained in Figure 3 is over a period of 566 days (2011 – 2012).

Firstly, the daily numbers were compiled for the counter and the usage was plotted over time. Three models were then created from these daily numbers. These models were:

- All year model
- Summer model
- Winter model

The all year model contains all the data for the year. The summer model contains the data from the 1st of April to the 31st of September whereas the winter model contains the data from the 1st of October to the 31st of March. Trend lines were inserted into the data in order to determine if there were any particular pattern observable and whether certain times of the year are busier than others (See Figure 3).

The averages for each hour of the day were calculated for all days, weekend days, and weekdays, for the three different models. This allowed an average hourly day profile to be created for the three models and different usage patterns between weekdays and weekend days to be observed. The charts created indicate that weekdays and weekend days carry approximately similar quantities over the course of a day but vary at different times. From these models, the following table was formed with the expected numbers between the hours of 6:00 and 22:00.

Table 2 illustrates how the usage patterns change depending on the time of the year. There is approximately a drop of 100 users on the path on average per day between the summer model and the winter model. The table also illustrates how usage increases for weekends. There is estimated to be an increase of 30 to 40 users on average at the weekends compared to weekdays.

Table 2 Average User Numbers

The first chart in Figure 3 illustrates the changing nature of usage along the GWG over the course of a year. It can be seen how the usage is seasonal in nature, as there is a peak in usage in the summer and trough in usage in the winter. It can be seen how there is an upwards trend in usage for the first half of the year, with usage peaking in August and then from the peak in August to the end of the year, there is a downward trend in usage. The average daily usage at different times of the year varies from just over 100 users a day in December and January to over 400 users a day in August. The trend line used to fit on the data in the chart has an R^2 of 0.174.

The second, third and fourth chart in Figure 3 illustrate how the profile of the daily usage varies depending on the season. The second chart displays the average hourly usage profile between the hours of 6:00 and 22:00 for every day of the year. The third and fourth chart displays the same except the third chart only displays the results from analysis on summer data whereas the fourth only displays results from the winter data. By displaying the data as such, it can be seen how usage varies at different times of year and also different days of the week.

All the charts have a morning peak Monday to Friday between the hours of 7:00 and 9:00. The summer time model has a smaller peak in the morning than that of the winter model. It is believed the reason for this is that the schools, along the route, are out of term and therefore there would not be any students using the GWG to commute to and from school in the mornings and the afternoon. All models have a peak at 13:00/14:00. The counter is located adjacent a very scenic village that would be popular for lunch. It is believed that many recreational users plan their journey with lunch in this village in mind.

The winter usage profile is smaller than the summer profile, because as stated previously, there are fewer users along the path in winter time that summer. For Monday to Fridays, the winter usage profile has a very much a commuter profile appearance with users most likely coming to and from school and places of work in the morning and evening time. These users are believed to be mixed with recreational users as there is consistent usage throughout the day and a plateau shape in evening time until 20:00. The weekend usage profile for the winter model is of a more recreational usage shape with a small morning peak, and then increasing until 13:00 and then peaking again at 17:00.

The summer usage profile contains a less pronounced morning peak. As stated previously, this is probably mainly due to the schools being closed for summer holidays. The summer model profiles for both weekdays and weekends are very similar shapes, except with the weekends have a very pronounced increase and plateau after 14:00. It is believed that the majority of users over the summer months are recreational users, with usage peaking in the afternoon time, particularly at the weekends.

5.1 Benefits from the GWG

The overall cost of the GWG is approximately €5.7 million (National Trails Office, 2012). The current economic crisis in Ireland has led to decreased spending on infrastructural projects and as a result it is important that only projects that provide the greatest return to the state go ahead. Therefore, determining the value of this project would provide a clear indication of whether similar projects should go ahead. Working on the assumption that usage of the GWG was to continue at the same level of usage, Table 3 was created. The usage data in Table 4 comes from the Mulranny counter in order to prevent double counting of users who may travel along the entire length of the GWG. The results in Table 4 indicate that the increased spend by tourists in the local area alone would justify the construction costs of the GWG.

Fáilte Ireland commissioned a report by Fitzpatricks consultants in the summer of 2011 (Fitzpatricks, 2011). This report found that approximately 8,000 of the users were non-domestic tourists spending on average €50.71/day while cycling the GWG. The report also found that there were 14,800 domestic tourists cycling the GWG spending on average €49.85/day. From Table 3, it can be estimated that after a 6 year period, the facility will have returned the initial investment from solely tourism revenue.

TABLE 3 Quantifying the benefits from the cycleway

FIGURE 3 Charts containing usage data

5.2 How weather affects usage of the GWG

Weather data from the station was corroborated with the usage data from the counters along the GWG and regression analysis was performed. Graphs with weather records and user data imposed can be viewed in Figure 4, and the tables containing the results of the multinomial logistic regression analysis can be viewed in Table 5. These graphs indicate relationships between weather and the usage of the greenway.

For the data retrieved from the counter, it can be seen in Figure 4 that usage of the GWG is inversely proportional to the rainfall and the mean wind speed, and that there is a positive relationship between temperature and usage. When rainfall over a day is 0mm, the average usage for that day will generally be over 300 cyclists, and when rainfall is over 10mm the usage will generally be below 200 cyclists. When the average temperature over a day is below 5°C, the average usage will generally be below 200 users and when the average temperature is above 15 °C, the usage is generally above 400. When the mean wind speed over a day is below 10 knots the average numbers passing along the GWG that day is generally above 300 and when mean wind speed is above 20 knots, the usage is generally below 200.

In order for these relationships to be analysed effectively, it is necessary to perform multinomial logistic regression analysis on the data. The three models mentioned previously (all year, summer, winter) were used in this analysis. Within these models the usage numbers, rainfall, mean temperature and mean wind speed, were split into quartile groups. These groups were categorised as low, low-medium, medium-high and high and were categorised as 1, 2, 3, and 4 respectively. Multinomial logistic regression analysis was performed on these categories with usage as the dependent variable. These continuous variables are categorised in order to create a better prediction model. The group quartile values within each of the three models can be observed in Table 4.

Table 4 Variables and their Quartiles

The results for the three regression models can be viewed in Table 5. The significance for all the variables were less than 0.05, with the exception of rainfall in the summer model which was only marginally over 0.05 with a value of 0.051. The R^2 for the three models was adequate, with the winter model having the best R^2 of 0.39. The data in the regression model is non-parametric and therefore R^2 of above 0.5 would not be expected. The R^2's in the models are more than adequate for this type of regression. The all year model contained the most data with 566 entries, followed by the summer model with 320, and then the winter model had 246.

The reference category for the dependent variable (usage) is category 4. When reading Table 5, the beta values (B) are referenced off when usage is high. For example, we can see if we look at temperature for the all year model, when everything else is held the same:

- That when usage is low (Usagecat=1),
- Temperature will be 3.826 times more likely to be low (tempcat = 1 or temperature less than 8.45°C) than when usage is high,
- Temperature will be 4.127 times more likely to be low-medium (tempcat = 2 or temperature between 8.45°C and 10.999 °C) than when usage is high, and
- Temperature will be 2.523 times more likely to be medium-high (tempcat = 3 or temperature between 11°C and 13.44 °C) than when usage is high.

To summarise the previous bullets, when all else is held the same, when temperature is low, then it is more likely that there will be fewer users than when the temperature is high. So using Table 5, we were able to determine the following about the different weather parameters for the different times of the year.

5.2.1 Rainfall

The all weather model was not very conclusive for rainfall. This model predicts that when usage is low, that rainfall is 1.7 times more likely to be low than high and that when usage is high, it is 1.7 times more that rainfall is high rather than low. This is not very intuitive and anecdotal evidence would suggest otherwise. It was results like these (and the all year wind section) that resulted in the summer and winter models being considered. It was found that when the data was separated into seasons, more intuitive results were received, as can be seen in the following paragraphs. This issue is believed to arise due the presence of more commuters/local usage in the winter model than the summer model.

The summer model indicates that users over the summer are more sensitive to the rainfall than at winter. It can be seen that if usage is low, then it is approximately 18 times less likely that rainfall is low than high. From this it can be deduced that when usage is high, it is 18 times more likely that rainfall is low than high.

This winter model indicates that when usage is low that it is 2.6 times less likely that rainfall is low than high. Similarly, we can say that when usage is high, it is 2.6 times more likely that rainfall is low than high.

5.2.2 Temperature

The all year model indicates that users throughout the year are sensitive to temperature. When usage is low, it is approximately 4 times more likely that temperature is low and low-medium, than high. Similarly, when usage is high, it is approximately 4 times more likely that temperature is not low or low-medium.

The summer model agrees with the all year model except it is more exagerated with the coefficients. When usage is low, it is approximately 20/21 times more likely that temperature is low and low-medium, than high. Similarly, when usage is high, it is approximately 20/21 times more likely that temperature is not low or low-medium.

The winter model also agrees with the previous two models. When usage is low, it is approx approximately 2 times more likely that temperature is low and low-medium, than high. Similarly, when usage is high, it is approximately 2 times more likely that temperature is not low or low-medium.

5.2.3 Wind

Wind was found not to have an overly bearing affect on usage for the all weather model. It can be seen however, that when usage is low, that it is 0.062 time more likely that wind is low than high. This beta value is very small and for the entire all year model it can be seen that wind played a small part of the impact on usage.

Wind was found to have a greater role in the affect on usage for the summer model. It was found that when wind was low-medium or medium high, it was approximately 18 times more likely that usage was low than high.

Similar to the summer model it was found that when usage is low, it is 23 times for likely that wind is high rather than low. When usage is high, it is 23 times more likely that wind is low rather than high.

Table 5 Table of Multinomial Logistic Regression of the three models

FIGURE 4 Graphs containing weather data and usage numbers

6 CONCLUSION AND DISCUSSION

Providing infrastructure similar to the GWG throughout the country could prove to be important at reducing pollution, obesity and traffic congestion. The Greenway is located in a predominantly rural area and was expected to be mostly used by tourists. From analysis of the usage counters along the Greenway, it can be seen that there are pronounced morning peaks and afternoon/evening Monday to Friday. This indicates that not only are tourists using this facility, but it is being used as a sustainable travel mode for locals.

The usage and weather data indicate certain intuitive relationships. It can be seen from Figure 4 and Table 5 that for the summer and winter models that as rainfall increases usage decreases. As for temperature, the all year, summer and winter models all agree that as temperature increases, there is an increase in usage along the GWG. Wind appears to be the least important weather parameter of the three in the model, but it still has an impact on the usage. It can be seen across the three models that there was a general reduction in the usage of the GWG with the increase in mean wind speed.

From looking at the tourism expenditure, it can be estimated that domestic and non-domestic tourists profit for the local area is approximately €1,065,000 per year while visiting. From these figures alone, the facility has a payback period of 6 years. These figures indicate that investing in cycling facilities in areas that cater not just for local usage, but also for tourists can be very worthwhile to the local economy. The small local population of the area alone would not warrant an investment of €5.5 million in cycling facilities. However, the amount of tourists using the Greenway has made the facility a very worthwhile investment.

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Figure (including maps and photographs)
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Figure 1 Image of the GWG

Source: Discover Ireland (2010)

Figure (including maps and photographs)
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FIGURE 2 Maps containing location of GWG. (Purple dots represent 1 person)

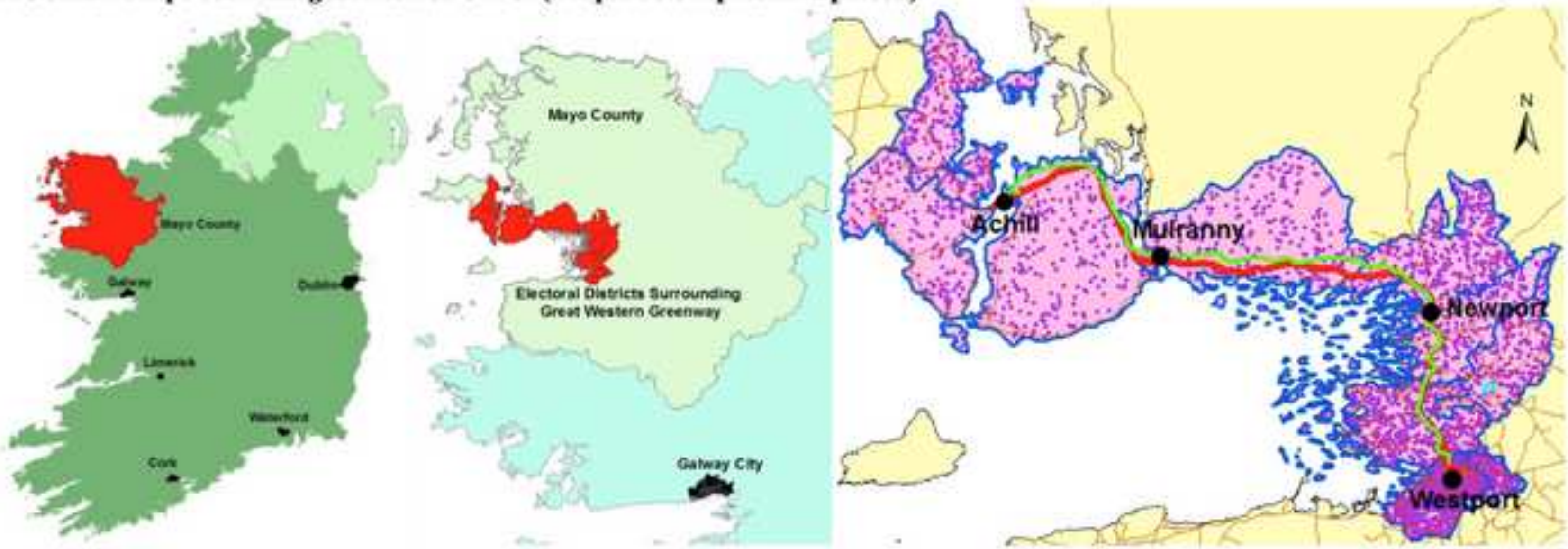

Figure (including maps and photographs)
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FIGURE 3 Charts containing usage data

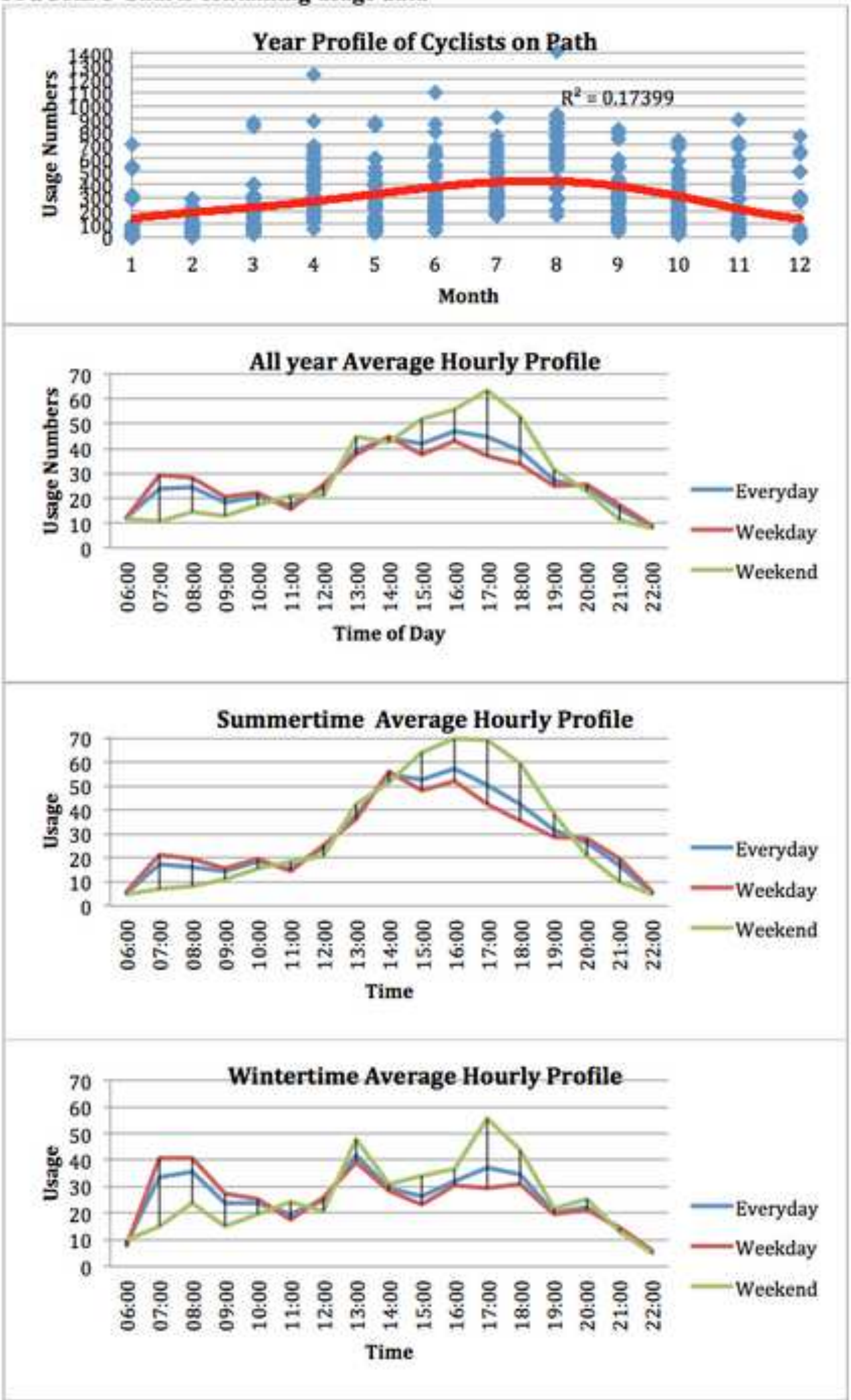

Figure (including maps and photographs)
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FIGURE 4 Graphs containing weather data and usage numbers

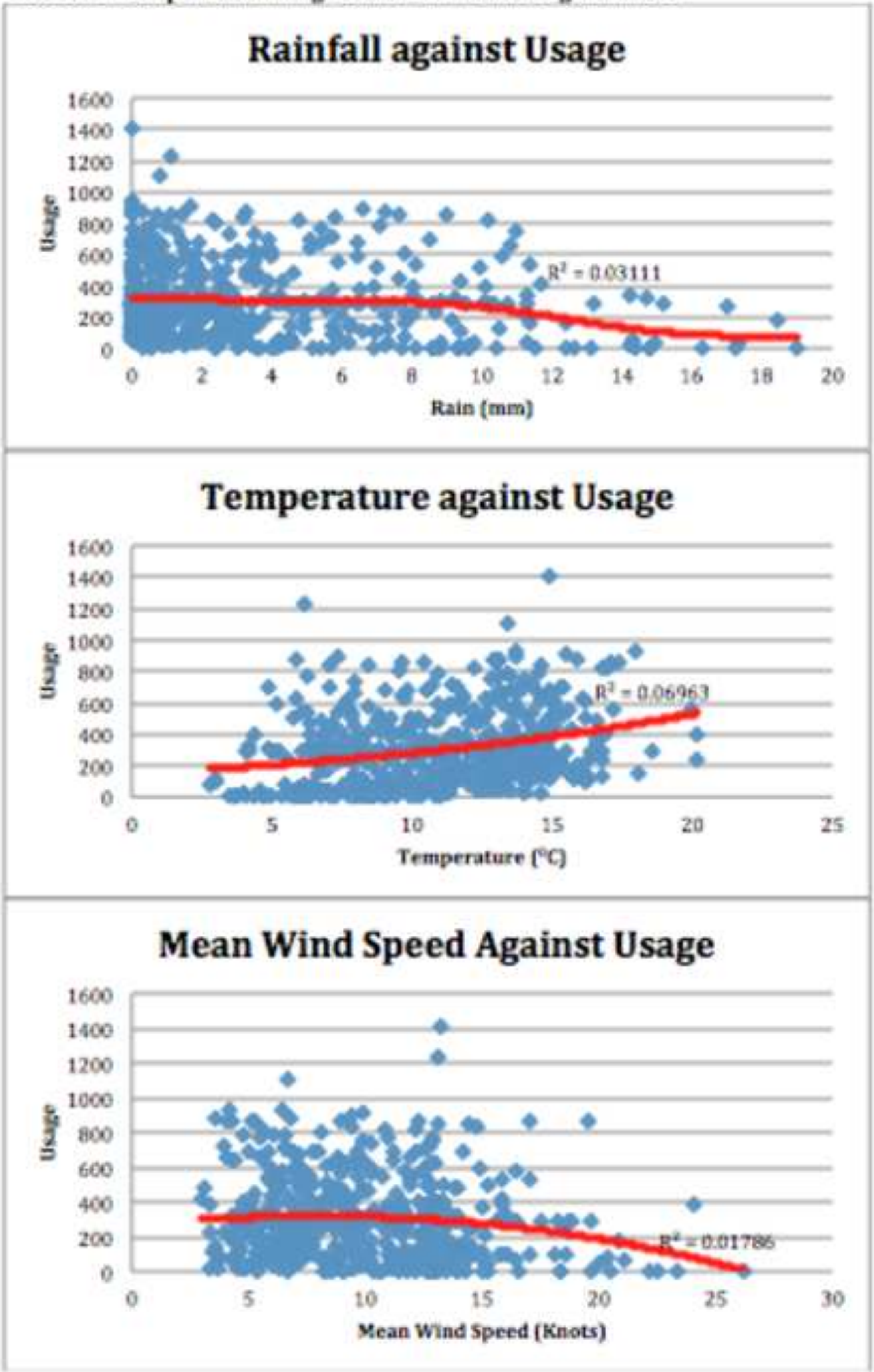

Table 1
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TABLE 1 2006 Census statistics for the area around the GWG

	Category	Quantity	Percentage
Gender	Male	2801	56.4%
	Female	2166	43.6%
Means of Transport	Walk/Cycle	765	15.4%
	Bus/Rail	50	1%
	Car	3193	64.3%
	Work from Home	169	3.4%
	Other	790	15.9%
Age	15 – 24 years	581	11.7%
	25 – 34 years	1272	25.6%
	35 – 49 years	1833	36.9%
	50 – 64 years	1167	23.5%
	65 + years	114	2.3%
Cars in Households	No Car	318	6.4%
	1 Car	1585	31.9%
	2 Cars	2260	45.5%
	Three Cars	576	11.6%
	Four or More Cars	228	4.6%

Table 2
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Table 2 Average User Numbers

	Average Numbers	Standard Deviation
All Year Model		
All Days	471	237
Week Days	450	238
Weekends	494	230
Summer Time Model		
All Days	488	234
Week Days	476	241
Weekends	518	213
Winter Time Model		
All Days	363	203
Week Days	354	198
Weekends	385	215

Table 3

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TABLE 3 Quantifying the benefits from the cycleway

Usage over a 1 Year Period		172,000 Trips	
Usage over 10 Year Period		1,720,000 Trips	
Cost of Construction of GWG		€5.7 million	
Maintenance Per Annum		€40,000	
Total Cost to Local area over 10 years		€6,100,000	
Cost per Trip over 10 Year Period		€3.55	
Assuming that the usage figures neither rise or decline over a 10 year period, and that a tourist is only cycling along the GWG for one day			
Domestic Tourists		**Non Domestic Tourists**	
Total Numbers	14,800	**Total Numbers**	8,000
Spend in area over a year	€737,780	**Spend in area over a year**	€405,680
Cost of these trips	€52,540	**Cost of these trips**	€28,400
Spend after cost for the local area	€685,240	**Spend after cost for the local area**	€377,280
Total spend in area from Tourists minus the cost per trips, per year		€1,062,520	
Over 10 year Period		€10,625,200	
Payback Period		6 years	

Table 4

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Table 4 Variables and their Quartiles

Group	Quartile	Category	All Year Model	Summer Model	Winter Model
Usage (Users)	1st Quartile	1	Less than 119	Less than 236	Less than 46
	2nd Quartile	2	119 to 290	236 to 290	46 to 136
	3rd Quartile	3	291 to 437	291 to 481	137 to 150
	4th Quartile	4	More than 437	More than 481	More than 150
Rainfall (mm)	1st Quartile	1	Less than 0.2	Less than 0.1	Less than 0.375
	2nd Quartile	2	0.2 to 1.699	0.1 to 1.199	0.375 to 2.499
	3rd Quartile	3	1.7 to 5.3	1.2 to 3.8	2.50 to 6.7
	4th Quartile	4	More than 5.3	More than 3.8	More than 6.7
Mean Temperature (°C)	1st Quartile	1	Less than 8.45	Less than 11.2	Less than 6.55
	2nd Quartile	2	8.45 to 10.999	11.2 to 12.999	6.55 to 8.699
	3rd Quartile	3	11 to 13.44	13 to 14.4	8.7 to 10.1
	4th Quartile	4	More than 13.44	More than 14.4	More than 10.1
Mean Wind Speed (Knots)	1st Quartile	1	Less than 6.7	Less than 6.5	Less than 7
	2nd Quartile	2	6.7 to 9.199	6.5 to 8.799	7 to 9.649
	3rd Quartile	3	9.2 to 12.3	8.8 to 11.9	9.65 to 12.7
	4th Quartile	4	More than 12.3	More than 11.9	More than 12.7

Table 5

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Table 5 Table of Multinomial Logistic Regression of the three models

Likelihood Ratio Tests

Effects	All Year Model – Usage Data: Chi^2	Sig.	Summer Model – Usage Data: Chi^2	Sig.	Winter Model – Usage Data: Chi^2	Sig.
Intercept	.000	.000	.000	.000	.000	.000
Rain	29.487	.001	16.532	.051	48.857	.000
Temp	136.442	.000	26.018	.002	22.449	.008
Wind	19.105	.028	22.110	.009	30.683	.000

-2Log likelihood of Reduced Model

	All Year Model – Usage Data	Summer Model – Usage Data	Winter Model – Usage Data
Intercept	505.07	237.037	267.178
Rain	534.55	253.569	316.035
Temp	641.51	263.055	289.628
Wind	524.17	259.147	297.861

Parameter Estimates

		All Year B	Sig.	Summer B	Sig.	Winter B	Sig.
Usagecat=1	Intercept	-1.536	.005	-1.966	.274	.637	.410
	[RainCat=1]	1.701	.000	-17.916	.996	-2.608	.037
	[RainCat=2]	.976	.018	.086	.952	-1.668	.047
	[RainCat=3]	.003	.995	.770	.622	-1.135	.088
	[RainCat=4]	0	.	0	.	0	.
	[Tempcat=1]	3.826	.000	21.463	.000	2.311	.006
	[Tempcat=2]	4.127	.000	20.337	.000	1.090	.177
	[Tempcat=3]	2.523	.000	2.791	.032	.801	.323
	[Tempcat=4]	0	.	0	.	0	.
	[Windcat=1]	.062	.879	-.551	.597	-23.120	.
	[Windcat=2]	.859	.070	-17.882	.996	-.570	.419
	[Windcat=3]	-.091	.813	-18.877	.996	-.041	.957
	[Windcat=4]	0	.	0	.	0	.
Usagecat=2	Intercept	-1.134	.011	2.476	.010	-.105	.890
	[RainCat=1]	1.680	.000	-1.043	.208	2.167	.005
	[RainCat=2]	1.406	.001	-1.102	.185	1.214	.090
	[RainCat=3]	.687	.085	-.522	.561	.161	.820
	[RainCat=4]	0	.	0	.	0	.
	[Tempcat=1]	-.238	.573	19.089	.000	-.175	.809
	[Tempcat=2]	.725	.077	18.518	.000	-.046	.948
	[Tempcat=3]	.664	.064	1.097	.029	.476	.472
	[Tempcat=4]	0	.	0	.	0	.
	[Windcat=1]	.668	.093	-.969	.169	-.479	.495
	[Windcat=2]	1.374	.003	.091	.912	-.643	.357
	[Windcat=3]	.098	.801	-.669	.373	.166	.824
	[Windcat=4]	0	.	0	.	0	.
Usagecat=3	Intercept	-1.042	.016	1.178	.240	.759	.255
	[RainCat=1]	1.575	.000	-.108	.901	1.300	.064
	[RainCat=2]	1.233	.002	-.277	.751	.809	.191
	[RainCat=3]	.547	.159	-.068	.942	.420	.469
	[RainCat=4]	0	.	0	.	0	.
	[Tempcat=1]	.479	.221	19.202	.	-.288	.655
	[Tempcat=2]	.864	.035	18.687	.	.080	.897
	[Tempcat=3]	.405	.272	.906	.080	-.270	.658
	[Tempcat=4]	0	.	0	.	0	.
	[Windcat=1]	.301	.453	-.779	.287	.060	.925
	[Windcat=2]	1.452	.001	.620	.460	-.213	.734
	[Windcat=3]	.232	.540	-.242	.754	.592	.385
	[Windcat=4]	0	.	0	.	0	.

The reference category is Usagecat = 4 (all three models)

	All Year Model	Summer Model	Winter Model
-2log-likelihood convergences	505.072	237.037	267.178
N	566	320	246
Nagelkerke R^2	.300	.216	.390

**Author Biography*

Mr Gerard Deenihan
Mr Gerard Deenihan is a PhD candidate in the in the Department of Civil, Structural and Environmental Engineering at Trinity College Dublin, Ireland. His doctoral research is examining the benefits of introducing inter-urban cycleways.

Dr Brian Caulfield
Dr Brian Caulfield is an Assistant Professor in Civil Engineering in the Department of Civil, Structural and Environmental Engineering at Trinity College Dublin, Ireland. His main areas of research are in the field of transportation, more specifically determining the benefits of the introduction of new transport

schemes and the environmental impacts of transport. He has been active in transportation research for 10 years had has published over 40 peer reviewed papers.

Dr Dermot O'Dwyer

Dr Dermot O'Dwyer is an Associate Professor in Civil Engineering in the Department of Civil, Structural and Environmental Engineering at Trinity College Dublin, Ireland. His research areas are in structures and transportation.