TRANSPORT RESEARCH LABORATORY

# Monitoring and evaluation of the Bikeabout scheme in Portsmouth

## Prepared for Hampshire County Council

Transport Research Laboratory, Transportation Research Group
(University of Southampton) and University of Portsmouth

TRL REPORT 412

First Published 1999
ISSN 0968-4107


This report is the result of collaborative effort by a number of authors at the Transport Research Laboratory, Transportation Research Group (Southampton University) and the University of Portsmouth. For enquiries about the technical content of the report, please contact Dr Jane Cloke at the Transport Research Laboratory.

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# Executive Summary

This report describes the evaluation of a cycling initiative, Bikeabout, which is part of a wider University Mobility Policy, aiming to reduce car use by staff and students of the University of Portsmouth. The scheme was implemented and evaluated as part of the ENTRANCE project.

The ENTRANCE project is a European project funded partly by the European Commission's Directorate-General for Energy (under the THERMIE programme for promotion of European energy technology) and partly by the cities and other partners involved. The project was launched in February 1994 and is led by nine cities in eight member states. The evaluation in Hampshire is being carried out by TRL, the University of Southampton and the University of Portsmouth, for Hampshire County Council.

The purpose of ENTRANCE is to demonstrate through implementation and assessment various integrated measures for promoting alternatives to car travel and alternative patterns of travel, improving public transport operations and use, and making better use of existing road space in European cities. It is intended that these measures will lead to energy savings and lower emission levels and a better quality of life for residents and visitors. The project targets a number of technologies offering significant improvements to urban public transport, to encourage the use of this mode of travel in preference to private vehicles, but is also concerned with promoting alternative patterns of travel (for example through teleworking and cycling), and with techniques for managing congestion to improve the use of existing road space.

The Hampshire partners aim to raise awareness of energy and environmental issues by demonstrating a number of integrated applications within and in the vicinity of Southampton and Portsmouth. The evaluation aims to assess the energy consumption benefits and the associated environmental benefits due to individual system elements. In addition the evaluation seeks to determine the impacts of the applications in behavioural and economic terms. Although the applications are each evaluated and reported separately in the ENTRANCE study, the full impact of each scheme will not be felt in isolation.

In Portsmouth the ENTRANCE project is evaluating three applications: public transport priority along a major route through the centre of Portsmouth, a hybrid bus that can be operated in either diesel or electric mode, and the cycle pool, which is part of the Bikeabout Scheme for University Transport. Students will benefit from both of these initiatives.

This report describes the monitoring and evaluation of the Bikeabout scheme introduced in Portsmouth. The aim of Bikeabout was to use new technology to provide self-regulated access to a pool of bicycles and provide improved cycle infrastructure and facilities on selected routes and at key destinations. The Bikeabout scheme consisted of two storage depots holding a pool of 100 specially adapted bicycles in three different designs, for loan during the day. Cycles were tagged electronically so that they could be identified and traced. The depots contained electronically operated cycle stands and a computer, smart card reader and screen. Staff and student members of the scheme wishing to borrow a cycle could swipe their smart card through the reader, and a cycle was released electronically from a stand; cycles had to be returned within three hours. The scheme was strongly marketed across the University and was directed at those staff and students using private vehicles for short distance inter-site trips within the city.

The University of Portsmouth is located to the south of Portsmouth city, with facilities spread over three sites, Guildhall, Milton and Langstone. The scheme was considered necessary because this dispersed geography resulted in substantial traffic generation during the day and contributed to major congestion in the city centre. The University's Mobility Policy was set up with the aim of reducing staff and student car use, and as an integral part of this, Bikeabout aimed to bring about a transfer of journeys from cars to bicycles, with resulting energy and environmental benefits. The University Transport Scheme was part of this wider Mobility Policy, providing free minibus transport between the University sites.

The City of Portsmouth is an ideal locality in which to promote cycling due to its compact layout, close proximity of key facilities and attractions, and flat topography. Portsmouth City Council has exploited this in recent years through the ongoing development of a network of cycle routes across the urban area.

The cycle pool scheme was evaluated by means of 'before and after' surveys of students and staff at the University of Portsmouth, comprising questionnaire and interview surveys and surveys of traffic movements through a cordon.

The evaluation took place one month after the scheme began to operate and 303 people had registered to use Bikeabout then. The number of users increased subsequently; in October 1997 there were 415 registered users. Although Bikeabout had only limited success initially in attracting users to the cycle pool, there was a marked increase in the number of students cycling to and from the University (from about one in eight to about one in three of the students surveyed). For registered Bikeabout users, a number of benefits were realised, such as providing a means of keeping fit, representing a 'green' mode of travel during the day, and secure, convenient cycle parking facilities. The new technology incorporated into Bikeabout enabled the cycle pool to operate efficiently and effectively, but at the time of the evaluation this was not sufficient in itself to attract large numbers of users.

One of the fundamental objectives of Bikeabout was to encourage a shift from the car to the bicycle, specifically for journeys between the Milton and the Guildhall Sites. The potential extent of this was estimated from surveys carried out before implementation which found that about 340 journeys were made from Milton to the Guildhall Site during the day. Of these journeys 24% were made by car and 5% by bicycle.

The ‘after’ survey showed that just over a fifth of the journeys made on Bikeabout had previously been made by car, taxi or motorcycle. The extent to which the minibus service attracted people who would otherwise have travelled by car can be gauged from the fact that 18% of minibus users said that they would travel by car if the service were not available.

From the ‘after’ surveys it was estimated that 40 miles/day which had previously been made by private car or motorcycle were being made using Bikeabout, and 80.6 miles had previously been made on foot. However, in total only 0.5% of the average daily mileage had been substituted with Bikeabout.

These changes meant that only modest savings in fuel consumption and pollutant emissions were achieved. In terms of the economics of Bikeabout, the usage at the time of the evaluation was not economically viable as the capital and running costs of the scheme significantly outweighed any benefits in terms of savings in time, vehicle operating costs and fuel consumption. For the scheme to be economically viable, a greater transfer from cars would be required as this is where the majority of benefits would be expected, particularly in respect of savings in fuel and vehicle operating costs.

The University Transport Scheme also included a University-operated minibus service running between sites which affected use of Bikeabout. Users of this service found it to be quicker and to offer protection from the weather and traffic, and were therefore unlikely to use a cycle pool even if cycle hire were provided free of charge. The evaluation showed that while 13% of the mileage substituted by Bikeabout had come from the minibus service, there was unlikely to be much further transfer to Bikeabout even if the minibus service were withdrawn; minibus users and cyclists had different criteria for choosing modes, for example, the former preferred to avoid physical exertion while the latter preferred exercise. Thus the two services can be seen as being complementary to each other.

A number of reasons were identified as to why Bikeabout had yet to attract substantial numbers of users. Many potential users preferred to use their own bike, use the car either as a driver or a passenger, or walk. Many were put off by the pool cycles’ design and appearance while many were unaware of the launch of the scheme, indicating a requirement for more effective and targeted marketing to staff and students.

After the completion of the study the number of registered users of the scheme increased during 1997, perhaps due to better weather in summer and the closure of the University minibus service during the vacation improving the attraction of cycling and the opening of a third depot in October 1997. With greater use of Bikeabout, its greater visibility may publicise the scheme further; however the evaluation stage of the study did not extend into 1997 so it was not possible to evaluate these effects within ENTRANCE.

At a city-wide level, although the uptake of the Bikeabout cycle pool was limited, the parallel transport initiatives supported by the University and Portsmouth City Council do appear to have had some success in encouraging a shift towards cycling. Bikeabout included the implementation of a continuous east-west cycle route between the Guildhall and Milton sites and this together Portsmouth City Council’s ongoing cycle route expansion programme across the urban area appears to have helped to bring about a marked increase in the proportion of students cycling to the University. This indicates that whilst the cycle pool itself was only modestly successful, the wider University Mobility Policy objectives (and those of ENTRANCE) are being addressed.

For Bikeabout to be regarded as achieving greater success in meeting its objectives, the scheme needs to attract far more car drivers because of the potential for reductions in vehicle emissions and fuel consumption. In this context, it is clear from the evaluation of the scheme to date that providing an alternative travel option on its own is unlikely to bring this about and that further measures, particularly those that penalise car use directly, will be necessary to increase use of the cycle pool. Now that Bikeabout and the minibus service offer an alternative means of transport for inter-site journeys it may be appropriate for the University to consider parking restrictions. Such restrictions have already been discussed for future development within the University Mobility Policy.

Since the project began, a number of changes in the use of University facilities were proposed. These included the expansion of the facilities at the Langstone site and a move out of the Milton site, relocating to a new building on the Guildhall campus. These changes would provide the potential for a further Bikeabout depot. Demand for travel during the day would remain high and the consequent increased demand for inter-site travel mean that the University Transport Scheme will continue to play an important role in encouraging the use of cycling and providing access to bicycles.

The Bikeabout scheme will be a useful tool to enhance the use of bicycles within the University, and the detailed information provided by this report will help improve the future success of the scheme and illustrate some of the obstacles, particularly the behavioural barriers, to increasing cycle use in general.

# 1 Evaluation plan

### 1.1 Description of the application.

The University of Portsmouth is located in the south of Portsmouth city on Portsea Island, with facilities spread over three sites, Guildhall, Milton and Langstone. The distance between the Guildhall site and the Langstone site is about 3 km and student accommodation is scattered largely within the area between these two sites (see Figure 1). The University Mobility Policy aims to reduce private car trips by staff and students by:

- using information technology to reduce the overall demand for travel;
- increasing bus services, including a free minibus service linking the Guildhall and Milton sites;
- reducing on-site car parking;
- establishing safe and direct cycle routes;
- providing secure cycle storage facilities; and
- providing a pool of bicycles for use between the teaching sites.

As part of this University Mobility Policy, the University Transport Scheme initiative known as Bikeabout received funding under the ENTRANCE project to promote the use of cycles for transport between University sites. The Bikeabout scheme is outlined here, but a comprehensive document providing detailed information and illustrations of various aspects of the scheme is available from Portsmouth City Council (Stunnell et al, 1997).

Bikeabout consisted of two storage depots[1] , one each on the Guildhall and Milton sites, holding a pool of some 100 specially adapted bicycles for loan during the day. Three different designs of bicycle were available, in a distinctive purple and white colour scheme, each with a dynamo lighting system and a carrying basket. One of the three designs was standard ladies' cycle; the second was a unisex modification of a standard bicycle, and the third was a specially-designed city bike which was commissioned for the project.

Each depot comprised a series of electronically operated cycle stands under shelter. At the entrance to the depot was a terminal housing a computer, smart card reader and screen. Staff and students wishing to use the bicycles registered at the University and paid a refundable £5 deposit to receive a smart card holding their details. This smart card could then be 'swiped' through the smart card reader and the screen indicated at which stand a bicycle would be electronically released. Users were then free to keep the bicycle for up to three hours free of charge. Cycles could be returned to either depot at the end of this time. The depots were open between the hours of 08:30 and 18:00 on weekdays. Usage of the system was automatically monitored and any abuses of the system logged. Those who seriously abused the system could be automatically denied access to the bicycles.

When the scheme was first introduced, an interim manual system was used for booking the bicycles in and out and temporary storage containers were installed at Ravelin Park (near Mercantile House), while staff car parking at Mercantile House was being removed to accommodate the automated depot.

Security was seen as crucial to the success of the system. Cameras providing CCTV were installed at the depots. In addition, a bicycle identification system was used, based on the 'TIRIS' sensing system with an electronic tag attached to each bicycle so that all the bicycles could be identified and traced. This meant that bicycles could be automatically logged on return, users did not need to process bicycle details, and any stolen cycles could be identified. Initially a flexible security chain with a lock was provided on each bicycle so that users could secure them when they were parked away from a depot. However the lock proved attractive to thieves, and these were discontinued. Subsequently, locks were issued to a limited number of regular users and others were encouraged to provide their own lock if they wished to leave the cycle unattended away from a depot.

Advertising was essential prior to the launch of the scheme, and continued to be an important feature. Publicity took the form of posters on notice boards, introductory leaflets distributed across the university, display boards at Freshers' fair and other events, publicity leaflets by Hampshire County Council and Portsmouth City Council, and national and local press and TV coverage. Direction signs for the scheme, and the bicycles themselves with the colours of the University livery, also promote the scheme.

Bikeabout also included improvements to the accessibility and safety of cycling throughout the University, benefiting Bikeabout users and other cyclists by the:

- extension of the existing cycle route between the Milton and Guildhall sites linking the two (shown in Figure 2), with improvements in surfacing and in segregation of cyclists on the original route;
- installation of new Toucan crossings along the cycle route, and alterations to other signals;
- improvements to cycle parking provision at key points around the University, which were provided by the University.

Since the project began, a number of changes in the use of University facilities were proposed. These included expansion of the Langstone site in terms of its provision of sports facilities and halls of residence, making it a potential site for a further depot. Also there was a desire to move out of the Milton site and relocate to a new building on the Guildhall campus. With these changes, demand for travel during the day by staff and students was expected to remain high, with a potential increase in the demand for the Bikeabout cycles. The University Transport Policy aimed to ensure that a substantial amount of this demand was met by alternative modes rather than the private car.

[1] *Subsequent to the evaluation, a third depot was added at Burnaby in October 1997.*

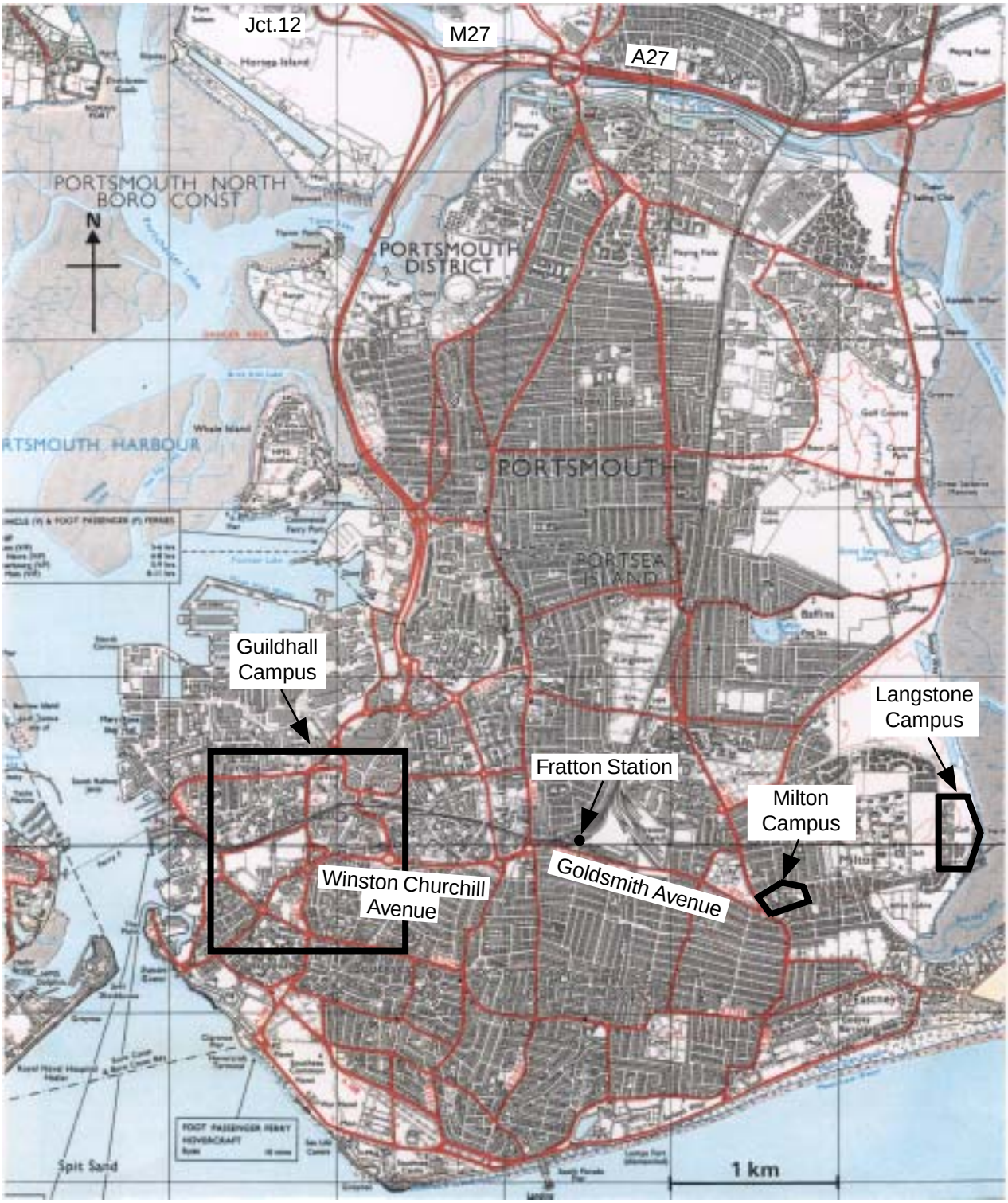




**Figure 1** The campuses of Portsmouth University

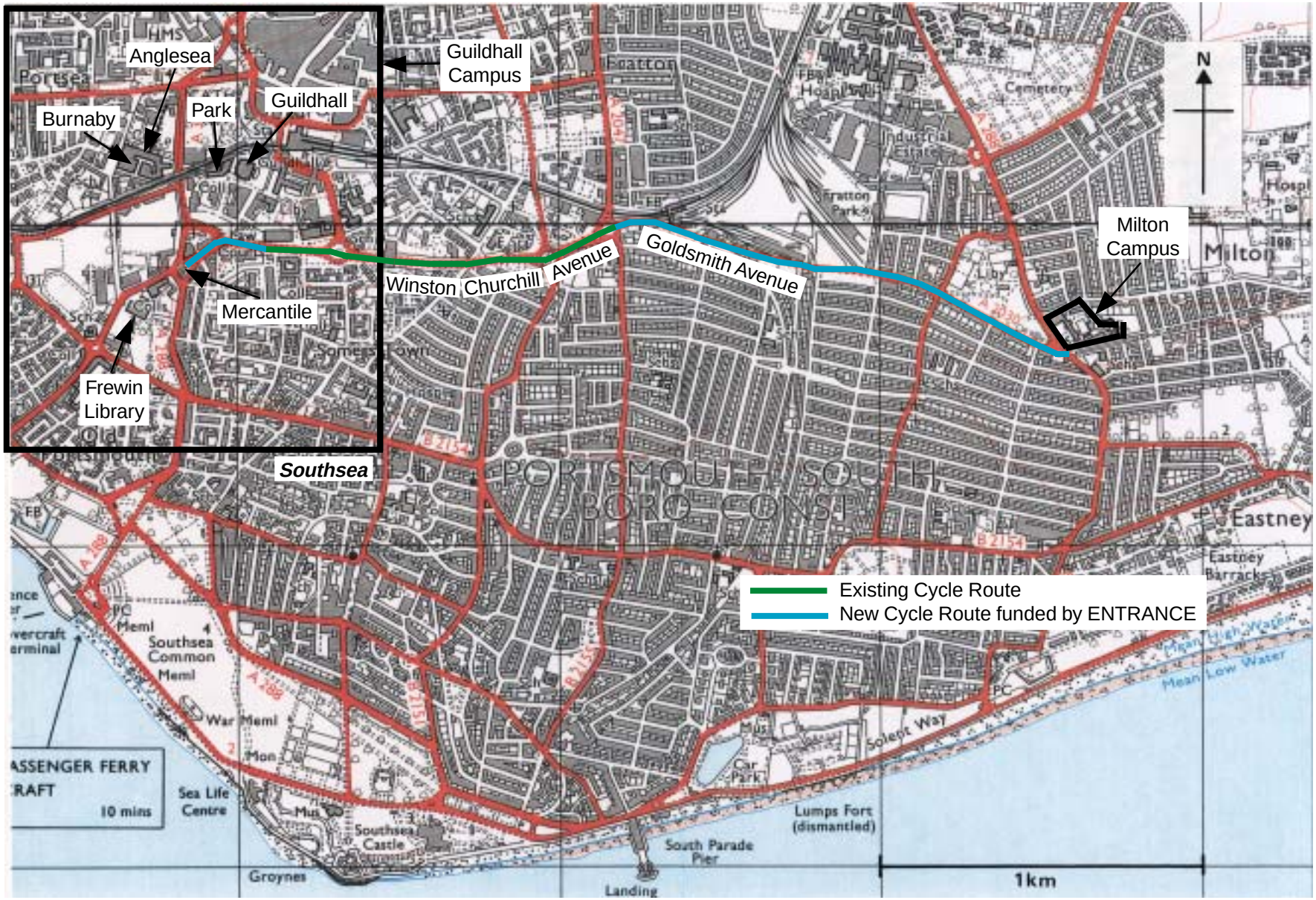




**Figure 2** University cycle route

### 1.2 Evaluation objectives

The scheme was intended to minimise energy usage and the environmental impact of journeys by staff and students at the University of Portsmouth by:

- encouraging greater awareness of the alternatives to car use for inter-site travel;
- making bicycles more accessible to people needing to travel in Portsmouth during the day;
- providing a safer environment in which bicycles could be used.

### 1.3 Expected impacts

By encouraging more staff and students to cycle to and between teaching sites, energy consumption and pollutant emissions were expected to be reduced. The value in changed journey times and travel costs needed to be evaluated alongside the capital and running costs of the scheme. Increased awareness of the opportunity to reduce private vehicle travel was anticipated amongst staff and students as a result of the marketing campaign, and the evaluation sought to determine awareness of the scheme.

### 1.4 Experimental plan

#### *1.4.1 Indicators to be measured*

The following indicators were required for the evaluation:

- modal split of trips between the two sites, their length, duration, average speed and purpose;
- capital costs of the measures, operation of cycle pool and maintenance of cycles;
- the value of journey times and travelling costs;
- awareness and use of the scheme;
- how to overcome reluctance to use the scheme.

#### *1.4.2 Measurement method*

The impact of the scheme was measured from surveys made before and after implementation. Data collection for the 'before' study was achieved with questionnaire and traffic survey techniques. A self-completion questionnaire incorporating a one-day travel diary and a survey to investigate attitudes to cycling were carried out. A cordon survey at the two University sites counted traffic movements and interviews were conducted among people entering the site to establish their travel habits. For the 'after' surveys, users of Bikeabout completed a travel diary and non-users were interviewed at various locations around the Guildhall and Milton sites, and also on the minibus which provided a free service between the two.

### 1.5 Analysis

#### *1.5.1 Behaviour*

Behaviour was analysed using a variety of survey-based approaches. Attitudes to and awareness of users and non-users to the availability of an alternative to private cars were evaluated, and the extent to which cycling could contribute towards the overall transport policy was assessed.

#### *1.5.2 Energy and emissions*

Energy usage was calculated from the change in the number and length of journeys made by students and others in private vehicles between the University sites. Appropriate fuel consumption factors relating to vehicle type, journey length and average speed were used in the calculations. Similarly changes in emission levels were calculated from the change in the number and length of journeys made by students and others in private vehicles, using appropriate emissions factors (see Section 4.2).

#### *1.5.3 Economic*

The evaluation identified the costs and benefits to the university, students and the local authority. Costs of the scheme included capital costs of the equipment (cycles, storage, access cards) as well as maintenance of the equipment (funded from car parking charges) and administration of the scheme. The value of time saved or spent in using the scheme was also included in the cost-benefit analysis.

## 2 'Before' survey

### 2.1 Survey methods

#### *2.1.1 Introduction*

The data for the 'before' study were obtained from a series of surveys. The Staff Survey and the Student Survey used self-completion questionnaires. These contained three sections: the first to elicit general information about the sample population; the second was a travel diary for recording all travel movements during one day; the third was a questionnaire on opinions and attitudes towards cycling. The other main survey was a Cordon Survey conducted at two University sites, counting traffic movements across a cordon and interviewing people about their travel.

The surveys aimed to collect detailed information from both staff and students at the University of Portsmouth in order to formulate an accurate profile of travel patterns, energy use, attitudes and opinions. The primary source of data was a questionnaire sent to all members of staff and made available to all students. Although not obligatory, respondents were encouraged to fill in their name and a contact address. This was to enable the possibility of comparing travel behaviour and attitudes before the scheme was implemented, with travel patterns once the scheme was operational. The surveys were designed to collect information on type of employment for staff (as defined by University payroll) and by course name for students, along with gender. The student course data were compared with a breakdown of course and departmental numbers provided by the University Registry. The staff data were compared with a breakdown of staff employment types provided by the University payroll. From postcode and road name information it was possible to locate most origins and final destinations of the travel diaries accurately, using national grid reference co-ordinates. The surveys also collected further details, including age, ownership of a bicycle, and of the capacity

to drive (i.e. hold a driving licence). Staff and students were also asked whether a vehicle had been used on the survey day, and if so, details of its type, make, model, engine size, age and fuel type were requested.

#### *2.1.2 Self-completion questionnaires*

The travel diary was the section of the surveys which collected details about student and staff travel for one day: Thursday 12 October 1995. This date and day was carefully selected to be representative of a typical day's travel by members of the University, being far enough into the new term for travel patterns to have become routine. A journey was defined as a one-way course of travel having a single main purpose. The travel diary obtained details of purpose of journey, the time the journey started and ended, and the origin and destination, for up to ten journeys. Each journey could list up to three modes of travel and their corresponding distances and journey times. To enhance the accuracy of the survey the respondents were asked to quote times using the 24 hour clock and to estimate distance to the nearest half a mile.

At the same time, staff and students were asked a set of questions, devised to highlight attractions and disincentives towards certain factors associated with cycling. This provided a profile of attitudes and opinions towards cycling and the accessibility of other modes of transport. Evaluation of the strength of particular attitudes was facilitated by the use of a semantic differential scale, which enabled people to respond along a sliding scale, e.g. from 'Likely' to 'Unlikely'.

#### *2.1.3 Cordon surveys*

The cordon surveys aimed to collect information on the modes used to access the Langstone and Milton Sites. At the Langstone site an interviewer was stationed at the only entrance /exit to the site, and another in the car park to interview the car drivers as they parked. A third person counted the traffic by mode i.e. car, cycle, and walk. The bus stop was outside of the cordon and these people were counted as pedestrians. At the Milton site interviewers and counters stationed at each of the five entrances /exits to the site. All people entered as pedestrians and the modal splits were to be obtained using the interview data.

### 2.2 Analysis of travel patterns

#### *2.2.1 Introduction*

The analysis in this section considers the travel patterns of staff and students before implementation of Bikeabout. An analysis of behavioural aspects is given in Section 4.1.

#### *2.2.2 University Staff Travel Survey*

The Staff Travel Survey achieved an overall response rate of 39%. A comparison of the staff profile compiled by the University with the responses from the questionnaire (see Appendix A) indicated that a representative sample was achieved. The proportions of each sex responding to the survey in all the employment categories appeared reasonably consistent with the University staff profile.

The ages of the respondents were split as shown in Table 1. Approximately 42% of the University staff are over 46 years old. Most staff had a valid driving licence (81%), and 62% indicated that they already owned a bicycle.

**Table 1 Staff ages**

| *Age group* | *%* |
|---|---|
| <25 | 7.9 |
| 25-35 | 24.5 |
| 36-45 | 25.3 |
| 46-55 | 32 |
| >55 | 10.1 |

The travel survey recorded a total of 2546 journeys made by members of staff on Thursday 12 October 1995. Most (68%) of the journeys were to or from home. By extrapolating the data for the respondents to all staff, it was estimated that all staff could generate up to about 6576 journeys a day. Table 2 shows that most staff came to University by car (57%), either driving or as a passenger, followed by walking (16%) and cycling (13%).

**Table 2 Staff journeys to University from home**

| *Mode* | *Average distance* | *Average time* | *Modal split %* |
|---|---|---|---|
| Walk | 1.33 | 15 | 16 |
| Bicycle | 2.64 | 13.47 | 13 |
| Bus | 4.39 | 21.37 | 6 |
| Train | 12.82 | 25.33 | 6 |
| Ferry | 2.62 | 11.55 | 1 |
| Motorcycle | 5.40 | 11.6 | 1 |
| Car passenger | 6.98 | 17.83 | 11 |
| Car driver | 10.58 | 24.91 | 46 |

*Although 6% of journeys included the use of a ferry, only 1% listed it as the main mode*

During the day staff travel used different modes as shown in Table 3. During the day 46% of travel was on foot, however, an almost equal proportion (40%) was carried out by car.

**Table 3 Staff journeys made during the day (not to or from home)**

| *Mode* | *Average distance* | *Average time* | *Modal split %* |
|---|---|---|---|
| Walk | 1.01 | 11.43 | 46 |
| Bicycle | 1.98 | 12.79 | 7 |
| Bus | 9.83 | 23.5 | 2 |
| University minibus | 1.67 | 11.67 | 0.5 |
| Train | 43.5 | 68 | 1 |
| Ferry | 5.25 | 11.25 | 1 |
| Motorcycle | 7.90 | 11.60 | 1.5 |
| Car passenger | 5.02 | 16.44 | 9 |
| Car driver | 6.08 | 15.52 | 31 |
| Taxi | 3.40 | 12.00 | 1 |

The data collected and presented in Appendix D allowed an analysis to be undertaken of journey origins and destinations. Overall, 12% of all recorded journeys made during the day were between the eastern sites (Milton and Langstone) and the west sites (Guildhall Site and Commercial Road shops). The main origin/ destination for staff was from/ to the Guildhall site.

Most journeys from the Milton site were made to the Anglesea, Commercial Road or the Ravelin Park areas of Portsmouth. More detail of the journeys into/out of Milton and Langstone is available from the Cordon Survey data - Appendices E and F.

Inter-site travel from the Mercantile, Park and Anglesea areas, and University House, was mostly concentrated locally, i.e. within half a mile with the other main destination being Commercial Road.

The Ravelin Park area appears to be the origin of travel to a wide range of University sites including Milton, but predominantly short journeys to nearby sites.

### *2.2.3 Student Travel Survey*

The Student Travel Survey achieved an overall response of 826. There were approximately 14,612 students registered at the University in 1995, although these numbers include courses franchised to other institutions, some of which are outside Portsmouth. Also, some of these students would have been on work placements, studying abroad, or working part-time. Table 4 illustrates that, as expected, a majority (68%) of the students were under 25 years old. It was found that 83% of the students held a driving licence. About the same proportion of students as staff owned a bicycle (65%).

**Table 4 Student ages**

| *Age group* | *%* |
|---|---|
| <20 | 25 |
| 20-25 | 43 |
| 26-45 | 28 |
| 46-55 | 3 |
| 55> | 1 |

The student survey respondents were equally split between men and women. The survey achieved an overall response rate of between 6 and 7% and the responses came from about half of the 289 courses currently running at the University. Inevitably it represented disproportionate numbers of students on each course and since the University departments were located in different areas of Portsmouth, such biases may have influenced the accuracy of the travel data. However, there does not appear to be any significant pattern in the location of departments with the highest and lowest response rates (see Appendix A).

A total of 3105 journeys were made by students in the survey sample on Thursday 12 October 1995; 24% of these journeys were made during the day (i.e. not to or from home). Assuming that there were approximately 12,000 students in Portsmouth (i.e. allowing over 2000 for part-time, and placement, students), it is estimated that in total, students could generate up to 45,000 journeys a day.

Table 5 shows that while most students travelled into University by foot (40%), a large proportion (23%) travelled by car and by bus (17%).

**Table 5 Student journeys to University from home**

| *Mode* | *Average distance* | *Average time* | *Modal split %* |
|---|---|---|---|
| Walk | 0.7 | 7.97 | 40 |
| Bicycle | 2.1 | 11.62 | 12 |
| Bus | 3.74 | 17.78 | 17 |
| Train | 17.06 | 33.83 | 6 |
| Ferry | 2.67 | 12.16 | 1.5 |
| Motorcycle | 9 | 15 | 0.5 |
| Car passenger | 2.46 | 10.46 | 8 |
| Car driver | 7.35 | 19.73 | 15 |

*10.6% of journeys included use of the ferry*

During the day student travel patterns changed (Table 6) and a greater proportion of journeys were made by foot (54%). Less people used the bus, although this was substituted in part by use of the University minibus. The proportion of students using their car for travel during the day was the same as the proportion who used their car to drive to University.

**Table 6 Student journeys made during the day (not to or from home)**

| *Mode* | *Average distance* | *Average time* | *Modal split %* |
|---|---|---|---|
| Walk | 1.18 | 13.65 | 54 |
| Bicycle | 1.66 | 9.71 | 13 |
| Bus | 4.57 | 16.83 | 6 |
| University minibus | 2.17 | 10.39 | 3 |
| Train | 18.60 | 24.50 | 1 |
| Ferry | 1.65 | 13.92 | 1 |
| Motorcycle | 4.36 | 10.43 | 1.5 |
| Car passenger | 4.03 | 13.50 | 5 |
| Car driver | 6.12 | 16.70 | 15 |
| Taxi | 2.50 | 12.50 | 0.5 |

An analysis of the journey origins and destinations data (Appendix D) shows that overall, 19% of all recorded journeys made during the day were between the sites in the east (Langstone and Milton) and the west (Guildhall site and the Commercial Road shopping area). Generally, the student travel diaries illustrated a much larger number of journeys in and around Portsmouth. Most student journeys were focused around the Anglesea, Mercantile, Park and Milton areas, where a large proportion of the academic departments were located, and the Ravelin Park area, where the Library, Students Union, are located.

Inter-site travel for students reflected a similar pattern to that of the staff, although obviously in greater numbers. Travel from the Mercantile area, Park area, and Anglesea area was concentrated locally with a large proportion to and from the Ravelin Park area. The other main non-University destination for students was Commercial Road.

#### *2.2.4 Cordon survey*

The data for the cordon surveys are shown in Appendices E and F. The data were used as an indication of the amount of travel into and out of the Milton and Langstone sites. According to the cordon survey, the travel survey represented approximately 20% of all journeys into and out of the Milton site on 12/10/95. The value of the data were limited because detailed analysis revealed that the survey was unable to reflect a proportional cross-section of the people travelling into/out of the sites. However, the data were used as an indication of the representativeness of the travel diary data and to illustrate traffic flows into and out of the Langstone and Milton Campus.

### 2.3 Summary

One of the fundamental objectives of the University Transport Scheme was to encourage a shift from the car to the bicycle. Bikeabout specifically targeted the journey between the Milton and the Guildhall Sites as one journey where reductions in energy use and pollutant emissions could be achieved through the greater use of cycling. From a combination of the cordon survey and the travel diaries it was estimated that 690 journeys were made from the Milton Site during the day. A further breakdown of the data provided an estimate that approximately 340 journeys were made from Milton to the Guildhall Site during the day. From the cordon interview data the way journeys from Milton to the Guildhall Site were split between transport modes was identified, and shown in Table 7 along with the proportional amounts of traffic. If the figures are doubled to account for the return journeys then it is possible to estimate that 162 journeys were made between the Guildhall and Milton Campus each day by car during term time. The total traffic would be higher if other destinations were considered, such as the city centre. Data for the Langstone site (see Appendix C) indicated that an average of 260 journeys a day were made between the Milton and Langstone sites. However, only 6% of the journeys were made by car, most were by foot (71%), with the remainder by bus (17%) or by bicycle (4%).

**Table 7 Modal split and traffic between Milton and Guildhall campus**

| *Mode* | *Modal split %* | *Traffic (movements)* |
|---|---|---|
| Walk | 4 | 14 |
| Bicycle | 5 | 17 |
| Bus | 5 | 17 |
| University minibus | 62 | 210 |
| Car | 24 | 81 |

## 3 'After' survey

### 3.1 Introduction

The fully automatic Bikeabout scheme was, after some delays, operational at the start of the new academic year in October 1996. Before carrying out an evaluation it was important to allow sufficient time for the scheme to operate and for users to register and test the scheme. However, because of time constraints in reporting the evaluation, only a month was given for this settling period.

Although this enabled a number of people to register and use the scheme, it should be noted that more people were expected to register later on during the spring / summer terms, with the onset of better weather. Also, during this settling period, several factors affected the efficiency with which the system could be run. A number of software and hardware faults were identified and were 'ironed-out' during this period. Petty vandalism and theft of components from some of the bicycles meant that for a period of time a number of bikes did not have the lights, or integral locks for use outside the depots as intended. All these factors will have affected take-up of membership and usage of the scheme.

Because of the relatively small number of people using Bikeabout over the evaluation period immediately after implementation, it was unlikely that changes in travel behaviour due to the scheme could be detectable to a reasonable level of statistical significance using the travel diary approach used in the 'before' study. Therefore the 'after' surveys were approached differently.

### 3.2 Survey methods

#### *3.2.1 Bikeabout users survey*

The Bikeabout user survey was performed using a self completion questionnaire posted to the 303 people who had registered with the scheme at the time of the survey. The survey was designed to provide some general information about those people using the Bikeabout scheme, such as age, status, sex, home location, etc. Information was also requested on the respondent's mode of travel to the University from home to enable any changes in modal preferences to be identified.

Each Bikeabout user was asked to provide details about some of the journeys that they made using the Bikeabout bicycles. They were asked to provide information about the start and return depots, the frequency of the journey, the destination and the mode of travel used before the Bikeabout scheme was implemented. From this information it was then possible to calculate the current reductions in energy use and pollutant emissions attributable to the scheme.

To understand the reasons behind the decision to join and use the Bikeabout scheme, respondents were asked to evaluate the relative importance of a number of influential factors. The users were also asked how long it would take to walk to their nearest depot in order to provide an indication of how far people were prepared to walk to use a bicycle. A significant proportion of the questionnaire was made available for the respondents' personal comments about the scheme to facilitate a better understanding of why people will, or will not, be using the scheme in the future.

#### *3.2.2 Non-user survey*

Since the fully automatic version of the Bikeabout scheme only had the opportunity to operate for a month before it was necessary to carry out the evaluation, many potential users would not have had sufficient time to register. The

non-user survey aimed to gauge the numbers of potential users who could be expected to join the scheme in the future. The survey was performed using a team of interviewers who approached staff and students around the University to ask their opinions of the scheme.

All respondents were asked whether they were aware of the scheme and the location of the depots, in order to identify the level of awareness about the Bikeabout scheme. They were also asked to provide some general information about status, age, previous use of bicycle, bicycle ownership, travel to the University, etc., as this information would assist in profiling the characteristics of people who would be most likely to utilise the scheme.

Each interviewee was given detailed information about the Bikeabout scheme and how it operated. They were then asked if they could envisage any journeys that they could use the bicycle for while at University during the day, and questioned about the modes of transport currently used to perform these journeys. From this information it was possible to consider the potential energy savings that could be facilitated by modal substitution by Bikeabout bicycles.

All respondents were questioned in detail by the interviewer about whether they intended to join the scheme and each was asked to estimate how long it would take to walk to their nearest depot. Those people that would not be joining the scheme were encouraged to explain why. All respondents were asked if there were any measures that they considered would encourage greater patronage of the scheme and to make any general comments about the scheme.

#### *3.2.3 Minibus-user survey*

A free University inter-site minibus service offers students an alternative to Bikeabout for journeys between Milton and the Guildhall site. A separate survey was therefore carried out in order to understand the decision to use the minibus service, instead of the bicycle scheme. An interviewer sat on the minibus and interviewed the users while travelling between sites. Most of the questions were similar to those asked to the non-users, however, additional questions enquired about the usage of the minibus service and the effect of introducing a fare on the service. The interviewees were also asked if they would consider using the Bikeabout scheme and questioned about some of the factors that influenced their decision on choice of mode for inter-site travel. They were further requested to comment on any measures that could encourage more people to use the scheme or enhance its desirability.

### 3.3 Analysis of travel patterns

#### *3.3.1 Introduction*

The analysis provided in this section of the report presents an overview of the impact of the University Transport Scheme on travel patterns to date. However, it is important to remember that the scheme had been fully operational for barely a month before it was necessary to carry out the evaluation. For this reason the analysis concentrated on likely future impacts as much as it did on the impact at the time of the survey. An analysis of the attitudes of users and non-users (including minibus passengers) is included in Section 4.1.

#### *3.3.2 Bikeabout user survey*

A 10% response rate was obtained from the questionnaires. The low response rate will have been influenced by two significant factors. Firstly, it is likely that a majority of the students who registered in the previous academic year will have changed address or moved away from the area since then. Secondly, a number of the provisionally registered users had not yet received the smart card and therefore had not been able to use the fully automatic system: they may have considered themselves unable to evaluate the scheme fairly and so did not respond.

Over 80% of the Bikeabout users were male and 90% held a driving licence. It was interesting to note that 65% of the respondents lived on Portsea Island and therefore within a reasonable distance to use their own bikes to cycle to the University. Two thirds of the users owned a bicycle and 78% of these people had used their own bicycle within the last few months. The scheme was clearly attracting people who already owned and used bicycles fairly frequently. The survey also showed that a third of the users were people who did not have a bicycle or had not used one for a significant period of time, in most cases several years. The Bikeabout scheme therefore appeared to be a valuable mechanism for re-introducing people to bicycles.

The users who responded to the survey were predominately students (39%) and full time academics (36%) with some (19%) support staff. The ages of people using the scheme appeared to represent a broad range of different ages. The scheme did not appear to be dominated by younger people, indeed, 47% of the users surveyed were in their mid thirties or older.

It was noticeable from the list of registered users that a number of people (13%) were overseas students.

Approximately one third (30%) of the users arrived at the University on foot, therefore the availability of the cycles enabled them to have greater mobility during the day. The second most common means of travel to the University was by car (27%). The Bikeabout scheme enabled these cars to be left parked during the day. However, over one fifth of the registered users usually rode their own bike to the University.

A majority of the smart card holders (83%) said that they envisaged continuing to use the scheme in the foreseeable future. About one quarter of the respondents had not yet registered for the fully automatic scheme using the smart card, although 38% of these people indicated that they would in the future.

For a majority of the users (76%) the nearest Bikeabout depot was within five minutes walk. For 14% it was between five and ten minutes walk and for 10% more than 10 minutes away. The Milton depot appeared to be the most popular, with 67.5% of journeys originating from here. Nearly half of all journeys were round trips where the bicycle was returned to the same depot it was originally taken from. About 30% of the journeys made using Bikeabout bicycles were made every week, however most (41%) were made occasionally, i.e. every few weeks or monthly. Approximately 29% of journeys made were one-off journeys that were hardly ever repeated.

From Table 8 it is evident that the most popular destination for journeys using the Bikeabout bicycles was the main site, more specifically the Mercantile area where the sports facilities are located and Ravelin Park where the main library and student union are located. About 61.5% of all journeys made during the day using the cycles were to destinations not directly linked to the University, such as to visit home, or simply to go for a ride. For example, 31.5% of journeys made by Bikeabout were to the Commercial Road or Southsea shopping centres.

**Table 8 Destination of journeys made by Bikeabout users**

| *Destination* | *% of journeys per day* |
|---|---|
| Home | 14 |
| Milton site | 13.5 |
| Guildhall site | 25 |
| Commercial Road shopping centre | 14 |
| Southsea shopping centre | 17.5 |
| Just a ride | 7 |
| Others | 9 |

By far the largest modal substitution to Bikeabout bicycles was from walking (Table 9). This is probably because the scheme offers the greatest marginal utility for these users, in terms of time savings. The scheme also generated a number of new journeys as the improved personal mobility meant a number of trips had become possible within a reasonable period of time. Many of these journeys were made by students visiting their home between lectures. An additional 5% transferred from personally owned cycles. A number of these people owned expensive bikes and preferred to use the Bikeabout cycles rather than worry about the safety of their own.

**Table 9 Modes previously used to make journeys now made using Bikeabout cycles**

| *Mode* | *% of journeys per day* |
|---|---|
| New journey | 4 |
| Walk | 41 |
| Own bicycle | 5 |
| Bus | 16 |
| University minibus | 13 |
| Motorcycle | 2 |
| Car passenger | 5 |
| Car driver | 11 |
| Taxi | 3 |

The survey indicated that 16% of journeys were previously made by public transport. The bicycles offer a door-to-door alternative that the bus cannot provide. The relative time flexibility of the bicycle compared to the bus was also evident in the number of transfers (13%) from the minibus service.

Almost one fifth of the journeys were previously made using a car. For these people the attraction of the scheme was not so much the improved flexibility, although it may have been a factor for car passengers and taxi users, but more a willingness to travel in a more ‘environmentally friendly’ manner, or to do more exercise.

### *3.3.3 Non-user survey*

A total of 404 responses were obtained from a survey carried out by interviewers around the University, targeted at those people who had not yet used Bikeabout. Approximately 74% of those interviewed were students, the remainder being staff. Most of the people interviewed had heard of the scheme, although almost a third had not. Also half of the students and 39% of staff did not know where the depots were located.

Most of the non-users had used a bicycle fairly recently as shown in Table 10. This was not surprising considering that 66% of the respondents owned a bicycle and that for students this was a popular mode of transport. Overall, approximately 28% of the respondents interviewed cycled to University.

**Table 10 Time period since a bicycle was last used**

| *Time period* | *% of non-users* |
|---|---|
| Less than a month | 45 |
| Several months | 17 |
| Over a year | 16 |
| More than 3 years | 22 |

Nearly a third of the students who were non-users cycled to the University and cycling to the University was more common among students than in the ‘before’ survey while public transport use was less common, as comparison of Table 5 and Table 11 shows. Some of this may have been due to differences in sampling techniques, but this in itself will not be large enough to explain the considerable change in cycling observed. However, no significant changes in staff travel were evident from the data.

**Table 11 Mode of travel to University by student non-users**

| *Mode* | *% of student non-users* |
|---|---|
| Walk | 39 |
| Bicycle | 31 |
| Bus | 11 |
| Train | 1 |
| Motorcycle | 1 |
| Car passenger | 5 |
| Car driver | 12 |

### *3.3.4 Minibus-user survey*

Of the 47 responses obtained, 91% of people using the minibus service were students aged under 25 and almost all of them had not registered with the Bikeabout scheme. There was a roughly equal split between the sexes of the respondents and approximately 63% held a driving licence.

The scheme had attracted some people who previously travelled by car, but nearly 70% of people using the minibus service had travelled to the University on foot, or by bus (Table 12). The minibus users were more likely than other non-users to have travelled to the University by bus.

Although about 64% of all minibus users own a bicycle, only 13% had used it to travel to the University. Comparison with student travel before Bikeabout indicated

**Table 12 Mode of travel to University by minibus users**

| *Mode* | *% of minibus-users* |
|---|---|
| Walk | 38 |
| Bicycle | 13 |
| Bus | 31 |
| Train | 5 |
| Car passenger | 6 |
| Car driver | 7 |

** includes journeys by ferry and by motorcycle.*

little change in cycle use (unlike for general non-users) but an increase in the numbers travelling by bus, perhaps at the expense of the number of drivers.

#### *3.3.5 Current and potential Bikeabout use*

Using the data from the survey of users, an estimate of the average daily mileage travelled using the Bikeabout bicycles was made from the distance travelled, the frequency the journey was made and the mode that they would have used had the bicycles not been available. An estimate was made of potential use by the people in the survey of non-users who said they would consider joining the scheme in the future, based on the pattern of use by current users.

Table 13 shows the estimated average daily distances scaled for all current and potential users. Using the data from the 'before' and 'after' surveys, it can be roughly estimated that at the time of the surveys the current users of the scheme substituted approximately 0.5% of the average mileage made for journeys during the day with Bikeabout bicycle.

**Table 13 Average daily distances substituted by Bikeabout cycles by mode**

| | *Estimated average daily distances (miles)* | |
|---|---|---|
| *Mode used previously* | *All current registered users* | *Projected level of Bikeabout use* |
| New journey | 4.5 | 30 |
| Walk | 80.6 | 537.6 |
| Own bicycle | 4.9 | 32.7 |
| Bus | 35 | 233.5 |
| University minibus | 36 | 240 |
| Motorcycle | 2.6 | 17.3 |
| Car passenger | 7 | 46.7 |
| Car driver | 29.6 | 197.4 |
| Taxi | 1 | 6.7 |
| Total | 201.2 | 1341.9 |

*To calculate the average daily mileage according to each mode some basic assumptions were made about the frequency each journey was made. Very frequent journeys were categorised as four journeys a week; frequent journeys as once a week; occasional journeys as once every three weeks; and, rare journeys as once every six weeks. Journeys made purely for the purpose of going for a ride were calculated to be an average of two miles*

Overall 14% of respondents to the survey of non-users said that they would probably join the scheme. There were about 15,000 staff and students at the University in 1996, therefore it is reasonable to estimate that up to 2000 people might register with the scheme. If all potential users registered with the scheme and used it in the way that Bikeabout users did, they would substitute approximately 3.3% of the average daily University mileage with Bikeabout bicycles.

#### *3.3.6 Summary*

The Bikeabout scheme aimed to encourage a shift from cars to bicycles, in particular for journeys made during the day between the Guildhall and Milton sites. From surveys of registered Bikeabout users it was estimated that 40 miles/day were transferred from private car and motorcycle compared with 80.6 miles from walking. In total, the initial users substituted with Bikeabout cycles about 0.5% of the average mileage made during the day. It was also estimated that if all the potential users joined the scheme, about 3.3% of the average daily University mileage would be substituted with Bikeabout cycles.

Many of those who had not used the Bikeabout scheme had cycled fairly recently, and cycling to the University accounted for almost a third of journeys by students in the 'after' survey and an eighth of the minibus users.

# 4 Evaluation

### 4.1 Behaviour

#### *4.1.1 Before implementation*

This section of the report provides a summary of the opinions of staff and students at the University of Portsmouth before implementation of Bikeabout.

Both students and staff identified that cycling could offer the following benefits:

- it is a way of keeping fit;
- it is an 'environmentally friendly' mode of travel;
- delays due to heavy traffic can be avoided;
- it is relatively easy to find a place to park a bicycle; and
- it can save money, which appeared to be more important to students than the staff.

However factors that discourage staff and students from cycling include:

- adverse weather conditions;
- the need to carry bags;
- the likelihood of encountering heavy traffic, poor road surface conditions and aggressive drivers;
- the exposure to vehicle fumes; and
- the likelihood of having their bike stolen.

There was also a tendency for staff and students to overestimate the true distance of a destination. About 40% of the respondents thought they would be likely to have to cycle in excess of 5 miles if travelling within Portsmouth. This is highly unlikely because of the compact nature of the city.

Perceptions of the accessibility of certain modes of travel highlighted the differences in travel patterns between staff and students. Of the students, 64% indicated that it was easy to gain access to a bicycle in Portsmouth as opposed to only 49% of staff despite cycle ownership levels being similar. Access to a car in Portsmouth was easier for staff, whilst more students thought it relatively easy to gain access to public transport.

The influence of family and friends may have affected attitudes towards cycling. More staff thought their families would disapprove (29%) than the students (16%). The differences in the two groups were more marked when their perception of friends' attitudes towards them cycling in Portsmouth were analysed. A majority (71%) of students said their friends would approve, whilst for staff only 49% considered this so. However, most staff said that their friends' opinions were unimportant to them.

### *4.1.2 Users of Bikeabout*

This and the following sections describe the travel behaviour of staff and students after implementation of the Bikeabout scheme. Surveys of users, non-users and minibus users were carried out as described in Section 3.

Users of Bikeabout were asked to evaluate the relative importance of a number of factors that may have influenced their decision to join the scheme. The relative importance of these factors are illustrated in Figure 3. For the users, the benefits of cycling identified in the surveys before implementation were largely realised. One of the most important factors in joining Bikeabout was to provide exercise. Other important factors include the location of a depot close to their normal place of work or study and not having to wait, for example, for a bus. Environmental considerations did appear to be an influential factor affecting the decision to join, as was the cheaper cost of the bicycle compared to public transport.

By far the most important of the factors influencing the decision to use a Bikeabout bicycle for a particular journey was the weather, as shown in Figure 4. Other significant factors were: whether the journey could be completed within twenty minutes (this is a threshold over which people are generally less likely to consider using a bicycle to make a journey), the availability of parking if the respondent was to travel by car, and the availability of a minibus or bus service for the journey. Additionally, the amount of hand luggage which needed to be carried and the perceived volume of traffic along the route were important.

Users were asked to assess specific features of the Bikeabout scheme and the responses are illustrated in Figure 5. Users of the scheme were generally content with the reliability of the equipment, the ease of use of the system, and the depot locations. However the security of the bicycles when parking them away from the depots and the period of time for which the bicycles can be taken out were issues which need to be addressed.

Of those registered smart card users, 17% said they probably would not continue to use the Bikeabout scheme. Mostly these people no longer studied at the University, had purchased a bicycle of their own, or were moving away from the area.

A number of people who had registered with the earlier manual version but not yet for the smart card considered the scheme to be too difficult or expensive to use. Additionally, some people had been put off by difficulties in obtaining a bicycle at Milton, felt prohibited by the operating times, or by errors in the computer system such as paying for a bicycle that they had not borrowed. These factors were being addressed at the time of writing and will be less likely to influence use of the scheme in the future. A full list of comments made by registered users is included in Appendix E.

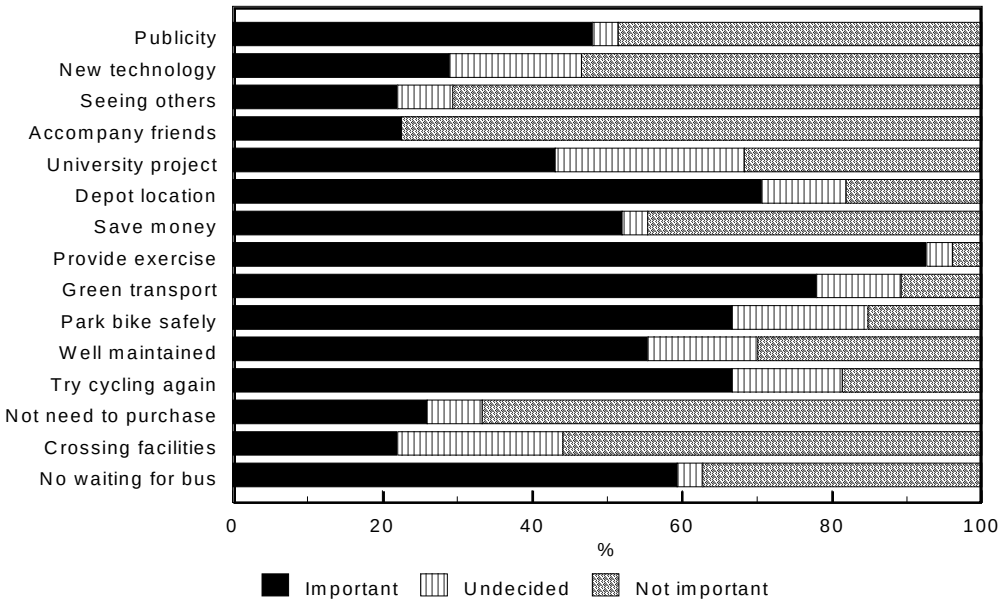


**Figure 3** Importance of certain factors in the decision to join Bikeabout

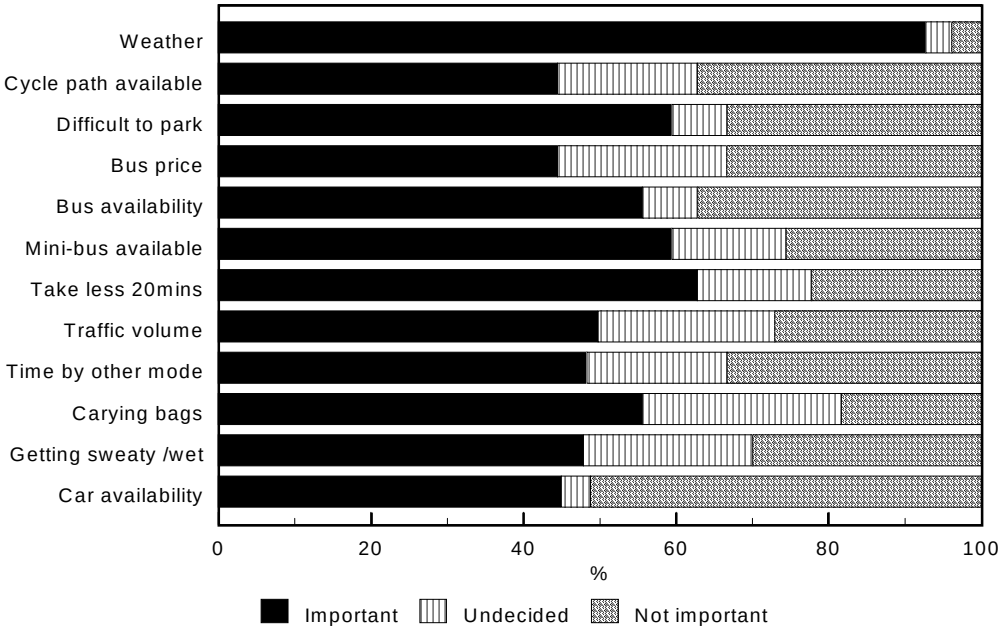


**Figure 4** Influences on the decision to use Bikeabout

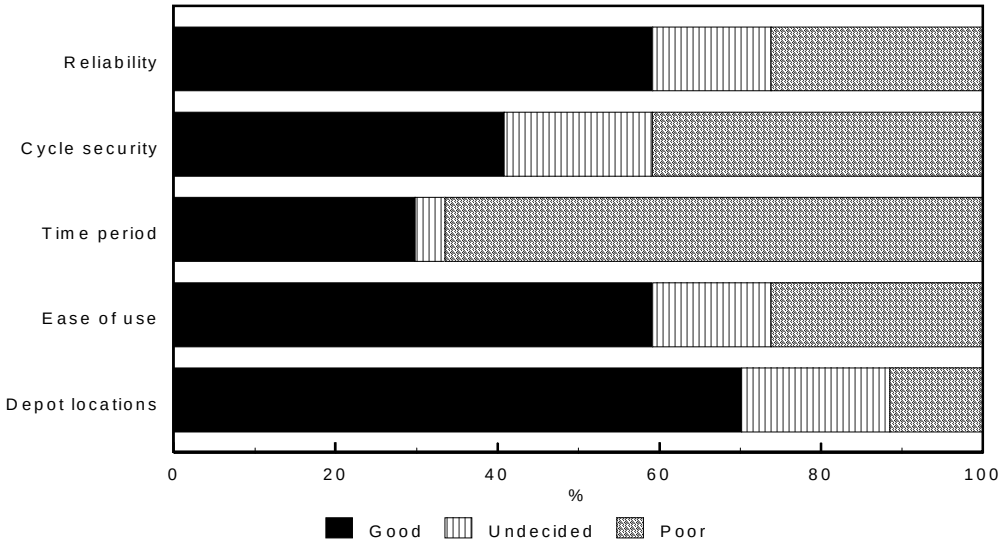


**Figure 5** Users' ratings of features of Bikeabout

### *4.1.3 Non-user survey*

Section 3.3.3 showed that there were marked differences in the modal split of student travel to the University before and after implementation of Bikeabout. In the period between the 'before' and the 'after' surveys, the proportion of students cycling to the University more than doubled (Table 14) while the percentage travelling by public transport decreased. Some of the differences may have been due to differences in sampling, but this in itself will not be large enough to explain a change of this magnitude. Undoubtedly, the encouragement of cycling by the University and the City Council, exemplified by the expansion of the cycle route network, priority measures, and secure parking facilities, will have been a very significant factor in initiating this increase. However, no significant changes in staff travel were evident from the data.

**Table 14 Mode of travel to University by non-users**

| *Mode* | *Students (before *) %* | *Students (after) %* | *All non -users %* |
|---|---|---|---|
| Walk | 40 | 39 | 34 |
| Bicycle | 12 | 31 | 28 |
| Bus | 17 | 11 | 10 |
| Train | 6 | 1 | 1.5 |
| Motorcycle | 0.5 | 1 | 1.5 |
| Car passenger | 8 | 5 | 6 |
| Car driver | 15 | 12 | 19 |

** included 1.5% journeys by ferry*

There was evidently a greater potential for Bikeabout, since 35% of respondents said that they made journeys for which the scheme would be useful. The journeys people suggested they could make using a Bikeabout cycle are shown in Table 15.

**Table 15 Journeys of potential Bikeabout users**

| *Destination* | *% of non-users* |
|---|---|
| Home | 20 |
| Between Milton /Guildhall site | 51 |
| Langstone | 6 |
| Commercial Road shopping area | 18 |
| Other | 5 |

Journeys between the Guildhall site and Milton were the most frequently cited destinations for potential users. Within the Guildhall site the most popular destinations were the library and sports facilities. The majority of people said they would undertake this journey by Bikeabout bicycle rather than on foot. However, this was slightly different from the current users who in general substituted more journeys previously made by buses, as shown in Table 16.

**Table 16 Modes non-users would transfer to Bikeabout for inter-site travel**

| *Mode* | *% of non-users* |
|---|---|
| Walk | 46 |
| Bicycle | 3 |
| Bus | 10 |
| University minibus | 26 |
| Car | 15 |

However, 86% of respondents indicated that they would not be joining the scheme and their reasons are summarised in Table 17.

**Table 17 Reasons why people will not use Bikeabout**

| *Reasons* | *Percentage* |
|---|---|
| Have own bicycle | 45 |
| No need to use the scheme (do not make journeys that they could substitute with Bikeabout), no advantages, no benefits | 20 |
| Have own vehicle, prefer to drive, or get a lift | 16 |
| Do not have enough information about the scheme | 11 |
| Prefer to walk, easier to walk, | 9 |
| Don't like cycling, or can't cycle | 6 |
| Weather | 4 |
| Depots inconveniently located | 4 |
| Time limit too prohibitive | 4 |
| Do not feel safe cycling | 3 |
| Too much effort to join, lazy | 3 |
| Design of the bikes | 3 |
| Have too much to carry by bike | 1 |
| Use the minibus | 1 |
| Health reasons, asthma | 1 |

Obviously, considering the levels of bicycle ownership, the most common reason for not using the scheme at present was because the respondent already owned a bicycle; this reason was given by 45% of respondents. A fifth of the respondents indicated that they did not make journeys which Bikeabout bicycles could be used for. Many inferred that this was because using the scheme would not offer them any advantages over existing travel patterns. Indeed a number of respondents indicated that they would rather use their car or get a lift or that most of the journeys that they made during the day were more easily made by walking.

About 11% of people surveyed said that they would not use the scheme because they did not have enough information about it (despite being given an explanation by the interviewer).

Measures that respondents suggested might encourage additional users of Bikeabout are shown in Table 18. A full list of responses is included in Appendix E. Three topics accounted for three-quarters of the responses: publicity (43%), the time period for which cycles can be used (26%), and the design and colour of the bicycles (15%).

**Table 18 Suggestions to encourage greater patronage of the Bikeabout scheme**

| *Measures suggested* | *% of respondents* |
|---|---|
| More advertising, publicity | 43 |
| Allow cycles out for a longer time period | 26 |
| More modern bikes, without baskets and a better colour scheme | 15 |
| Increase number of depots | 9 |
| More dedicated cycle paths | 7 |
| Improve cycle facilities (stands, shelters, etc.) | 5 |
| Limit accessibility of cars on campus | 3 |

There appears to be generally a lack of information about the scheme. A classic response when asked what would encourage more people to join was 'Better information - I didn't know about the scheme until I noticed the purple bikes'. There are many opportunities to publicise the scheme, including providing information to new students before they arrive at the University so that they don't buy a bicycle before they come. A number of people mentioned that they would use the scheme if they could lock the bicycles up in other places apart from the depots. In fact they can, and this illustrates one example of how misinformation has prevented some people from joining.

Respondents also felt that the period the bicycles could be taken out (2 hours) was too short.

A number of current non-users, mostly students, said that they were put off by the design and colour of the bicycles and would not use the scheme because they were image conscious. Although the purple colour scheme is functional, i.e. to allow the bikes to be easily identified for publicity and in case they are stolen, many students did not like it. A number of students also considered the baskets to be unnecessary although the ability to carry bags had been identified as a concern of respondents before Bikeabout.

A need for more depots was identified by some respondents. At the time of the survey the nearest depot for almost 80% of the respondents was at Mercantile House on the Guildhall campus. For a majority of people surveyed the nearest depot was only five minutes walk away from

their usual place of work or study (Table 19), but a significant proportion would have to walk for more than five minutes to get to a depot. This can represent quite a significant proportion of a short journey.

**Table 19 Estimated time to nearest Bikeabout depot**

| *Time (minutes)* | *% of non-users* |
|---|---|
| <5 | 85 |
| 5-10 | 10 |
| 10> | 5 |

The need for more dedicated, 'cycle-only' routes was identified by some as a measure that would encourage more people to use bicycles. It was felt that where cyclists share the pavement, pedestrians get in the way and also cyclists have to stop to cross the side roads. It is easier therefore to cycle on the road.

Other suggestions included: ensuring the bicycles and depots were kept cleaner; seeing more people using the bicycles; reducing the minibus service; introducing parking charges; and, cycle training.

Most people believed that the scheme was a good idea and to be encouraged, even if they could not envisage using it. Generally, there was a demand for an improved cycle infrastructure and many recommended better publicity about the scheme.

### *4.1.4 Minibus-user survey*

Section 3.3.4 showed that a comparison with student travel before Bikeabout indicated little change in cycle patronage among minibus users (unlike for general non-users) but an increase in the numbers travelling by bus, perhaps at the expense of the number of drivers (see Table 20).

**Table 20 Mode of travel to University by minibus users**

| *Mode* | *Students (before *) %* | *% of minibus users* |
|---|---|---|
| Walk | 40 | 38 |
| Bicycle | 12 | 13 |
| Bus | 17 | 31 |
| Train | 6 | 5 |
| Car passenger | 8 | 6 |
| Car driver | 15 | 7 |

** includes journeys by ferry and by motorcycle.*

The minibus service was used frequently by about half of its users. If a fare of 50p were levied however, 80% of respondents said they would not continue to use the service. If the service was discontinued, only 13% said they would cycle instead (6% by Bikeabout bicycle) with 18% expecting to transfer to the car either as driver or passenger (Table 21).

Only 6% of respondents from the minibus survey had used a Bikeabout bicycle to travel between sites. The main reasons for not using the Bikeabout scheme were:

- they were too lazy to cycle, and could not understand why anyone would want to cycle when there was a free minibus service available;

**Table 21 Mode of travel between sites if the minibus service were not available**

| *Mode* | *% of minibus users* |
|---|---|
| Walk | 19 |
| Bicycle | 7 |
| Bus | 50 |
| Bikeabout bicycle | 6 |
| Car passenger | 5 |
| Car driver | 13 |

- they had used their own bike to travel to the University and so felt that they had 'already done their bit to help the environment';
- it is generally quicker by minibus;
- the minibus provides protection from the weather;
- they would not want to cycle in the heavy traffic;
- they did not know their way; and
- it is easier to carry luggage, particularly books from the library.

### *4.1.5 Summary*

For the users of Bikeabout, the scheme appears to have realised the benefits of cycling identified before implementation, i.e. it provided them with: a means of keeping fit; a 'green' mode of travel during the day, and secure, convenient cycle parking facilities. The weather and the distance to be travelled largely determine if a particular journey will be made by a Bikeabout cycle. There was however some lack of confidence in the computer system; computer functionality and reliability subsequently improved substantially.

The minibus service operated by the University between sites can be seen as being complementary to the Bikeabout Scheme. Users of this service saw no clear advantage in using Bikeabout cycles as they found the minibus to be quicker and it provided them with protection from the weather and traffic. The scheme attracted some people who had previously travelled by car, so it was also playing its part in reducing car use.

Other non-users of Bikeabout also saw little advantage, preferring to use their own bike, drive, get a lift or walk; a substantial number of the non-users said they did not use the scheme because they had their own bicycle, and this is a positive result for the overall policy objective of encouraging cycle use. Many non-users were also put off by the bikes' design and looks. Also there still appears to be a lack of knowledge of the scheme which more effective publicity could counter.

Although there was limited take-up of the Bikeabout scheme, the number of users has subsequently increased to 415 (October 1997), and the parallel transport initiatives supported by the University and Portsmouth City Council appear to have encouraged a shift towards cycling and using the University minibus; for example the proportion of students cycling to the University more than doubled between the 'before' and the 'after' surveys. This indicates that whilst the scheme itself had a modest direct success, the wider University Transport Policy objectives (and those of ENTRANCE) were being met.

## 4.2 Energy and emissions

### *4.2.1 Introduction*

The combustion of hydrocarbon fuels in an engine leads to the production of carbon dioxide ($CO_2$), unburnt hydrocarbons (HC), carbon monoxide (CO) and particles (PM) containing carbon and other contaminants. Sulphur dioxide ($SO_2$) is produced as a result of sulphur compounds present as impurities in the fuel. Also, at the high temperatures and pressures found in the combustion engine, nitrogen and oxygen in the air combine to produce nitric oxide (NO) and a small amount of nitrogen dioxide ($NO_2$), collectively known as $NO_x$.

Within ENTRANCE the evaluation of the applications is concerned with emissions of $CO_2$, CO, HC, PM, sulphur (S), $NO_x$ and fuel consumption. The evaluation focused on the impact of the Bikeabout cycle pool, rather than on the impact of the wider initiatives which appear to have had the effect of encouraging the use of cycles and minibuses at the expense of cars. Using known relationships between speed and emission rates, changes were calculated from the distances transferred from each mode (e.g. motorbike, car) to the Bikeabout cycles and the average journey speeds of those modes.

### *4.2.2 Impact on mode of travel*

#### *4.2.2.1 Modal shift*

The average daily distances substituted by the Bikeabout cycles for all registered and potential users were estimated in Table 13. Bikeabout cycles were not used for the main commute to and from the University as they were available for only a limited period of time. Average journey speeds for each of these modes were therefore estimated (rounded to the nearest 5 mph) from information on student and staff journey patterns made during the day. It can be reasonably assumed that the Bikeabout scheme will have had little effect on average journey speeds between and around the University sites and so speeds estimated from the 'before' surveys will be valid for both usage scenarios. Table 22 lists these estimated distances and speeds.

**Table 22 Transfer of travelled distance from each mode to Bikeabout**

| | *Distance transferred (miles)* | | |
|---|---|---|---|
| *Mode* | *Registered users* | *Potential users* | *Speed (mph)* |
| Walk | 80.6 | 537.6 | 5 |
| Own bicycle | 4.9 | 32.7 | 10 |
| Bus | 35 | 233.5 | 15 |
| Minibus | 36 | 240 | 15 |
| Motorcycle | 2.6 | 17.3 | 30 |
| Car passenger | 7 | 46.7 | 20 |
| Car driver | 29.6 | 197.4 | 20 |
| Taxi | 1 | 6.7 | 15 |

#### *4.2.2.2 Impact on journeys by bus*

Some journeys originally made by public transport buses and the University minibus were transferred to Bikeabout cycles. Surveys of current users suggested savings of some 56 km and 58 km respectively each day in term-time. However, if the buses continued to make those journeys with or without the Bikeabout users there would be no fuel consumption or pollutant emissions savings to be made.

#### *4.2.2.3 Impact on journeys by cars*

Some of the Bikeabout users transferred from cars, either as drivers or passengers in private cars or in taxis. It is reasonable to assume that for private car passengers, the vehicle would continue to do the same or a similar journey without them. No fuel consumption or pollutant emissions savings were likely for car passengers transferring to Bikeabout.

The journeys saved by drivers and taxi passengers were assumed to have been taken in an average passenger car of composition (according to engine size, fuel and emissions control) similar to that of the national fleet. A combined emission factor was derived according to this distribution as described in Appendix F.

#### *4.2.2.4 Impact on journeys by motorcycles*

The transfer from motorcycles to Bikeabout was less marked than for cars and buses. From information collected in the 'before' surveys half of the motorcycles used by staff and students had engine sizes between 250 and 750 cc and half were greater than 750 cc. A combined emission factor for motorcycles was derived according to these proportions as described in Appendix F. It should be noted that there is no information on emissions of particles from motorcycles. Hence the overall impact on this pollutant may have been underestimated.

#### *4.2.2.5 Impact on journeys made by walking or use of own cycle*

There was no change in fuel consumption or pollutant emissions as a result of transferring journeys from walking or users' own cycle to Bikeabout.

### *4.2.3 Effect of the transfer of journeys to Bikeabout*

Using the estimated speeds and distances in Table 22 the daily savings in pollutant emissions and fuel consumption that could be achieved by the existing and potential users during term-time were calculated. The results are shown in Table 23 and Table 24 respectively. The calculations show that modest savings in fuel consumption and pollutant emissions could be made if registered and potential users transferred journeys from private motorised transport (i.e. cars, motorcycles and taxis) to Bikeabout cycles. The estimate assumed that all registered and potential users utilise the cycles to the same extent as the respondents to the Bikeabout user questionnaire. The majority of the savings were made by car drivers because on average the surveys showed that a greater distance was transferred from this mode than from taxis and motorcycles. Although a greater distance was transferred from public transport buses and the University minibus than cars, no fuel or pollutant emissions savings were made because the vehicles would have continued the same journey with or without the Bikeabout users.

**Table 23 Savings in pollutant emissions and fuel consumption if all registered users transferred to Bikeabout**

| Mode | HC (g/day) | $CO_2$ (g/day) | CO (g/day) | PM (g/day) | $NO_x$ (g/day) | Sulphur (g/day) | Fuel (g/day) |
|---|---|---|---|---|---|---|---|
| Motorcycle | 6.46 | 256 | 68.7 | N/A. | 0.70 | 2.42 | 121 |
| Car driver | 49.8 | 8500 | 288 | 1.51 | 45.6 | 57.1 | 2900 |
| Taxi | 2.07 | 333 | 12.1 | 0.05 | 1.50 | 2.26 | 113 |
| Total | 58.3 | 9090 | 369 | 1.56* | 47.8 | 61.8 | 3130 |

** note that this does not account for motorcycle emissions of PM for which there are no data*

**Table 24 Savings in pollutant emissions and fuel consumption if all potential users transferred journeys to Bikeabout**

| Mode | HC (g/day) | $CO_2$ (g/day) | CO (g/day) | PM (g/day) | $NO_x$ (g/day) | Sulphur (g/day) | Fuel (g/day) |
|---|---|---|---|---|---|---|---|
| Motorcycle | 43.0 | 1700 | 457 | N/A. | 4.70 | 16.1 | 804 |
| Car driver | 332 | 56500 | 1900 | 10.1 | 304 | 381 | 19000 |
| Taxi | 13.9 | 2200 | 81.3 | 0.36 | 10.1 | 15.1 | 755 |
| Total | 389 | 60400 | 2440 | 10.5* | 319 | 412 | 20560 |

** note that this does not account for motorcycle emissions of PM for which there are no data*

The estimated savings related to journeys undertaken during the day and in term-time, i.e. not for general commuting.

#### *4.2.4 Summary*

The evaluation shows that modest savings in fuel consumption and pollutant emissions could be achieved by encouraging the transfer of short journeys made during the day, in particular, by cars and motorcycles, to Bikeabout cycles. Although the largest transfer of travel mode was seen to be from buses, these vehicles continue their journeys with or without the Bikeabout users. Therefore no savings can be made by encouraging a shift from buses to the cycles.

### 4.3 Economic evaluation

#### *4.3.1 Introduction*

The economic evaluation of the Bikeabout scheme concentrated on the savings generated by staff and students transferring from their normal mode of transport to using bicycles owned by the University, rather than the wider impact of the University Transport Policy aiming to reduce car use associated with the University. One of the main objectives of the scheme was to encourage the use of bicycles, as an alternative to car use, for travel between the Guildhall and Milton sites. The potential economic benefits from this shift in mode would be savings in the costs of vehicle operation and fuel savings. In addition, where there was a shift from walking to bicycle use there will have been time savings which can be evaluated in monetary terms. The main project costs included the initial capital costs of the scheme, the subsequent running costs and increased time where there was a shift from motor vehicles to bicycles.

The analysis used value of time and vehicle operating cost from the COBA (Cost-Benefit Analysis) manual (Department of Transport, 1994). COBA sets the method used for the economic assessment of trunk road schemes including motorways. This analysis assumed 1996 prices net of taxes.

The Bikeabout scheme had high initial capital costs because of the new technology involved. It took time for the physical infrastructure to be put in place and as such full marketing of the scheme was delayed. For this reason it was expected that some time would elapse before ridership levels reached a maximum. The free University minibus service between the Guildhall and Milton sites offered an alternative to the Bikeabout scheme for those journeys and it seems likely that this service attracted some users who might otherwise have joined the Bikeabout scheme.

#### *4.3.2 Time savings*

Time savings are the difference between the total journey time taken using the original mode to do the transferred distance by Bikeabout and the time taken using Bikeabout. The speed and total distance transferred for each mode in Table 22 were used to calculate time savings. It was assumed that the speed of a Bikeabout journey was the same as that for the other bicycles i.e. 10 mph. The value of the time savings was calculated by multiplying the time savings by the value of time; this was assumed to be that for an average single occupancy car, a standard COBA value of £4.40 per hour. It is important to note that while it is necessary to value time in order to perform the evaluation, the valuation does not reflect differences, such as, employment status, income, personal values, etc., which in reality mean that the value of time is extremely difficult to determine accurately. The Bikeabout scheme can be assumed to be used mainly between Monday and Friday during term time. This approximates to five days a week, 30 weeks per year i.e. a total of 150 days. Table 25 shows the time savings associated with the Bikeabout scheme.

Not unexpectedly, there were negative time savings when there was a transfer of mode from motorised vehicles to the Bikeabout scheme. However, there were positive time savings from those who transferred from walking and this accounted for a significant proportion of the total miles transferred.

**Table 25 The monetary value of time savings estimated for registered Bikeabout users**

| *Mode* | *Speed (mph)* | *Distance transferred to Bikeabout (miles/day)* | *Time savings (hours/day)* | *Annual time savings (£/year)* |
|---|---|---|---|---|
| Walk | 5 | 80.6 | 8.1 | 5320 |
| Own bicycle | 10 | 4.9 | 0 | 0 |
| Bus | 15 | 35.0 | -1.2 | -792 |
| Minibus | 15 | 36.0 | -1.2 | -792 |
| Motorcycle | 30 | 2.6 | -0.2 | -132 |
| Car passenger | 20 | 7.0 | -0.4 | -264 |
| Car driver | 20 | 29.6 | -1.5 | -990 |
| Taxi | 15 | 1.0 | -0.03 | -19.8 |
| Total | | 196.7 | 3.57 | 2,330 |

*Time savings assumptions*

*1 Time savings are based on the COBA values of time for an average car based on a single occupancy - £4.40/ person/ hour (1996 prices).*

*2 Bikeabout operates for 150 days per year.*

*3 Average speed for a Bikeabout bicycle was 10 mph.*

### *4.3.3 Vehicle operating cost savings*

Vehicle operating costs (VOC) were calculated based on the following formula from COBA:

Where *C* is cost in pence per kilometre per vehicle, *V* is the average link speed in kilometres per hour and *a* and *b* are speed dependent values (taken from COBA). As can be seen from Table 26 the savings in vehicle operating costs were small. This was because the Bikeabout scheme did not attract people who would otherwise have travelled by motorised modes.

### *4.3.4 Fuel savings*

The value of fuel savings were calculated from Table 23. The analysis was undertaken only for those vehicles which had totally ceased operating because of Bikeabout, i.e. motorcycles, car (driver) and taxis. Table 27 shows the fuel savings of the registered users.

### *4.3.5 Implementation costs*

The implementation costs for the fully automated Bikeabout scheme were £130,646. This includes the bicycles, shelters, smartcard equipment, electrical racks, software development and other items necessary for the operation of the scheme. In addition, £30,811 was spent on a pilot scheme. The total Bikeabout installation costs therefore amounted to £161,457. The estimated annual running costs for the scheme (to include maintenance of the bicycles, racks and administration) were estimated at £26,200.

**Table 26 Vehicle operating costs estimated for registered Bikeabout users**

| *Mode* | *Distance transferred to Bikeabout* | *a* | *b* | *Total VOC (pence /mile)* | *Total VOC savings (£/year)* |
|---|---|---|---|---|---|
| Walk | 80.6 | | | | |
| Own bicycle | 4.9 | | | | |
| Bus | 35.0 | 17.6 | 294.5 | 47.7 | 100.20 |
| Minibus | 36.0 | 4.2 | 3.3 | 6.9 | 53.10 |
| Motorcycle | 2.6 | | | | |
| Car passenger | 7.0 | 3.6 | 13.1 | 6.4 | 33.60 |
| Car driver | 29.6 | 3.6 | 13.1 | 6.4 | 284.10 |
| Taxi | 1.0 | 3.6 | 13.1 | 6.6 | 9.90 |
| Total | 196.7 | | | | 480.90 |

*VOC assumptions*

*1 bus savings are 1/25 of total VOCs*

*2 minibus savings are 1/7 of total VOCs*

*3 car passenger savings are 1/2 of total VOCs*

*4 Bikeabout operates for 150 days per year.*

**Table 27 The monetary value of fuel savings estimated for Bikeabout users**

| *Mode* | *Distance transferred to Bikeabout (miles)* | *Fuel savings (g/day)* | *Fuel cost savings (p/day)* | *Fuel cost savings (£/day)* |
|---|---|---|---|---|
| Walk | 80.6 | | | |
| Own bicycle | 4.9 | | | |
| Bus | 35.0 | | | |
| Minibus | 36.0 | | | |
| Motorcycle | 2.6 | 121 | 2.89 | 4.34 |
| Car passenger | 7.0 | | | |
| Car driver | 29.6 | 2900 | 69.21 | 103.82 |
| Taxi | 1.0 | 113 | 2.70 | 4.05 |
| Total | 196.7 | | | 112.21 |

*Fuel assumptions*

*1 Price of fuel is 17.9 pence per litre (1996 prices).*

*2 The density of fuel is 750g/l*

*3 Where the transfer is from buses, minibuses and cars passengers there will be a negligible change in fuel consumption.*

### *4.3.6 Total savings*

The total savings from the Bikeabout scheme can be regarded as being the sum of time savings, VOC savings and fuel savings. For the number of users registered at the time of the surveys, this represented a total saving of £2,923 per year which is significantly below the scheme's capital and running costs. As the costs outweighed the benefits, no attempt was made to conduct a conventional cost-benefit analysis.

The transfer from cars was not as high as first anticipated and this is where the majority of benefits would have been expected to be found, particularly in respect of fuel and VOC savings. If it is assumed that in the future Bikeabout will attract the use projected in Table 22, the potential benefits could reach £25,000 per year, which is still less than the overall cost of the scheme. The majority of any benefits would still be from the value of time

savings of those people transferring from walking to the Bikeabout scheme. Unless people can be persuaded to shift from motorised modes the benefits from reduced fuel consumption and VOCs will remain extremely limited.

#### *4.3.7 Summary*

The economic evaluation of the Bikeabout cycle pool has shown that initially the capital and running costs of the scheme significantly outweighed the benefits in terms of the value of time, vehicle operating costs and fuel. The transfer from cars was not as high as anticipated and this is where the majority of benefits would have been expected, particularly in respect of fuel and VOC savings. Unless Bikeabout can attract travellers from private motorised modes the benefits from reduced fuel consumption and VOCs will remain extremely limited.

## 5 Discussion

Prior to the implementation of the Bikeabout scheme, it was evident that a significant amount of travel during the day was performed by private car (40% for staff and 20% for students). The aim of Bikeabout was to encourage a switch from private motorised transport to bicycles particularly for inter-site travel, thus reducing pollutant emissions and fuel consumption. At the time of the evaluation, conducted shortly after the scheme became fully operational, the switch had yet to be realised with only modest reductions in fuel consumption and pollutant emissions. At the levels of use identified initially, the scheme was not economically viable. However this was against a background of increased cycle use outside of the scheme and some generally positive reactions to the University's and Portsmouth City Council's investment in the wider cycle network across the city centre.

The University minibus service could be seen as complementary to the Bikeabout, and also attracted people who had previously driven cars; this scheme, together with Bikeabout was clearly having some success in contributing to the overall objective of reducing car use.

Although for users of the scheme Bikeabout provided a useful service (secure parking facilities, a way of keeping fit and a 'green' mode of transport) there were some other negative aspects that needed to be overcome before more people thought they would be attracted to use the scheme.

Some of the factors preventing people joining could be addressed by a more effective marketing strategy. Many people did not see any advantage in using Bikeabout, and a significant proportion did not feel that they had sufficient information about the scheme. A higher profile publicity campaign could help to realise more of the scheme's potential. Promotional opportunities such as including information in the University prospectus could be utilised.

Students from overseas expressed considerable interest in using the Bikeabout bicycles. To encourage foreign students to use the scheme, publicity and operating instructions could be provided in their own languages.

Information about the average distance and time involved may be beneficial, since many of the respondents were likely to have overestimated the effort involved. Maps of the area and the cycle routes would be useful, particularly to people who usually travel by car or bus, as a lack of geographical knowledge of the area was a common concern. Minibus users may be encouraged to use the bicycles by pointing out to them that it would be quicker to cycle between the two sites if they had just missed a minibus.

Simplifying the enrolment procedures may encourage more people to join. Many people registered with the pilot scheme because operators were on hand to fill out the necessary application form and to explain the system to the users.

Many people commented on the relatively short time period available to use the bicycles, however, if the scheme in its present format is to work efficiently and cater for increasing numbers of users then it is difficult to see how this demand for an extended time period can be addressed.

It is important that standards of maintenance and cleanliness for the depots and bicycles are high. It was evident that just one experience of a bicycle in unsatisfactory condition, or the system not operating properly can significantly undermine confidence in the scheme and may be sufficient to discourage a new user.

The majority of journeys were made to and from the Guildhall Campus but many of the academic buildings were about 7 minutes walk from the nearest cycle depot (close to Mercantile). Further expansion to include more depots could improve the attractiveness of the cycle scheme in the future; a third depot was opened in October 1997.

It is recommended that Bikeabout and the minibus service should be promoted as being complementary to each other, each having different advantages in terms of duration of journey, safety, comfort, or protection from adverse weather. The attributes of Bikeabout which offer an advantage over the minibus service which could be better publicised, include:

- Bikeabout provides a high level of flexibility as there is no fixed route and it is possible to stop off en-route;
- cycling offers the possibility to travel in a more environmentally friendly manner;
- cycling offers the opportunity to keep fit;
- at periods when the traffic is busy, the time taken to cycle between the Milton and Guildhall Campus compares favourably with the time it would take by car or minibus;
- during the holiday periods, cycles are available through Bikeabout, unlike the minibus service, offering a service which is cheaper than public transport.

The scheme should be seen in the context of the other initiatives to reduce car use. In the words of Bateman and Perry (1994), 'It would seem unlikely that the development of a cycle pool could alone bring about a decrease in the use of private transport. As part of a wider, integrated programme, however, it may have a significant part to play.' The University's Mobility Policy and Portsmouth City Council have important roles in the

promotion and success of the scheme. It will be difficult for Bikeabout to attract car users whilst sustaining current levels of provision for cars. The University has relatively high levels of free parking provision for its staff and there is generally adequate space for students. Further restrictions on parking and the introduction of charging could enhance the utility of the cycle scheme. The public transport priority scheme and Portsmouth City Council's programme to expand the cycle routes and cycle facilities in Portsmouth, especially in Southsea, could further enhance the success of the scheme.

## 6 Summary and conclusions

By implementing Bikeabout, the University Mobility Policy addressed some of the obstacles preventing cycling from reaching its true potential as a viable alternative to the car for inter-site travel. This report provides an indication of the opportunities available for cycle use and an indication of the scale of use that could be expected. The evaluation of the Bikeabout cycle pool focused on the benefits in terms of energy use, vehicle emissions, economics and travel behaviour. It is important to consider the impact of the scheme as part of the wider, integrated programme of measures to reduce car use in Portsmouth, including public transport priority, the University Minibus service and improved facilities for cyclists.

The evaluation took place one month after the scheme began to operate and about 300 people had registered to use Bikeabout then. Although Bikeabout had only limited success initially in attracting users to the cycle pool, there was a marked increase in the number of students cycling to and from the University. However, for the users of Bikeabout, the scheme appears to have realised a number of benefits such as providing them with a means of keeping fit, representing a 'green' mode of travel during the day, and secure, convenient cycle parking facilities. Most of the users were generated from a latent demand for accessibility to bicycles during the day. By October 1997 the number of registered users had increased to 415, perhaps partly as a result of better summer weather and the closure of the minibus during the vacation improving the attraction of cycling. With greater use of Bikeabout, its greater visibility may further publicise the scheme.

One of the fundamental objectives of Bikeabout was to encourage a shift from the car to the bicycle, specifically for journeys between the Milton and the Guildhall Sites. The scheme had some success in reducing car use. From surveys of registered Bikeabout cycle pool users after implementation of the scheme a fifth of the journeys made on Bikeabout had previously been made by car, taxi or motorcycle. It was estimated that 40 miles/day were transferred from private cars and motorcycles compared with 80.6 miles from walking. In total, the current users substituted with Bikeabout cycles only 0.5% of the average mileage made during the day. This meant that only modest savings in fuel consumption and pollutant emissions were achieved. In terms of the economics of Bikeabout, the levels of usage at the time of the evaluation meant that the scheme was not economically viable. The capital and running costs of the scheme significantly outweighed any benefits in terms of savings in time, vehicle operating costs and fuel consumption. The transfer from cars was not as high as anticipated and this is where the majority of benefits would have been expected, particularly in terms of savings in fuel and vehicle operating costs.

The minibus service operated by the University between sites appears to complement the Bikeabout Scheme, with users of each scheme seeing advantages which the other did not offer. Users of the minibus service saw no clear advantage in using Bikeabout cycles as they found the minibus to be quicker, providing them with protection from the weather and traffic. Approximately 13% of the mileage substituted by Bikeabout was from the University minibus service, and interviews with these people revealed that the bicycles were thought to offer a more convenient and flexible service. It seems that the people who cycle base their decision on a different set of criteria to those who decide to use the minibus (or a motorised alternative), for example, the preference for exercise rather than to avoid physical exertion. The scheme attracted some people who had previously travelled by car, so the minibus service was also playing its part in reducing car use.

Other non-users of Bikeabout also saw little advantage in the scheme, although the main reason was a positive one for the overall policy, with many preferring to use their own bike (some 85% of staff and students owned a bike); others preferred to drive, get a lift or walk. Some were put off by the bikes' design and appearance. Also there still appeared to be a lack of knowledge of the scheme which more effective publicity could counter.

The new technology incorporated into the Bikeabout system enabled the scheme to operate efficiently and effectively, but at least initially, this was not sufficient in itself to attract large numbers of users.

Although there was limited uptake of the Bikeabout scheme, the transport initiatives supported by the University and Portsmouth City Council do appear to have had some success in encouraging a shift towards cycling. The establishment of a continuous east-west cycle route between the Guildhall-Milton sites helped to encourage cycling in general and the use of Bikeabout in particular. Thus while the cycle pool itself was only modestly successful initially, the wider University Mobility Policy objectives were being addressed. The continuation of Portsmouth City Council's programme to expand the cycle routes and facilities in the city, and especially in Southsea, could further encourage general cycle use. There was some praise for the City Council and the University for promoting cycling, many commenting that the new cycle paths, crossings, and parking facilities were most welcome. Around the campus people were generally aware of the benefits of cycling and the measures that had been taken to promote it.

Depot location was highlighted as an important factor in the decision to join the Bikeabout scheme. For the majority of academic buildings in the Guildhall Campus it was quite a distance to the nearest cycle depot at Mercantile, and the walk to collect a bicycle can add significantly to the

duration of a short journey. Funding was subsequently secured for another depot which should improve the attractiveness of the Bikeabout scheme in the future.

It is recommended that Bikeabout and the minibus service should be promoted as being complementary to each other, each having different advantages in terms of duration of journey, safety, comfort, or protection from adverse weather. For Bikeabout to be successful, the scheme needs to attract car drivers because of the potential reductions in terms of vehicle emissions, fuel consumption and also congestion. However it is unlikely that the Bikeabout scheme will attract significant numbers of car users purely by providing an alternative. To attract significant numbers of car drivers, the University Transport Scheme as a whole needs to be able to instigate measures which discourage car use. Now that an alternative means of transport is available for inter-site journeys it would be prudent for the University to introduce a number of disincentives, for example parking restrictions.

Since the project began, a number of changes in the use of University facilities have been proposed. These include expanding the Langstone site in terms of its provision of sports facilities and halls of residence, creating a potential site for a further Bikeabout depot. Also there was a desire to move out of the Milton site and relocate to a new building on the Guildhall campus. With these changes, staff and student demand for travel during the day will remain high and the demand for inter-site travel could increase. The University Transport Scheme will continue to play an important role in encouraging the use of cycling and providing access to bicycles. One of the strengths of Bikeabout is the comparatively small amount of time needed to set up new depots and the flexibility of relocating, now that robust design criteria have been established and thoroughly tested.

In summary, the following main conclusions can be drawn from the study:

- a cycle pool such as Bikeabout needs to be carefully marketed to its potential users; this marketing needs to start before students arrive for their first term at the University;
- rather than relying on a cycle pool, many cyclists will continue to buy and use their own cycles, particularly if conditions of use are considered to be too restrictive;
- whilst the introduction of a cycle pool scheme may have only limited appeal, cycling as a mode of transport can be rendered considerably more attractive with parallel investment in safe cycle routes and cycle parking facilities;
- the effectiveness of any cycle scheme will not be realised without the imposition of restrictions on car use, for example parking controls and charges.

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# Appendix A: University staff and student profiles

**Table A1 University staff profile and survey response rates by type of employment and sex**

| *Type* | | *Uni. staff* | *Uni. staff %* | *Survey* | *Survey %* | *Response -%* |
|---|---|---|---|---|---|---|
| Academic | Female | 235 | 28 | 103 | 31 | 44 |
| | Male | 604 | 72 | 233 | 69 | 39 |
| | Total | 839 | | 336 | | 40 |
| Research | Female | 68 | 40 | 30 | 50 | 44 |
| | Male | 103 | 60 | 31 | 50 | 30 |
| | Total | 171 | | 61 | | 36 |
| Support | Female | 554 | 64 | 260 | 70 | 48 |
| | Male | 308 | 36 | 112 | 30 | 36 |
| | Total | 862 | | 372 | | 43 |
| Manual | Female | 117 | 58 | 19 | 60 | 16 |
| | Male | 85 | 42 | 12 | 40 | 14 |
| | Total | 202 | | 31 | | 15 |
| All | Female | 974 | 47 | 414 | 52 | 43 |
| | Male | 1100 | 53 | 388 | 48 | 35 |
| | Total | 2074 | | 803 | | 39 |

**Table A2 Student response rates — a comparison of a selected number of courses**

| *Course* | *Students* | *Survey* | *Response rate %* |
|---|---|---|---|
| BA Business Studies | 435 | 42 | 10 |
| BSc Computer Science | 227 | 44 | 20 |
| BA Land Management | 262 | 15 | 6 |
| DipHE Health Studies | 76 | 3 | 4 |
| BSc Applied Environmental Geology | 71 | 6 | 9 |
| BA Architecture | 104 | 12 | 12 |
| BSc Pharmacy /Pharmacology | 347 | 18 | 5 |
| BA Geography | 282 | 30 | 11 |
| BSc Biomedical Science | 61 | 10 | 16 |
| BSc Psychology | 270 | 26 | 10 |
| BSc Biology | 351 | 8 | 2 |
| BSc Med Lab Science | 57 | 10 | 18 |
| BSc Civil Engineering | 272 | 39 | 14 |
| BA Accounting | 271 | 2 | 1 |
| BA Economics | 227 | 2 | 1 |
| BA Art, Design & Media | 611 | 38 | 6 |
| DipHE Nursing Studies | 426 | 13 | 3 |
| BA French Studies | 111 | 3 | 3 |
| BA German Studies | 76 | 2 | 3 |
| BSc Radiography | 101 | 17 | 17 |
| DipHE Midwifery | 33 | 4 | 12 |

# Appendix B: Cordon data — Milton

**Table B1 Milton Cordon Count — traffic flows (1325 responses)**

| *Time period* | *Total flow* | *People in* | *%* | *People out* | *%* |
|---|---|---|---|---|---|
| 08:30-08:59 | 244 | 234 | 96 | 10 | 4 |
| 09:00-09:29 | 251 | 224 | 89 | 27 | 11 |
| 09:30-09:59 | 257 | 228 | 89 | 29 | 11 |
| 10:00-10:29 | 204 | 157 | 77 | 47 | 23 |
| 10:30-10:59 | 155 | 99 | 64 | 56 | 36 |
| 11:00-11:29 | 160 | 56 | 35 | 104 | 65 |
| 11:30-11:59 | 154 | 58 | 38 | 96 | 62 |
| 12:00-12:29 | 217 | 77 | 35 | 140 | 65 |
| 12:30-12:59 | 235 | 135 | 57 | 100 | 43 |
| 13:00-13:29 | 253 | 120 | 47 | 133 | 53 |
| 13:30-13:59 | 261 | 144 | 55 | 117 | 45 |
| 14:00-14:29 | 277 | 134 | 48 | 143 | 52 |
| 14:30-14:59 | 280 | 108 | 39 | 172 | 61 |
| 15:00-15:29 | 194 | 43 | 22 | 151 | 78 |
| 15:30:15:59 | 172 | 72 | 42 | 100 | 58 |
| 16:00-16:29 | 227 | 56 | 25 | 171 | 75 |
| 16:30-16:59 | 212 | 52 | 25 | 160 | 75 |
| 17:00-17:29 | 148 | 24 | 16 | 124 | 84 |
| 17:30-18:00 | 104 | 8 | 8 | 96 | 92 |
| Totals | 4005 | 2029 | | 1976 | |

**Table B2 Time interviews performed (Milton)**

| *Time period* | *Number interviewed* | *Count (traffic)* | *Percentage interviewed* |
|---|---|---|---|
| 08:30-08:59 | 35 | 244 | 14% |
| 09:00-09:29 | 67 | 251 | 27% |
| 09:30-09:59 | 9 | 257 | 4% |
| 10:00-10:29 | 3 | 204 | 2% |
| 10:30-10:59 | 52 | 155 | 34% |
| 11:00-11:29 | 2 | 160 | 1% |
| 11:30-11:59 | 3 | 154 | 2% |
| 12:00-12:29 | 64 | 217 | 30% |
| 12:30-12:59 | 20 | 235 | 9% |
| 13:00-13:29 | 14 | 253 | 6% |
| 13:30-13:59 | 74 | 261 | 28% |
| 14:00-14:29 | 4 | 277 | 1% |
| 14:30-14:59 | 5 | 280 | 2% |
| 15:00-15:29 | 102 | 194 | 53% |
| 15:30:15:59 | 18 | 172 | 10% |
| 16:00-16:29 | 6 | 227 | 3% |
| 16:30-16:59 | 79 | 212 | 37% |
| 17:00-17:29 | 22 | 148 | 15% |
| 17:30-18:00 | 5 | 104 | 5% |

**Table B3 Staff types interviewed**

| *Employment type/status* | *Number interviewed* |
|---|---|
| Full time academic | 113 |
| Academic research staff | 16 |
| Support (technical/admin.) | 65 |
| Support (manual) | 7 |
| Student | 1125 |

**Table B4 Modes used by people interviewed**

| *Mode* | *Number* |
|---|---|
| Walk | 472 |
| Cycle | 102 |
| Bus | 129 |
| University minibus | 92 |
| Train | 12 |
| Ferry | 4 |
| Car | 505 |
| Taxi | 6 |

# Appendix C: Cordon data — Langstone

### Table C1 Cordon Count at Langstone (457 responses)

| *Time period* | *Total flow* | *People in* | *%* | *People out* | *%* |
|---|---|---|---|---|---|
| 08:30-08:59 | 42 | 11 | 26 | 31 | 74 |
| 09:00-09:29 | 134 | 85 | 63 | 49 | 37 |
| 09:30-09:59 | 90 | 31 | 34 | 59 | 66 |
| 10:00-10:29 | 37 | 12 | 32 | 25 | 68 |
| 10:30-10:59 | 56 | 22 | 39 | 34 | 61 |
| 11:00-11:29 | 110 | 41 | 37 | 69 | 63 |
| 11:30-11:59 | 28 | 15 | 54 | 13 | 46 |
| 12:00-12:29 | 61 | 29 | 48 | 32 | 52 |
| 12:30-12:59 | 86 | 38 | 44 | 48 | 66 |
| 13:00-13:29 | 85 | 57 | 67 | 28 | 33 |
| 13:30-13:59 | 60 | 24 | 40 | 36 | 60 |
| 14:00-14:29 | 50 | 31 | 62 | 19 | 38 |
| 14:30-14:59 | 84 | 30 | 36 | 54 | 64 |
| 15:00-15:29 | 92 | 64 | 70 | 28 | 30 |
| 15:30:15:59 | 88 | 54 | 61 | 34 | 39 |
| 16:00-16:29 | 77 | 57 | 74 | 20 | 26 |
| 16:30-16:59 | 94 | 36 | 38 | 58 | 62 |
| 17:00-17:29 | 102 | 77 | 76 | 25 | 24 |
| 17:30-18:00 | 92 | 58 | 63 | 34 | 37 |
| Totals | 1468 | 793 | | 675 | |

### Table C2 Traffic flows

| *Time* | *Cycle in* | *Cycle out* | *Car in* | *Car out* | *Ped. in* | *Ped out* | *Total in* | *Total out* | *Total* |
|---|---|---|---|---|---|---|---|---|---|
| 08:30-08:59 | — | — | 5 | 2 | 6 | 29 | 11 | 31 | 42 |
| 09:00-09:29 | 9 | 7 | 30 | 18 | 46 | 24 | 85 | 49 | 134 |
| 09:30-09:59 | 3 | 10 | 14 | 10 | 14 | 39 | 31 | 59 | 90 |
| 10:00-10:29 | 2 | 1 | 6 | 5 | 4 | 19 | 12 | 25 | 37 |
| 10:30-10:59 | 5 | 4 | 7 | 7 | 10 | 23 | 22 | 34 | 56 |
| 11:00-11:29 | 3 | 10 | 13 | 19 | 25 | 40 | 41 | 69 | 110 |
| 11:30-11:59 | 0 | 0 | 4 | 7 | 11 | 6 | 15 | 13 | 28 |
| 12:00-12:29 | 3 | 3 | 8 | 11 | 18 | 18 | 29 | 32 | 61 |
| 12:30-12:59 | 4 | 8 | 7 | 9 | 27 | 31 | 38 | 48 | 86 |
| 13:00-13:29 | 6 | 1 | 16 | 13 | 35 | 14 | 57 | 28 | 85 |
| 13:30-13:59 | 1 | 3 | 9 | 13 | 14 | 20 | 24 | 36 | 60 |
| 14:00-14:29 | 1 | 3 | 8 | 4 | 22 | 12 | 31 | 19 | 50 |
| 14:30-14:59 | 10 | 4 | 13 | 7 | 28 | 22 | 30 | 54 | 84 |
| 15:00-15:29 | 11 | 2 | 18 | 11 | 35 | 15 | 64 | 28 | 92 |
| 15:30:15:59 | 10 | 5 | 14 | 14 | 30 | 15 | 54 | 34 | 88 |
| 16:00-16:29 | 5 | 2 | 7 | 8 | 45 | 10 | 57 | 20 | 77 |
| 16:30-16:59 | 5 | 9 | 3 | 10 | 28 | 39 | 36 | 58 | 94 |
| 17:00-17:29 | 9 | 4 | 9 | 8 | 59 | 13 | 77 | 25 | 102 |
| 17:30-18:00 | 6 | 5 | 14 | 15 | 38 | 14 | 58 | 34 | 92 |
| Totals | 93 | 81 | 205 | 191 | 495 | 403 | 793 | 675 | 1468 |

## Table C3 Time interviews performed

| *Time* | *Interviews* | *Count* | *%* |
|---|---|---|---|
| 08:30-08:59 | 12 | 42 | 29% |
| 09:00-09:29 | 10 | 134 | 8% |
| 09:30-09:59 | 24 | 90 | 27% |
| 10:00-10:29 | 12 | 37 | 32% |
| 10:30-10:59 | 7 | 56 | 13% |
| 11:00-11:29 | 26 | 110 | 24% |
| 11:30-11:59 | 16 | 28 | 57% |
| 12:00-12:29 | 22 | 61 | 36% |
| 12:30-12:59 | 28 | 86 | 33% |
| 13:00-13:29 | 36 | 85 | 42% |
| 13:30-13:59 | 13 | 60 | 22% |
| 14:00-14:29 | 28 | 50 | 56% |
| 14:30-14:59 | 28 | 84 | 33% |
| 15:00-15:29 | 52 | 92 | 57% |
| 15:30:15:59 | 36 | 88 | 41% |
| 16:00-16:29 | 28 | 77 | 36% |
| 16:30-16:59 | 28 | 94 | 30% |
| 17:00-17:29 | 27 | 102 | 27% |
| 17:30-18:00 | 22 | 92 | 24% |
| Totals | 455 | 1468 | 31% |

## Table C4 Origin and destinations of people interviewed

| | *Destination* | *No.* | | *Origin* | *No.* |
|---|---|---|---|---|---|
| 1 | Home | 62 | 1 | Home | 44 |
| 2 | Milton Site | 61 | 2 | Milton Site | 108 |
| 3 | Langstone Site | 256 | 3 | Langstone Site | 191 |
| 4 | University House | 0 | 4 | University House | 1 |
| 5 | Mercantile /Wiltshire /Nuffield /St. Pauls | 9 | 5 | Mercantile /Wiltshire /Nuffield /St. Pauls | 15 |
| 6 | Park /St. Michaels /King Henry | 8 | 6 | Park /St. Michaels /King Henry | 14 |
| 7 | Anglesea /Burnaby /Lion Gate /Buckingham /Milldam | 7 | 7 | Anglesea /Burnaby /Lion Gate /Buckingham /Milldam | 17 |
| 8 | Ravelin Park Buildings (inc. S.U., Frewen Library) | 8 | 8 | Ravelin Park Buildings (inc. S.U., Frewen Library) | 8 |
| 9 | Portsmouth Management Centre | 0 | 9 | Portsmouth Management Centre | 0 |
| 10 | Kings Room /Kings Terrace | 0 | 10 | Kings Room /Kings Terrace | 0 |
| 11 | Dept of Phycology | 0 | 11 | Dept of Psychology | 0 |
| 12 | Sarah Duffen Centre | 2 | 12 | Sarah Duffen Centre | 0 |
| 13 | Guildhall Walk | 2 | 13 | Guildhall Walk | 8 |
| 14 | Eldon Building | 0 | 14 | Eldon Building | 0 |
| 15 | Queen Alexandra Hospital | 0 | 15 | Queen Alexandra Hospital | 1 |
| 16 | St. Mary’s Hospital | 3 | 16 | St. Mary’s Hospital | 0 |
| 17 | St. James’ Hospital | 0 | 17 | St. James’ Hospital | 0 |
| 18 | Other | 37 | 18 | Other | 48 |

# Appendix D: Travel flows

**Table D1 Key to codes used in column and row headings in Table D2 and D3**

| | |
|---|---|
| 701 | Home |
| 702 | Milton Site (Business School, etc) |
| 703 | Langstone Site (Halls of Residence, Ed. Centre, etc) |
| 704 | University House (Personnel, Registry, Finance, etc) |
| 705 | Mercantile /Wiltshire /Nuffield /St. Paul's (sports) |
| 706 | Park /St. Michael's /King Henry |
| 707 | Anglesea /Burnaby /Lion Gate /Buckingham /Milldam |
| 708 | Ravelin Park Buildings (Frewen Library, Student Union, Gun House, Cambridge Building, etc) |
| 709 | Portsmouth Management Centre |
| 710 | Kings Rooms /Kings Terrace |
| 711 | Dept. of Psychology, King Charles Street |
| 712 | Sarah Duffen Centre |
| 713 | Guildhall Walk (Careers, Marketing, etc) |
| 714 | Eldon Building |
| 715 | Queen Alexandra Hospital |
| 716 | St. Mary's Hospital |
| 717 | St. James' Hospital |
| 718 | Albert Road (shops) |
| 719 | Guildhall area (including Civic Offices, Public Library, Bateson & Harry Law Halls of Residence) |
| 720 | Lord Montgomery Way (shops) |
| 721 | Elm Grove (shops) |
| 722 | North End (shops) |
| 723 | Commercial Road (shops) |
| 724 | Southsea Shopping Precinct |
| 725 | Southsea Seafront |
| 726 | Craneswater Centre |
| 727 | Omega Centre, Port Royal Street |
| 728 | Fratton (shops) |
| 729 | Highbury College |
| 730 | Old Portsmouth (High Street, Spice Island) |
| 732 | The Hard |
| 733 | Victoria Park and Victoria Swimming Pool |
| 734 | Portsmouth College |
| 735 | Havant |
| 736 | St. Andrews Road, Baileys Road, Margate Road (student area) |
| 737 | Budds Farm Research Centre, Hayling Island |

## Table D2 Staff all travel to University and other destinations

*Rows: From columns: To (See Table D1 for key)*

| | ***MIS*** | ***701*** | ***702*** | ***703*** | ***704*** | ***705*** | ***706*** | ***707*** | ***708*** | ***709*** | ***710*** | ***711*** | ***712*** | ***713*** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MIS | 35 | 108 | 19 | 4 | 8 | 4 | 10 | 18 | 8 | 2 | 0 | 0 | 1 | 3 |
| 701 | 90 | 5 | 127 | 16 | 43 | 87 | 90 | 182 | 93 | 24 | 4 | 9 | 5 | 15 |
| 702 | 24 | 111 | 0 | 1 | 2 | 3 | 0 | 7 | 3 | 3 | 1 | 0 | 0 | 0 |
| 703 | 5 | 9 | 2 | 0 | 0 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 704 | 6 | 35 | 3 | 0 | 0 | 7 | 0 | 1 | 9 | 8 | 0 | 0 | 0 | 3 |
| 705 | 9 | 72 | 3 | 1 | 8 | 5 | 15 | 14 | 7 | 1 | 1 | 0 | 0 | 2 |
| 706 | 12 | 82 | 0 | 0 | 0 | 13 | 7 | 6 | 6 | 0 | 0 | 2 | 0 | 2 |
| 707 | 29 | 159 | 2 | 0 | 5 | 11 | 4 | 6 | 15 | 1 | 0 | 0 | 0 | 0 |
| 708 | 11 | 82 | 3 | 2 | 6 | 7 | 4 | 12 | 5 | 0 | 1 | 4 | 0 | 5 |
| 709 | 3 | 25 | 2 | 0 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 710 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 711 | 2 | 10 | 0 | 0 | 1 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 712 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 713 | 5 | 11 | 1 | 0 | 2 | 1 | 1 | 3 | 6 | 0 | 0 | 0 | 0 | 1 |
| 714 | 1 | 27 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 715 | 3 | 13 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 716 | 1 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 717 | 1 | 15 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 718 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 719 | 0 | 2 | 0 | 0 | 2 | 0 | 5 | 0 | 3 | 0 | 0 | 0 | 0 | 1 |
| 720 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 721 | 0 | 4 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 722 | 2 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 723 | 1 | 10 | 3 | 0 | 6 | 7 | 12 | 22 | 7 | 1 | 0 | 1 | 0 | 1 |
| 724 | 1 | 11 | 1 | 1 | 0 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 725 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| 726 | 1 | 7 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 727 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 4 |
| 728 | 0 | 4 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 729 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 730 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 732 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 734 | 2 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 736 | 0 | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 737 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ALL | 249 | 835 | 167 | 27 | 88 | 155 | 155 | 282 | 174 | 41 | 7 | 17 | 6 | 38 |

| | ***714*** | ***715*** | ***716*** | ***717*** | ***718*** | ***719*** | ***720*** | ***721*** | ***722*** | ***723*** | ***724*** | ***725*** | ***726*** | ***727*** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MIS | 1 | 2 | 1 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 2 | 1 | 0 | 0 |
| 701 | 27 | 20 | 2 | 14 | 3 | 1 | 0 | 0 | 2 | 3 | 6 | 0 | 4 | 3 |
| 702 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 2 | 6 | 1 | 0 | 1 | 0 |
| 703 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 |
| 704 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 2 |
| 705 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 13 | 0 | 0 | 1 | 0 |
| 706 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 1 | 18 | 1 | 0 | 0 | 0 |
| 707 | 2 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 1 | 24 | 2 | 1 | 1 | 0 |
| 708 | 0 | 1 | 0 | 0 | 0 | 4 | 2 | 2 | 0 | 11 | 3 | 1 | 1 | 0 |
| 709 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 1 | 0 |
| 710 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 711 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 712 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 713 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 3 |
| 714 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 715 | 0 | 0 | 4 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 716 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 717 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| 718 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 719 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 720 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 721 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 722 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 723 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 724 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 725 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 726 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 727 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 728 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 729 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 730 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 732 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 734 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 736 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 737 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ALL | 35 | 30 | 12 | 25 | 4 | 18 | 5 | 5 | 9 | 88 | 19 | 4 | 10 | 9 |

| | *728* | *729* | *730* | *732* | *734* | *736* | *737* | *ALL* |
|---|---|---|---|---|---|---|---|---|
| MIS | 2 | 0 | 0 | 0 | 1 | 1 | 0 | 235 |
| 701 | 2 | 0 | 0 | 1 | 3 | 4 | 2 | 887 |
| 702 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 173 |
| 703 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 |
| 704 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 83 |
| 705 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 155 |
| 706 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 156 |
| 707 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 269 |
| 708 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 171 |
| 709 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 39 |
| 710 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 711 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 18 |
| 712 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| 713 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 38 |
| 714 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35 |
| 715 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 |
| 716 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 717 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 |
| 718 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 719 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 17 |
| 720 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 721 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 722 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 723 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 74 |
| 724 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 |
| 725 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 726 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| 727 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 728 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| 729 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 730 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 732 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 734 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| 736 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 737 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| ALL | 7 | 1 | 2 | 4 | 9 | 7 | 2 | 2546 |

## Table D3 Student travel to and from University and other destinations

*Rows: From columns: To (see Table D1 for key)*

| | ***MIS*** | ***701*** | ***702*** | ***703*** | ***704*** | ***705*** | ***706*** | ***707*** | ***708*** | ***709*** | ***710*** | ***711*** | ***712*** | ***713*** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MIS | 25 | 103 | 9 | 2 | 0 | 4 | 9 | 7 | 8 | 0 | 0 | 0 | 0 | 0 |
| 701 | 89 | 4 | 216 | 9 | 1 | 70 | 98 | 245 | 61 | 3 | 4 | 15 | 2 | 3 |
| 702 | 14 | 198 | 4 | 13 | 2 | 2 | 1 | 3 | 33 | 0 | 0 | 0 | 0 | 1 |
| 703 | 3 | 10 | 17 | 7 | 1 | 4 | 3 | 6 | 6 | 0 | 0 | 0 | 0 | 1 |
| 704 | 0 | 4 | 2 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 |
| 705 | 4 | 55 | 5 | 2 | 2 | 4 | 2 | 3 | 23 | 1 | 0 | 0 | 0 | 1 |
| 706 | 5 | 70 | 1 | 4 | 0 | 4 | 7 | 5 | 25 | 0 | 0 | 4 | 0 | 2 |
| 707 | 11 | 176 | 1 | 7 | 0 | 6 | 8 | 6 | 97 | 2 | 1 | 0 | 0 | 3 |
| 708 | 15 | 83 | 24 | 6 | 2 | 17 | 14 | 63 | 12 | 2 | 1 | 4 | 0 | 10 |
| 709 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 710 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 711 | 1 | 12 | 0 | 0 | 1 | 0 | 1 | 1 | 6 | 0 | 0 | 0 | 1 | 1 |
| 712 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 713 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 5 | 3 | 0 | 0 | 0 | 0 | 1 |
| 714 | 1 | 19 | 2 | 1 | 2 | 1 | 2 | 2 | 6 | 0 | 0 | 0 | 1 | 0 |
| 715 | 1 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 716 | 1 | 18 | 2 | 1 | 0 | 0 | 4 | 3 | 7 | 0 | 0 | 0 | 0 | 2 |
| 717 | 0 | 3 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 718 | 0 | 28 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 719 | 1 | 9 | 0 | 0 | 0 | 0 | 2 | 1 | 4 | 0 | 0 | 0 | 0 | 0 |
| 720 | 0 | 4 | 0 | 0 | 0 | 2 | 3 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| 721 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 722 | 6 | 13 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 723 | 8 | 80 | 10 | 7 | 0 | 7 | 16 | 23 | 10 | 1 | 0 | 0 | 0 | 0 |
| 724 | 3 | 14 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 725 | 1 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 726 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 728 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 729 | 0 | 1 | 0 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 730 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 732 | 0 | 3 | 0 | 1 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 733 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 734 | 2 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 735 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 737 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| ALL | 196 | 960 | 300 | 68 | 12 | 124 | 175 | 386 | 309 | 10 | 6 | 24 | 4 | 26 |

| | ***714*** | ***715*** | ***716*** | ***717*** | ***718*** | ***719*** | ***720*** | ***721*** | ***722*** | ***723*** | ***724*** | ***725*** | ***726*** | ***728*** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MIS | 1 | 2 | 0 | 0 | 1 | 1 | 0 | 1 | 3 | 2 | 3 | 1 | 0 | 0 |
| 701 | 34 | 14 | 26 | 3 | 22 | 4 | 3 | 3 | 8 | 45 | 9 | 2 | 13 | 2 |
| 702 | 0 | 0 | 2 | 1 | 5 | 0 | 0 | 0 | 2 | 11 | 1 | 1 | 0 | 0 |
| 703 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| 704 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 705 | 1 | 0 | 0 | 0 | 1 | 0 | 4 | 1 | 0 | 11 | 1 | 1 | 0 | 0 |
| 706 | 2 | 0 | 0 | 0 | 1 | 6 | 4 | 0 | 1 | 20 | 1 | 0 | 0 | 1 |
| 707 | 2 | 3 | 1 | 0 | 0 | 6 | 1 | 1 | 3 | 36 | 0 | 1 | 0 | 0 |
| 708 | 7 | 0 | 3 | 0 | 1 | 6 | 2 | 1 | 1 | 21 | 3 | 0 | 0 | 0 |
| 709 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 710 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 711 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 712 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 713 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 714 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 5 | 0 | 0 | 0 | 0 |
| 715 | 0 | 0 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 716 | 0 | 2 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 717 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 718 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| 719 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 |
| 720 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 721 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 722 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 723 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 2 | 5 | 1 | 0 | 0 | 0 |
| 724 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 |
| 725 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 726 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 728 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 729 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 730 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 732 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 733 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 734 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 735 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| 737 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| ALL | 56 | 22 | 41 | 8 | 35 | 26 | 14 | 9 | 25 | 173 | 22 | 9 | 13 | 4 |

| | *729* | *730* | *732* | *733* | *734* | *735* | *737* | *ALL* |
|---|---|---|---|---|---|---|---|---|
| MIS | 1 | 0 | 0 | 0 | 1 | 3 | 0 | 187 |
| 701 | 1 | 2 | 1 | 4 | 3 | 2 | 0 | 1021 |
| 702 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 295 |
| 703 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 67 |
| 704 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| 705 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 123 |
| 706 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 169 |
| 707 | 1 | 0 | 2 | 0 | 1 | 1 | 1 | 378 |
| 708 | 0 | 1 | 1 | 0 | 0 | 4 | 0 | 304 |
| 709 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 710 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 711 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 26 |
| 712 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 713 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 |
| 714 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 50 |
| 715 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 |
| 716 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 45 |
| 717 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| 718 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 |
| 719 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 26 |
| 720 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 721 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 722 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 |
| 723 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 176 |
| 724 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 |
| 725 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| 726 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 728 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 729 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 |
| 730 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 732 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 733 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 734 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| 735 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 737 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| ALL | 7 | 6 | 9 | 5 | 7 | 10 | 4 | 3105 |

## Appendix E: Respondents' comments on the scheme

Measures or incentives to encourage more people to use BIKEABOUT suggested by registered users.

Easily extended loan times over telephone.

Possibly car parking charges or restricted use of cars in the city. Perhaps if all members of staff (possibly students) were routinely issued with a card they would be more likely to use the system?

All linked into one card e.g. NUS, library, university and Bikeabout.

More access points. Longer time allowed.

Advertise more extensively.

Need parks at Fratton and Portsmouth Harbour stations. I'd use it a lot if I could combine it with commuting. Now I tend to bring my bike by train.

The presence of bikes which could actually be used and taken from the Milton Depot, as often there are no bikes available. More cycle paths.

Free smart card.

More publicity. More publicity. Bike days in Portsmouth, no cars allowed on the island (perhaps a little over-the-top but its such a good place for cycling!) Perhaps a gift scheme for those who use a bike the most each month? Emphasis on health and environmental benefits.

In view of my chosen residential location, I would regard the introduction of car parking charges as the arbitrary confiscation of my personal resources and for that reason oppose it. I suggest that 'availability' of parking during the day is already a perfectly effective deterrent to within day car trips.

I am NOT in favour of car park charges. Continued wide publicity suggested.

Extend the length of time that a bike can be used for. i.e. Think of the student who lives in North End, studies at Milton uses the Frewen library and needs to pop into Commercial Rd in the afternoon. Extend the week day closing time to about 8 pm (again, think about students using the library or language school).

Install crossing lights at top of Fawcett Rd and Victoria Rd North.

Clear explanations of how to obtain a bicycle. I still can't work out how to use it. That is why I haven't.

There is a lot of prejudice and mockery of the bicycles and users of them (mainly in jest). Provide more security measures (e.g. locks and keys supplied with Bikeabout card, for use in town, etc). How about a bike depot in town, near, Commercial Rd. Everyone goes shopping weekly or monthly and the bikes carry cage are ideal for transporting books and groceries home.

Increased period of time that you are allowed to take the bicycles out for. Time to give them back could be later than 17.30h. Much more publicity (word of mouth is not enough). Move depots. New lockers system.

Ensuring that there are no charges involved.

Provide lock device for every bicycle. The computerised system should never break down as I have experience it once, especially if one is in a hurry to attend a lecture or tutorial and he or she face the problem with the machine either to borrow or return a bicycle.

Easier to get smartcard Milton? Available in evening when intersite bus does not run.

Make it more accessible. (Current sites of limited use, unless you travel between them regularly.) Allow bikes to be used for longer, i.e. three hours is way to short, considering limited number of depots. Car park charges (Yes, good idea!) Pay allowance for staff to use scheme, e.g. to help with cost of protective clothing.

Have a site in QEQM, so students can cycle in to the Milton site in the morning and back home in the afternoons.

Many of dept. don't realise how easy it is! Publicise more e.g. in the Bulletin. I like it tend to stay on the road, not cycle ways. Much heavier than my own bike, for obvious reasons, but they do give exercise. I do wish crash hats were available. I never remember to bring mine in! A colleague in DIS owes his life to his.

To be able to collect cards from Milton site too. Allow to use the bikes for more than three hours at a time. A later time to be introduced for bike returns e.g. one hour later? When vandals are a problem, could there be a security system, so users are not disadvantaged. For both depots to be open at the same time in Bikeabout hours.

The bikes should be allowed to be kept overnight by students therefore they don't need to use a car or public transport to get to university.

Better, wider publicity. Seats that actually stayed up when you adjusted them.

Waive limit of three hours for university staff.

Provision of locks. Better system (computerised system is faulty). Longer borrowing period. Move bikes. Move depots. Longer or later opening hours.

**Comments about the BIKEABOUT scheme by registered users**

Excellent scheme which should be expanded in conjunction with bicycle only lanes, etc.

At least one out of three journeys have been affected by problems with the software. This is of some concern if required to attend functions at a particular time. Guildhall tenance should be improved, i.e. checked more frequently.

Great scheme. Cycle path great, but you feel the lack of it at the Fratton roundabout between University House and Milton. Keep up the good work.

The cycle paths are excellent - especially as the cars in Portsmouth are not cycle friendly. More cycle paths would be welcomed.

I hope that security is now improved, sad that cycling was disrupted at Mercantile in the summer.

I like using the cycles to get from Milton to University House, but on two occasions technical problems with the card reader prevented me from using them, I have consequently lost some faith in the system.

Good idea, it seems to work well. The main reason I don't use it much is that I live 20 minutes walk from the main site and 35 minutes walk from Milton (where I study), it is easier for me to have my own cycle. Its a shame that the roads between Milton and the Guildhall site are so busy, the cycle ways help a lot.

The cycle path by University House (the one on the pavement) is stupid and just inviting trouble. Cycle paths should be on the road and separate from pedestrian walkways. Many times people have run out in front of cycles in order to cross at the pelican crossing, forgetting bikes now use that area! Anyway, riding on pavements is against the law. Thus it encourages cyclists to ride on the pavement in other places.

Smart card system is very good. Beautiful bike depots. Good luck!

Car parking charges would raise resentment amongst those who travel from outside Portsmouth! Guildhall use appears to be between Milton and the centre, what happens when Milton goes? Most support staff are static once they arrive for work, for them the scheme is irrelevant!

I did try to register for the Bikeabout scheme on two occasions at University House in my non-teaching lunch hour, but on both visits there was no one behind the counter able to fill the appropriate forms. Also in Freshers week the club tents gave me some information, but was not geared up to register me. I am still not registered.

Is it safe for non-cyclists to be thrown into rush hour traffic?

Needs to be clarification of red tarmac strips, crossing roads on cycle route. Some of these crossings are very dangerous, e.g. Victoria Road North. Traffic moves very quickly off the roundabout. How about traffic lights with cycle priority lights!

I have not managed to put my card into a machine without it telling me I already have a bike out and need to seek assistance. Although it is only a two minute walk to University House from the main site. When using a bike I usually have not got time to go to a queue, and problem!

When cycling on Orbit bikes the seat goes down while cycling. I am satisfied with the present infrastructure.

The only problem I encountered was trying to obtain a Bikeabout card i.e. I was at Milton site and University House is the only place from which you can obtain cards. Also the Milton site is closed at weekends - I need to get to the Frewen library.

I don't use the cycle paths at all, it is safer to cycle on the road.

**Comments about the BIKEABOUT scheme by non-users**

***Summarised comments***

The scheme is a very good idea (94 mentions).

More publicity and advertising is essential (20 mentions).

A much better cycle infrastructure is needed (29 mentions).

The new cycle facilities are most welcome/much better for cyclists (10 mentions).

It is important to have more depots (10 mentions).

The depots need to be kept much cleaner (5 mentions).

***Other comments***

Not aware of any bicycle infrastructure.

The proposed cycle path near Milton should be installed.

The cycleways are very dangerous.

More provisions for cyclists required.

Longer hours needed as time is not long enough.

Students from Holland are not used to cycling on roads or sharing paths.

The scheme can provide instant use with no waiting for mini bus.

The cycle tracks are a waste of money.

Why can't cyclists use all pavements.

Have not seen anyone using bikes yet.

The scheme is very limiting in just providing for travel between sites.

The cycle tracks require better marking, need more along Elm Grove - Kings Road and Albert Road.

The scheme only allows for intersite use, people still have to get home after the journey.

I think I will use them to travel to and from classes and around the town.

Lecturers from Milton should use them, rather than class of students going to Milton.

The scheme should be free to students.

Very impressed with cycle paths but need more.

Need to limit the access to cars.

Cycling around Portsmouth is good.

The changes by Mercantile are very welcome they make it much safer.

Should issue face masks for the pollution.

Could organise small trips to Milton campus.

I would never use unless it was nice weather.

Scary to cycle around Portsmouth, better cycle paths needed. Good idea but not practical for people who just use the main site.

It is a good idea but it would be better to keep the bikes for 3 days - a week rather than just 3 hours.

Makes crossing the roads safer and easier.

It’s a good idea but most students already own their own bikes, so the need to hire them is very limited. I don’t feel it was economically viable to start such a project.

The new infrastructure makes it much safer for cyclists and pedestrians.

Doesn’t seem to have been any advertising for the scheme.

The new Toucan crossing by Mercantile may be good for cyclists, but it doesn’t give enough time for pedestrians to cross the road.

# Appendix F: Calculation of energy and emissions

### F1 Background

This appendix sets out the approach to the evaluation of the energy and environmental impact of the University Transport application. This approach is common to all the applications in ENTRANCE, except those involving the alternative fuels buses where direct measurements of pollutant emissions and energy use are made. Within ENTRANCE the evaluation of the applications is concerned with emissions of carbon dioxide ($CO_2$), hydrocarbons (HC), carbon monoxide (CO), particulates (PM), sulphur (S), nitrogen oxides ($NO_x$) and fuel consumption. Using known relationships between speed and emission rates, changes can be calculated using speeds and flows collected in the 'before and after' surveys.

### F2 Emissions and fuel consumption factors

#### *F2.1 Sources of data*

In common with the other ENTRANCE applications, German data on emissions were used. For some applications it was important to have data on a comparable basis for emissions from buses and cars. Data on emissions from buses are available for Germany but not for the UK. Therefore the source of data for emissions used in all the applications, including teleworking, was the Workbook on Emission Factors for Road Transport in Germany and Switzerland (FEA, 1995), known as HB-EFA. Because of the conformity between Swiss/German and UK passenger cars, and the common emission standards, this means that the HB-EFA data is quite similar to UK data as shown in Figure F1.

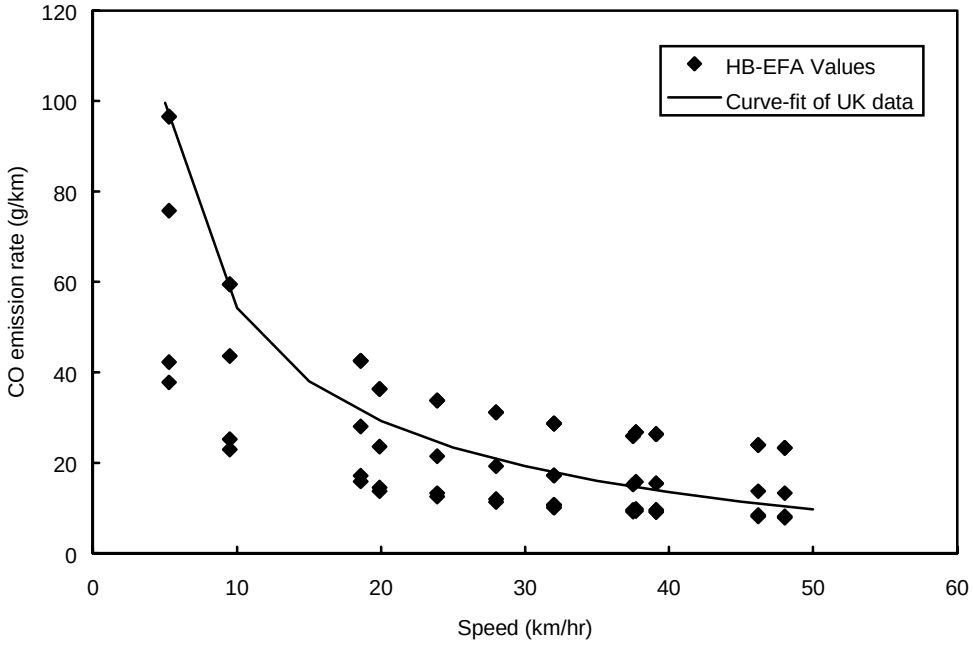


**Figure F1** Comparison of CO emision factors for non-catalyst passenger cars

#### *F2.2 Passenger cars*

Each passenger car type is required to conform to different emissions standards according to relevant emissions control legislation (when it was registered), size of engine and fuel type. To simplify the calculations a combined relationship between speed and emissions is required, which accounts for all the different types of vehicles in the traffic stream.

In this study passenger cars were assumed to fall into ten categories according to fuel type, engine size and emissions control. It was also assumed that the traffic in Portsmouth was of a similar composition in terms of the proportion of vehicles in each category, to that of the national fleet. According to the number of vehicles and their annual mileage (Table F1), a weighted distribution of the proportion to which each vehicle category contributes to traffic emissions as a whole was calculated (Figure F2). This distribution was then used to calculate a combined speed-emission factor from the rates for the individual categories.

**Table F1 UK vehicle car fleet composition**

| *Passenger car category (fuel, EC emissions control category and engine capacity)* | *Total number in each category* | *Total mileage in each category* |
|---|---|---|
| All diesel, >2 l | 562805 | 47662.89 |
| All diesel, <2 l | 375203 | 40107.64 |
| All petrol, 15.01/02 | 34734 | 12579.44 |
| All petrol, 15.03 | 3493517 | 9918.50 |
| All petrol, 15.04, < 1.4 l | 5197438 | 15119.52 |
| All petrol, 15.04, 1.4 - 2 l | 5277574 | 15119.52 |
| All petrol, 15.04, > 2 l | 468741 | 13168.20 |
| All petrol, 91/441, < 1.4 l | 3161603 | 20986.82 |
| All petrol, 91/441, 1.4 - 2 l | 3210350 | 20986.82 |
| All petrol, 91/441, > 2 l | 1096278 | 19121.87 |
| All categories | 22878243 | |

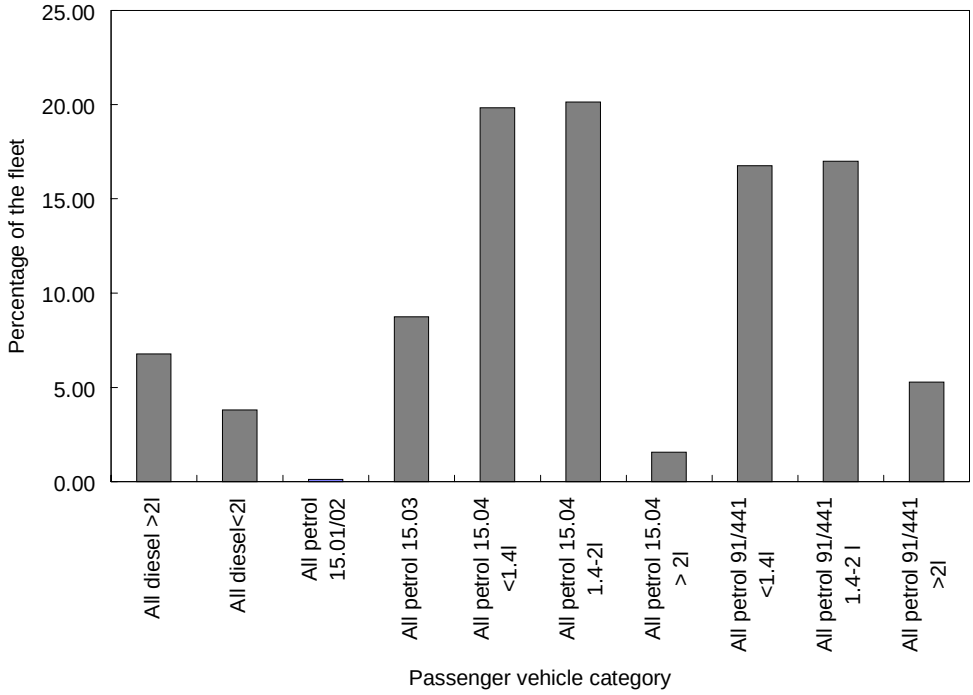


**Figure F2** Distribution of passenger cars in the national fleet

### *F2.4 Motorcycles*

There are relatively few data available on emissions from motorcycles. The most recent compilation of emissions data for European motorcycles (Rijkeboer, 1997) was used in this study. The emissions data are given for the following motorcycle categories: 2-stroke and 4-stroke (<250 cc, 250-750 cc, >750 cc). From data collected in the 'before' survey it was found an equal distribution of staff and students motorcycles between the 250-750 cc class and those >750 cc. This distribution was thus used to calculate a combined speed-emission factor for motorcycles.

## F3 Calculatins of speed emission curves

HB-EFA allows the determination of speed-emission curves for CO, $CO_2$, HC, PM and $NO_x$ from knowledge of the type of vehicle. Using the distributions of types of vehicles within each classification (derived locally for motorbikes and buses but according to national statistics for passenger cars) a combined speed-emission curve for each pollutant was derived according to the proportion of each vehicle type in the traffic stream.

Fuel consumption was derived from a mass balance of carbon atoms in the exhaust. The mass emissions of CO, $CO_2$, HC and PM found using the factors derived above were in turn used in the following equation to calculate the mass of fuel consumed (Eggleston et al., 1993).

$$M_{FUEL} = (12.011 + 1.008 \times r_{H/C}) \times \left( \frac{M_{CO2}}{44.011} + \frac{M_{CO}}{18.011} + \frac{M_{HC}}{13.85} + \frac{M_{PM}}{12.011} \right)$$

where:

*M* denotes the mass of fuel, $CO_2$, CO, HC and PM;

$r_{H/C}$ is the ratio of hydrogen to carbon atoms in the fuel (1.8 for petrol, 2.0 for diesel).

Emissions of sulphur were estimated by assuming that all the sulphur in the fuel is emitted e.g. $M_S = k_S \times M_{FUEL}$

where $k_S$ is the sulphur content of the fuel. For petrol this is 200 ppm for diesel 500 ppm.

## Abstract

This report describes the evaluation of a cycling initiative, Bikeabout, which is part of a wider University Mobility Policy, aiming to reduce car use by staff and students of the University of Portsmouth. The scheme was implemented and evaluated as part of the ENTRANCE project.

The aim of Bikeabout was to use new technology to provide self-regulated access to a pool of bicycles and provide improved cycle infrastructure and facilities on selected routes and at key destinations. The cycle pool scheme was evaluated by means of 'before and after' surveys of students and staff at the University of Portsmouth. The evaluation shortly after the scheme was launched showed that there was a small shift of journeys from car to cycle, but only modest savings in fuel consumption and pollutant emissions were achieved. For the scheme to be economically viable, a greater transfer from cars would be required, as this is where the majority of benefits would be expected, particularly in respect of savings in fuel and vehicle operating costs.

Bikeabout included the implementation of a continuous east-west cycle route between the Guildhall and Milton sites and this together with the cycle route expansion programme across the urban area appears to have helped to bring about a marked increase in the proportion of students cycling to the University.


## Related publications

TRL415 *Monitoring and evaluation of the applications in Hampshire* by Transport Research Laboratory, Transportation Research Group (Southampton University) and University of Portsmouth. (*In production*)

TRL413 *Monitoring and evaluation of a public transport priority scheme in Southampton* by Transport Research Laboratory, Transportation Research Group (Southampton University) and University of Portsmouth. 1999 (price £35, code H)

TRL411 *Monitoring and evaluation of a public transport priority scheme in Eastleigh* by Transport Research Laboratory, Transportation Research Group (Southampton University) and University of Portsmouth. 1999 (price £35, code H)

TRL371 *Alternative routes for cyclists around pedestrian areas* by D G Davies, T J Ryley and M E Halliday. 1999 (price £25, code E)

TRL369 *New cycle owners: Expectations and experiences* by D G Davies and E Hartley. 1999 (price £25, code E)

TRL365 *Achieving the aims of the national cycling strategy: Summary of TRL research* by D G Davies, P Emmerson and G Gardner. 1998 (price £35, code H)

TRL347 *Transport implications of leisure cycling* by G Gardner. 1998 (price £25, code E)

TRL309 *Trip end facilities for cyclists* by G Gardner and T Ryley. 1997 (price £25, code E)

TRL266 *Attitudes to cycling: A qualitative study and conceptual framework* by D G Davies, M E Halliday, M Mayes and R L Pocock. 1997 (price £25, code E)

CT15.1 Planning for pedestrians and cyclists update (1993-1997). *Current Topics in Transport: selected abstracts from TRL Library's database* (price £20)

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