

- **Abstract Title:** Measuring the Health Impacts of Scotland's Canals

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I do not want this abstract considered a "Pecha Kucha" presentation.

The lead author will be under the age of 30 on 16 May 2012 and would like to be considered for the "Best Paper Presented at the Conference by a Young Professional".

Summary

Scotland's network of canal towpaths is extensively used for different forms of active travel eg walking, jogging / running and cycling. This is for leisure purposes and for commuting trips. This paper will consider the health benefits generated by use of Scotland's canal towpaths in terms of increased physical activity; absenteeism; air quality; and road safety. Based on an extensive survey of canal users, this paper, using new and innovative techniques will set out how Scotland's canals contribute almost £7 million of additional public health benefits per annum.

Abstract

This paper will consider the health benefits of Scotland's network of canals in terms of increased physical activity; reduced absenteeism; improved air quality; and improved road safety. Canals are an important element of Scotland's greenspace which combine both a high quality rural environment with direct access into Edinburgh, Glasgow, and Inverness. They are extensively used for a range of active travel trips. In 2011, Scottish Canals, The Waterways Trust Scotland and MVA successfully bid for funding to calculate the health benefits of the canals. The aim was to investigate the use of the network for walking, running and cycling and determine whether these activities would still be carried out if the network was not available. The findings were then used to quantify and monetise the additional health benefits associated with the additional activity.

The study was based on a detailed survey of towpath users. We developed four different innovative approaches to define how the canals contribute towards improved public health:

- the quantified physical health benefit of undertaking additional activities on the canal – this used the new HEAT tool developed by the World Health Organisation;
- the benefit of travelling in 'clean' air as opposed to 'polluted' air;
- the impact on absenteeism; and
- the safety benefits of using a canal towpath rather than a road for undertaking cycle journeys.

The study demonstrated that the canals generate:

- 3.9 million additional person kilometres per annum, with a public health value of £6.4 million;
- £220k of road safety benefits;
- £77k in terms of reduced absenteeism; and
- a reduction of 85,000 hours of exposure to poor air quality.

We believe these exciting findings will be important in informing the appraisal process for future cycling and walking projects.

Overview

The promotion of public health is becoming an ever more important aspect of policy across local and national government. It is widely acknowledged that fostering a physically and mentally healthy population leads to higher levels of both labour force participation and productivity, whilst also reducing health service and social security costs. Whilst there are many aspects of health promotion, the availability of high quality greenspace has assumed increasing importance in recent years. Greenspace can act as a multi-functional health asset, encouraging people to take more exercise, providing a peaceful environment and offering a real alternative to undertaking journeys by the private car in some places.

An important element of Scotland's greenspace is its canal network, which combines both a high quality rural environment with direct access into Edinburgh, Glasgow, and Inverness. The potential contribution of the Forth & Clyde and Union Canals to improving the health of the population has to some extent been overlooked in the past. This paper will consider the health benefits of Scotland's network of canals in terms of increased physical activity; reduced absenteeism; improved air quality; and improved road safety. It will chart the remarkable transformation of the canals, demonstrating how they have progressed from a state of dereliction and stagnation in the late 1990s to being key corridors for active travel and healthy leisure pursuits. Perhaps the key message to emerge from this paper is that for a relatively modest investment, and through close networking with the third sector, Scotland's canals have delivered substantial long-term health benefits to a large number of Scotland's population and savings to the Scottish Government.

Scotland's Canal Network

It is perhaps worthwhile at this stage to put the canal network in context. Scotland's 137 mile canal network, originally built between 1768 and 1822, includes the Caledonian, Crinan, Forth & Clyde, Monkland and Union Canals. Although small in number, the canals are both attractive active travel corridors and historic treasures. Indeed, at the UK level, only the Church of England possesses more Scheduled Ancient Monuments than the various waterway authorities. Despite this, in the 1960s and 1970s, the concentration of many canals in decaying industrial areas led to closures, rescinding of navigational rights and a general public apathy towards the waterways. This philosophy of managed (and in some cases unmanaged) decline meant that, in Scotland, only the Caledonian and Crinan Canals, both important thoroughfares, remained largely untouched.

However, the reopening of the Lowland Canal Network to navigation (the Millennium Link project) in 1999 has transformed the use of the waterways and the surrounding land. The centrepiece of this restoration was the Falkirk Wheel, which is now a hub for social and family activities. Canal towpath use has increased exponentially – in 1997, there were 4.5 million towpath visits, which have increased to 24 million visits in 2010. The towpaths and waterspace are now used for a wide variety of healthy activities, including walking; running; cycling; watersports; and community events. The following sections clearly establish how this transformation has delivered quantifiable positive health benefits.

Geographical and Methodological Scope

This study was part funded by the Central Scotland Green Network (CSGN) and the focus was therefore on the Central Belt of Scotland. The study did not consider the health impacts of either the Caledonian or Crinan canals. In addition, a lack of data on usage of both the Monkland Canal and the Glasgow Branch of the Forth & Clyde Canal limited our ability to conduct any quantitative

research on these waterways. Accordingly, the quantified outputs detailed in this paper relate only to **the Forth & Clyde Canal and the Union Canal**.

“Health” and “Mental Wellbeing” are not easy terms to define and there are numerous different means of defining health impacts and outcomes. With this in mind, we developed five different approaches to defining how the canals contribute to public health, namely the:

- quantified physical health benefit of undertaking additional activities on the canal;
- safety benefits of using a canal towpath rather than a road for undertaking cycle journeys;
- benefit of travelling in ‘clean’ air as opposed to ‘polluted’ air;
- benefits of reduced absenteeism; and
- use of the canals by Scottish Canals and the third sector in engaging local communities and promoting healthy activities

Data Collection

The study area focused on a 70 mile linear corridor and quantitative data were required for each section of the canal in order to capture the outturn health benefits. The project team designed and carried out an extensive survey of canal users. The survey established the types of exercise that people undertake on the canal, how often they do so, and whether they would partake in this exercise elsewhere if the canal did not exist. The SNAP-based survey also asked a range of qualitative questions designed to seek the views of users on the amenity of the canals more generally.

The canals were split into 14 sections, with each enumerator location roughly half way between two pedestrian counters. In addition to the two surveys at each location, Scottish Canals publicised the surveys widely through the use of their website, towpath notices, and through discussions with local authorities and canal users. A classified count was also undertaken at each location, which was used to validate the Scottish Canals count data provided.

Survey Content

The survey was focused on identifying the types and frequency of activity that people undertake on the canal towpath in a **typical week**. Respondents were asked to think of all answers in the context of what would be a typical week for them. Users were then asked to provide more details on the different uses that they had made of the canal in their typical week. Each different type of use was to be described separately, with the survey permitting details to be filled in for up to three journeys.

For each journey, respondents were asked to indicate both where they joined and left the canal. Given that there are numerous unmarked access and egress points on both canals, we set 166 standard access / egress points identified on the *BWS Skipper’s Guide to the Forth & Clyde and Union Canals* map. This may in some cases have led to an over or under-estimation of the distances travelled. In general, however, this approach was seen to be a reasonable and proportionate means of identifying where users were joining and leaving the canal.

Users were then asked the particulars of each journey, namely whether:

- their journey was to a specific destination (eg work, shops etc) or purely for recreation (eg going for a walk or cycle etc);

- the mode of travel for undertaking the journey;
- how many times they undertake this journey in a typical week; and
- whether the journey is a return journey.

Survey Results

There were a total of 791 individual responses, accounting for 1,141 distinct trips / activities undertaken by users. Figure 1 identifies the means by which respondents were made aware of the survey.

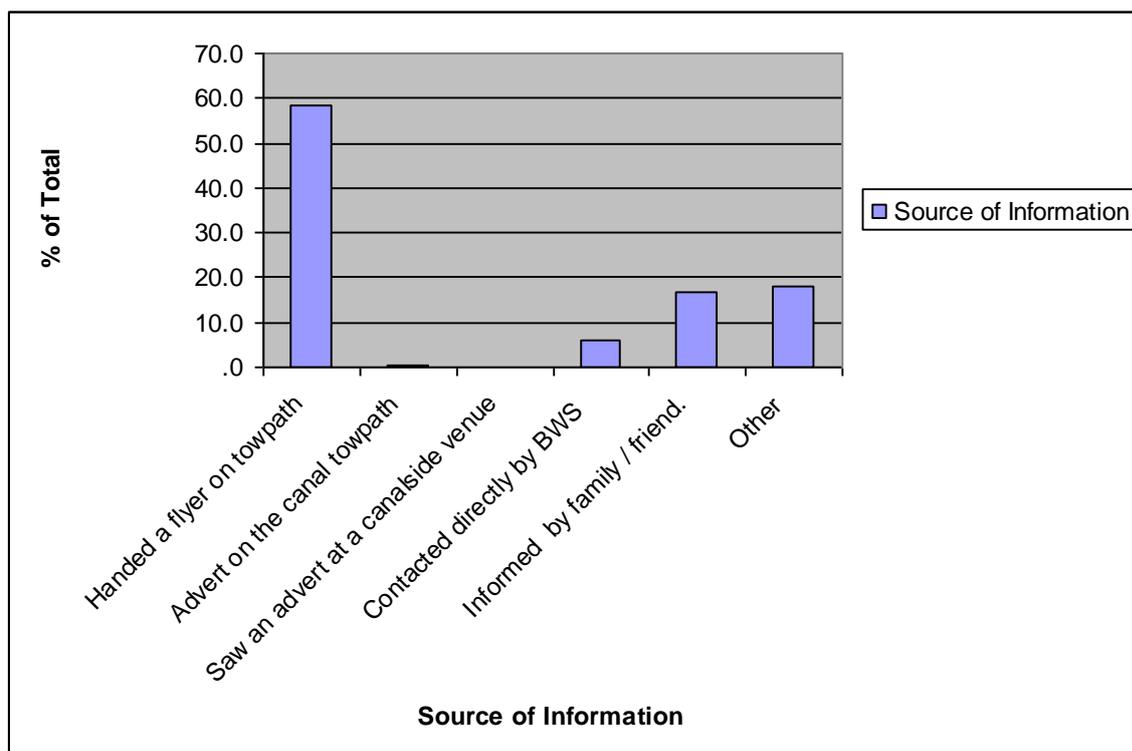


Figure 1: How did you find out about the survey?

Almost 60% of those who responded to the survey were made aware of it through meeting an enumerator on the towpath. Some 17% of respondents found out through other means (eg through cycle groups, the NHS, third sector bodies etc), while a further 17% were informed by family or friends.

Geographical Distribution

Towpath users were asked to consider both their point of access and point of egress from the canal. In the interests of clarity, we have aggregated these responses into eight canal sections.

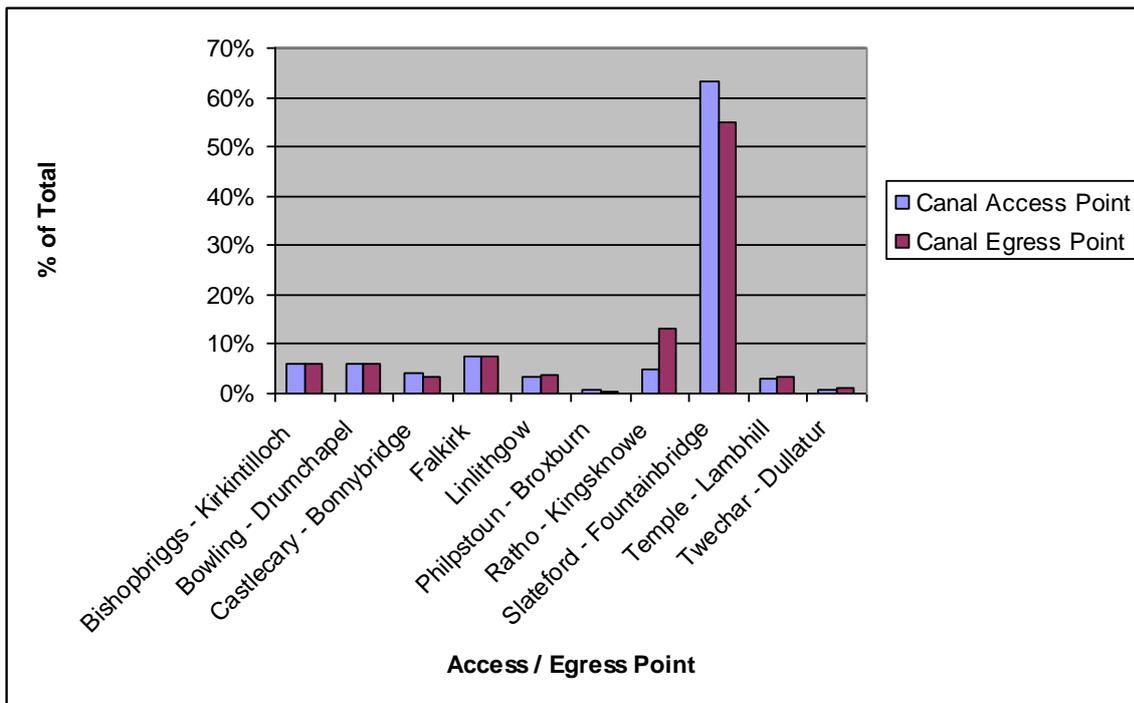


Figure 2: Canal Access and Egress Points

As would perhaps be expected from analysing the towpath count data, traffic is heaviest in and around central Edinburgh. On average, 63% of users access the towpath at the eastern end of the Union Canal between Slateford and Fountainbridge. There was also a relatively large number of responses from the Falkirk area. The volume of traffic on the Edinburgh sections of the Union Canal does suggest that the majority of the benefits accrue in this area. Nonetheless, the significant health benefits generated elsewhere should not be ignored.

Journey Purpose

The survey revealed that use of the canal is split relatively evenly between travelling to specific destinations (eg work) and use purely for recreational purposes (eg walking, cycling etc). As would be expected, there is something of an urban / rural split in purposes, with urban journeys more focused on travel to a destination and rural journeys more focused on leisure.

Use of the canal for travel to a specific destination amounted to 43% of the overall total. It is likely that this figure is strongly influenced by the large travel-to-work contingent in the Edinburgh area. Use of the canal for purely leisure purposes accounted for 57% of the total sample. Figure 3 shows the breakdown of journey purpose for those travelling to a destination:

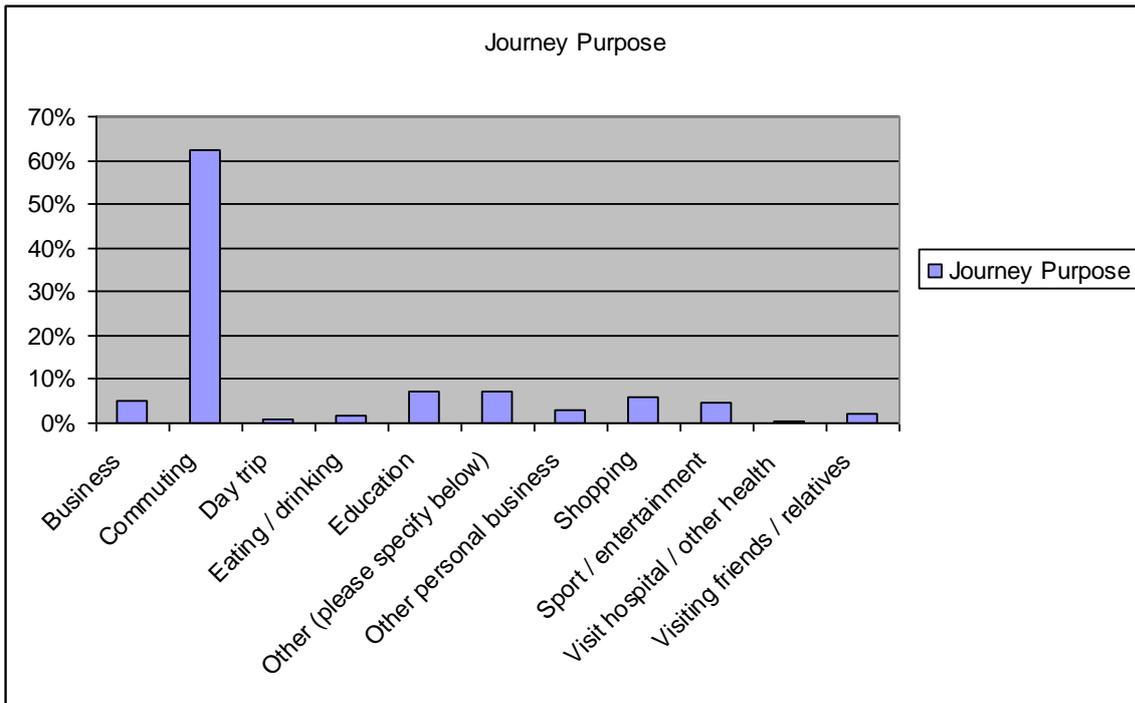


Figure 3: Travel to a Destination – Journey Purpose

Of the 43% of respondents travelling to a destination, 62% of those people are using the towpath for their commute to work. This is likely to be a particularly noticeable trend in the Edinburgh area, where travelling on the restored Union Canal appears to be relatively popular.

Figure 4 shows the selected mode of travel across all journey purposes:

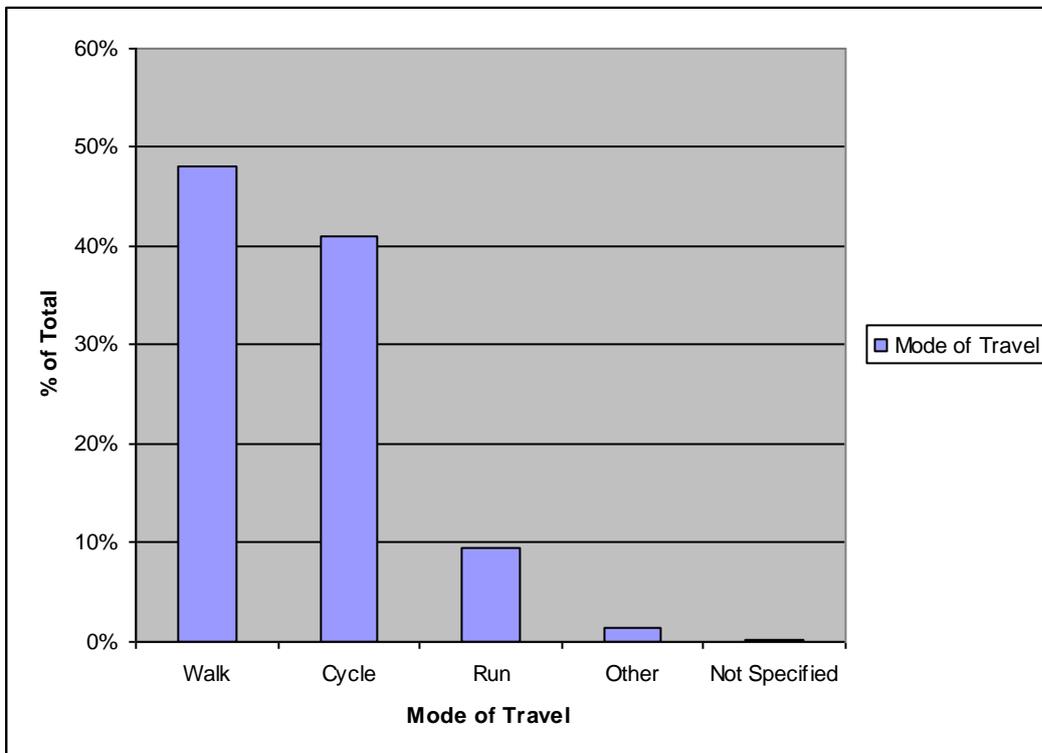


Figure 4: Mode of Travel

It can be seen from Figure 4 that walking and cycling account for almost 89% of travel on the canal towpaths. This in part reflects the large travel-to-work movements on the Union Canal but is also related to the use of the canal as a safe environment for leisure pursuits, particularly dog walking.

A key question in this survey was that related to **what canal users would do if they did not have access to the towpaths**. If a respondent would carry out the same activity somewhere else, there are no net additional quantifiable health benefits (except those related to air quality and safety) as the journey would simply be displaced from one path to another. In contrast, health benefits can be derived from the use of the canal instead of a motorised mode of transport if the person in question would not have made a journey without an accessible towpath. Figure 5 shows the outcomes of this analysis:

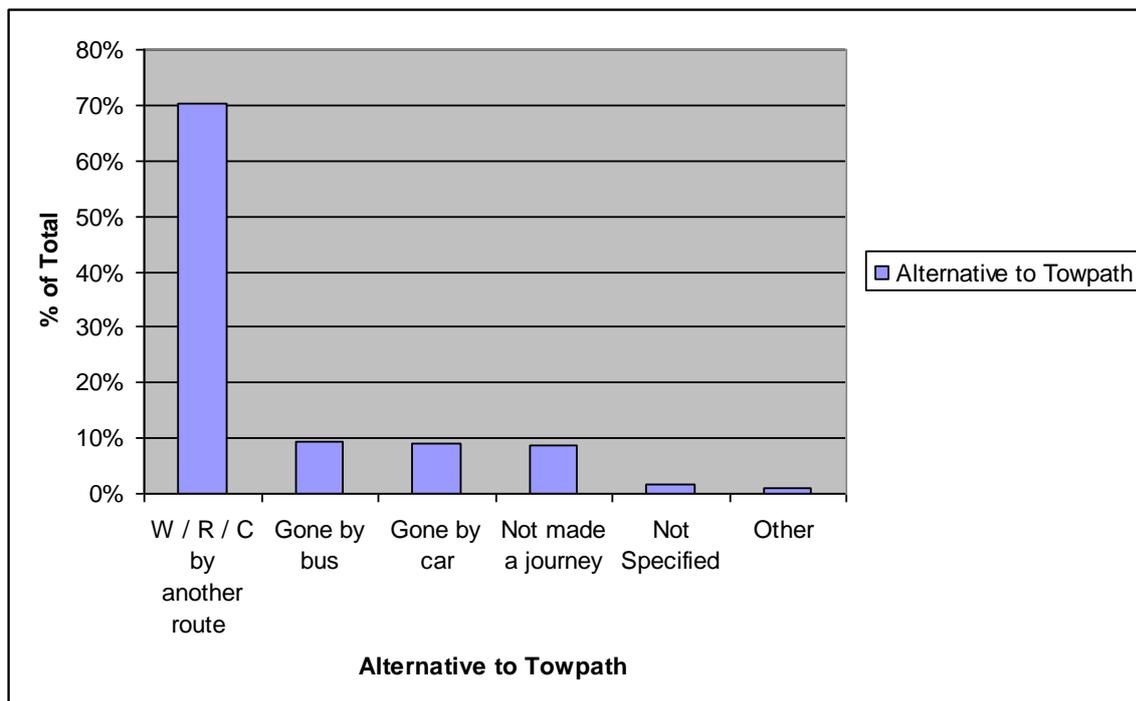


Figure 5: What respondents would have done in the absence of the canal

70% of respondents noted that they would walk / run / cycle somewhere else or by another route if the canal towpath was not accessible. In health economic terms, these journeys cannot be counted as a benefit, because they are simply displaced from one path to another. Nonetheless, it can be argued that those people who do undertake their activity elsewhere still value the canal more highly than the alternative (because they choose to use it). Without the canal, 28% of respondents would either have used a motorised mode of transport or not made a journey. Therefore, the use of the canal in these instances can be considered to provide 'additional' health benefits.

In general, the survey discovered that the majority of users would travel a similar distance if they were to walk / run / cycle by another route. In light of this, we have factored out the potential health impacts of longer or shorter distances travelled on alternative routes.

Establishing a Baseline

In the interests of simplicity, we partitioned the canals into four sections, as follows:

- Union Canal (Urban);
- Union Canal (Rural);
- Forth & Clyde Canal (Urban); and
- Forth & Clyde Canal (Rural).

The initial step in developing the analysis involved calculating the total person kilometres travelled by each survey respondent in each section, broken down by cycling, running, and walking trips. This in turn allowed us to estimate the total proportions of cycling, running and walking in each section of the canal, as illustrated in Table 1 below.

Table 1: Proportion of Person-km Cycling, Running and Walking from Survey¹

Canal Section	Cycling	Running	Walking
Union (Urban)	59%	21%	19%
Union (Rural)	34%	10%	50%
F&C (Urban)	54%	13%	32%
F&C (Rural)	31%	18%	50%

At this stage, it is important to be clear as to what can be classified as a health benefit generated by the canal. The H.M. Treasury *Green Book* explains that an economic impact can only be included as a benefit if it is 'additional' – ie it would not have occurred without the intervention. In the context of this study, use of the canal can only be counted as 'additional' if a person has transferred from a motorised mode to the canal or if they are undertaking exercise which they would not have undertaken without the canal. Where a person has simply transferred their physical activity, say from walking on another path or cycling on the road, there are no net benefits to physical health – any benefits that accrue are simply displaced.

In order to address this issue, the survey included a question for each journey asking:

- “Thinking about this trip / activity, if you had not had access to the canal towpath, what would you have done?
Walk / Run / Cycle by another route or somewhere else;
Gone by bus;
Gone by car;
Mot made a journey / not gone walking / running / cycling at all;
Other (please specify).”

¹ Note – “Other” purposes are factored out as there is no way of quantifying their benefits.

Where a person selected “walk / run / cycle by another route or somewhere else”, it was assumed that they did not receive any net health benefits from the canal because they would simply have taken exercise elsewhere. However, where a person selected any of the other four options, we assumed that they receive a health benefit as this would be net additional physical exercise. Table 2 shows the proportion of cycling, running and walking determined as additional.

Table 2: Proportion of Cycling, Running and Walking which is ‘Additional’

Canal Section	Cycling	Running	Walking
Union (Urban)	38%	6%	36%
Union (Rural)	50%	12%	30%
F&C (Urban)	34%	12%	55%
F&C (Rural)	64%	57%	48%

In order to factor up the survey results to cover the whole canal ‘population’, we estimated the total annual person kilometres travelled on the canal network, based on Scottish Canals counter data. Having calculated the total person kilometres on the canal, we then applied the proportions for walking, running, and cycling in each section to calculate the total person kilometres travelled by each mode. Thereafter, we factored in the proportions of additional travel to calculate the total ‘additional’ person kilometres by mode on the canal network, as set out in Table 3.

Table 3Error! No text of specified style in document.: Additional Person Kilometres Generated by the Canal – Cycling, Running and Walking

Canal Section	Cycling (KM S)	Running (KMs)	Walking (KMs)	Total Per son KM S
Union (Urban)	376,606	20,944	110,177	507,778
Union (Rural)	419,629	29,428	375,303	824,360
F&C (Urban)	587,316	49,200	561,224	1,197,740
F&C (Rural)	489,727	251,676	586,031	1,327,436
			Grand Total	3,857,313

Monetising the Impacts

The World Health Organisation has developed a Health Economic Assessment Tool (HEAT) for walking and cycling, which places a monetary value on additional walking and cycling kilometres generated.² The HEAT tool is used to estimate the value of the reduction in mortality that results from a specified amount of walking or cycling.

The tool applies a financial benefit to a given distance, time etc travelled by each person. Our survey returns suggested that the average walk on the canal is 2.5km, while the average cycle is 5km. These values have been used to develop a 'per km' benefit associated with walking, cycling and running, and these values are shown in Table 4 below. In the interests of simplicity, we assume that the benefits of additional travel generated do not differ based on the physical fitness of the individual in question, although this will be the case in reality.

At present, there is not a corresponding tool for monetising the benefits of running or water-based activity. In order to monetise the benefits of running, we have undertaken an approximate calorie-burn comparison with cycling and proportioned the monetary value accordingly, as also shown in Table 4.

Table 4: Comparison of Cycling Calorie Burn with Running and Walking

Mode	Calories per KM ³	Ratio to Cycling	Monetary Value (£/km)
Cycling	31	N/A	£1.25
Running	85	2.74:1	£3.43
Walking	57	N/A	£1.73

Based on the above values, Table 5 sets out the annual monetary benefit of the additional kilometres travelled on the canals.

Table 5: Monetised Health Benefits of Canal Network

Mode	Additional Person Million KMs / annum	£/KM	Monetised Benefit (£m)
Cycling	1.873m	£1.25	£2.348m
Running	0.351m	£3.43	£1.205m

² <http://www.euro.who.int/en/what-we-do/health-topics/environmental-health/Transport-and-health/activities/promotion-of-safe-walking-and-cycling-in-urban-areas/quantifying-the-positive-health-effects-of-cycling-and-walking/health-economic-assessment-tool-heat-for-cycling>

³ <http://www.internetfitness.com/calculators/calburncalc.htm>

Walking	1.633m	£1.73	£2.818m
Grand Total	3.587m		£6.372m

The estimated **total physical activity benefits** of the canals amount to **around £6.4m**.

It is perhaps worth noting for illustrative purposes that, if all of the activity on the canal had been additional, the total benefits would have been around £16.2m. However, it is clear that much of the activity on the canal would have certainly occurred elsewhere.

Safety Benefits

Another benefit of the canals is that they offer a relatively safe and traffic free environment for travelling. This is particularly true in an urban environment where roads are often busy and there are conflicting movements of people and traffic. We have used the survey outputs to determine the safety benefits offered by the canals for **cyclists**. We have not included pedestrians within this analysis as this group is seen to be relatively low risk.

The safety benefits of cycling accrue only to those who were travelling for a specific purpose and who reported that they would have made the journey by a different route. Without sufficient evidence detailing the alternative route cyclists would travel, we have assumed that, without the canal, they would cycle on roads and that the distance would be equivalent. In reality, such cyclists may use other 'safe' paths for part of or their entire journey. It is important to keep this caveat in mind when interpreting the results presented below.

The safety benefits of the canals for cyclists are calculated by:

- identifying the total kilometres cycled at the national (Scotland) level;
- deriving the total "Killed", "Seriously Injured" and "Slightly Injured" casualties for every one million kilometres cycled;
- identifying from the survey the number of cycle kilometres that have switched from roads to the towpath;
- multiplying the number of 'switched' cycle kilometres by the casualty rate for each casualty type. This identifies the number of casualties averted by the canals; and
- multiplying the number of casualties saved by the cost per casualty in 2010 prices.

Table 6 summarises the findings of the above steps.

Table 6: Annual Value of Casualties Saved by the Canal Towpaths

Casualty Type	No. of Casualties Saved	Cost per Casualty (2010 Prices) ⁴	Savings
Killed	0.04	£1,658,782	£64,645

⁴ Reported Road Casualties Scotland 2009 (The Scottish Government, 2009), p. 99.

Seriously Injured	0.62	£186,393	£115,399
Slightly Injured	2.76	£14,375	£39,622
Total	3.41		£219,667

In proportional terms, it is estimated that:

- 46% (£101k) can be attributed to the urban section of the Union Canal;
- 32% (£70k) can be attributed to the urban section of the Forth & Clyde Canal;
- 14% (£31k) can be attributed to the rural section of the Union Canal; and
- 8% (£17k) can be attributed to the rural sections of the Forth and Clyde Canal.

The benefits presented above offer a reduction of between three and four cycling casualties per annum, with a “Killed or Seriously Injured” casualty avoided on average in 2 years out of every 3.

Our analysis also indicates that over **1 million** cycling kilometres per annum are transferred from on-street routes to the safer towpaths of the four sections of the canal network included in this survey. This is made up of over 500,000 km per annum on-street cycling removed by the urban section of the Union Canal, over 350,000 km per annum removed by the urban section of the Forth & Clyde and around 150,000 km and 90,000 km using the corresponding rural sections respectively.

The findings of this analysis support the argument that the canal towpaths actively contribute towards travel safety. It can be argued that further investment in the quality of the towpaths (eg tarmac, drainage, towpath width etc) could play some part in encouraging more cyclists to move from roads onto the canalside. Further research would be required to identify the extent to which towpath investment would encourage cyclists to switch route.

In addition, a number of respondents pointed out that the towpath is a safe environment for teaching children to cycle. This in turn potentially contributes to promoting safe and active lifestyles at a young age, breeding good habits for the future.

Air Quality Benefits

Air quality is becoming an increasingly prominent issue in government policy – poor air quality contributes to many early deaths each year and is a factor in conditions such as asthma, heart disease and cancer. The canals generally represent areas of good air quality and provide a corridor of clean air into the heart of Scotland’s two largest cities.

Recognising the importance of air quality impacts, we have attempted to identify the positive benefits that the canals provide in this area. The air quality benefits of the canals accrue to those identified in the survey who were travelling for a specific purpose and who reported that they would have made the same walking / cycling journey by a different route.

Before outlining the benefits of air quality on the canals, it is important to outline the key assumptions in our analysis. These are:

- the alternative routes to the canal towpath are again assumed to be made using the road network parallel to the canals;
- the air quality benefits are only assumed on the urban sections of the two canals, as roadside air quality is not an issue in rural areas;
- the length of the alternative route is assumed to be the same as the canal route (this is likely to underestimate the canal air quality benefits since, on both sections of urban canal, significantly more people noted that the alternative route would have been longer than shorter. However, it is not easy to quantify this under-estimation of the benefits); and
- it is assumed that the air quality on parallel urban routes is significantly poorer than the canal towpath – this will not always be the case.

Our analysis has estimated the amount of additional time that towpath users spend in ‘clean air’ as opposed to ‘polluted air’. Unfortunately, it is not possible to monetise these benefits at this juncture.

Based on the assumptions outlined above, Table 7 below summarises the reduction in the number of hours spent walking, running or cycling in the poor air quality in the road corridors parallel to the urban sections of the two canals.

Table 7: Reduction in Time Spent in Poor Air Quality (Person hours per annum)

Canal Section	Mode	Reduction in exposure to poor air quality (Person Hours per annum)
Forth and Clyde Urban	Walk	22,188
	Run	-
	Cycle	14,855
	Total	37,043
Union Canal Urban	Walk	26,247
	Run	543
	Cycle	21,108
	Total	47,898
Urban Combined	Walk	48,435
	Run	543
	Cycle	35,963
	Grand To	84,941

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The values suggest that the two sections of urban canal towpath reduce exposure to the poor air quality in the parallel road corridors by over 48,000 hours of walking time and almost 36,000 of cyclist-hours. This is a significant saving and clearly demonstrates the benefit of the canals as part of the wider urban path network.

Absenteeism

Increased physical exercise is also proven to have a positive effect on reducing levels of absenteeism at work. This section outlines the quantified estimate of additional exercise undertaken on the canal on levels of absenteeism.

The Department for Transport’s (DfT) WebTAG guidance was used to calculate the benefits of the canals in terms of reduced absenteeism. WebTAG is the standard dataset used for transport appraisals and can thus be considered robust. The guidance explains that taking 30 minutes of exercise five days per week reduces absenteeism by an amount equal to 0.4% of gross salary costs. So for example, assuming a person works 48 weeks per year, they would have to walk 7,200 minutes in a year for the employer to benefit from the 0.4% reduction in gross salary costs.

Confederation of British Industry figures suggest that the gross costs to the employer of one day off work is £88.82. Of those surveyed here, 70% were in employment.

Using the above figures, the benefits of this additional exercise on absenteeism are estimated to be as shown in Table 8.

Table 8: Benefits of the Canals in terms of Absenteeism

Mode of Travel	Absenteeism Benefit (£ / annum)
Cycling	£18,700
Running	£5,300
Walking	£52,900
TOTAL	£76,900

Table 8 illustrates that physical activity undertaken on the canals offer employers a **direct financial saving of almost £77k per annum**. In addition, there are, at present, unquantifiable benefits in terms of improved productivity.

Attitudinal Views towards the Canals

As part of the survey programme, users were asked about their general views of the health benefits of the canals. Respondents were asked to consider ten statements related to the canals and public health and indicate their level of satisfaction (ranging from “Strongly Agree” to “Strongly Disagree”). Key headlines to emerge include:

- 81% of canal users either “Strongly Agree” or “Agree” that the canal encourages them to take more exercise;
- 57% of respondents either “Strongly Agree” or “Agree” that the presence of the canal encourages them to walk / cycle to work;
- 91% of respondents either “Strongly Agree” or “Agree” that the canal enhances their sense of personal wellbeing; and
- 86% of respondents either “Strongly Agree” or “Agree” that the presence of the canal encourages them to visit the outdoors more often.

Wider Benefits of Scotland’s Canals

While canals generate health benefits that can be monetised, they also offer a wide range of additional benefits over and above a simple money value. Investment in the canal network has, in many respects, been focused on improving the quality of the greenspace and health related facilities on the canal. Canal groups, including Scottish Canals and The Waterways Trust Scotland, have worked extensively to actually make use of the canal for health related activities – excellent examples of this include the Community Canal Liaison Officer and Green Action. Efforts are also being made to promote community cohesion and social wellbeing amongst communities through canal events. In summary, there is a strong evidence base to suggest that the canals are making a substantial contribution to the health and wellbeing of the Scottish population.

What does this all mean for appraising active travel investment?

It has been argued that investment in cycling and walking facilities has suffered due to a suggested bias in traditional transport appraisal methodology and guidance. For example, appraisal and modelling techniques have favoured road projects due to the ability to measure, value and monetise the benefits, mainly through improvements in journey times. For cycling and walking projects it has been more difficult to capture the benefits using conventional appraisal techniques. This study shows that the benefits of active travel can be estimated and monetised. This should provide a facility to enable a more accurate estimate of the true benefits of cycling and walking schemes and allow a like-for-like comparison with the value for money generated by investment in other schemes.

Conclusion

This paper has set out the positive health impacts of Scotland’s Lowland Canal network. The wide ranging analysis undertaken has established that the canals generate health benefits in terms of increased physical activity; safety; air quality; and social and community cohesion.

In quantitative terms, the canals deliver:

- almost 3.9 million additional person kilometres of travel per annum, equating to a **physical health benefit of £6.4 million per annum**;
- the towpaths remove over 1 million cycle kilometres from the roads, with an **annual safety benefit of £220k**;
- additional physical activity on the canal leads to a **£77k direct reduction in employer costs through reduced absenteeism**. There are also wider, but as yet unquantifiable benefits, in terms of **increased productivity**.
- The canals **reduce exposure to poor air quality by almost 85,000 hours per annum**;

In addition, investment in the canals and canal related activities are successfully promoting improved public health. As well as encouraging physical activities, social enterprises are engaging hard to reach groups including those with special needs, young people, and the elderly. Scottish Canals and their partners are also arranging numerous canal focused community events, promoting community cohesion and social wellbeing.

Looking forward, the approach adopted in this study is transferable and can be applied in support of other walking and cycling schemes or policies. The methodology clearly demonstrates that active travel delivers various quantifiable health benefits that can strengthen the case for investment...or as one survey respondent put it, “the health benefits of using the canal are many!”