Commuter Cycling Weather in Belfast

Abstract

The British Isles, and particularly the north and west, is traditionally associated with wet weather. This perception leads to a typical view that cycling in Northern Ireland is a risky endeavour because of rain. With Government efforts to increase the level of cycling – particularly as an everyday activity for shorter journeys – the question arises as to whether this is a feasible objective in terms of the weather. This study considers a commuting journey of 2½ miles between a residential area of Belfast and the city centre which took, typically, 15 minutes in the morning and late afternoon. Over a period of one calendar year (2015), the weather conditions were recorded and classified according to ground conditions and levels of precipitation. The results of the study confirm that Belfast is a damp city. However, they also show that, although ground conditions are often damp, only about one in six of the journeys in the study were affected by precipitation – over 85% of journeys were 'rain free'.

Introduction

In discussions about commuter cycling or cycling for everyday reasons there are a number of factors that are frequently mentioned as reasons why people do not cycle. Generally, the most frequently cited is 'safety concerns' but high on the list is 'poor weather'. In a 2014 Transport for London study, 22% of cyclists indicated 'poor weather' as something that stopped them cycling for trips other that sport, fun or exercise[1]. In the same study, 25% of respondents gave 'poor weather' as a reason why they were put off cycling more[2]. Also in 2014, the Department for Regional Development in Northern Ireland published a report which indicated that 19% of people gave 'bad weather' as a barrier that discouraged them from cycling short distances (less than three miles)[3] – the figure in 2011 was 24%.

The climate of the British Isles is notoriously changeable[4]. The western and northern parts tend to lie close to the normal path of the Atlantic depressions with the result that, in those parts, winters tend to be mild and stormy while the summers are mostly cool and windy. The mountains in these regions produce a marked increase in rainfall. Overall, the south is usually warmer than the north, and the west is wetter than the east. The more extreme weather tends to occur in mountainous regions where it is often cloudy, wet and windy[5]. In Northern Ireland, the climate is characterised by equability, a consequence of the moderating effects of the Atlantic Ocean – bringing relatively mild winters and cool summers. However, the indented shape of the coastline and the presence of high ground introduce localised differences in temperature, cloud and precipitation[6].

Bad weather takes many forms including cold temperatures, wind conditions, precipitation (rain, sleet and snow) and ice. As indicated previously, extremes of weather are fairly rare in Northern Ireland and very cold temperatures and snow are infrequent. In terms of cycling, weather conditions can have various impacts. For example, windy conditions may require additional effort on the journey (or less, if it is a tailwind). On the other hand, precipitation can leave an individual wet and uncomfortable for a prolonged period of time after the journey is completed. Although views of bad weather can be subjective, of the four factors mentioned above, it is considered that precipitation is the most problematical for people who want to use a bicycle.

Rainfall in Northern Ireland varies widely. The wettest places are in the upland area in the extreme west of County Tyrone (annual average reaches about 2000 mm) while the driest places are around Strangford Lough and near the southern and eastern shores of Lough

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[1] http://content.tfl.gov.uk/attitudes-to-cycling-2014-report.pdf, page 30.

[2] Ibid, page 60.

[3] https://www.drdni.gov.uk/sites/default/files/publications/drd/public-awareness-of-travelwise-ni-initiatives-may-2014.pdf, page 18.

[4] http://www.metoffice.gov.uk/media/pdf/b/d/MetLIB_13_001_Factsheet_4.pdf, page 3.

[5] Ibid, page 4.

[6] http://www.metoffice.gov.uk/climate/uk/regional-climates/ni.

Neagh (annual totals are around 800 mm). October to January are wettest and the late spring and early summer months the driest. Over much of Northern Ireland, the number of days with a rainfall total of 1mm or more ('wet days') tends to follow a pattern similar to the monthly rainfall totals. In higher parts, over 55 days is the norm in winter (December to February) and over 45 days in summer (June to August). In the driest areas in the east, fewer than 45 days in winter and about 35 days in summer are typical[7].

Data for the Met Office Belfast Newforge climate station (1981 – 2010 average figures) indicate that there are, on average, 156 days annually when there is total rainfall in excess of 1mm[8]. This represents 43% of days. However, the total amount of rainfall annually is less than 950mm. These two factors result in relatively little rainfall being spread relatively thinly increasing the relative risk of being rained on at some point on a given day.

The annual Travel Survey for Northern Ireland contains information about trends in personal travel for Northern Ireland residents. The most recent report covers the calendar years 2012 – 14. Among other things, this report provides information on the length of the various journeys undertaken by people during the year[9]. The results are summarised below.

Length of journey

- Less than 1 mile (14.0%)
- 1 - 2 miles (19.2%)
- 2 - 5 miles (29.4%)
- Over 5 miles (37.4%)
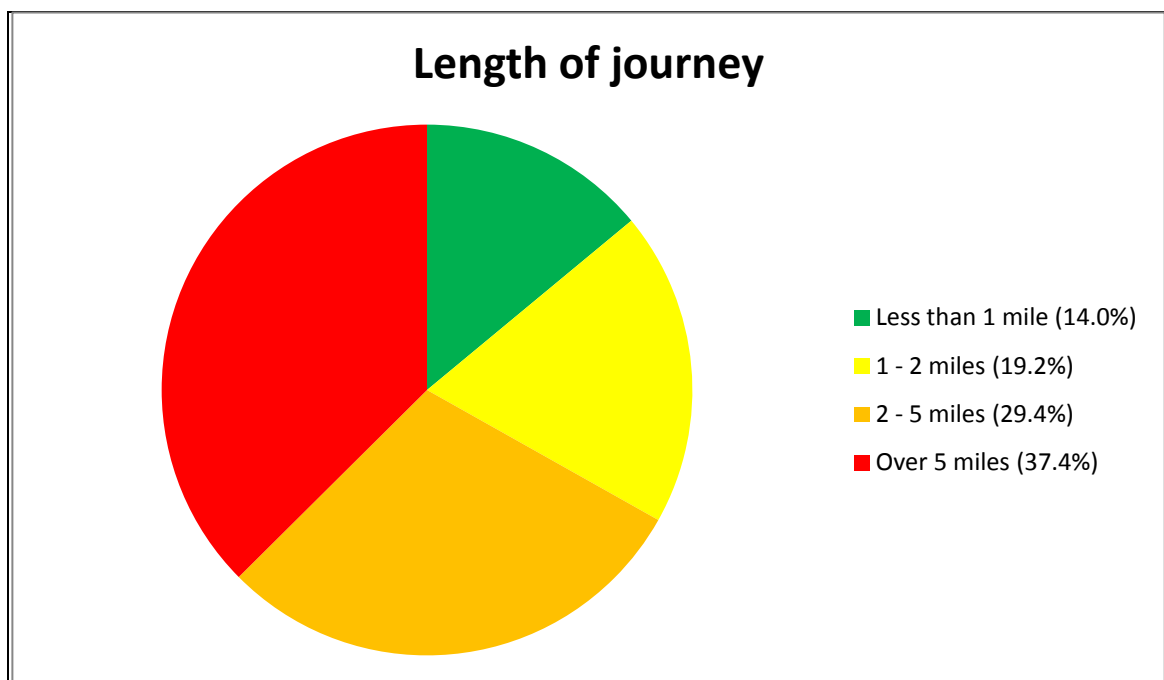
33% of the journeys undertaken by people in Northern Ireland are less than 2 miles in length. Such journeys could be cycled in 10 – 15 minutes. In Northern Ireland, the Bicycle Strategy published in August 2015 is focussed on increasing the number of everyday

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[7] Ibid.

[8] http://www.metoffice.gov.uk/public/weather/climate/gcey2u2yw.

[9] https://www.drdni.gov.uk/sites/default/files/publications/drd/travel-survey-for-northern-ireland-in-depth-report-2012-2014.pdf, page 18

journeys that are cycled by encouraging people to use the bicycle for shorter journeys[10] – i.e. journeys of up to 15 minutes duration.

The reality that Northern Ireland has a high proportion of days where there is precipitation and that this precipitation is 'spread out' creates the situation that the weather may be as often 'going to rain' as it is actually raining. It raises the question as to how likely it is that a person travelling by bicycle will get wet on a 15 minute journey.

This study seeks to investigate the issue of precipitation for a commuter cyclist in Belfast over the course of one year (2015). It provides information on one cyclist's journey to and from work nominally between the hours of 8.0 – 9.0 am and 5.0 – 6.0 pm.

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[10] https://www.drdni.gov.uk/sites/default/files/publications/drd/a-bicycle-strategy-for-northern-ireland.pdf, page 36.

Materials and Methods

The study was concerned with the 2½ mile journey from a residential area off Holywood Road in the east of Belfast to a place of employment at Alfred Street in Belfast city centre (and the 2½ mile return journey). The time of the morning journey was generally between the hours of 8.0 and 9.0 am. The evening journey was generally between the hours of 5.0 and 6.0 pm. The starting and finishing time of each journey was noted to the nearest minute using the time displayed on a mobile phone. These were the times when the bicycle was mounted at the start of the journey and dismounted at the end.

The main part of each journey (almost 90%) was on the busy arterial route: Holywood Road – Albertbridge Road – East Bridge Street. The starting point in the morning was at an elevation of 90 feet and the route descended to about 10 feet over the first ¾ of a mile. The remaining journey was on relatively level ground. The evening journey was the reverse.

On the route into the city centre there were four sections of bus lane totalling almost 1.1 miles (over 40% of the route). There were ten sets of traffic lights and nine signal-controlled crossings. On the route out of the city centre there was a 300 yard section of shared footway / cycleway on Albertbridge Road and four sections of advisory cycle lane totalling 0.6 miles (almost 25% of the route). There were nine sets of traffic lights and eight signal-controlled crossings.

The precipitation conditions were noted by observation for each journey throughout the journey. The conditions were recorded using the classifications in Table 1.

Category	Sub-category	Description
Dry		No precipitation throughout the journey and the ground was dry
Damp	1	No precipitation throughout the journey but the ground was largely damp
	2	No precipitation throughout the journey but the ground was wet from earlier rain with puddles in various places
	3	Some intermittent spitting during part of the journey but insufficient to wet clothes
	4	Light or intermittent rain / spitting during the journey but insufficient to wet waterproofs
Rain		Rain throughout the journey
Table 1: Precipitation classifications		

This classification was adopted because of the changeable maritime climate where there is a lot of moisture in the air even when there is little rain. Weather conditions in Northern Ireland are not simply 'wet' or 'dry' but often 'damp' (to varying degrees).

The classification was determined entirely by observation and was therefore, to some extent, subjective. For example, there were a small number of days where half of the ground was dry and half damp. Was this 'Dry' or 'Damp[1]'? Sub-dividing of the 'Damp' category was done to provide more information about the damp climate of Northern Ireland. It was designed to reflect the situation where the weather could appear to be 'wet' even though it might not have been raining – this was more often the case in the winter.

When the journey outlined above was undertaken (and at least part of the journey was) between the relevant hours, these journeys were categorised as 'BICYCLE COMMUTE'. There were a small number of days when the commute was undertaken between 8.0 – 9.0 am or 5.0 – 6.0 pm by means other than bicycle (private car or public transport). These journeys were categorised as 'OTHER COMMUTE'. On a number of days a journey was undertaken in Belfast between 8.0 – 9.0 am or between 5.0 – 6.0 pm but not on the commuting route (e.g. due to the subject attending work meetings in other parts of Belfast). These journeys were categorised as 'BICYCLE OTHER'. Both these later types of journeys were included in the analysis.

Observations of the weather were also made during the hours 8.0 – 9.0 am and 5.0 – 6.0 pm on days when the commuting journey was undertaken outside these hours. These journeys were categorised as 'NO COMMUTE'. An additional analysis included this data to provide a more complete picture for the year.

On various days, either on business or leave, the subject was out of Belfast and no observations could be made (categorised as 'NO DATA') – these days were excluded from the analysis although they were recorded.

Data was only collected on weekdays (Monday, Tuesday, Wednesday, Thursday and Friday). No data was collected at the weekend (Saturday and Sunday). Given that data was not available for every weekday, the results were scaled up to provide 'full year' annual figures.

A hybrid city bicycle with 24-speed gears was used for every journey throughout the study. Various items of equipment and various goods were also carried in panniers.

Results

The aim was to record data for each morning and evening of the weekdays during the period 1st January – 31st December 2015 (261 days). The maximum number of journeys possible was, therefore, 522. However, as indicated previously, this was not always possible owing to holidays and other work commitments. The Table 2 categorises the availability of data by month: 'BICYCLE COMMUTE', 'OTHER COMMUTE' and 'BICYCLE OTHER' is data collected when travelling between 8.0 – 9.0 am and 5.0 – 6.0 pm; 'NO COMMUTE' is data collected by observing weather conditions in Belfast during those hours when not travelling; 'NO DATA' relates to occasions where data could not be collected.

	BICYCLE COMMUTE		OTHER COMMUTE		BICYCLE OTHER		All commutes		NO COMMUTE		All with data		NO DATA		TOTAL
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	
January	16	18	1	1	1	0	18	19	4	3	22	22	0	0	44
February	16	16	2	1	0	0	18	17	2	2	20	19	0	1	40
March	17	13	0	1	3	3	20	17	2	4	22	21	0	1	44
April	13	12	0	0	0	0	13	12	6	6	19	18	3	4	44
May	15	17	0	0	1	0	16	17	3	3	19	20	2	1	42
June	12	14	1	0	2	2	15	16	5	3	20	19	2	3	44
July	6	6	0	0	0	0	6	6	2	1	8	7	15	16	46
August	18	17	0	0	0	0	18	17	2	0	20	17	1	4	42
September	18	17	1	0	0	1	19	18	2	2	21	20	1	2	44
October	16	17	1	0	0	0	17	17	1	1	18	18	4	4	44
November	16	15	0	0	0	2	16	17	5	4	21	21	0	0	42
December	11	12	1	0	3	1	15	13	7	8	22	21	1	2	46
2015	**174**	**174**	**7**	**3**	**10**	**9**	**191**	**186**	**41**	**37**	**232**	**223**	**29**	**38**	**522**
	66.7%		1.9%		3.6%		**72.2%**		14.9%		**87.2%**		12.8%		100.0%
Table 2: Availability of data by journey type															

During 2015 the commuting journey was made into Belfast on 174 occasions and the return commuting journey on 174 days (348 journeys in total). In addition, 29 comparable journeys were made in Belfast at the relevant commuting times. The data indicates that commuting data was collected for 377 journeys (72% of the total) and proxy data (i.e. conditions observed when no journey was undertaken) for a further 78 journeys (15% of the total). No data was available for 67 commuting times (13% of the total).

The time taken for each journey was variable. The Table 3 presents the earliest, latest, mean, mode and median departure and arrival times for the journeys to and from the city centre and similar data for the duration of the journeys.

	MORNING	EVENING
Earliest departure time	07:47	16:49
Mean departure time	08:13	17:33
Modal departure time	08:16	17:40 / 17:45
Median departure time	08:13	17:37
Latest departure time	08:58	18:00
Earliest arrival time	08:01	17:04
Mean arrival time	08:28	17:48
Modal arrival time	08:31	17:58
Median arrival time	08:28	17:53
Latest arrival time	09:13	18:15
Shortest journey time	11 minutes	12 minutes
Mean journey time	15 minutes	16 minutes
Modal journey time	14 minutes	15 minutes
Median journey time	15 minutes	16 minutes
Longest journey time	19 minutes	20 minutes
Table 3: Journey times		

The precipitation conditions are set out in Table 4 for each commuting journey – for both morning and evening journeys. Journeys categorised as 'Dry', 'Damp[1]' or 'Damp[2]' are grouped together as 'DRY' because during these journeys no precipitation fell although ground conditions were sometimes wet. 'Damp[3]' is considered as 'BORDERLINE' as some precipitation fell although insufficient to wet clothes. 'Damp[4]' and 'Rain' are grouped together as 'WET' because precipitation fell throughout these journeys although of various intensities.

| | MORNING – COMMUTES | | | | | | | AFTERNOON – COMMUTES | | | | | | |
| | DRY | | | BORDERLINE | WET | | | DRY | | | BORDERLINE | WET | | |
	Dry	Damp[1]	Damp[2]	Damp[3]	Damp[4]	Rain	TOTAL	Dry	Damp[1]	Damp[2]	Damp[3]	Damp[4]	Rain	TOTAL
January	2	7	5	4	0	0	18	7	1	6	0	4	1	19
February	1	9	5	2	1	0	18	8	5	4	0	0	0	17
March	6	5	3	2	0	4	20	12	0	3	1	0	1	17
April	9	3	0	0	0	1	13	10	2	0	0	0	0	12
May	11	3	1	0	0	1	16	10	4	2	1	0	0	17
June	13	1	1	0	0	0	15	14	1	1	0	0	0	16
July	4	1	0	1	0	0	6	4	1	0	0	1	0	6
August	10	2	2	1	2	1	18	11	3	2	1	0	0	17
September	14	3	0	1	0	1	19	16	1	0	0	1	0	18
October	11	1	2	2	1	0	17	12	1	0	2	1	1	17
November	4	6	4	0	1	1	16	3	4	8	2	0	0	17
December	1	4	8	1	0	1	15	4	3	2	0	1	3	13
2015	**86**	**45**	**31**	**14**	**5**	**10**	**191**	**111**	**26**	**28**	**7**	**8**	**6**	**186**
	45.0%	23.6%	16.2%	7.3%	2.6%	5.2%		59.7%	14.0%	15.1%	3.8%	4.3%	3.2%	
	84.8%			7.3%	7.9%			88.7%			3.8%	7.5%		
Table 4: Precipitation conditions for commuting journeys														

Table 5 sets out the proxy data for the cases where observational data was obtained (when journeys were not made 8.0 – 9.0 am or 5.0 – 6.0 pm).

	MORNING – PROXY (OBSERVED) DATA							AFTERNOON – PROXY (OBSERVED) DATA						
	DRY			BORDERLINE	WET			DRY			BORDERLINE	WET		
	Dry	Damp[1]	Damp[2]	Damp[3]	Damp[4]	Rain	TOTAL	Dry	Damp[1]	Damp[2]	Damp[3]	Damp[4]	Rain	TOTAL
January	0	0	3	1	0	0	4	0	1	0	1	1	0	3
February	1	1	0	0	0	0	2	1	1	0	0	0	0	2
March	0	1	1	0	0	0	2	2	1	0	1	0	0	4
April	6	0	0	0	0	0	6	4	0	0	2	0	0	6
May	2	1	0	0	0	0	3	3	0	0	0	0	0	3
June	3	0	0	0	0	2	5	3	0	0	0	0	0	3
July	2	0	0	0	0	0	2	1	0	0	0	0	0	1
August	2	0	0	0	0	0	2	0	0	0	0	0	0	0
September	1	1	0	0	0	0	2	2	0	0	0	0	0	2
October	1	0	0	0	0	0	1	1	0	0	0	0	0	1
November	0	1	4	0	0	0	5	1	0	1	1	1	0	4
December	0	3	3	0	0	1	7	0	1	2	1	1	3	8
2015	**18**	**8**	**11**	**1**	**0**	**3**	**41**	**18**	**4**	**3**	**6**	**3**	**3**	**37**
	43.9%	19.5%	26.8%	2.4%	0.0%	7.3%		48.6%	10.8%	8.1%	16.2%	8.1%	8.1%	
	90.2%			2.4%	7.3%			67.6%			16.2%	16.2%		
Table 5: Precipitation conditions for commuting times when no journey was made														

Table 6 combines all the data from the Tables 4 and 5.

| | MORNING – ALL DATA | | | | | | | AFTERNOON – ALL DATA | | | | | | |
| | DRY | | | BORD ERLINE | WET | | | DRY | | | BORD ERLINE | WET | | |
	Dry	Damp[1]	Damp[2]	Damp[3]	Damp[4]	Rain	TOTAL	Dry	Damp[1]	Damp[2]	Damp[3]	Damp[4]	Rain	TOTAL
January	2	7	8	5	0	0	22	7	2	6	1	5	1	22
February	2	10	5	2	1	0	20	9	6	4	0	0	0	19
March	6	6	4	2	0	4	22	14	1	3	2	0	1	21
April	15	3	0	0	0	1	19	14	2	0	2	0	0	18
May	13	4	1	0	0	1	19	13	4	2	1	0	0	20
June	16	1	1	0	0	2	20	17	1	1	0	0	0	19
July	6	1	0	1	0	0	8	5	1	0	0	1	0	7
August	12	2	2	1	2	1	20	11	3	2	1	0	0	17
September	15	4	0	1	0	1	21	18	1	0	0	1	0	20
October	12	1	2	2	1	0	18	13	1	0	2	1	1	18
November	4	7	8	0	1	1	21	4	4	9	3	1	0	21
December	1	7	11	1	0	2	22	4	4	4	1	2	6	21
2015	**104**	**53**	**42**	**15**	**5**	**13**	**232**	**129**	**30**	**31**	**13**	**11**	**9**	**223**
	44.8%	22.8%	18.1%	6.5%	2.2%	5.6%		57.8%	13.5%	13.9%	5.8%	4.9%	4.0%	
	85.8%			6.5%	7.8%			85.2%			5.8%	9.0%		
Table 6: Precipitation conditions for all commuting times where data was available														

Table 6 indicates that while the percentage of mornings that were 'DRY' was almost the same as the percentage of evenings that were 'DRY', morning conditions were damper. In the morning, conditions were 45% 'dry' and 41% 'damp' – in the evening they were 58% 'dry' and 27%

'damp'. Although not evident from the data presented in the table, an examination of the raw data indicated that there were no days during 2015 when precipitation conditions were both 'WET' in the morning and 'WET' in the evening.

The data from Tables 4 and 5 is summarised in Table 7 – the six precipitation categories and the three broad categories of 'DRY', 'BORDERLINE' and 'WET' are presented (with the scaled up total for the year) and the percentages that these represent of the total. Table 7 shows that a little over half of journeys were undertaken in completely dry conditions. It further shows that around one third of journeys were undertaken in conditions where the ground was damp or wet. These figures together indicate that 85% of journeys were undertaken when there was no precipitation. This indicates the likelihood of some precipitation on three journeys (out of 20) over a two week period.

	Dry	Damp[1]	Damp[2]	Damp[3]	Damp[4]	Rain	**DRY**	**BORDERLINE**	**WET**	TOTAL
Commutes	197	71	59	21	13	16	**327**	**21**	**29**	377
	52.3%	18.8%	15.6%	5.6%	3.4%	4.2%	**86.7%**	**5.6%**	**7.7%**	
Non commutes	36	12	14	7	3	6	**62**	**7**	**9**	78
	46.2%	15.4%	17.9%	10.0%	3.8%	7.7%	**79.5%**	**9.0%**	**11.5%**	
ALL	233	83	73	28	16	22	**389**	**28**	**38**	455
	51.2%	18.2%	16.0%	6.2%	3.5%	4.8%	**85.5%**	**6.2%**	**8.4%**	
SCALED UP	280	92	75	32	19	24	**447**	**32**	**43**	522
	53.6%	17.6%	14.4%	6.1%	3.6%	4.6%	**85.6%**	**6.1%**	**8.2%**	
Table 7: Summary of precipitation conditions by precipitation categories scaled up to full year figures										

Figure 1 illustrates the availability of data by month (from Table 2) with the observed precipitation conditions (from Table 6) according to the six categories. Figure 2 presents the same data by the three broader categories. Figure 3 presents the data from Figure 2 scaled up for the full year as summarised in Table 7.
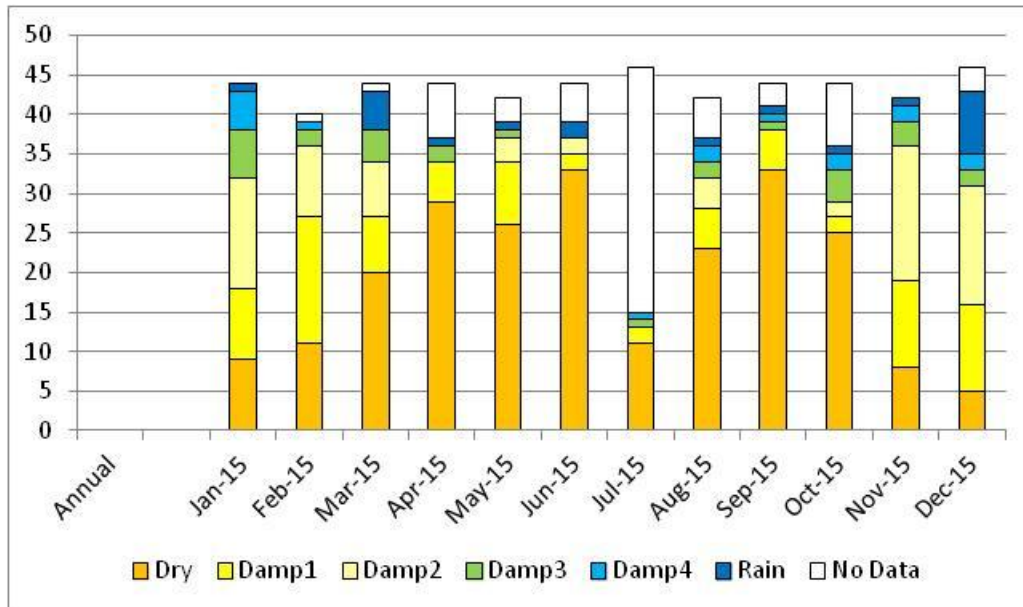

Figure 1: Availability of data and precipitation conditions for each month by total days observed and precipitation classification
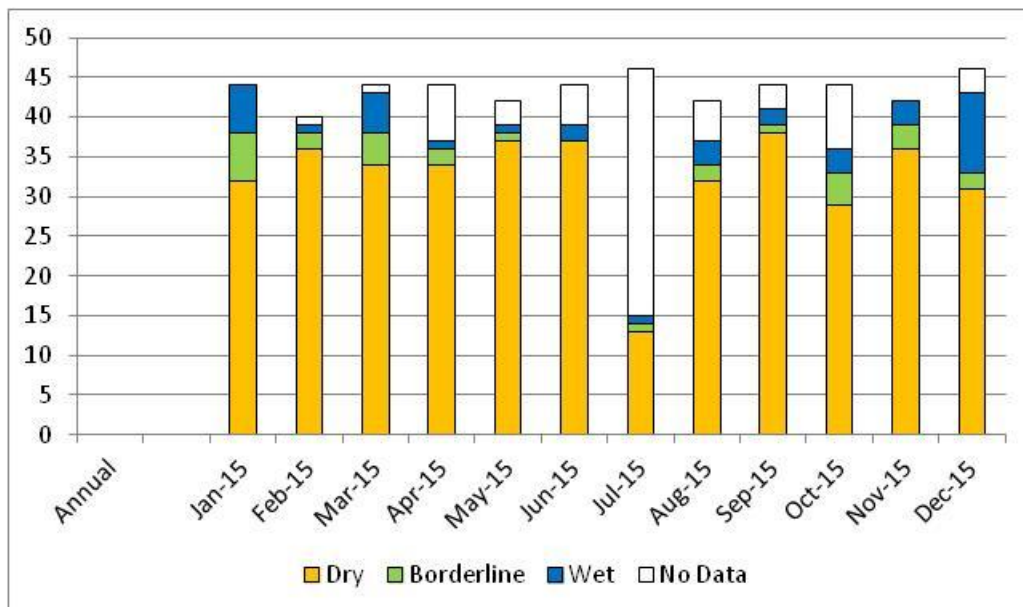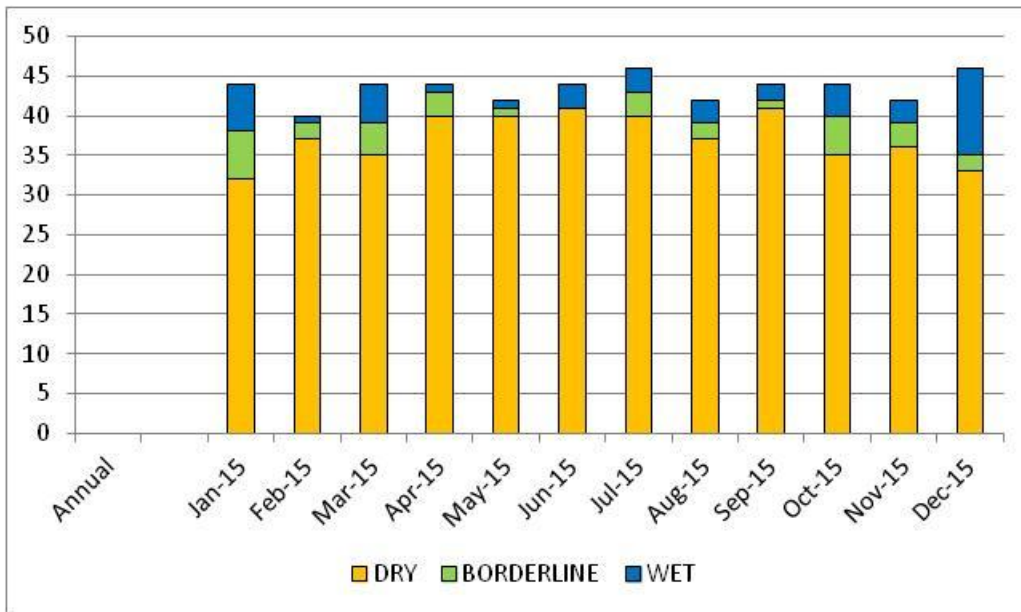

Figure 2: Availability of data and precipitation conditions for each month by total days observed and broad precipitation classification

Figure 3: Availability of data and precipitation conditions for each month by total days observed and broad precipitation classification scaled up for the full year

Using the data in Table 6 and setting aside journeys times where no data was available, Figures 4 and 5 show in percentage terms the precipitation conditions for each month. Figure 4 uses the six precipitation classifications from Table 1 and Figure 5 uses the broad classifications identified in Tables 4 – 7.
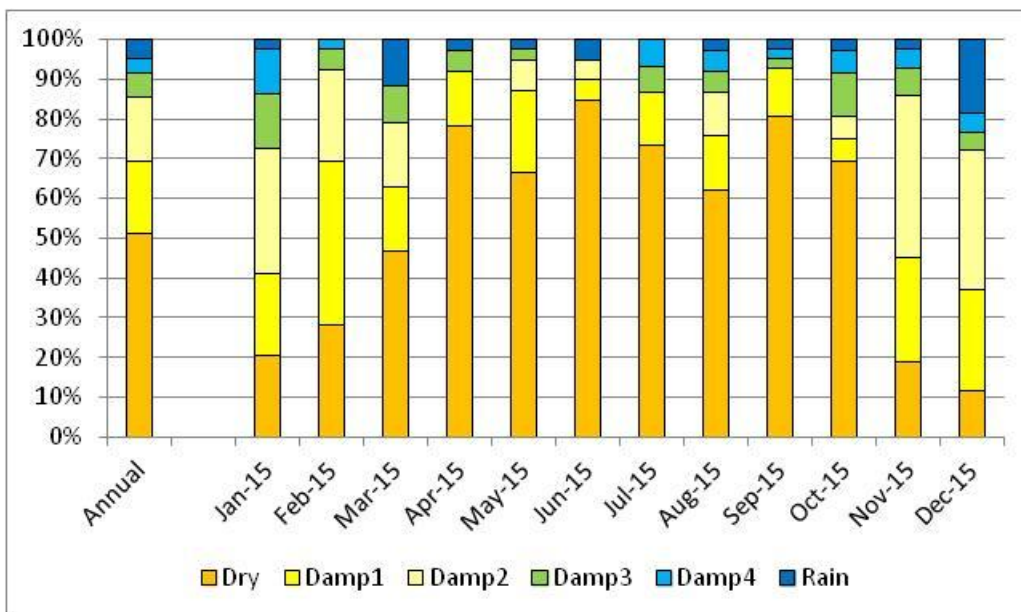

Figure 4: Frequency of precipitation conditions by month and for the full year
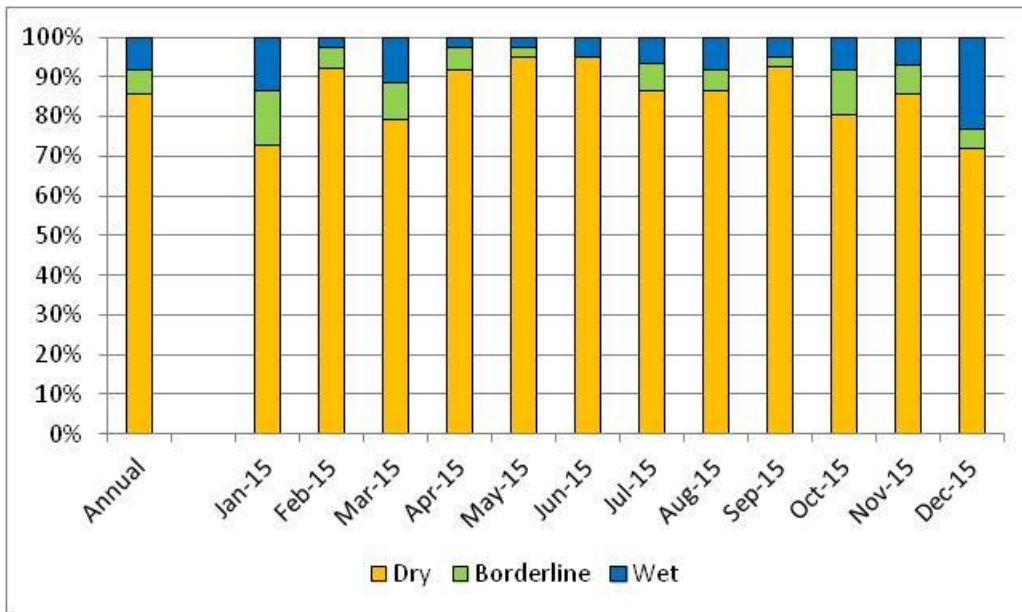
Figure 5: Frequency of broad precipitation conditions by month and for the full year

Discussion

There is a degree of subjectivity in the observations of this study. Some of this is down to the prevailing climate in Northern Ireland where there is a very broad range of conditions. The splitting of the 'Damp' category into four subgroups was an attempt to mitigate this subjectivity by, first of all, drawing attention to the difficulty and, secondly, thinning it out so that the truly 'borderline' conditions could be identified. However, the terminology used to categorise the precipitation conditions might suggest that there are six discrete types into which journey conditions can be easily classified. This is not the case. The actual conditions could be any one of a continuous range from dry to wet. In the winter time with lower temperatures, the ground can remain damp all day and there be no rain at all. In the summer it can be spitting for a lengthy period yet the ground never gets wet (nor do clothes). There is no sharp boundary between 'Dry' and 'Damp[1]' or any of the other categories – it is more a matter of observational judgement whether the ground is 'essentially' dry or 'largely damp'. This subjectivity can be particularly the case for the category 'Damp[3]' where on many occasions there is slight spitting throughout the journey but neither an umbrella in sight nor a car using windscreen wipers. The study attempted to deal with the subjectivity by erring on the 'wet' side. In other words, the ground needed to be almost completely dry to be categorised as 'Dry'; to have at least some patches of dry ground to be categorised as 'Damp[1]'; to have no precipitation at all during the journey to be categorised as 'Damp[2]'.

The information in Table 7 indicates that over 50% of the journeys undertaken were in 'Dry' conditions. Almost 45% were in a variety of 'Damp' conditions. 5% were in 'Rain' conditions. This fits in with the general perception that Northern Ireland is 'wet' even though it is 'damp' rather than 'wet'. This table also shows that in most of those cases of 'Damp' conditions, the dampness relates to ground conditions rather than precipitation – 156 of the 200 'Damp' conditions were 'Damp[1]' or 'Damp[2]'. It is this point that significantly increases the number of occasions when it is possible to make the journey 'Dry'.

The primary conclusion of the study is that 85% of journeys cycled during 2015 were undertaken when it was not raining – i.e. better than five out of six journeys (Table 7). Proxy data collected on days when no journey was undertaken during the relevant hours produced a lower figure (about 80% or four out of five journeys). The lower figure for proxy days may be the result of a number of factors. Firstly, a slightly higher proportion of proxy data (43 out of 78 or 55%) was obtained during the six wetter months (January – March and October to December). Secondly, the weather was observed over the full hour rather than the 15 minute journey time so the likelihood of precipitation given its nature in Northern Ireland (little and often) would have been higher. However, combining both sets of data together does not materially affect the overall result (the combined figure of 85.5% is still better than five journeys out of six). These figures should be seen against a backdrop of

2015 being wetter than average in Northern Ireland[11]. December 2015 was also one of the wettest months on record in Northern Ireland[12].

In this study it was not possible to collect data for every journey. However, the journey outlined was undertaken on 348 occasions (exactly two thirds of the maximum possible – 522) and 29 similar journeys made during the relevant periods brings the total to 377 (72.2% of the maximum possible). The observation of conditions on a further 78 occasions to supplement this data provides information for 455 occasions (87.2% of the maximum possible – or data for seven out of eight occasions). Data was missing for 67 journeys. The bulk of the 'missing data' (46 occasions or 68.7% of the total) was during the driest four month period of the year (April – July): 31 occasions were in July (46.3%). The high level of coverage across the year (i.e. 87.2%) and the fact that the bulk of the 'missing data' is in the drier months provides reasonable confidence that the 85% 'DRY' figure is not an overstatement.

A significant influence on the figures is the length of the journey undertaken. The information in Table 3 was collected using a mobile phone which displayed hours and minutes – the times recorded therefore have an accuracy of ± 1 minute. Looking at the shortest and longest journey times and the mean indicate that the morning journey took 15 ± 4 minutes and the evening journey was on average one minute longer at 16 ± 4 minutes. The difference is accounted for by the fact that about one fifth of the morning journey was downhill whereas about one fifth of the evening journey was uphill. To make the journey without rain requires a maximum dry period of 20 minutes (and sometimes less). As the journey length increases, the dry period required increases with the result that the likelihood of rain increases in the 'spread out' precipitation climate of Belfast. On the other hand, a shorter journey will require a shorter 'dry' period. The data from this study is particularly relevant for journeys of similar length in Belfast.

The issue of a 'dry' period is generally a more relevant factor when the precipitation conditions are damp – particularly $Damp^2$, $Damp^3$ or $Damp^4$ ($Damp^1$ conditions relate to a situation where earlier rain is 'drying up'). These account for 24.1% of all journeys. In $Damp^2$ and $Damp^3$ rain is 'in the air' (although not always heavy rain) and in $Damp^4$ rain is 'on and off'. In these situations the conditions could change either way – 'dry' or 'wet' is quite reliant on the starting time for the journey where starting ten or fifteen minutes earlier or later could make the difference between 'dry' or 'wet'. However, the study was carried out against the background that the Department for Regional Development in Northern Ireland is attempting to encourage more people to cycle shorter journeys (particularly those up to two miles). While the study may not have direct relevance to those who may wish to cycle greater distances, it has a direct relevance to those who undertake the one third of journeys up to two miles in length.

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[11] http://www.metoffice.gov.uk/mobile/news/article/news/releases/archive/2015/early-dec-stats.
[12] Ibid.

The study was carried out in Belfast – a small city of 330,000 inhabitants with its own particular geography and climate covering an area of around 40 square miles. The purpose of the study was to explore the feasibility of 'Dry' cycling in this location rather than making a general finding for all such cities. The relevance of the study to other cities will depend very much on the comparability of the weather conditions to Belfast. Nonetheless, the study could easily be carried out in any other location for a similar journey. There is nothing in the methodology that limits it to Belfast.

The study is limited to one calendar year which had its own characteristic weather pattern. The robustness of the analysis would be improved by continuing the study over a number of years to take account of the variableness of weather from year to year.

The results set out in this study indicate that in Belfast, for journeys up to 2½ miles (4 km) in length, wet weather is not a serious problem – affecting only around 3 journeys in 20 (15%). It also reports that it is rare for rain to affect both commuting journeys in the one day.