

Pedestrian Movement Analysis

Pontarddulais – Water St, Tidal Reach & Station Rd

May 2018



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Introduction

This report summarises pedestrian movement analysis undertaken at the crossroads of Water Street, Tidal Reach and Station Road in Pontarddulais as part of the Wales Rural Development Programme (RDP). There are three designated pedestrian crossings within the study area, two on Water Street and one on Tidal reach, these are visible in Figure 1 and are also highlighted in Figure 3. This junction was highlighted by local residents as being problematic to cross with issues including a very long wait for the green man, a very short time available to cross the junction and a lack of protected crossing on the Station Road arm of the crossroads.

Pedestrian movement analysis was undertaken in order to get a sense of how pedestrians move through the study area and their crossing behaviour. The main aim of this report is to understand whether pedestrians are using the designated crossings or whether they are crossing at undesignated points. The data will be reviewed to understand whether there is a rationale for a diagonal crossing at this crossroads.

The study area is outlined below.

Figure 1: Map and satellite image of study area including street names and location of designated pedestrian crossings circled in red



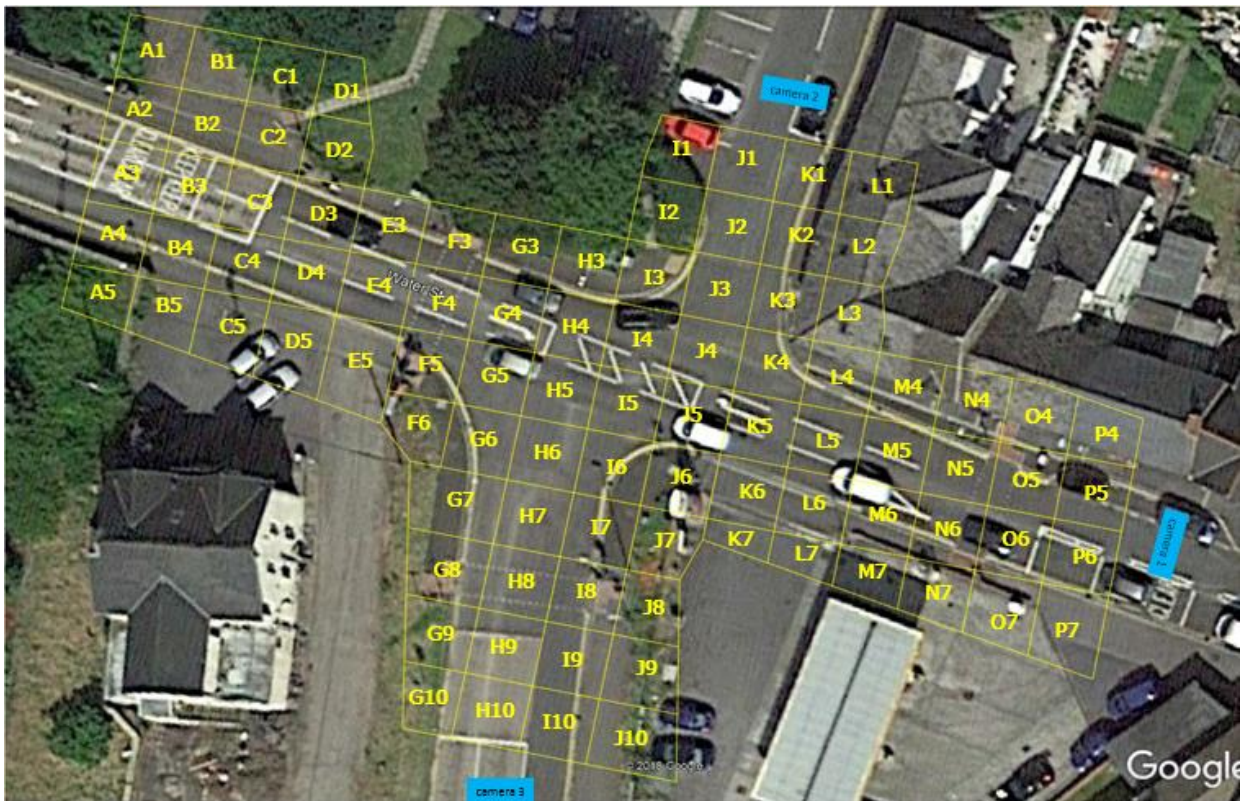
Methodology

Data Collection

A pedestrian count was undertaken using video monitoring. Three video cameras were set up, on Station Road, Water Street and Tidal Reach, to capture pedestrian activity across four days in April 2018. These were a Tuesday, Wednesday, Thursday and Saturday. Video monitoring was undertaken for 12 hours, from 7am to 7pm on each of the four days. Only pedestrians have been counted. Cyclists on the road have not been counted and cyclists pushing bikes on the pavement have been counted as pedestrians.

A reference grid was superimposed onto the video footage as a means of tracking pedestrian movement through the study area. Each cell in the reference grid was 5 meters by 5 meters in size and was given a cell reference in the format (letter, number). Figure 2 below shows the location of the video cameras as well as the grid system that was superimposed onto the video footage.

Figure 2: Location of video cameras and reference grid



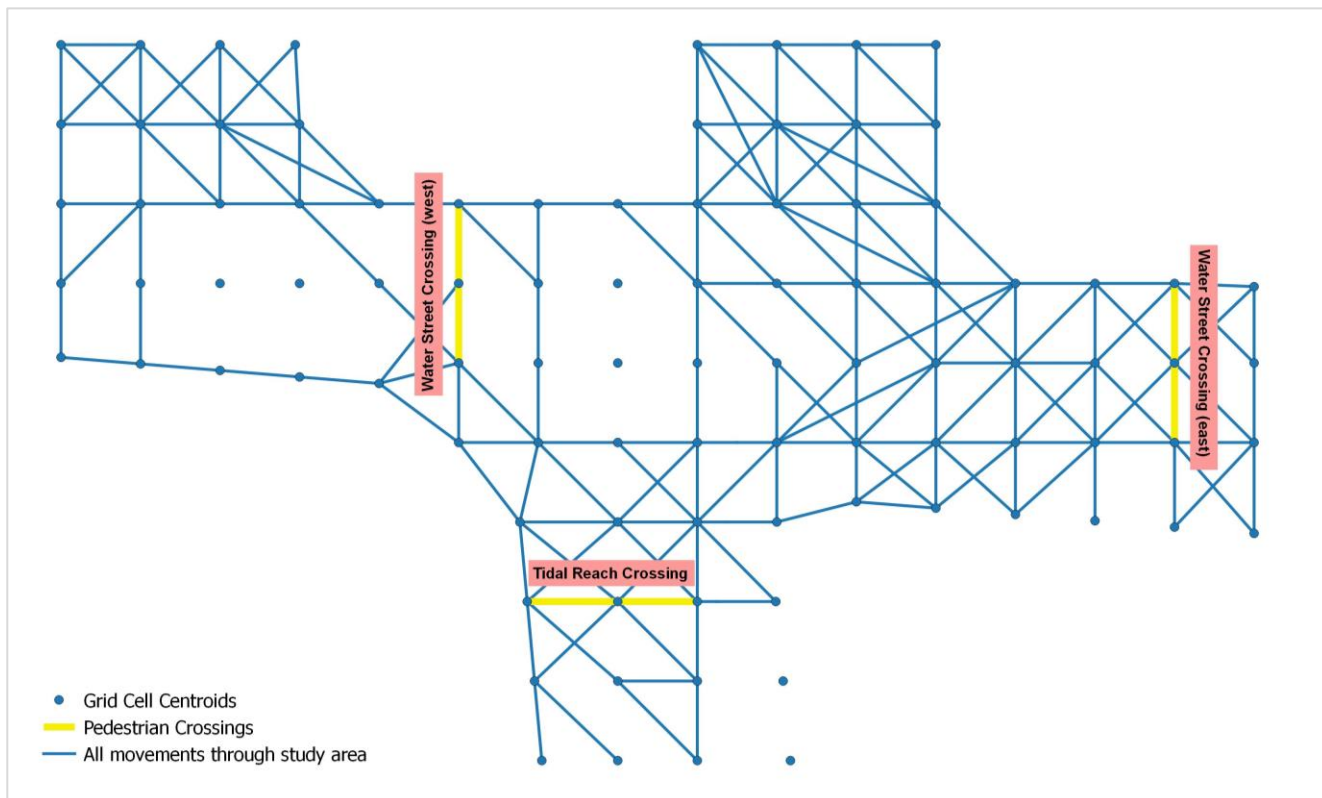
Analysis

Using the video footage data, the movement of each individual pedestrian was recorded according to which cell they entered the study area, which cells they moved through and at which cell they exited the study area.

Using GIS, a centroid (central point) for each grid cell was created. For each individual pedestrian movement that was recorded, a line was created to represent the pedestrian movement through the study area. This line links each centroid an individual moved through, until they exit the study area. These movements were also aggregated to indicate where multiple pedestrians moved through the same group of centroids. In these cases, the lines were combined and displayed as a thicker line to represent the number of people making a movement.

Figure 3 below shows the centroid for each grid cell used for video monitoring. The dark blue lines represent the movements made through the study area, but not the number of people making each movement at this stage. Each line in Figure 3 illustrates a movement made by at least one pedestrian through adjacent grid cells. The location of the pedestrian crossings within the grid system are highlighted yellow.

Figure 3: Location of pedestrian crossings within grid system used for analysis and all movements recorded through study area



Limitations

Using this approach it's only possible to track pedestrians moving through the study area and hasn't been possible to collect additional information such as crossing times, waiting times, vehicle yielding behaviour or traffic volumes that may have affected pedestrian movements as this would be too time intensive and may require a different data collection approach (manual recording or different camera position).

The scope of the study area has been set to include all three designated pedestrian crossings but not any wider due to the additional time analysing data from a larger area would take. This means that we cannot observe any behaviour outside the study area which may influence how individuals move through the study area and across the junctions. The analysis is also only as detailed as the size of the grid cells allows. If the grid reference cell size had been set any smaller the level of detail in the analysis would increase, but this would also increase the analysis time required.

Data from the video monitoring was manually entered into Excel before being entered into a GIS. As a result, there is a small possibility of human error.

Terminology

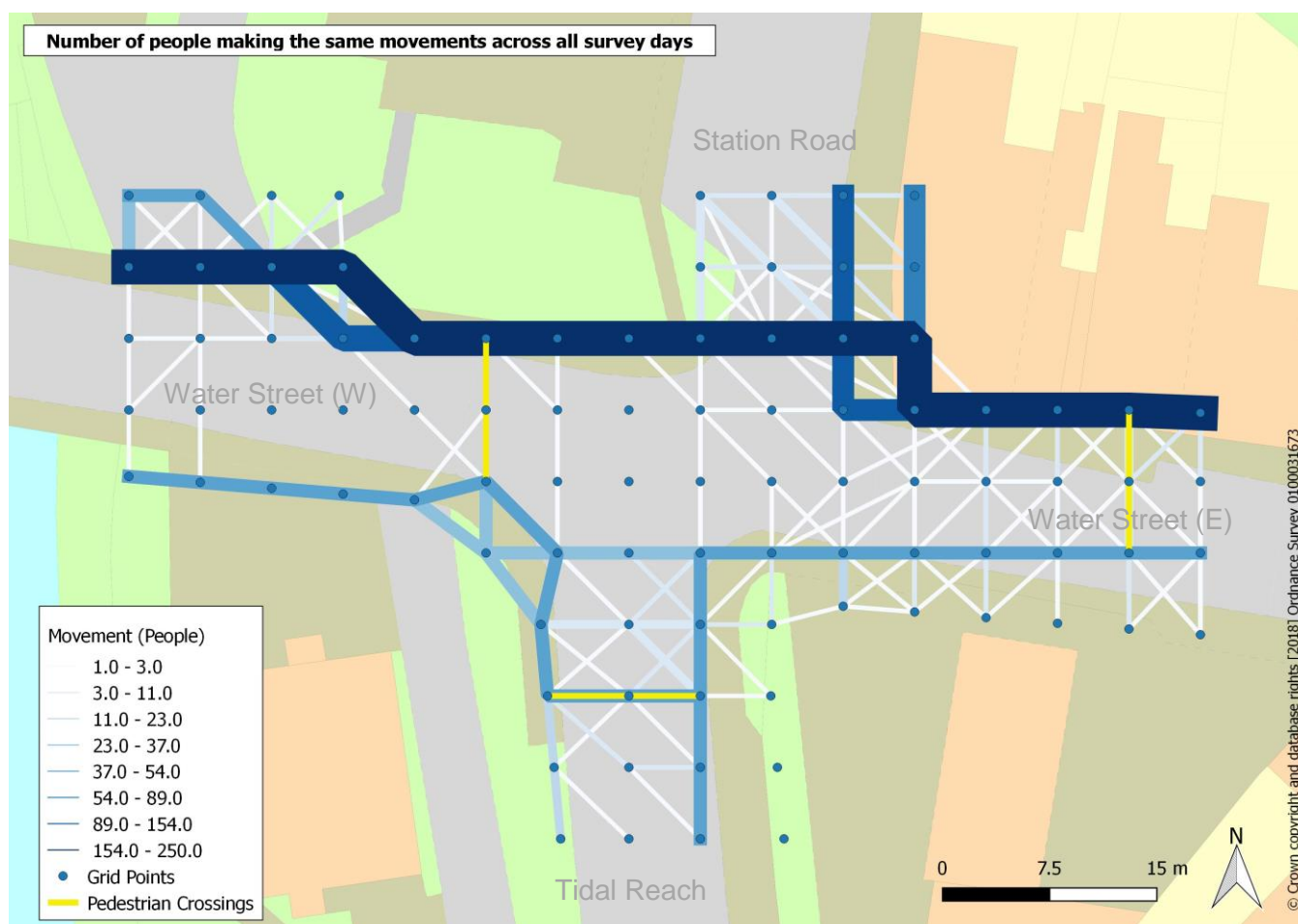
The term movement has been used throughout this report to describe the route or path a pedestrian has taken through the study area. For each movement we know where a pedestrian has entered the reference grid, which grid cells they moved through, and where they left the reference grid. Because we have this level of detail the same movement can be made by more than one person as they move through the same set of grid cells. The data has been aggregated to understand how many individuals have moved through the same group of reference grid cells (i.e. carried out the same movement through the reference grid).

Results

Pedestrian Movement

An overview of all unique movements across all survey days is displayed in Figure 4, overlaid onto Ordnance Survey Master Map output for Wales.

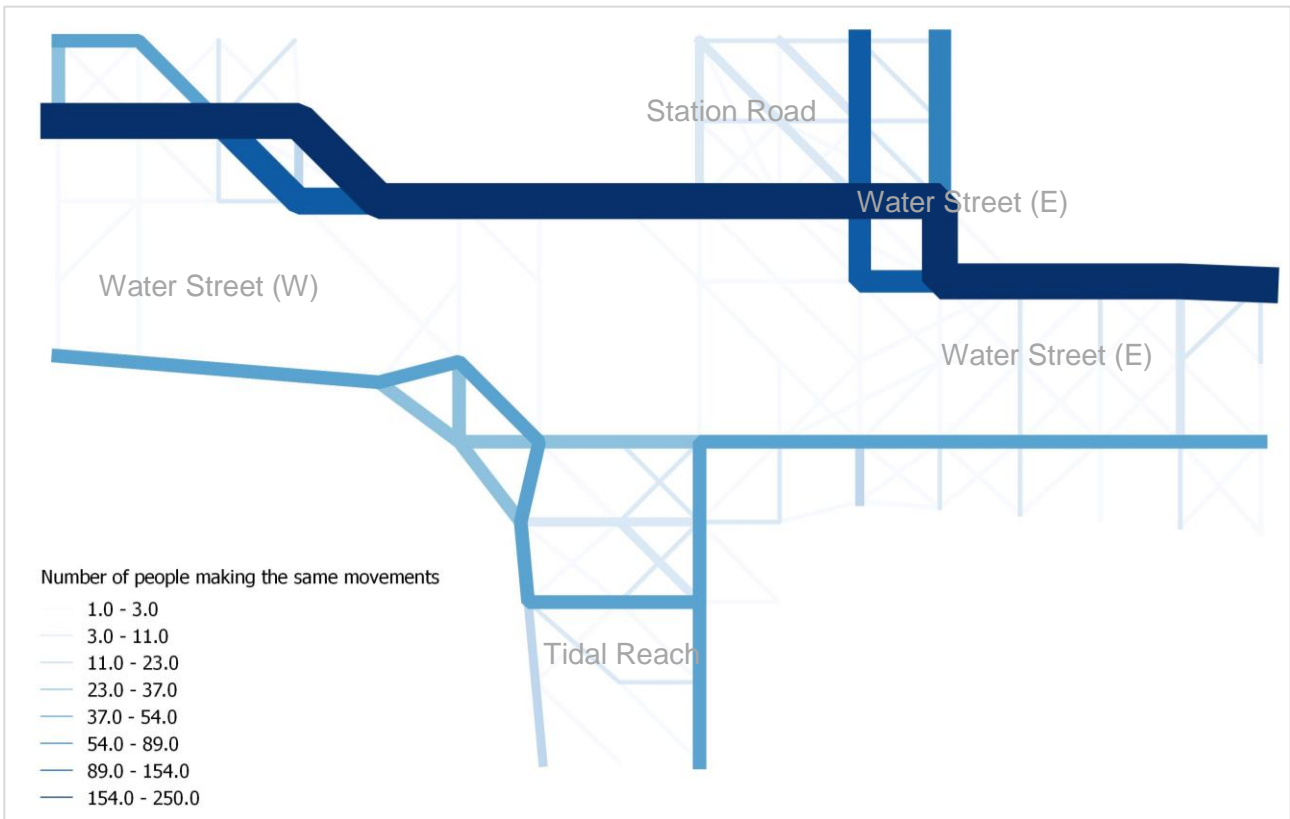
Figure 4: Number of people making the same movements across all survey days



The video analysis captured 2,968 people making 542 different movements through the study area across all four survey days.

Figure 5 highlights movements taken through the study area aggregated by the number of people making the same movement, across all survey days. The most popular movements are denoted by darker thicker lines and overlay the less popular movements.

Figure 5: Number of people making the same movements across all survey days



It's evident from Figure 5 that the most frequently observed movements through the study area occurred on the northern side of Water Street. The road where the most pedestrian crossing behaviour was observed is Station Road, the only road in the study area without a designated pedestrian crossing. Figures 4 and 5 also show more movements from west to east or east to west across the study area rather than north to south or south to north.

Figure 6 highlights the most popular movement made through the whole study area, along the northern side of Water Street. This movement was made by 250 people.

Figure 6: Most popular movement through study area

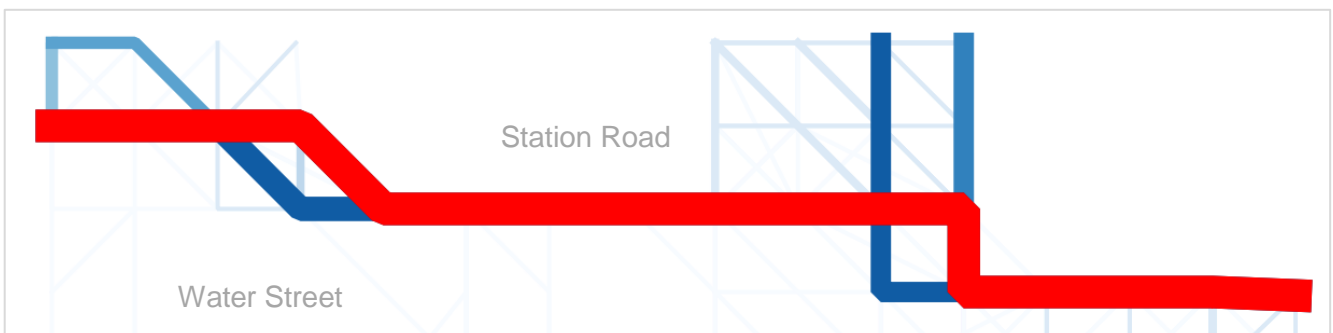
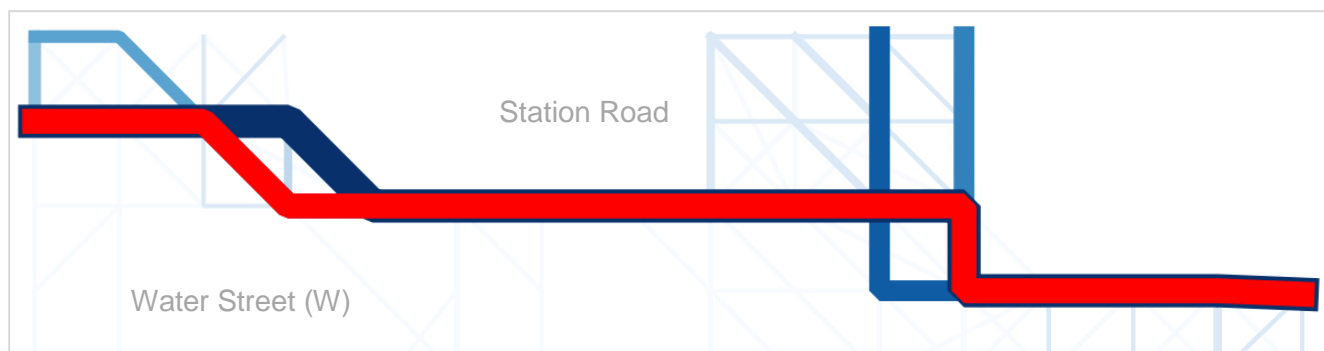


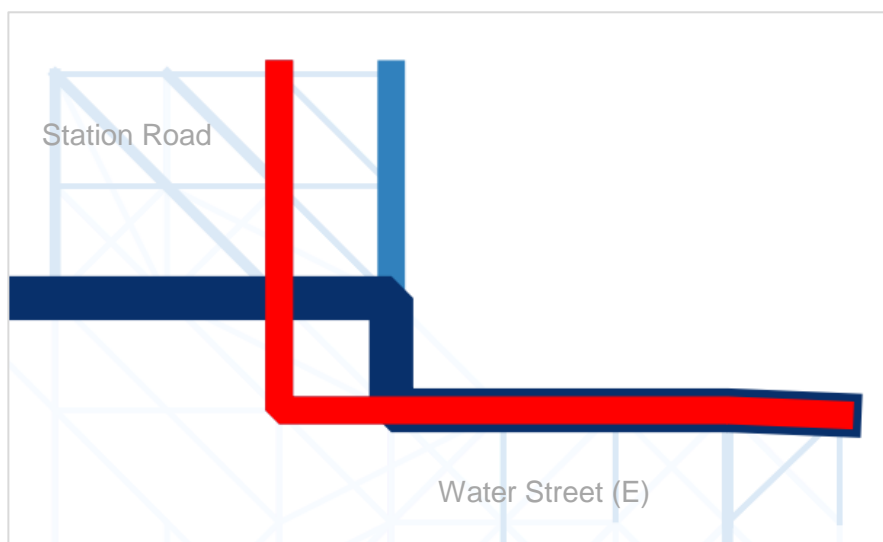
Figure 7 shows that an additional 154 people also travelled along the northern side of Water Street however their movements differed slightly to those seen in Figure 6 near the entrance to the train station.

Figure 7: Second most popular movement through study area



The third most popular movement was made in the north eastern corner of the study area, with pedestrians entering on the eastern side of station road and exiting on the northern side of Water Street, or vice versa. This movement was made by 98 people.

Figure 8: Third most popular movement through study area



Evidence for Diagonal Crossing

The data was reviewed for any evidence that would support the installation of a diagonal pedestrian crossing across the junction, starting from the train station entrance on the north-west of Water Street and ending on the south-eastern corner of Tidal Reach and Water Street.

Two subsets of grid reference cells were defined as follows:

- North-west subset: a 4x4 grid of cells A1 to D4
- South-east subset: a 4x4 grid of cells I5 to L8

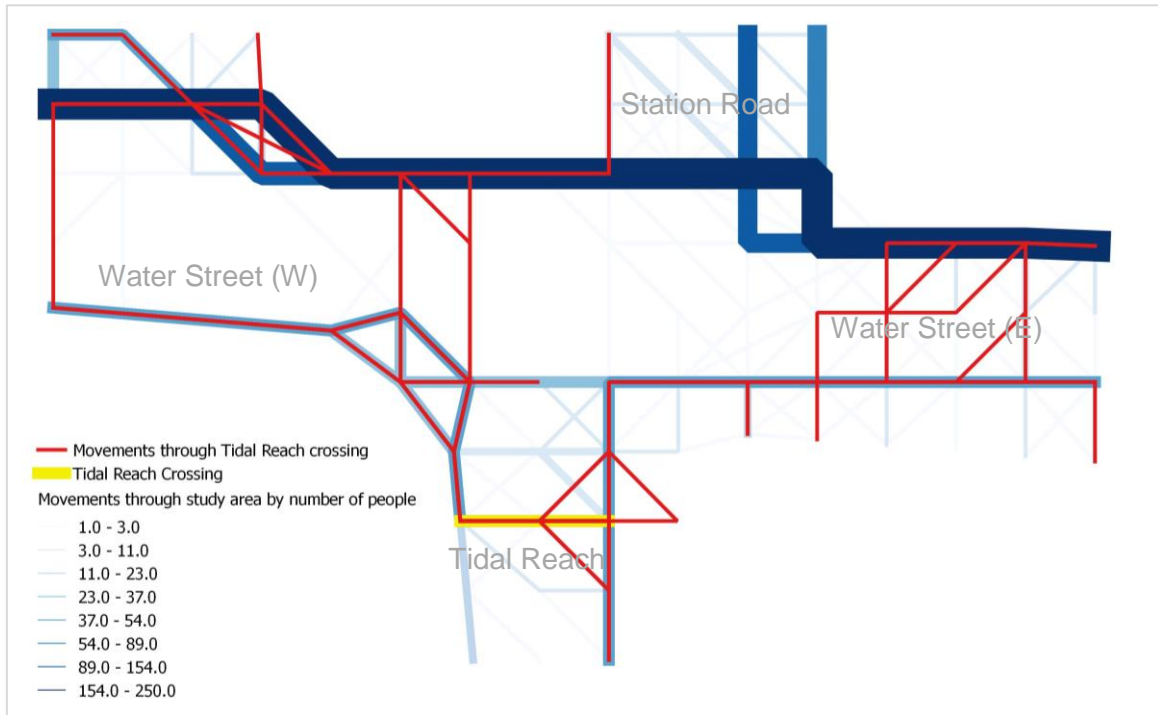
All pedestrian movements between the north-west and south-east subsets of cells across the four days were recorded. The total number of pedestrians making this movement across the four days was 11. Out of a total of 2,968 pedestrians observed on the junction, this represents 0.4% of the total.

Designated Pedestrian Crossings

Tidal Reach

Figure 9 shows all movements that passed through the designated pedestrian crossing on Tidal Reach indicated in red. There were a total of 53 different movements made by 375 people. 24 of the movements crossed both Tidal Reach and another road either at another designated crossing or an undesigned crossing. None of the movements using Tidal Reach crossing crossed more than two roads of the study area.

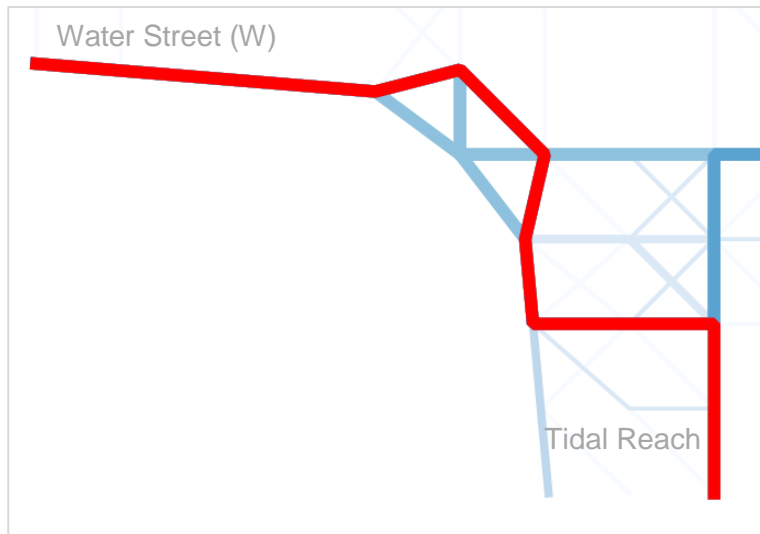
Figure 9: Movements that pass through the designated crossing on Tidal Reach



Figures 9 to 11 show the most popular movements using the designated crossing on Tidal Reach.

Figure 10 highlights one of the most popular movements that passes through the crossing on Tidal Reach, made by 47 people. This movement moves from the southern side of Water Street, across Tidal Reach and then down Tidal Reach on the eastern side of the road, or vice versa.

Figure 10: Joint most popular movement that passes through the designated crossing on Tidal Reach



The movement through the Tidal Reach crossing in Figure 10 was also made by 47 people. This movement follows the southern side of Water Street with pedestrians moving south to the Tidal Reach crossing to enable them to continue their movement along the southern side of Water Street.

Figure 11: Joint most popular movement that passes through the designated crossing on Tidal Reach

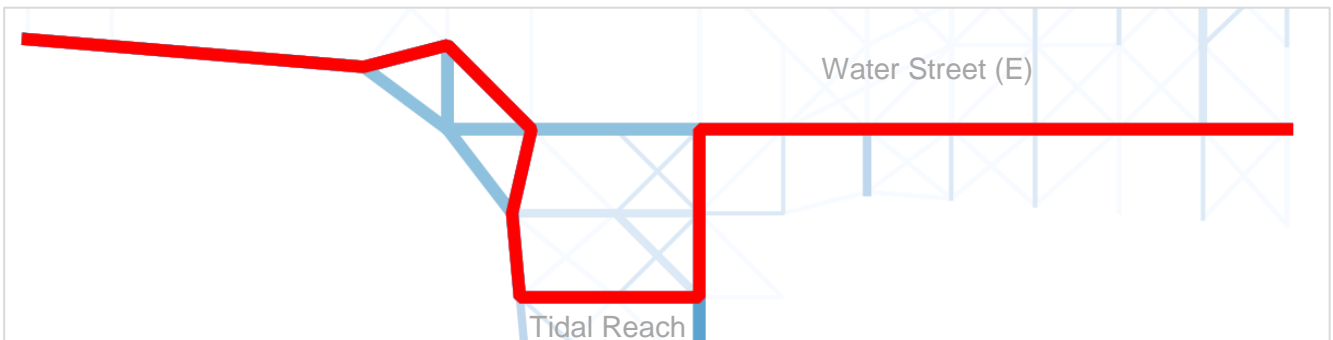
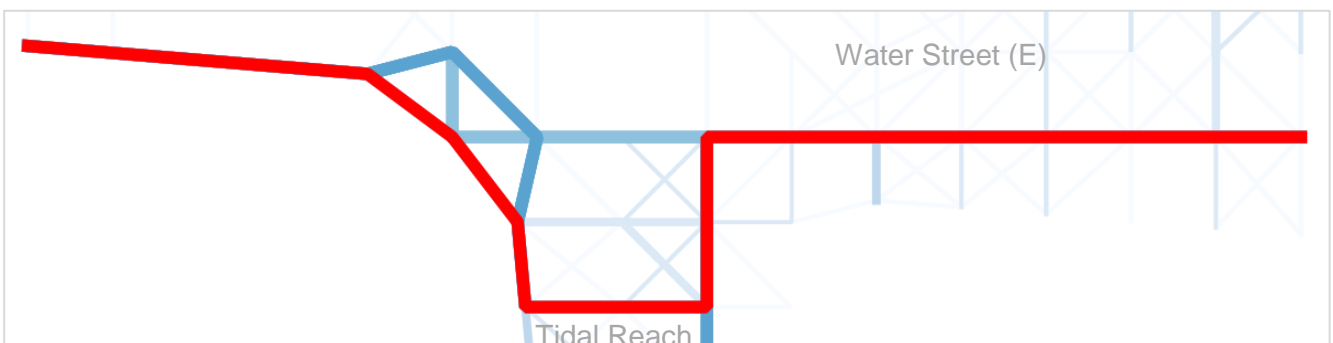


Figure 12 shows the third most popular movement made by pedestrians using the Tidal Reach crossing. This movement was made by 37 people and also follows the south side of Water Street with pedestrians moving south to cross at the Tidal Reach crossing. This is largely the same as the movement in Figure 11, the only difference being the grid reference cells used at the western corner of Tidal Reach and Water Street.

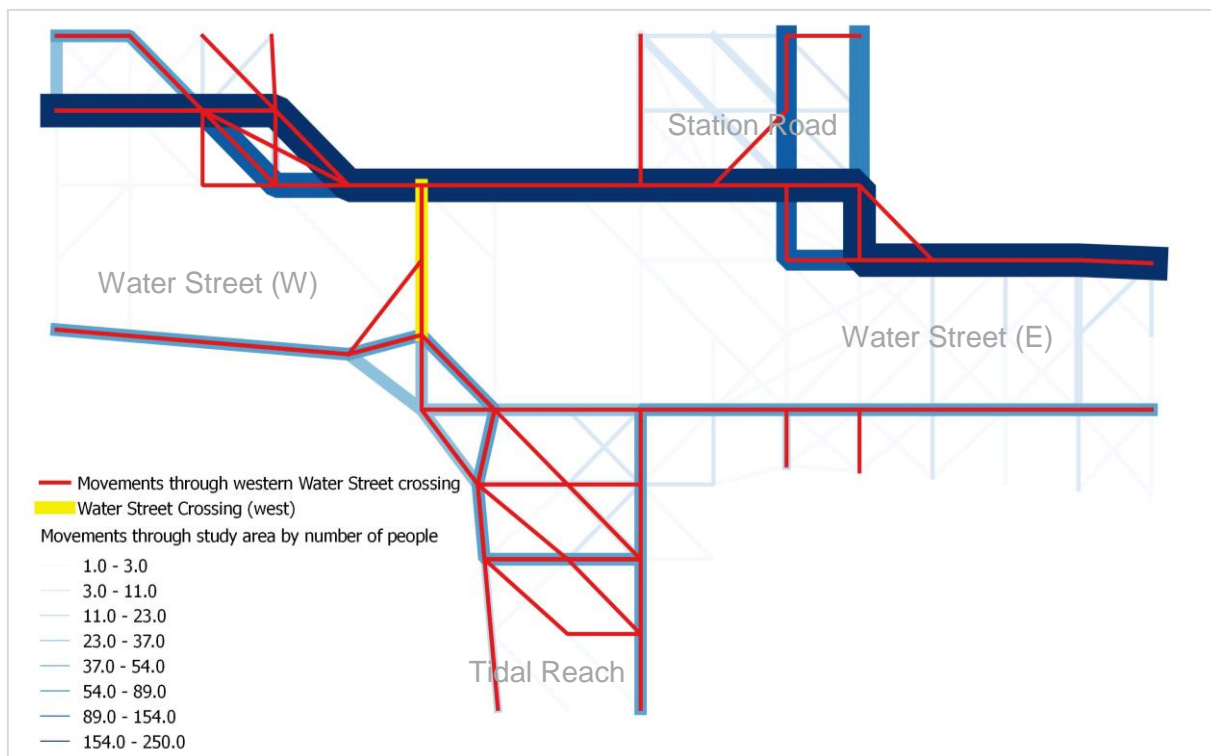
Figure 12: Third most popular movement passing through the designated crossing on Tidal Reach



Water Street (west)

Figure 13 shows all movements that passed through the western designated pedestrian crossing on Water Street. There were a total of 35 different movements made by 45 people. All except four movements crossed two roads of the crossroads, either at a designated or undesignated crossing.

Figure 13: Movements that pass through the western designated crossing on Water Street



Figures 13 to 15 show the most popular movements using the designated western crossing on Water Street.

Figure 14 shows one of the most frequent movements through the western Water Street crossing, made by 3 people. This movement starts at the entrance to the Station, crosses Water Street south, moving across the Tidal Reach crossing and then south down the eastern side of Tidal Reach, or vice versa.

Figure 14: Joint most popular movement passing through the designated western crossing on Water Street

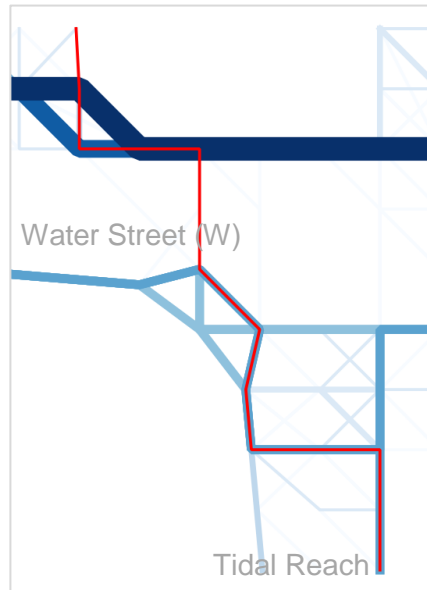
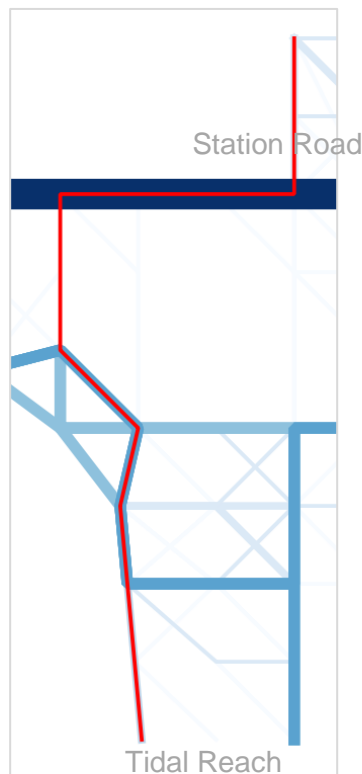


Figure 15 shows another frequent movement through the western Water Street crossing, also made by 3 people. This movement starts at the eastern side of Station Road, crosses Station Road and Water Street runs down the western side of Tidal Reach, or vice versa.

Figure 15: Joint most popular movement passing through the designated western crossing on Water Street

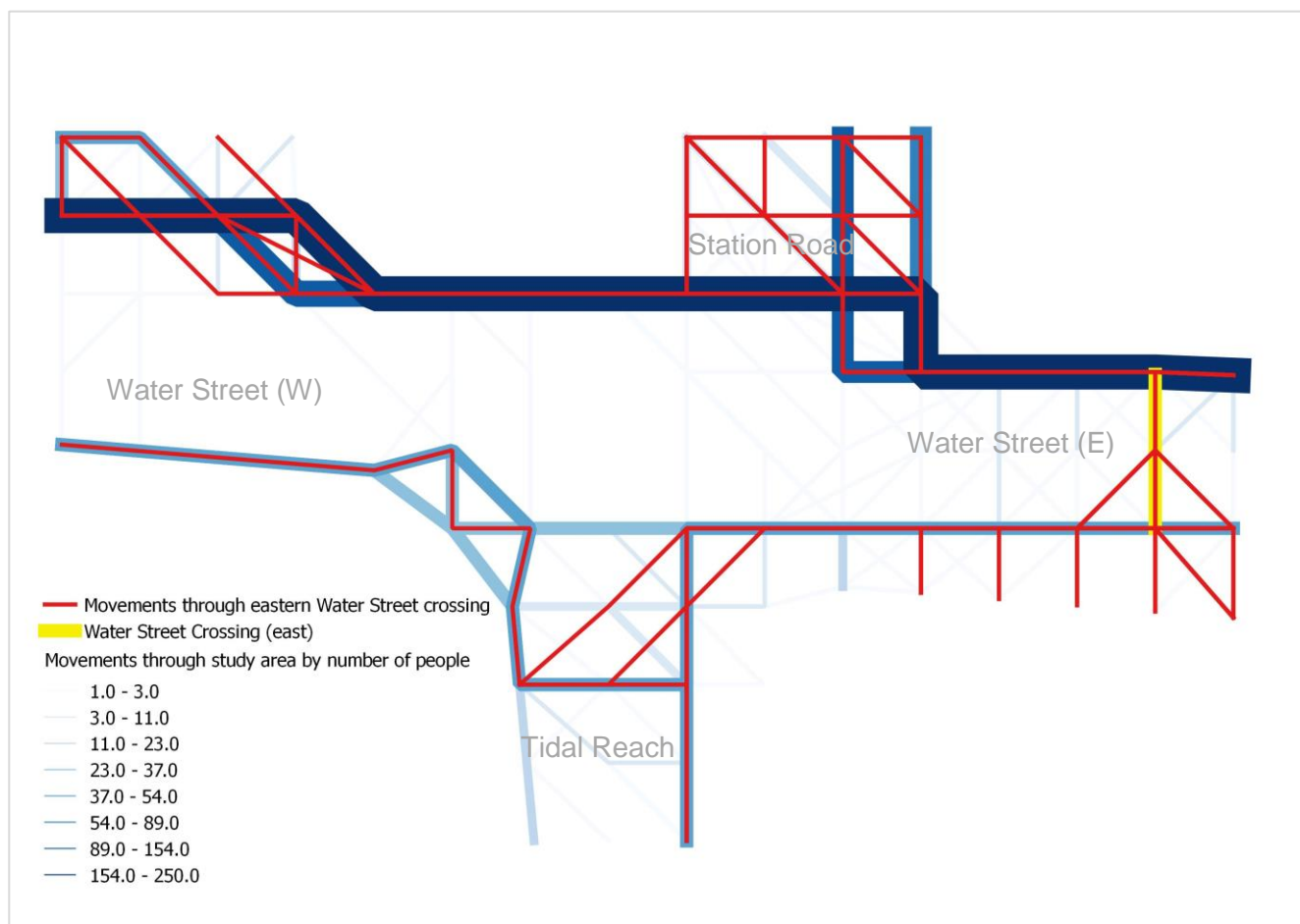


All other movements across the western Water Street crossing were made by only one or two people.

Water Street (east)

Figure 16 shows all movements that passed through the eastern designated pedestrian crossing on Water Street, of which there were 75 different movements made by 168 people. 15 of these movements also cross another road of the crossroads, with three crossing Tidal Reach and 12 crossing Station Road either at a designated or undesigned crossing.

Figure 16: Movements that pass through the eastern designated crossing on Water Street



The figures below show the most popular movements using the eastern Water Street crossing.

Figure 17 highlights the most popular movement that passes through the eastern Water Street crossing, made by 10 people. This movement follows the northern side of Water Street, crossing both Station Road and then Water Street and then continuing on the southern side of Water Street, or vice versa.

Figure 17: Most popular movement passing through the designated eastern crossing on Water Street



Figure 18 highlights the second most popular movement that passes through the eastern crossing on Water Street, made by 6 people. This movement runs across Water Street and onto the southern side of Water Street or vice versa.

Figure 18: Second most popular movement passing through the designated eastern crossing on Water Street



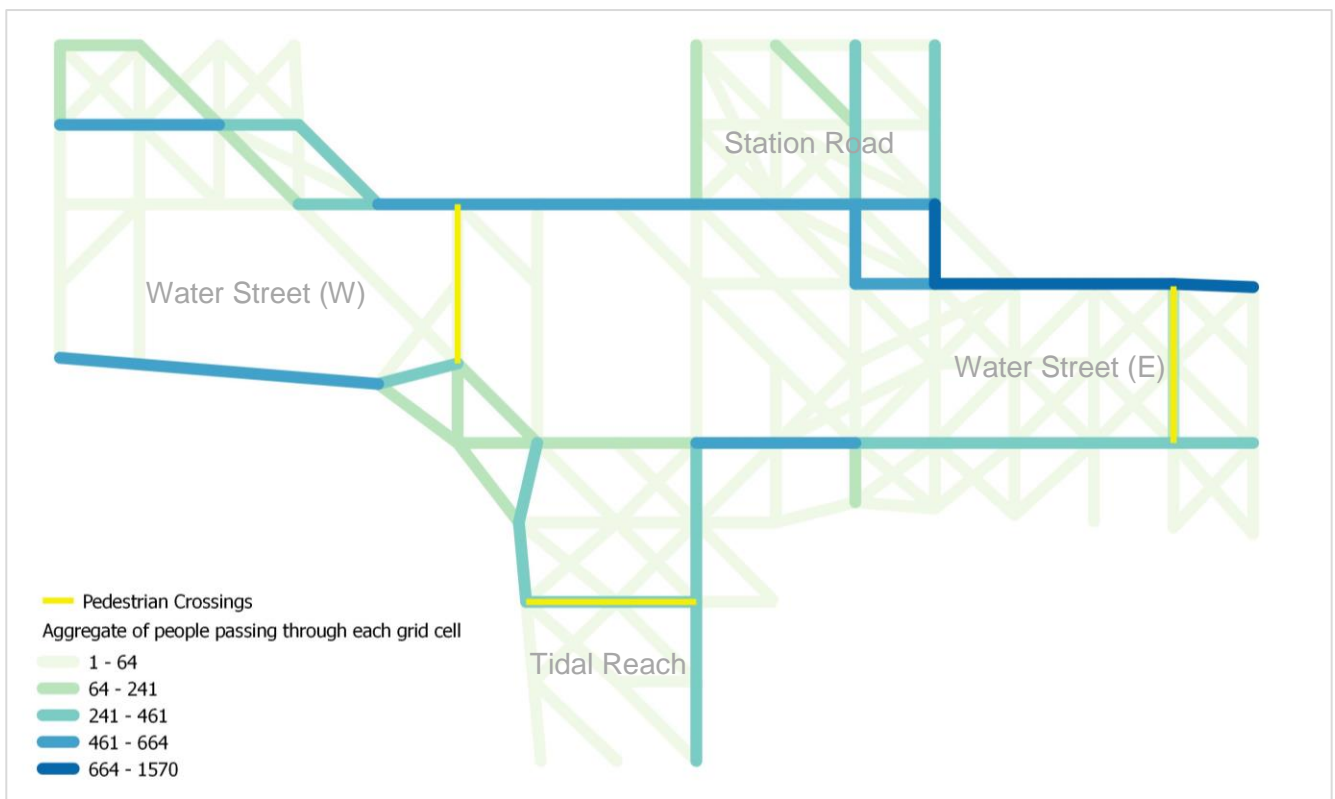
Heat map

Heat mapping highlights the grid cells of the study area that saw the most pedestrians pass through, regardless of the whole movement they were making. This differs from previous charts that emphasised movements as a whole, showing the most popular movements through the study area.

The heat maps displayed below have been created by giving each grid reference cell centroid (centre point) a count value to represent how many times it appears in the data set.

Figure 19 shows that when the study area is examined in terms of the number of people passing through each grid reference cell the area over on the north east of the map sees the most pedestrian activity than elsewhere, with up to 1,570 pedestrians passing through the darkest shaded areas of Water Street. The lightest shaded areas of the study area show where the least amount of pedestrians have moved through.

Figure 19: Heat map showing the number of people passing through each grid cell



Incorporating the designated crossings into Figure 19 provides an understanding of how many pedestrians are crossing the study area at undesigned crossings.

Figure 20 below highlights 614 pedestrians observed crossing the road at Station Road where there isn't a designated pedestrian crossing.

Figure 20: Pedestrians crossing Station Road at undesigned crossing

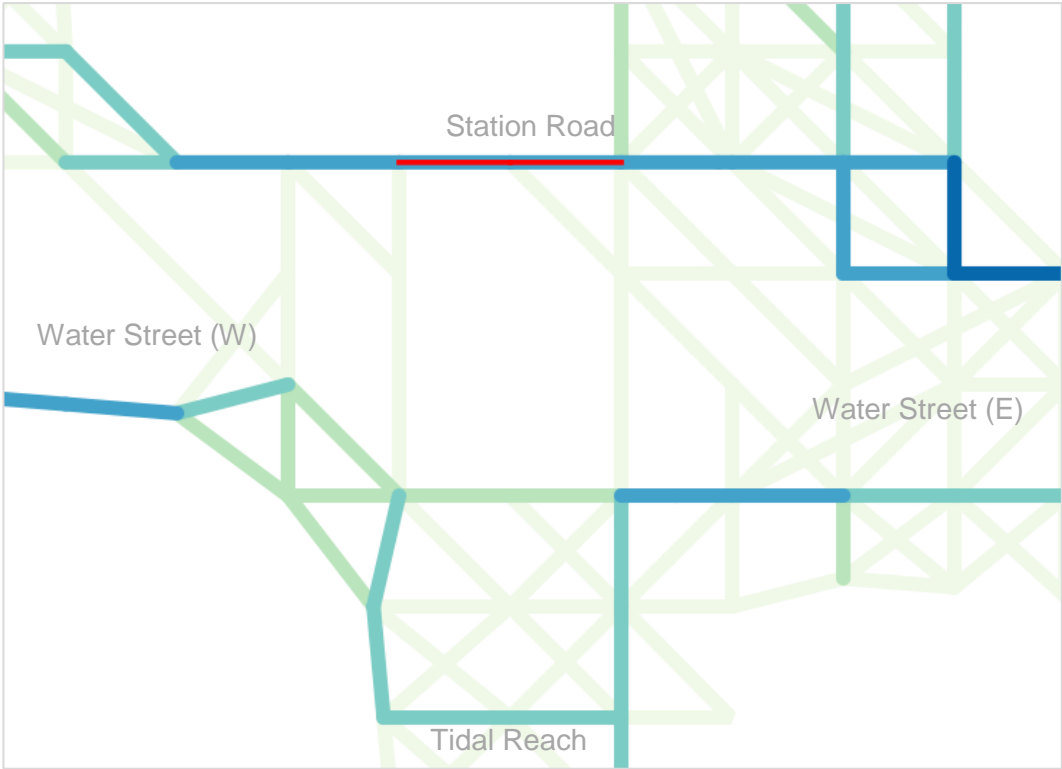


Figure 9 identifies 375 people who have used the designated crossing at Tidal Reach to move through the study area. The heat map shows that a further 159 pedestrians cross Tidal Reach at the undesigned crossing points highlighted in Figure 21.

Figure 21: Pedestrians crossing Tidal Reach at undesigned crossings

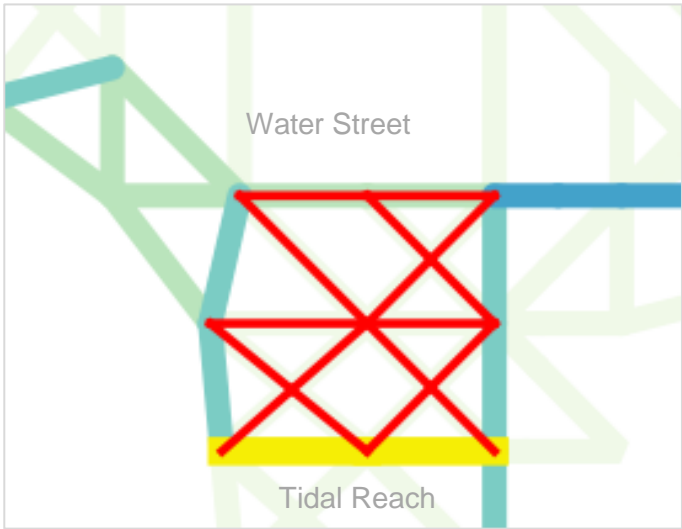


Figure 13 shows that 45 people used the designated crossing on the western side of Water Street, Figure 22 demonstrates the undesigned crossings made across the western side of Water Street by an additional 6 people.

Figure 22: Pedestrians crossing western side of Water Street at undesigned crossings

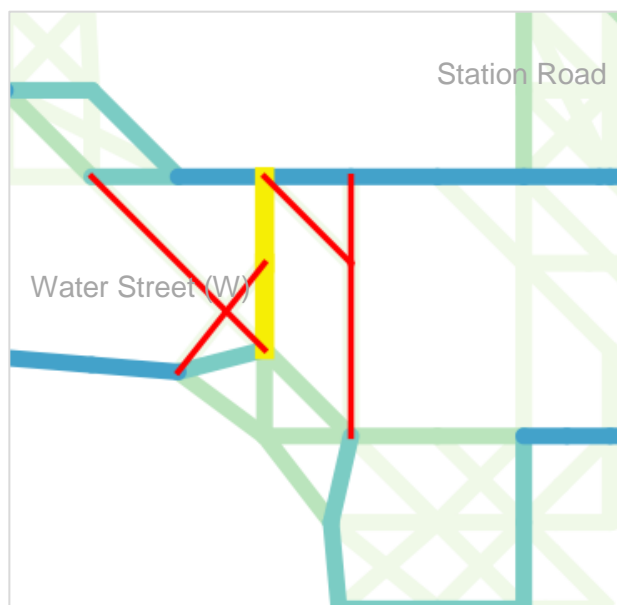
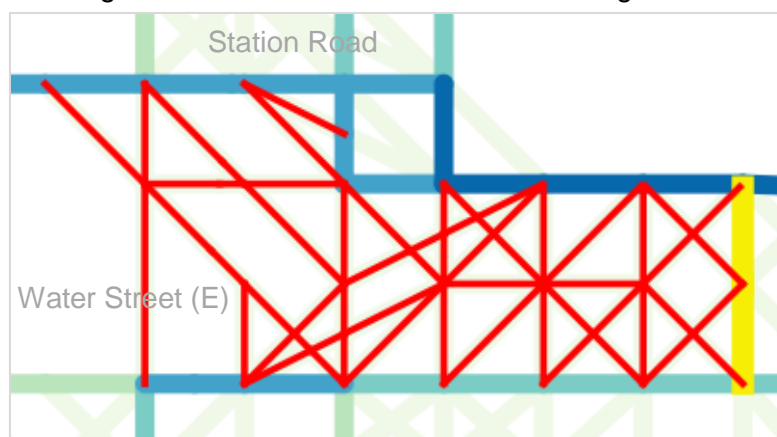


Figure 16 shows that 168 people used the designated crossing on the eastern side of Water Street. At least an additional 113 pedestrians crossed the eastern side of Water Street using the undesigned crossings highlighted in Figure 23. This figure is a reasonable assumption taken from the number of pedestrians using the vertical grid lines as people's movements will also have split off along the diagonal lines.

Figure 23: Pedestrians crossing eastern side of Water Street at undesigned crossings



Summary

There were 2,968 people observed making 542 different movements through the study area across the four observations days, with more movements running from west to east or east to west across the study area rather than north to south or south to north. Across the four days, 375 people crossed at the designated crossing on Tidal Reach, 45 crossed at the designated crossing on the western side of Water Street and 168 people crossed at the designated crossing on the eastern side of Water Street.

In addition, a further 159 people were observed crossing Tidal Reach at undesignated crossing points, an additional 6 people were observed crossing the western side of Water Street at undesignated crossing points and at least an additional 113 people were observed crossing the eastern side of Water Street.

The majority of pedestrians moving through the study area were doing so using the designated crossing points. Out of the total 866 pedestrians, 67.8% were using a designated crossing and 32.1% using undesignated crossings. Across the three designated crossing points, a total of 588 pedestrians used a designated crossing. This is 310 more individuals than the 278 pedestrians who used an undesignated crossing.

Based on the numbers above over 50% (53%) more people were observed crossing at designated crossings than undesignated crossings. Although more people are crossing at the designated crossings it's inconclusive from these figures whether there is a clear preference for using the designated crossings over the undesignated crossings without knowing whether there are other influencing factors at play that can't be learnt from the video analysis. Further monitoring would be needed to understand whether a long wait for the green man or a very short time available to cross could be influencing these movements.

To understand if there is evidence for the introduction of a diagonal crossing at this junction, pedestrian movement from the north-west to south-east of the study area was examined. This did not find substantial numbers of pedestrians crossing the junction in this direction, with a total of 11 individuals making a movement across the study area in this direction.

Although it's unclear from this analysis whether there is a need for a diagonal crossing across the study area a couple of areas have been highlighted as areas for potential improvement, these are the undesignated crossings observed across Station Road and Tidal Reach.

It's evident from Figure 5 that the most popular movement through the study area runs along the northern side of Water Street and across Station Road, the only road of the study area without a designated crossing and an area of concern raised by local residents. Figure 19 shows that 614 pedestrians crossed Station road over the four days, more than was observed at any other designated or undesignated crossing. It could therefore be argued that a designated crossing is needed at this point.

On the southern side of Water Street Figure 11 and Figure 12 show that a total of 84 pedestrians were observed to deliberately choosing a longer journey to use a designated crossing (by dropping down to the designated crossing across Tidal Reach while traveling from east to west or west to east along Water Street). In addition to this Figure 21 shows 159 people crossing Tidal Reach at undesignated crossing points. These findings indicate that a crossing that is more level with where Tidal Reach meets Water Street (further north than the current Tidal Reach crossing) would be of greater use to pedestrians.