
Project:	Fendon Road Junction	To:	Cambridgeshire County Council
Subject:	Dutch Style Roundabout Capacity	From:	James Walker Harrison
Date:	06 April 2017	cc:	David Boddy

Introduction

Skanska have been commissioned to look at the junction of Fendon Road and Queen Edith's Way in Cambridge to assess whether a 'Dutch Style' roundabout would operate within capacity based on observed traffic flows.

Location

Fendon Road junction is located to the South-East of Cambridge. The junction is comprised of Fendon Road to the South, Queen Edith's Way to the East and West, and Mowbray Way to the North. The junction currently takes the form of a conventional roundabout.

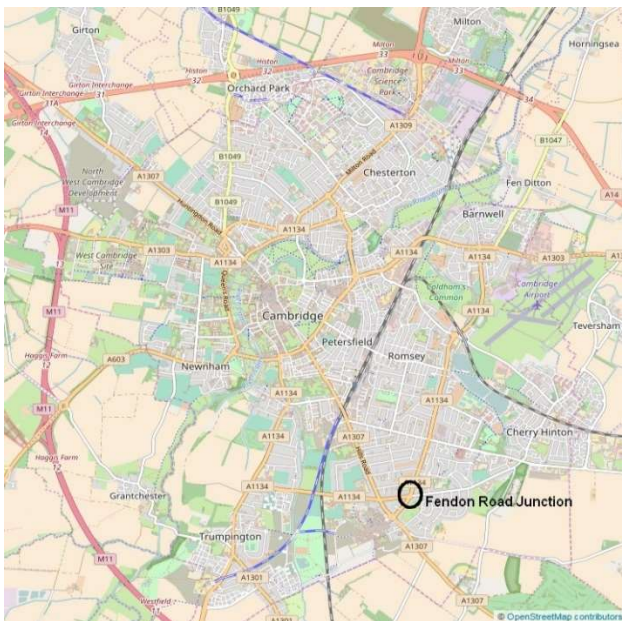


Figure 1: Location of Junction



Figure 2: Junction Layout

'Dutch Style' Roundabouts

Cambridgeshire County Council are considering the viability of a 'Dutch style' roundabout at this location. The Dutch style roundabout is based on a roundabout design that is commonly used in The Netherlands. It uses 'continental' geometry (short turning radii to reduce speeds and a single lane circulating carriageway) and has a kerb-segregated cycle track at carriageway level, orbiting around the outside of the roundabout. In urban areas cyclists are then given priority across the entry and exit lanes.

An example of this kind of roundabout is shown in Figure 3 below.

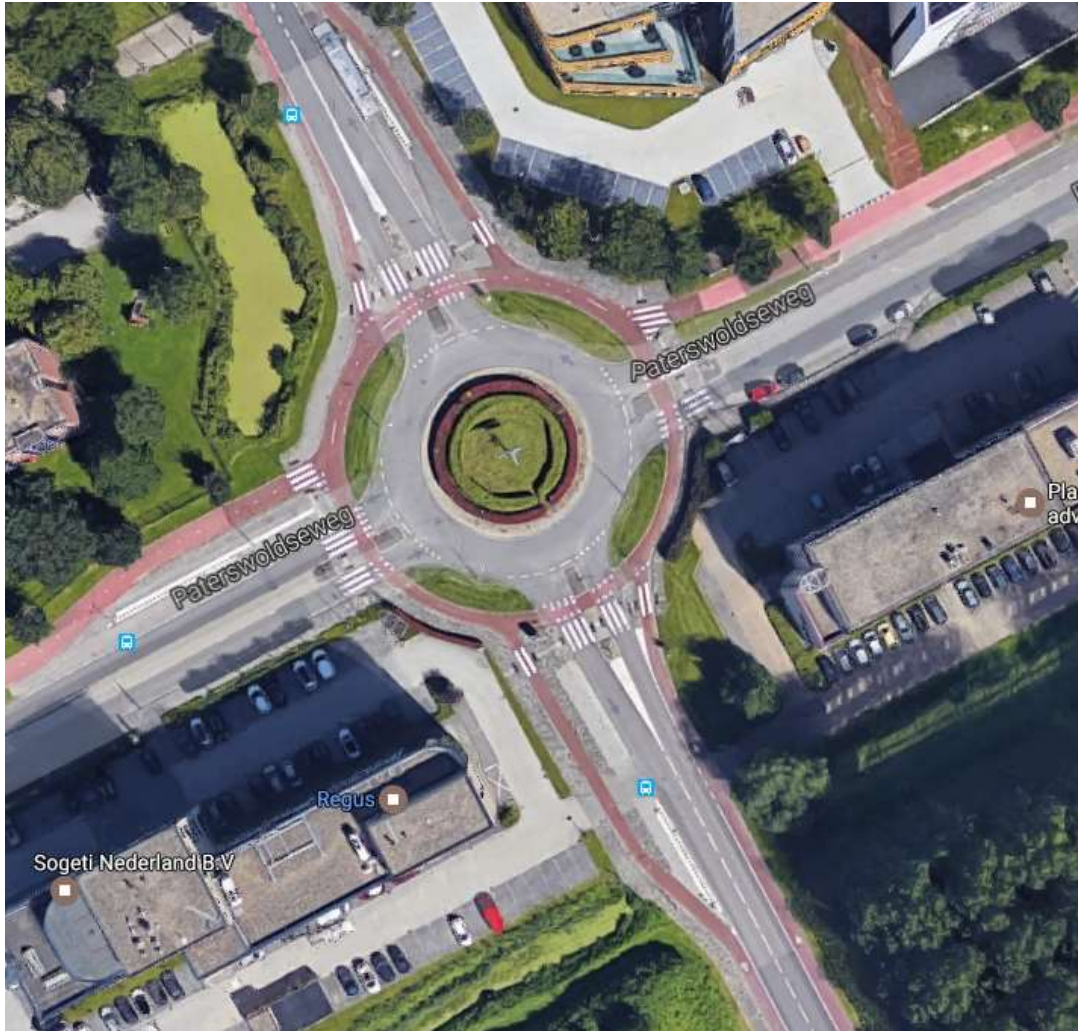


Figure 3: 'Dutch Style' actual layout in Groningen, Netherlands

TRL Research

The Transport Research Laboratory (TRL) has been researching "Dutch Style" roundabouts and investigating their potential impact on road safety and highway capacity. The research undertaken into the capacity characteristics of a 'Dutch Style' roundabout has been important in informing modelling of the new style of roundabouts to determine their viability in the United Kingdom. The results of the capacity assessment is published in their Published Project Report PPR 752.

The capacity research included under taking a trial at an off-street location of a roundabout but with predominantly UK road markings at on-street location to determine the capacity of a such a roundabout. The resulting observations showed a clear relationship between the maximum observed entry flow against the circulatory flow opposing that arm show, as in Figure 4.

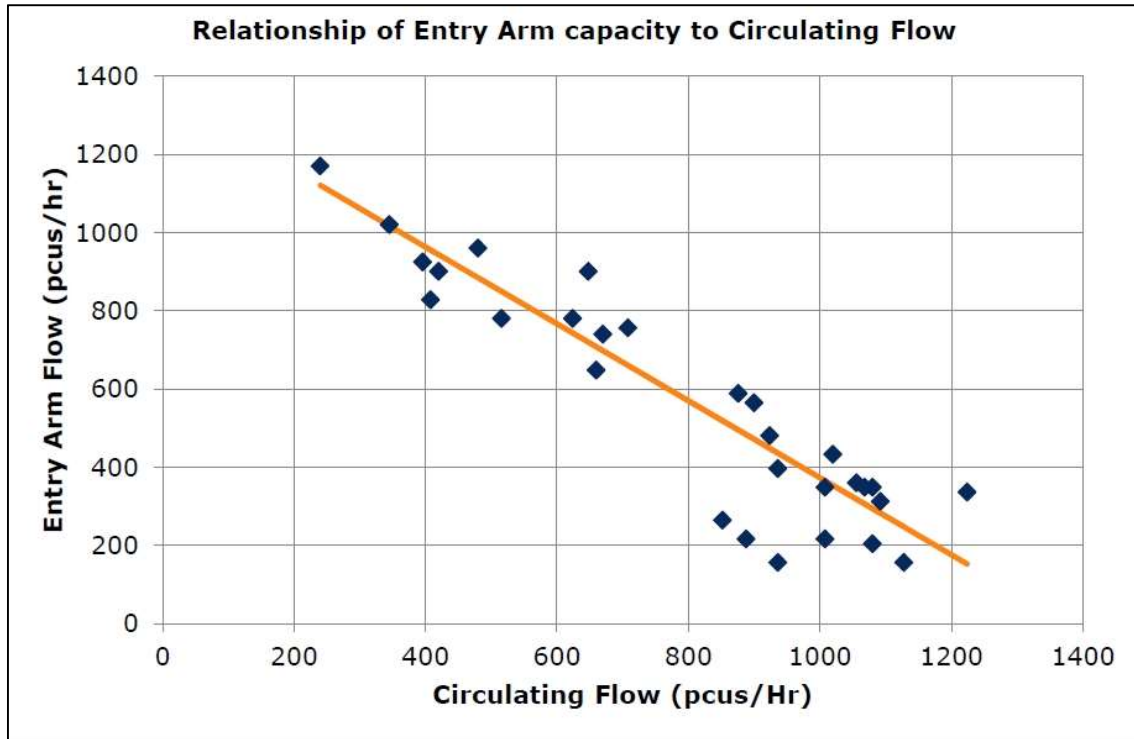


Figure 4: Observed Entry and Circulating Flows

The relationship between entry arm capacity and the circulating flows for a Dutch roundabout has then been expressed by TRL in the form of an equation:

$$\text{Entry arm capacity (pcus/hr)} = 1357 - 0.98 * \text{Circulating flow (pcus/hr)}$$

It is noted that this form of equation is not dissimilar that used by TRL within its ARCADY software for a conventional roundabout, and where the equation is based on equivalent Passenger Car Unit (PCUs) where 1 car = 1 PCU.

The Dutch style roundabout capacity equation has been used to determine the viability of installing a 'Dutch Style' roundabout at the Fendon Road junction.

Traffic Flow Survey

A turning movement survey was undertaken on Wednesday 8th March 2017 at the Fendon Road roundabout in Cambridge. The survey recorded vehicle turning movements at the junction over a 12-hour period between 07:00-19:00. The day of survey was considered typical, was during normal school and University term with no incidents reported that might affect the observed turning movements.

The results from the surveys are shown in diagrammatically Figures 5, 6 and 7 below for the 12-hour (7am-7pm), AM peak hour (8-9am) and the PM peak hour (5-6pm) survey periods respectively.

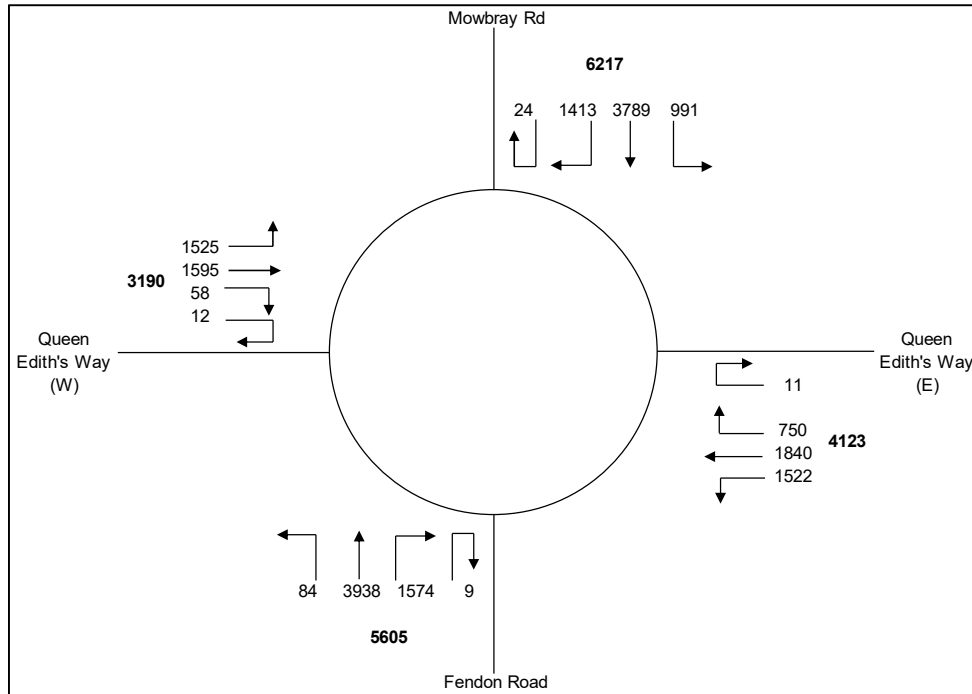


Figure 5: 12 Hour Traffic Flows

A total of 19,135 vehicles passed through the junction during the 12hr period. The busiest approach to this junction was Mowbray Road and Fendon Road respectively. 6,217 vehicles entered the junction from Mowbray Road to the north, of this traffic over 60% went straight ahead to Fendon Road. Likewise, 5,605 vehicles entered the junction from Fendon Road with over 70% of these going straight on to Mowbray Road.

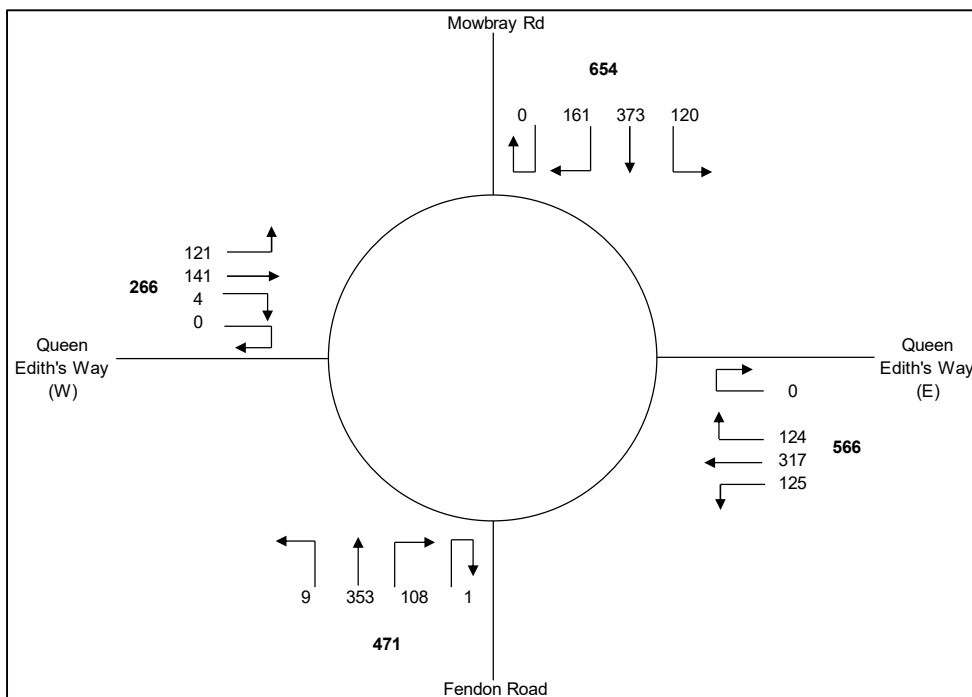


Figure 6: AM Peak Traffic Flows

A total of 1,957 vehicles were recorded passing through the junction during the AM Peak period. The highest number of vehicles (654) entered the junction from Mowbray Road, closely followed by Queen Edith’s Way East. The busiest exit from the junction was also Mowbray Road, however a similar number of vehicles also exited the junction at Fendon Road.

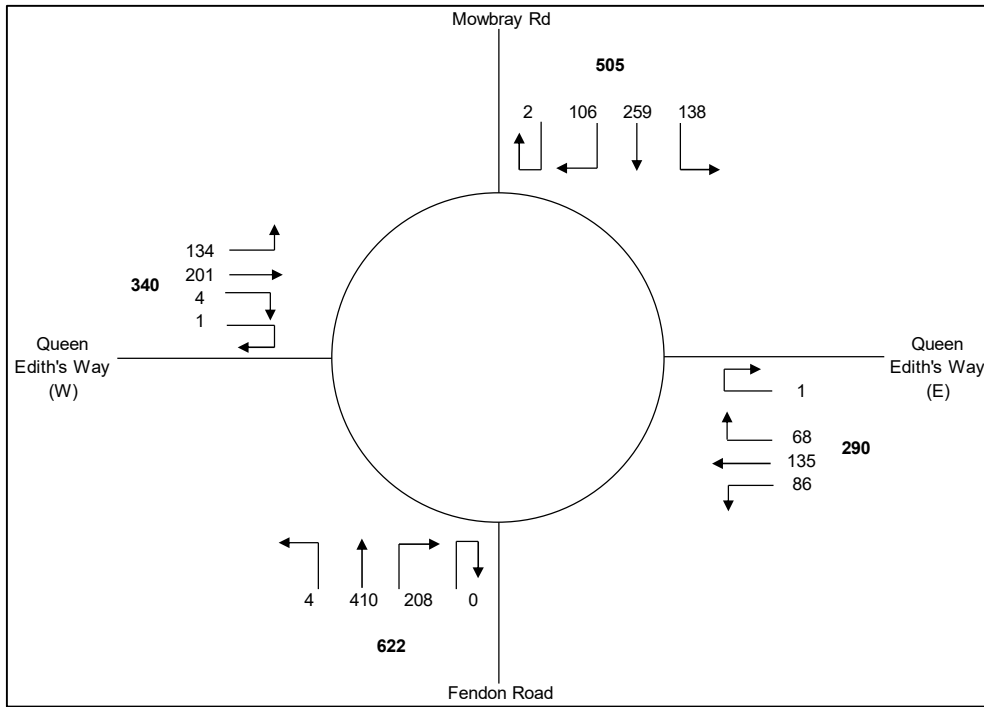


Figure 7: PM Peak Traffic Flow

A total of 1,757 vehicles were recorded passing through the junction during the PM Peak period. The highest number of vehicles (622) entered the junction from Fendon Road, closely followed by Mowbray Road. The busiest exit from the junction was also Mowbray Road, however a similar number of vehicles also exit the junction at Queen Edith’s Way East.

Traffic Flow summary and Roundabout Capacity

The traffic flow movements expressed as PCU have been summarised in Tables 1 and 2 below for the AM and PM peak hour respectively, with the circulatory flow added. The entry capacity has then been calculated using the TRL equation for ‘Dutch Style’ roundabout for each of the entry. It is noted that it normal practise to design a roundabout with a maximum operating Ratio of Flow to Capacity (RFC) of 0.85.

Table 1: AM Peak Hour PCU’s and Entry Capacity of Proposed ‘Dutch Style’ Roundabout

PCU	Total Entry	Circulatory Flow	Entry Capacity	Ratio of Flow to Capacity (RFC)
Mowbray Road	654	254	1,108	0.59
Queen Edith’s Way East	566	540	828	0.68
Fendon Road	472	602	767	0.62
Queen Edith’s Way West	266	586	782	0.34

Table 1 shows that during the AM peak hour the maximum RFC calculated at 0.59 for a ‘Dutch Style’ roundabout is 0.59, well below the 0.85 maximum threshold.

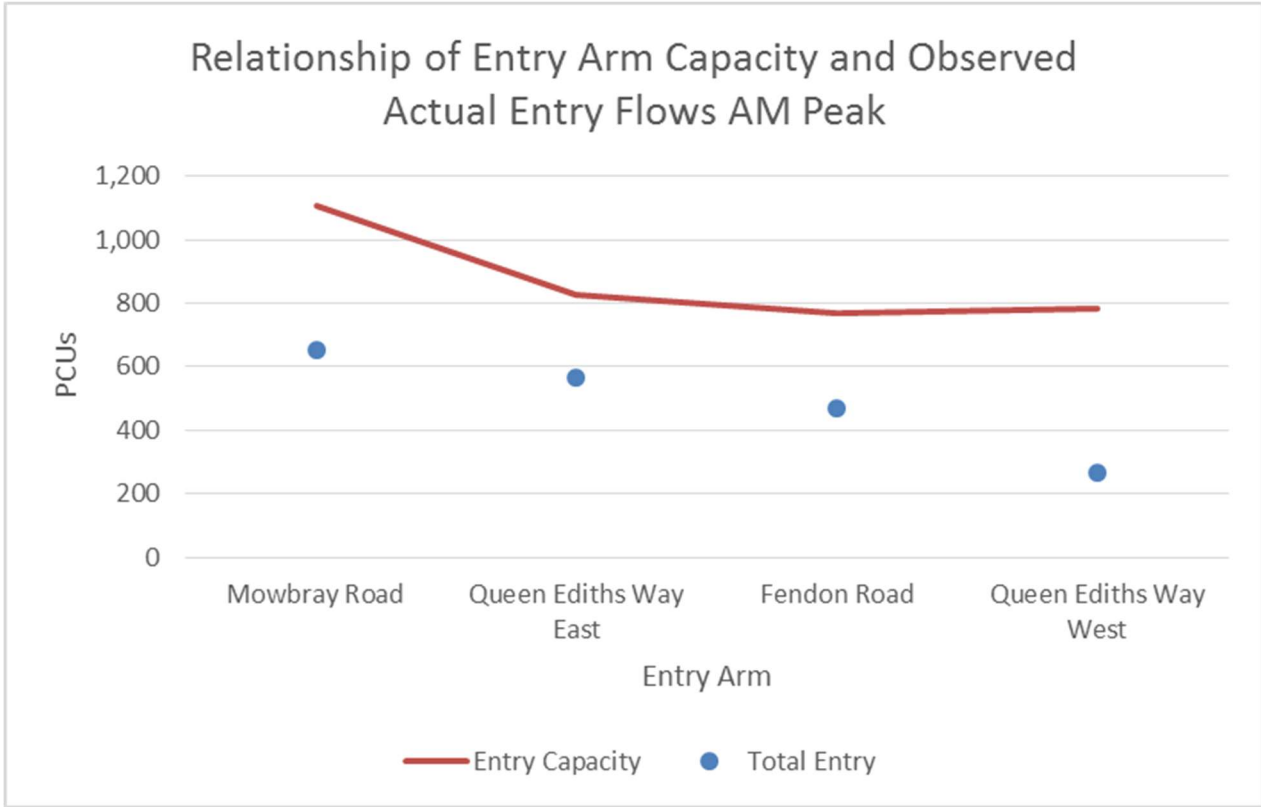


Figure 8: Entry Arm Capacity of 'Dutch Style' roundabout against observed flows (AM Peak)

Table 2: PM Peak Hour PCU's and Entry Capacity of Proposed 'Dutch Style' Roundabout

PCU	Total Entry	Circulatory Flow	Entry Capacity	Ratio of Flow to Capacity (RFC)
Mowbray Road	505	415	950	0.53
Queen Edith's Way East	289	372	993	0.29
Fendon Road	622	312	1,051	0.59
Queen Edith's Way West	340	689	682	0.50

Table 2 shows that during the PM peak the maximum RFC calculated at 0.59 for a 'Dutch Style' roundabout is 0.59, well below the 0.85 maximum threshold.

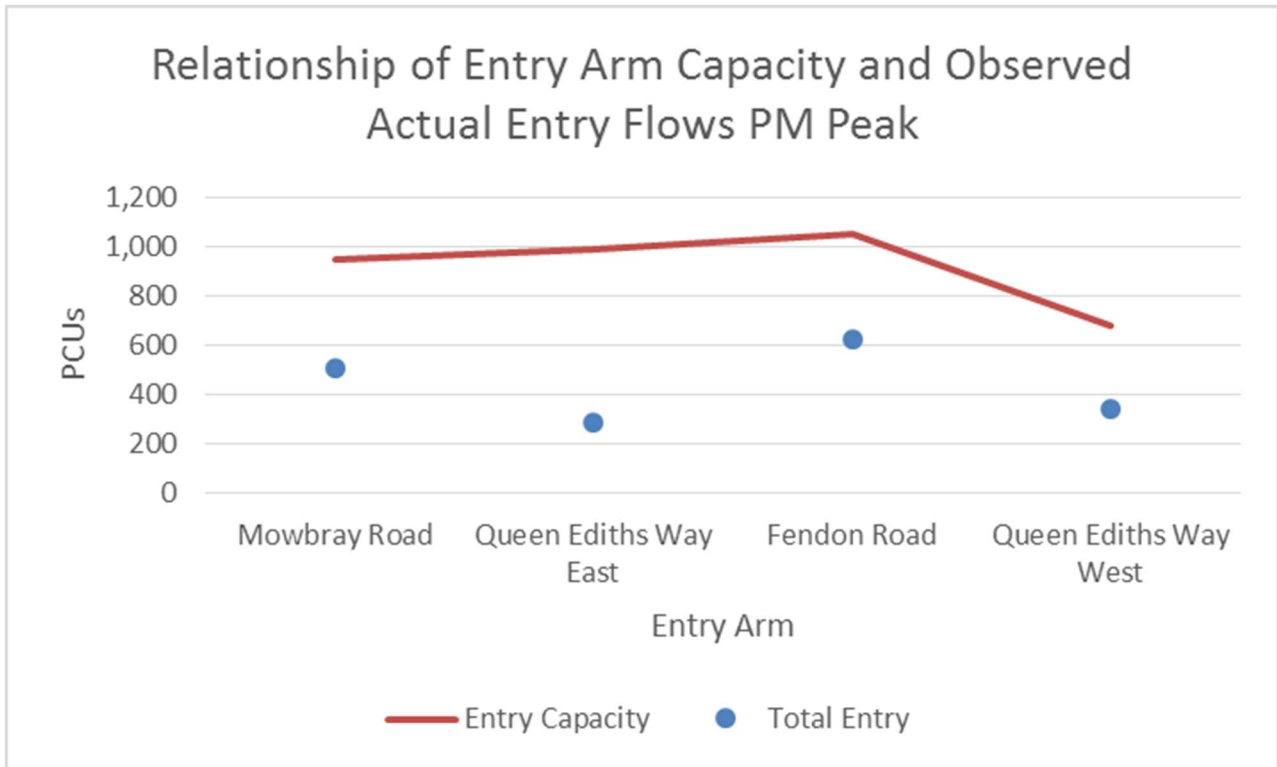


Figure 9: Entry Arm Capacity of 'Dutch Style' roundabout against observed flows (PM Peak)

Summary

The results show that a 'Dutch Style' roundabout in the Fendon Road location would operate within capacity. However it should be noted that this technical note only looks at the potential capacity of the junction based on traffic flow data and advice from TRL's published project report PPR752 ('Dutch Style' Roundabout Capacity Report). The TRL has carried out further research and trials into 'Dutch Style' roundabouts looking at user safety and this report (RPN751) should be read before any final design is decided upon. Whilst a 'Dutch Style' roundabout would operate within capacity, safety considerations should nevertheless be thoroughly examined.