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STILLORGAN QBC LEVEL OF SERVICE ANALYSIS

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Abstract

Previous studies [1] have analysed the walking catchment area for light rail and metropolitan rail stops in suburban parts of Dublin city's south-side. The purpose of this paper is to establish the catchment zone of stops on a bus corridor, also within the same sector of Dublin city.

The 2012 study looked at stops in four bands across the urban area, including: Urban, Outer Urban, Inner Suburban and Outer Suburban. Public transport users were surveyed at each stop and their street of trip origin identified. This information was then used to identify and approximate the catchment area for public transport at that stop.

This study focuses on the Stillorgan Quality Bus Corridor (QBC) from Cabinteely to Leeson Street. Bus stops in each of the respective urban bands were identified and user surveys carried out at each.

Across the 4 survey locations over 50% of trip-origins are more than 500m (as the crow flies) from the bus stop. An 85th percentile analysis suggests natural catchment limits of 950m – 1,100m. This equates to a catchment area traditionally associated in the literature with quality rail services. Catchment areas for quality bus corridor appear comparable and often greater than those for LRT or metro rail.

Approximately 1 in 7 (14%) of all passengers surveyed transferred either from or to another public transport service as part of their journey. This appears very significant in an urban transport market traditionally associated with low or negligible levels of transferability, especially as it is corroborated by studies in other parts of the city showing even higher levels of transfer [5].

Overall, public transport users seem very satisfied with the Quality of Service provided.

The study indicates that bus corridors with sufficiently high levels of service can have comparable or even greater walking catchment areas than light and metropolitan rail corridors. Public transport users, based on surveys of three adjacent modal corridors in the Greater Dublin Area, appear to be more influenced by Level of Service than by modal type.

Study Area and Context

A 2012 study by Harrison & O'Connor, which examined a light rail and metro rail corridor on the south-side of Dublin, demonstrated effectively that Euclidian (as-the-crow-flies) distances are an ineffective measure of catchment in an urban setting. The study also posited that conventional catchment thresholds are routinely misleading [1].

Much received wisdom in planning implies a catchment limit of 400-500m for bus corridors. Irish national planning guidance recommends that "*increased densities should be promoted within 500m walking distance of a bus stop, or within 1km of a light rail stop or rail station*" [2]. This suggests a natural inferiority of one transport mode over another, irrespective of levels of service or other critical operational factors.

This study sets out to test this assumption by examining the catchment of a bus corridor within the same urban sector as the light rail and metro rail corridors examined in the 2012 study. The latter study established four urban bands which were adopted for this study: urban; outer urban, inner suburban and outer suburban. Four well patronised bus stops, one within each band, along the Stillorgan Quality Bus Corridor (QBC) were identified. The LUAS B Light Rail Corridor, the DART metro rail corridor (both examined in the 2012 study) and the Stillorgan QBC, all serve the south east part of Dublin city, affording a unique laboratory for comparison across modes. Figure 1 shows the locations of the surveys undertaken on the Stillorgan QBC and other corridors.

Methodology

Surveys were undertaken at 4 designated stops on bus routes on the Stillorgan QBC (Leeson Street, Donnybrook Village, Stillorgan and Cabinteely). The surveys were undertaken on Thursday 12th and Thursday 19th June, from 8am – 10am on both days. The surveys were undertaken in pairs and the following data was captured: -

- Trip origin;
- Principle mode travelled to the stop;
- Principle mode of onward travel;
- User perceptions of service quality at the stop;
- Bus frequency;
- Boarding / alighting figures.

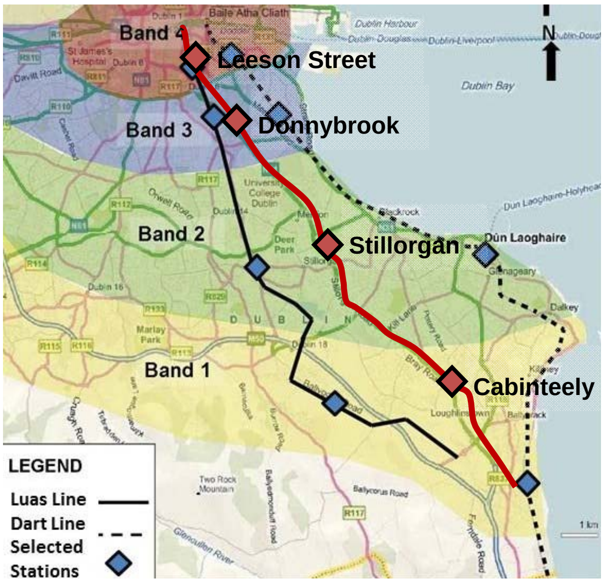

Figure 1: Stillorgan QBC showing survey locations (red) and earlier studies (blue)

A quota of 50 surveys was targeted for each of the stops. Quotas were met at the Donnybrook and Stillorgan stops. A lower, but adequate sample was achieved at the remainder stops. In total 139 boarding passengers were surveyed out of a total of 340 who boarded during the survey, yielding a sample of 41%. 496 people alighted during the survey.

For each stop location, a catchment distribution map was prepared showing the origin of each surveyed trip. Charts were also prepared illustrating user perception of service quality, propensity to transfer and bus operations at the stop.

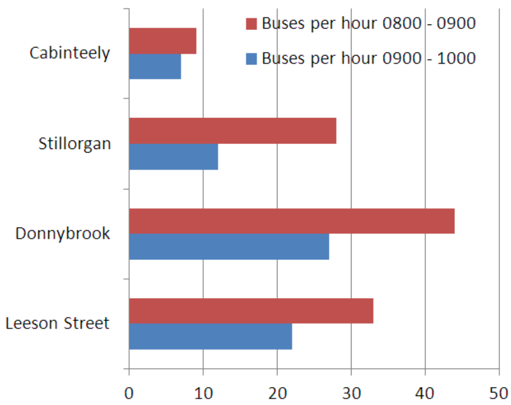

Table 1: Bus Frequency by survey location

Levels of Service

The number of buses per hour at each stop location was recorded, as shown in Table 1.

- Service frequencies increased as the corridor progressed inbound, and then tailed off at Leeson Street as some service routes split entering the city centre.
- The highest recorded frequency was 44 buses per hour at Donnybrook.
- All stops could be categorised as Level of Service (LoS) A in the context of the

Transportation Research Board's Transit Capacity and Quality of Service Manual (TCQSM) [3].

The TCQSM provides a multi-criteria toolkit for measuring the quality of a public transport service. Both the LUAS B LRT service and the DART metro rail service would both attain a LoS A rating under the same criteria.

Propensity for Transfer

At each stop, waiting passengers were queried as to which mode they arrived by and, also, how they planned to complete their onward journey at the other end of the service.

- 84% of passengers walked to their bus stop;
- 10% of passengers drove to their bus stop (mostly kiss & ride);
- 4% of passengers arrived at their stop by bus;
- 10% transfer onto another public transport service, while 1% transfer onto a bike.

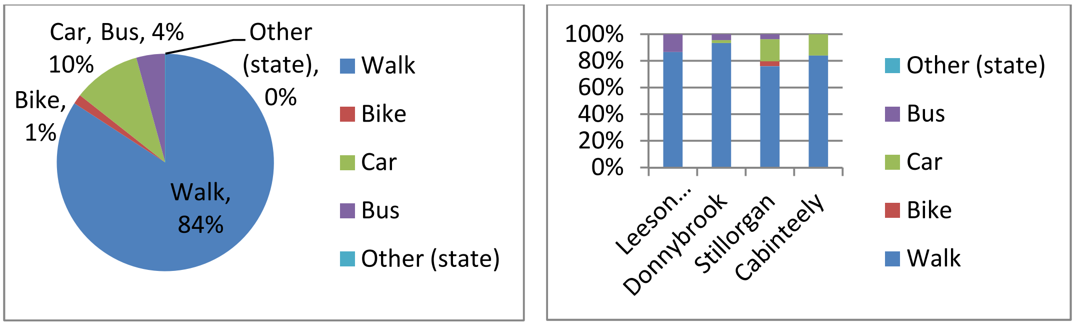

Table 2a&b: Arrival mode (left) and (right) Arrival mode by survey location

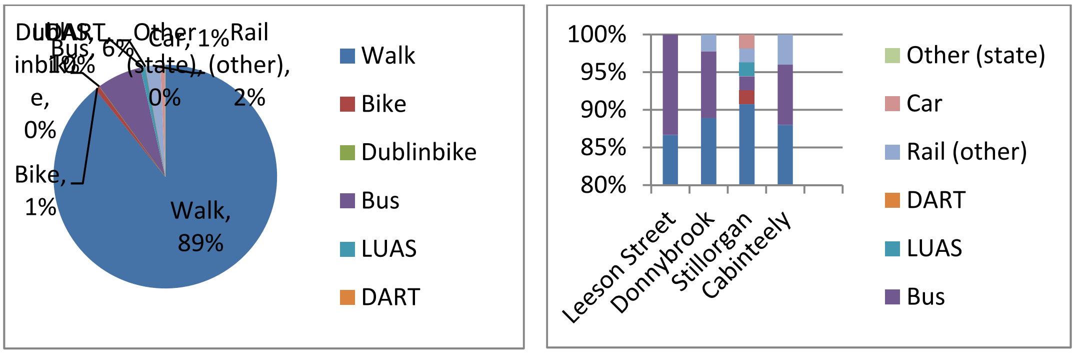

Table 3a&b: Onward travel mode (left) and (right) Onward travel mode by location

Approximately 1 in 7 (14%) of all passengers surveyed transferred either from or to another public transport service as part of their journey. Overall this appears a significant level of passenger transfer within an urban transport market where traditionally transferability is thought of as being low or negligible.

The highest level of public transfers (23%) was recorded at the Leeson Street stop, which is within the city centre sector.

A similar study, of the Malahide QBC, revealed a much higher level (35.5%) of public transport transfer. Both corridors provide a similarly high level of service. While there are differences in the socio-economic profiles of the neighbourhoods served by both corridors it is not clear what the underlying cause of such a difference may be. Irrespective, both corridors' level of transfer is significant and this in itself is noteworthy.

Level of Service Analysis

At each stop waiting passengers were queried how they would rate the service they were taking in terms of the following service factors: Frequency; Comfort; Convenience; Safety, and Reliability.

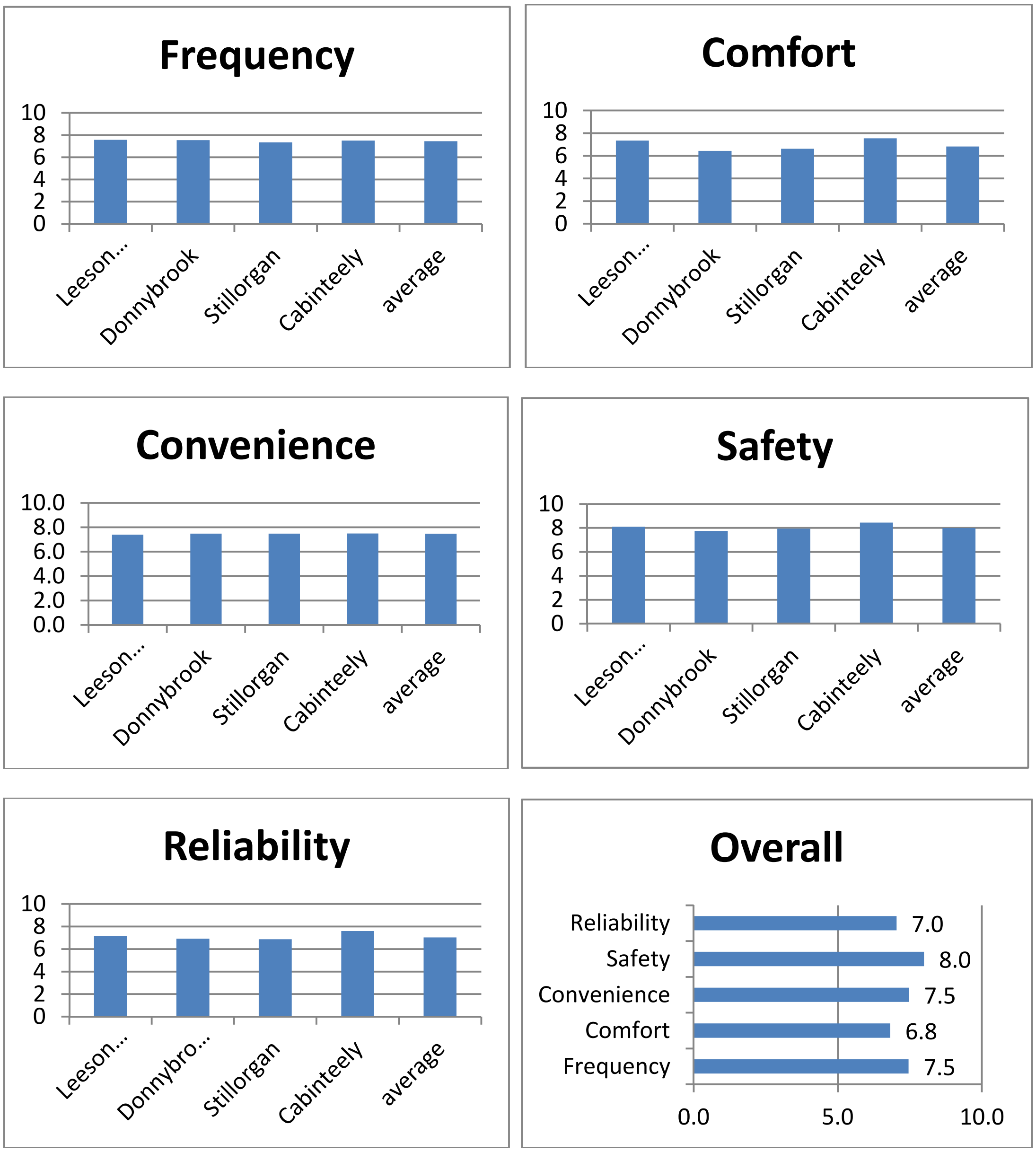

Table 4: Traveller's Perceptions of Service Quality at Each Stop Location

Overall perception of service quality was high, scoring approximately 7.5 out of 10 for reliability, safety, convenience, comfort and frequency.

Within the sampled population there is a consistently favourable perception towards both the overall Quality of Service and individual components. This survey was conducted during the peak and shoulder-peak service periods. A diurnal or off-peak study could possibly yield differing results.

Generally, analysing and interpreting perceptions of service quality and ordered choices can be complex [4]. It is hoped that this data, combined with that from other, similar studies in other parts of the city, will be analysed in further, more detailed studies.

Catchment Analysis

For each stop location, a catchment distribution map was prepared showing the absolute origin of each surveyed trip. In each case the trip was geo-referenced to a street or estate centroid and plotted accordingly.

Figures 2A-D shows the distribution of trip origins both for the surveys as part of this study and also the surveys undertaken by Harrison *et al* as part of the 2012 investigation of catchment areas for light rail and metro rail corridors [1]. (Some distant trip origins are excluded for reasons of scale).

The 2012 study methodology differed from the current methodology insofar as only pedestrian trips were enumerated. The 2012 study also had the benefit of ArcGIS Network Analysis, which identified the network distance bands (primarily the focus of that research). Resources for such an analysis were not available for this study so a proper network analysis was not undertaken [1]. It is hoped to do so in further stages.

Nevertheless, the distributions shown in Figure 2A-D demonstrate that across each of the 4 urban zones, catchment areas for the quality bus corridor are comparable or greater than those for LRT or metro rail. Across the 4 survey locations over 50% of trip-origins are more than 500m (as the crow flies) from the bus stop. An 85th percentile analysis suggests natural catchments of 950m – 1,100m. This equates to a catchment area traditionally associated in the literature with quality rail services. This is notwithstanding an analysis of network distances.

Table 5 provides a breakdown of the quantum of trips from each significant travel band.

50% of all trip-origins were in excess of 500m from the stops. In the case of the outermost suburban bands this was 76% and 56% for the Stillorgan and Cabinteely stops respectively.

		< 500m	500m - 1000m	> 1000m	85th Percentile
LoS A	Leeson Street	14	3	3	17
	Donnybrook	33	4	8	38
	Stillorgan	12	19	20	43
	Cabinteely	11	8	6	21
		70	34	37	
		50%	24%	26%	

Table 5: Quantum of Trip Origins by Travel Band

The study demonstrates that, within the study area, High Level of Service bus stops have catchment thresholds significantly greater than 500m. 85th percentile analysis suggests natural catchment thresholds of 950-1100m (and even as great as 1500 at one stop where a high number of car drop-offs occurred). This equates to a catchment area traditionally associated in the literature with quality rail services.

These catchments are measured in Euclidian (as the crow flies) distances. Actual network distance would with certainty, yield significantly larger catchment thresholds and it is hoped that this analysis will be carried out in continued studies.

Figure 2.A: Band A - URBAN

Figure 2.B: Band B – OUTER URBAN

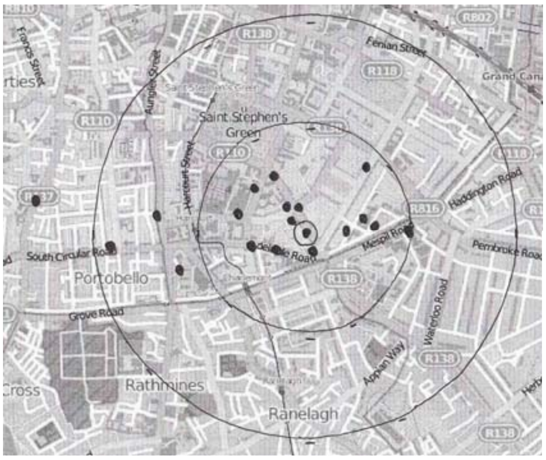

Fig. 2.A.i: Leeson Street bus stop

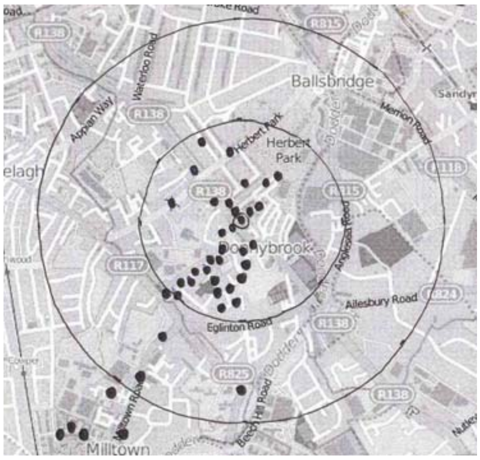

Fig. 2.B.i: Donnybrook bus stop

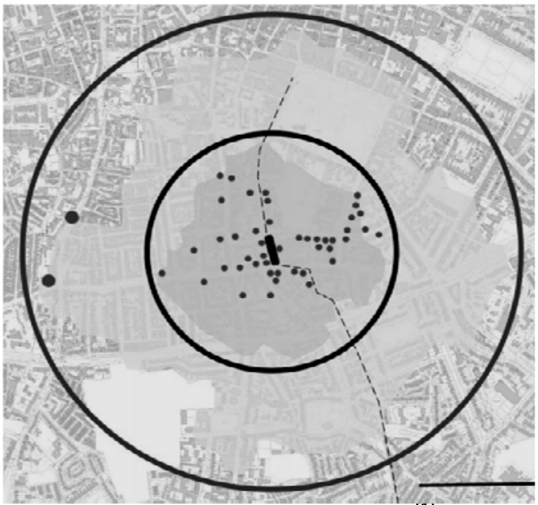

Fig. 2.A.ii: Harcourt St LUAS station [1]

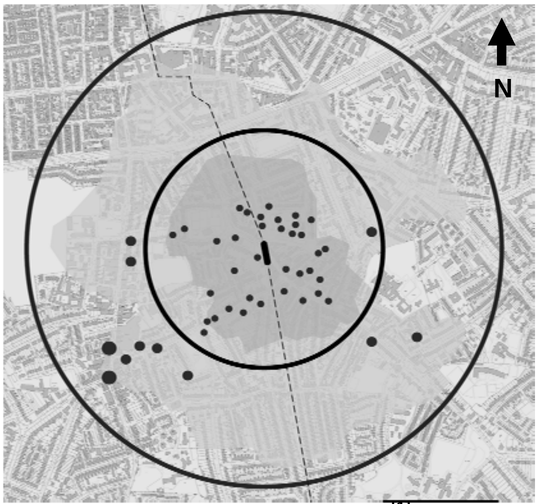

Fig. 2.B.ii: Ranelagh LUAS station [1]

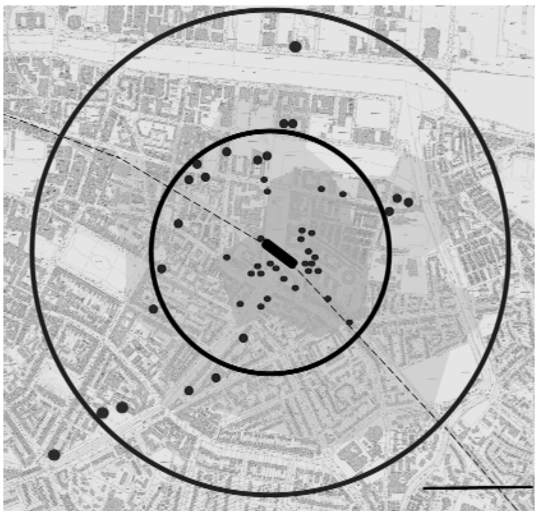

Fig. 2.A.iii: Grand Canal Dock DART station [1]

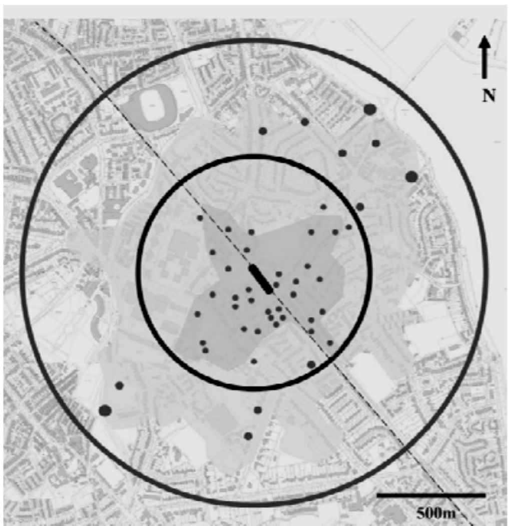

Fig. 2.B.iii: Sandymount DART station [1]

Figure 2.C: Band C – INNER SUBURBS

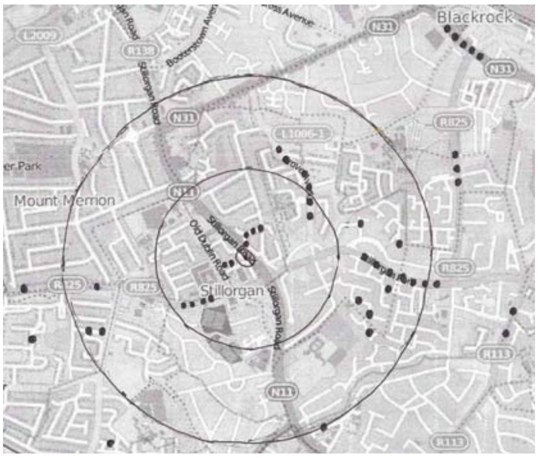

Fig. 2.C.i: Stillorgan bus stop

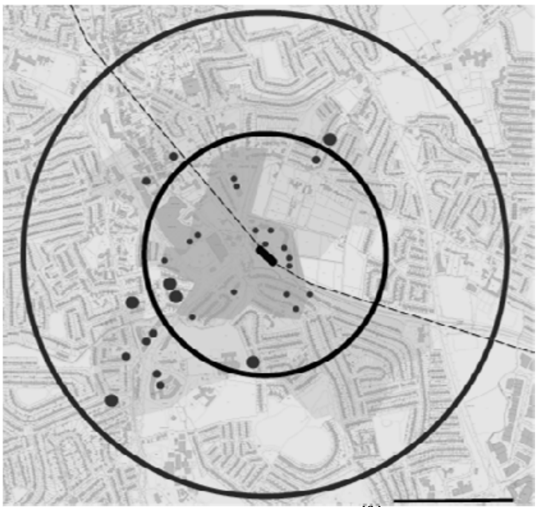

Fig. 2.C.ii: Balally LUAS station [1]

Fig. 2.C.iii: Dun Laoghaire DART station [1]

Figure 2.D: Band D – OUTER SUBURBS

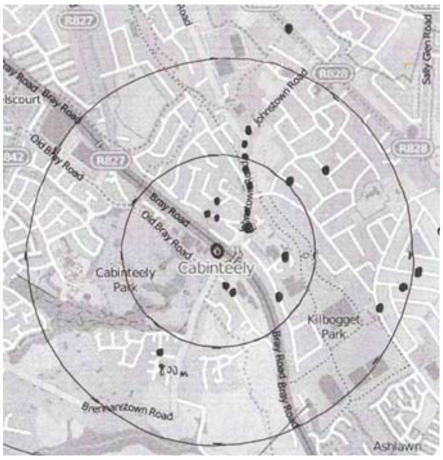

Fig. 2.D.i: Cabinteely bus stop

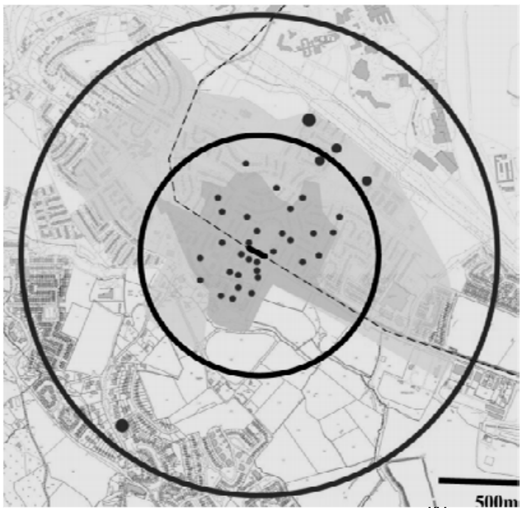

Fig. 2.D.ii: The Gallops LUAS station [1]

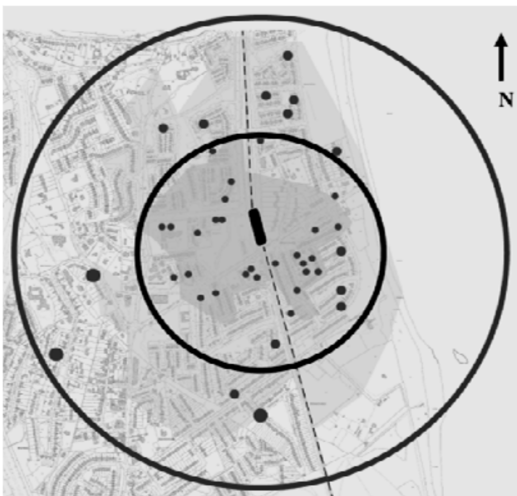

Fig. 2.D.iii: Shankill DART station [1]

Conclusions

This study focuses on the Stillorgan Quality Bus Corridor (QBC) from Cabinteely to Leeson Street. Bus stops in each of the same urban bands as earlier studies, which looked at LRT and metro rail, were identified and comparative surveys carried out in order to establish the catchment zone of stops on a quality bus corridor.

Across the 4 survey locations, over 50% of trip-origins are more than 500m (as the crow flies) from the bus stop. An 85th percentile analysis suggests natural catchments of 950m – 1,100m. This equates to a catchment area traditionally associated in the literature with quality rail services. Across each of the 4 urban zones, catchment areas for quality bus corridor appear comparable and greater than those for LRT or metro rail.

Approximately 1 in 7 (14%) of all passengers surveyed transferred either from or to another public transport service as part of their journey. This appears very significant in an urban transport market traditionally associated with low or negligible levels of transferability.

A similar study being carried out on the Malahide QBC, a corresponding QBC serving lower socio-economically stratified suburbs on the north-side of the city, yielded contrasting but noteworthy results. In the Malahide QBC study, transfer rates were much higher, at 35% of all trips. While transfer levels are lower on the Stillorgan corridor, both studies demonstrate significant latent demand for transfer within the overall network [5].

Overall perception of service quality was high, scoring approximately 7.5 out of 10 for reliability, safety, convenience, comfort and frequency.

The study indicates that bus corridors with sufficiently high levels of service can have comparable or even greater walking catchment areas as with light and metropolitan rail corridors. Public transport users, based on surveys of three adjacent modal corridors in the Greater Dublin Area, appear to be more influenced by Level of Service than by modal type.

These results point towards a number of potentially relevant and new understandings about public transport user behaviour within the Greater Dublin Area: -

i) that a high level of service bus corridor can have as large or larger a catchment area than light or heavy rail equivalents;

ii) that users may be more influenced by Quality of Service than by transport mode;

iii) that there is a demand for transfer within the Dublin transport market, even where it may be poorly provided for.

The available data and relevance of the findings suggest that further more detailed assessment is warranted. The "network analyst" function within ArcGIS should be applied to the trip-origin distributions to assess the relationship between catchment and urban form in more detail. The data associated with each survey point is nuanced and may be skewed by socio-economic and geographical factors such as urban density. Stopping pattern effects and modal patterns warrant examination. A larger study sampling a wider study area may add robustness to the analysis.

References

[1] Harrison, O. & O'Connor, D. Measuring Rail Station Catchment Areas in the Greater Dublin Area, Proceedings of the Irish Transport Research Network 2012, www.itrn.ie

[2] Guidelines for Sustainable Residential Development in Urban Areas, Department of Environment, Heritage & Local Government, 2009, p43

[3] Transit Capacity and Quality of Service Manual, Transport Research Board, 3rd ed., 2012

[4] Greene, W. H. & Hensher, D. A., *Modelling Ordered Choices, a Primer*. Cambridge, 2010

[5] O'Connor, D. & Kavanagh, P. Malahide QBC Public Transport Level of Service Analysis, Proceedings of the Irish Transport Research Network 2014