

## **Tube OTS pilot study: passengers' 'opportunity to see' posters in tube cars**

### **Summary:**

*Observations were made in uncrowded conditions on all the London tube lines to assess the "opportunity to see" (OTS) advertising panels in tube cars. Results are expressed in terms of (a) the number of positions within a car from which each 'tube card' panel is in view, and (b) the number of panels within a car which are in view from a given viewing position (seated or standing). These results are also reported as percentage OTS values. The report focuses on a single example but data are supplied for all environments. For the sample case, the percentage OTS scores for panels vary between 18% and 50% for seats and between 14% and 46% for the standing positions assessed. Likewise seats scored between 25% and 44% of the panels available for viewing. The average OTS score of about 30% for the sample case was based on 8 out of 26 panels (potentially viewed from 40 seats and 9 representative standing positions). The OTS scores averaged over lines were 33% for seats and 24% for standing positions. A number of issues are discussed: the possibility of adjusting the method of scoring; the need to check the observations made; and whether or not the study should be extended to other travel conditions.*

### Introduction:

This is a brief overview of the findings of the "Tube OTS pilot study"; detailed results are available in the Excel files attached to this report.

The scoring of OTS may be done in terms of how many panels an observer reports being able to see. A simple score of the number of panels in view would seem to suffice, but to enable comparisons across situations containing different numbers of panels; it would be useful to convert such numbers into percentages of the total available for viewing.

An alternative is to score the number of positions which an observer can occupy in a carriage (car) from which a given panel can be seen. As in the previous case this could alternatively be expressed as a percentage of the total number of observer positions. This measure focuses on the prominence of the panel and would seem to be useful in identifying the optimal location for a poster.

Scores for individual panels or viewing locations may of course be too detailed for practical purposes. Many cars are divided by standing wells between the entrance/exit sliding doors into seating/standing areas referred to as "bays", containing bench and other seats; it is understood that present practice is to allocate a percentage OTS score (33%) for every panel in a given "bay". That is, every passenger entering a car is assumed to be exposed to the advertising panels in one bay and has an opportunity to see each of them, so that if there are three bays, he/she will have an equal chance of seeing just one-third of the panels in the carriage. There appears to be no other adjustment, upwards to allow for OTS in getting on and off the train, downwards for obstructions to vision from whatever source. Scores per bay can be derived in a quite straightforward manner for most cars, and these results will also be provided.

There are 12 tube lines and the structural differences between the various car types are generally too great for the results to be pooled. For present purposes some grouping is possible and six different types of rolling stock can be identified; there is sufficient

similarity among them for five pairs to be treated as the same, with one unique case. Specifically, data for carriages on the Bakerloo and Victoria lines can be aggregated, as can data for the Central and Waterloo lines, the Circle and Hammersmith lines, the Northern and Jubilee lines, and the Metropolitan and East London lines. Only the District line stock requires separate treatment as its in-car posters run along the whole length of the car. In every case there are also differences between the motor carriage and the trailer carriages. In total there are data for 14 (see table at end) separate car 'environments'.

#### Method:

A set of recording templates were constructed for the various environments (see the Appendix for an example). A scoring scheme (see below) was devised and applied by an observer/assessor (co-author MS). Observations were made while the trains were in service but at times of the day when conditions were uncrowded, with no fellow passengers standing or personally obstructing the field of view.

#### Results: Panel-wise scoring of OTS

Several OTS scores are possible for each panel. First, the number of locations within the car from which the given panel can be seen is noted. This can be aggregated over seats (including 'flip' and 'bum' seats); this is the measure *N in-view locations (seated)*. Obviously the maximum score depends on the number of seats and so this is also reported as the corresponding percentage OTS score.

This is repeated for a number of standard standing positions (not all of which, for structural reasons, were possible in every car type). This is the measure *N in-view locations (standing)*, and a percentage version thereof is also reported.

These are summed to form a total score, *N in-view locations (total)*, and its percentage version.

The following table gives the results for the motor cars on the Bakerloo/Victoria lines. The layout diagram (see Appendix) needs to be consulted to see how the OTS scores vary across panels. It is important to notice that the motor car has cross benches and that the trailer car does not. The results are for panels 1-13 which are above seats 1-20 and opposite seats 21-40; because of the symmetry of the cars the results apply to the complementary panel-seat combinations, that is, panels 14-26 below seats 21-40 and opposite seats 1-20.

To assess the see-ability of each panel, the following simple scoring scheme was adopted<sup>i</sup>:

*Unobstructed and good (clear) view g*

*Unobstructed and moderately clear m*

*Unobstructed and poor (unclear) p*

*Completely obstructed or very unclear view (impossible to make anything of the content) blank*

*Partially obstructed but otherwise viable view pX*

These were converted into arithmetic values as follows:

*g = 1.0*

*m = 0.5*

*p = 0.25*

*Otherwise 0.0*

A panel that was scored relative to four seats which produced values of g, m, p and pX would thus score  $1 + 0.5 + 0.25 + 0.0 = 1.75$  and the average OTS % for the panel would be  $100 \times 1.75 / 4 = 44\%$ . If the panel received 'g' from all four seats, the total score would be 4 and the OTS would be 100%.

	P1	P2	P3	P4		P5	P6	P7	P8	P9		P10	P11	P12	P13
N in-view locations (seated)	9.0	7.0	10.0	8.3		17.0	20.0	17.3	18.0	14.0		11.0	12.0	10.8	10.5
N in-view locations (standing)	8.0	8.0	8.0	8.3		2.5	4.5	5.5	4.3	3.3		4.0	4.3	4.5	4.5
N in-view locations (total)	17.0	15.0	18.0	16.5		19.5	24.5	22.8	22.3	17.3		15.0	16.3	15.3	15.0

Percent in-view locations (seated)	23	18	25	21		43	50	43	45	35		28	30	27	26
Percent in-view locations (standing)	44	44	44	46		14	25	31	24	18		22	24	25	25
Percent in-view locations (total)	29	26	31	28		34	42	39	38	30		26	28	26	26

It may continue to be useful in deciding how these figures may be used to refer also to 'bay' scores. As noted above, in many carriages the seats are grouped in bays, and percentage scores are also provided for each bay, defined roughly by doors or aisles as their boundaries.

As an example, consider the Bakerloo/Victoria line spreadsheet. The schematic layout diagram (Appendix BV) needs again to be consulted to see how the OTS scores vary across bays. For the panels above seats numbered 1-20, the bay containing seats 1-6 have an OTS of 64%. A perfect score of 100% would mean that every panel in the bay (panels 1-4) would be in clear or unobstructed view for every seat in the car. This is obviously sometimes not the case, as when the passengers sit at the far end or along the side of the car and cannot see the poster/s behind them (without - unnaturally - turning through a full 180 degrees to look up and behind them). Additionally there are often obstructions such as bulkheads, protruding digital displays or shelves, preventing panels from being seen fully by an observer even when in the same bay. Typically, and unsurprisingly, OTS scores are much higher for panels in the same bay as a given seat, and often panels are, also unsurprisingly, not seen at all from a seat in another bay, even when it is on the opposite side to the seat.

	p1-p4	<i>drs</i>	P5-p9	<i>drs</i>	p10-13
<b>SEATS 21-26</b>	<b>64</b>		<b>31</b>		<b>1</b>
<b>SEATS 27-34</b>	<b>6</b>		<b>74</b>		<b>7</b>
<b>SEATS 35-40</b>	<b>0</b>		<b>14</b>		<b>82</b>
<b>STANDING</b>	<b>45</b>		<b>22</b>		<b>24</b>

Seat-wise scoring of OTS:

Because several of the car layouts are symmetrical seat-panel combinations can be paired. The “best” seats for the Bakerloo/Victoria lines can be judged from the following table, which breaks the data down into same side (18.8%) and opposite side pairings (44.6%), as well as the overall pooled figures (31.7%); these data are completed by the inclusion of results for some representative standing positions (29.8%). Overall the wall-seat 6 and the cross-seat 14 get the highest OTS ratings relative to the whole set of panels, with 39% (a score of 10.25 for 26 panels) and 44% (11.5 for 26 panels).

Bakerloo/Victoria lines	seat number	equivalent seat number	Total N viewable panels opposite side	Percent viewable panels opposite side		Total N viewable panels same side	Percent viewable panels same side		Total N viewable panels	Overall percent viewable panels
<b>Motor coach</b>	1	21	5.5	42		1.00	7.7		6.5	25
	2	22	6.3	48		1.00	7.7		7.3	28
	3	23	6.5	50		3.00	23.1		9.5	37
	4	24	7.3	56		0.00	0.0		7.3	28
	5	25	8.3	63		0.50	3.8		8.8	34
	6	26	7.0	54		3.25	25.0		10.3	39
	c7	27	5.5	42		4.50	34.6		10.0	38
	c8	28	6.0	46		3.00	23.1		9.0	35
	c9	29	4.5	35		2.25	17.3		6.8	26
	c10	30	4.0	31		3.25	25.0		7.3	28
	c11	31	4.8	37		2.00	15.4		6.8	26
	c12	32	6.5	50		2.00	15.4		8.5	33
	c13	33	5.3	40		2.75	21.2		8.0	31
	c14	34	6.5	50		5.00	38.5		11.5	44
	15	35	7.5	58		1.75	13.5		9.3	36
	16	36	6.0	46		1.50	11.5		7.5	29
	17	37	5.8	44		3.00	23.1		8.8	34
	18	38	4.0	31		3.00	23.1		7.0	27
	19	39	4.5	35		3.00	23.1		7.5	29
	20	40	4.5	35		3.00	23.1		7.5	29
<b>seat means</b>			<b>5.80</b>	<b>44.6</b>		<b>2.44</b>	<b>18.8</b>		<b>8.24</b>	<b>31.7</b>
<b>standing means</b>									<b>7.72</b>	<b>29.8</b>

A comparison between lines is provided by the next table. It should be remembered that stock varies in terms of the numbers (and types and position/direction) of seats and of panels, so possibly the percentage scores give the best indication of OTS comparability.

Line	Car	Total viewable panels (seated)	Overall percent viewable panels (seated)	Total viewable panels (standing)	Overall percent viewable panels (standing)
Bakerloo/Victoria lines	motor	8.2	32	7.7	30
Bakerloo/Victoria lines	trailer	8.7	33	4.6	18
Central/Waterloo	motor	4.6	33	2.9	20
Central/Waterloo	trailer	4.6	29	2.6	16
Circle/Hammersmith	motor	3.5	22	2.9	16
Circle/Hammersmith	trailer	3.4	21	2.9	18
District	motor	17.4	44	17.1	43
District	trailer	18.6	44	18.0	43
Metropolitan/East London	motor	2.0	17	0.3	2
Metropolitan/East London	trailer	1.8	15	0.2	2
Northern/Jubilee	motor	7.2	33	4.9	22
Northern/Jubilee	trailer	7.4	31	5.4	22
Piccadilly	motor	7.0	35	4.0	20
Piccadilly	trailer	7.0	35	3.9	20

The case of the Metropolitan/East London line may need to be revisited. It scores so poorly because panels are frequently obstructed by shelves/luggage racks between the posters. The highest OTS scores are for the District Line where panels are placed above doors in unobstructed view. What affects the scores in many cases is the presence of bulkheads, etc. The extraordinary fact is that when the Metropolitan/East London line is excluded, the average OTS score for seated positions is 33%! For the corresponding standing positions the average OTS score is 24%.

#### Comments: Scoring and reliability of scores

A graduated scoring scheme was used rather than a simple binary method (see-able vs. not see-able). This follows the Campbell-Daniels precedent and avoids what might be seen as a punitive approach if the criteria that occur from time to time in committee/technical discussions of OTS were applied. In the same spirit, it is worth examining the more generous stance of allowing some numerical credit to the instances where the panel was occluded and was assigned a pX score. The criterion for a pX score was that if all of the edges were visible it was rated on the usual scale but if any edge or more of the poster was occluded it was assigned pX (the degree of occlusion did vary noticeably across the lines and this is reflected in the table below).

Accordingly a count was made of all pX scores per line/car type/viewing position. Using these figures, a maximum adjustment per condition may be estimated. The following table shows clearly where to find the most and least occluded panels. The District Line has none (all the panels are over the doors) and the Metropolitan and East London Lines have the most, for both seated and standing passengers; they are closely followed by the Circle and Hammersmith Lines. Adjusting the OTS scores to the greatest extent possible makes for much greater parity among lines. This it may be reasoned would be

too generous, so taking a third way, revised OTS scores were obtained by adding half the pX scores to the raw OTS values. The result is shown in the last column in the table. This produces a new rank order distinguished chiefly by the appearance of the District Line in first position, with Circle and Hammersmith Lines languishing still in the relegation zone.

Line(s)	Type of car	% pX(seated)	%pX(standing)	%pX(total)	Overall percent viewable panels (seated)	TOTAL + PX	TOTAL + PX/2
Bakerloo & Victoria	Motor	3.6	4.7	3.8	31.7	35.5	33.6
Bakerloo & Victoria	Trailer	5.6	3.8	5.2	33.3	38.5	35.9
Central & Waterloo	Motor	12.2	8.4	11.3	33.0	44.3	38.7
Central & Waterloo	Trailer	10.3	7.5	9.7	28.9	38.6	33.7
Circle & Hmsmith	Motor	18.2	15.0	17.4	21.7	39.1	30.4
Circle & Hmsmith	Trailer	18.2	15.0	17.4	21.4	38.8	30.1
District	Motor	0.0	0.0	0.0	43.6	43.6	43.6
District	Trailer	0.0	0.0	0.0	44.2	44.2	44.2
Metrop & E London	Motor	29.0	35.4	29.8	16.8	46.7	31.7
Metrop & E London	Trailer	20.4	20.0	20.4	15.4	35.8	25.6
Northern & Jubilee	Motor	7.7	12.1	8.5	32.8	41.3	37.0
Northern & Jubilee	Trailer	6.9	10.2	7.5	30.9	38.3	34.6
Piccadilly	Motor	7.6	7.2	7.5	34.9	42.4	38.7
Piccadilly	Trailer	8.6	7.5	8.4	34.9	43.2	39.1

The summary results are underpinned by a set of detailed observations for each of the 14 'environments' defined by the 7 line types and 2 car types. These 'data' have not so far been subjected to a reliability check. That is, they are scores assigned by a single observer. To this extent, the investigation has to be considered a 'pilot study', and inter-observer-agreement could be required. The pros and cons for an extension of the study will need to be reviewed; the practical application of the results will no doubt be crucial in such deliberations, as will a review of the method and the time-frame required for obtaining further data. If reliability is to be assessed, it may be sufficient to do this for one or two line x car combinations. If agreement is reasonably high, then a full study could be dispensed with.

A related issue is whether or not the study should be repeated with observations made in crowded conditions with passengers in standing positions obstructing the field of view. This could be done with trains in service, during peak travel periods for example. The sheer logistical difficulty of this would be a serious obstacle. Furthermore the variation in how the visual environment could be obstructed is considerable and completely uncontrolled in normal circumstances of course. From the present study the impression was gained - and it is no more than an impression - that it takes very little to compromise OTS, that scores are radically affected during peak travel times, and that it would be next to impossible to make notes for observations under such conditions. It may be more efficient to take observations with one or more confederates in a train out of service, with the confederate taking standard (probable) standing positions while the observations are being made - if a follow-up study is required.

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**Appendix: Schematic layout diagram (and score sheet template) for Bakerloo and Victoria line motor coach: showing poster panel and seating positions:**

Line	<b>Bakerloo, Victoria</b>	date motor	time motor	date trailer	time trailer	Posters are above the vents that run along the window top and below the line maps. There are smallish bulk heads.
		stand motor	sit motor	sit trailer	stand trailer	

**Motor car**

p1	p2	map	p3	p4	doors	p5	p6	p7	p8	p9	doors	p10	p11	map	p12	p13	door

Seats

1	2	3	4	5	6	doors	7		10	11		14	doors	15	16	17	18	19	20	door
							8		9	12		13								

Seats

aisle

aisle

aisle

21	22	23	24	25	26	doors	27		30	31		34	doors	35	36	37	38	39	40	door
							28		29	32		33								

p14	p15	map	p16	p17	doors	p18	p19	p20	p21	p22	doors	p23	p24	map	p25	p26	door			

<sup>i</sup> *The quality of the opportunity to see of the posters visible from the given observation position was judged using: g (for good) when the Brand/Ad name/Product/Service could be seen; m (for moderate) when the Headline could be seen; p (for poor) when only a picture/design could be seen; vp (for very poor) when only colour could be seen; pX when the poster was partially occluded; blank when the poster is comprehensively occluded or could not be seen at all. This classification was based on the scheme employed in the Campbell-Daniels study of platform OTS.*