Video Advertising Impact on Driver Fixation Patterns

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ABSTRACT

In order to assess driver distraction due to video advertising signs, eye fixation data were collected from subjects who passed 4 video advertising signs, 3 at downtown intersections and 1 on an urban expressway. On average drivers looked at the signs 45% of the time they were present. When drivers looked, they made 1.9 glances on average, with an average duration of 0.48 seconds. The distribution of eye fixations on intersection approaches where video signs were visible was compared to that on approaches on which video signs were not visible. There were no significant differences in the number of glances made at traffic signals or street signs. On the video approach there was a trend towards a greater proportion of glances at the speedometer and rear-view mirrors. Glances were made at short headways (1 second) and in unsafe circumstances (while crossing an intersection). In the downtown area, glances at static commercial signs were made at larger angles and at shorter headways than was the case for video signs.

A comparison of our results with other studies showed that video signs were less likely to be looked at than traffic signs (about half the time versus virtually every time), that individual average glance durations and total durations were similar to those found for traffic signs. However, another on-road study indicates that some video signs can be very distracting. A video sign on a curve that was directly in the line of sight and visible for an extensive period attracted 5.1 glances per exposed subject.

INTRODUCTION

Road authorities are under increasing pressure from advertisers to allow commercialization of the right of way as one method of developing revenue streams to offset budget costs. In Toronto, Canada numerous applications have been made for the right to erect video advertising signs at downtown intersections and along urban expressways. A previous study has shown that video advertising is more effective in attracting driver's attention than static billboards *(1)*. This is no doubt linked to the presence of motion, which is picked up in the drivers' peripheral vision, the continuous stream of changing images, which is potentially more interesting to look at, and brighter and therefore more conspicuous presence as compared to static billboards. Given their greater attention-attracting qualities, road authorities are understandably concerned about whether or not video advertising signs constitute a driving hazard.

At the request of the Transportation Services Division of the Transportation Department, City of Toronto, a comprehensive assessment of traffic safety impacts related to video advertising signs was carried out in a series of studies. These studies included:

- measurement of driver eye fixations in relation to video signs
- assessment of before and after sign installation changes in speeds and headways
- assessment of traffic conflicts on approaches with versus without video signs
- assessment of before-and-after changes in collision patterns and frequency
- a public survey concerning distraction from video advertising and traffic safety impacts.

Only the results of the eye fixation study are reported in this paper. The results of the other studies will be reported at a later date.

The specific goals of the eye fixation study were to determine the following:

- Do drivers look at the video advertising signs, and if so for how long, and how frequently?
- Is the presence of video signs associated with a reduction in the proportion of glances at traffic-related signs and signals, or at speedometers and mirrors?
- Is the presence of video signs associated with increased glances at commercial signing in general?
- Are glances made in safe conditions (e.g. long headway to the vehicle in front)?
- Are headways any shorter than is the case with commercial signs?

BACKGROUND

The on-road study of driver eye movements was pioneered by Rockwell and his colleagues, and has provided significant insights into driver information processing. An early study determined that the vast majority of glances fall in a narrow region within 4 degrees of the focus of expansion - the point in the moving visual field straight ahead of the driver where objects appear stationary *(2)*. During close car following, approximately 70 to 75% of all glances were at the car ahead or other vehicles, or simply "looking ahead". This suggests that driving is very visually demanding. Another early study *(3)* examined driver sign reading behaviour and found that drivers typically look two or three times at each guide sign, and that the total glance duration is related to traffic density with 2.6 sec on average for low density traffic and 0.9 sec during close car following.

Later studies concerned warning signs. In an on-road study of advisory speed signs *(4)*, a total of 40 test drivers drove an unfamiliar rural route that included two typical curves with curve warning signs. The study determined that, on average, drivers look two times at a warning sign and fixations last between 0.5 to 0.6 seconds. In an on-road study of a game crossing sign and a speed limit sign, out of a sample of 102 drivers, 92% fixated on the signs. Those who fixated on the sign did so an average of 2.2 times (s.d.=0.9) and the mean fixation duration was 0.42 sec (s.d.=0.195 sec) *(5)*. When number of glances is multiplied by average glance duration, total glance times are 0.924 sec for the Luoma study, and approximately 1.0 to 1.2 sec for the Zwahlen study.

Although there is considerable interest by road traffic authorities in distraction due to commercial signs, no published studies were found on driver eye movements in relation to such signs. However there is a recent master's thesis on this topic *(1)*. Eye movement data were collected from 25 drivers along a 6 km section of an urban expressway in Toronto, Ontario, Canada. The route passed 61 commercial signs, including 24 small billboard, 18 large billboard, 12 scrolling text, 2 roller bar and 5 video signs. Moving signs were more likely to be looked at than static signs, as was the case for larger billboards compared to smaller billboards. The average duration of glances at the video signs was 0.6 sec. One of the video signs, with images that were resolvable over a 24 second period and which appeared in the center of the driver's field of view, in a curve, attracted considerable attention – on average, 5.1 glances per exposed subject. Drivers were divided into groups that were more or less familiar with the route (i.e. drove it more or less than once a week in the last 6 months). No statistically significant differences or trends related to familiarity were found in the number or length of glances at commercial advertising.

EXPERIMENTAL DESIGN

Driver eye movements were recorded for 16 subjects as they drove through 3 downtown intersections and along an urban expressway (Don Valley Parkway) in Toronto, Ontario, Canada. The route was designed so that subjects passed through the three downtown intersections on an approach on which the video sign could be seen, as well as on an approach on which it could not be seen. The route along the urban expressway passed a single video sign.

Figures 1 through 3 show the approaches on which the video sign could be seen, for the 3 intersections. The expressway video sign was located to the driver's left approximately 130 m. (426 ft.) from the road edge. This sign was intermittently partially or fully blocked from view by buildings and overpasses.

Subjects

In the interest of safety, drivers were selected from the age range with the lowest rate of accidents per kilometer, ages 25 – 50 (beyond age 50, the concern is not a decline in safety but rather potential changes in scanning patterns *(6)*). Mean driver age was 40.9 yrs (st.dev. 8 yrs). Drivers were required to have held a driver's licence for at least 6 years and to have a collision free record for the previous 3 years. Subjects were selected only if they spent a minimum of 5 hours driving per month or drove at least 5,000 km (3,105 mi) per year. On average subjects drove 16 hours per month (st. dev. 20 hrs.) and drove 22,920 km (st dev. 17,764 km) per year. Only one subject was unfamiliar with the downtown area; the others considered themselves somewhat familiar or very familiar with both the expressway and the downtown area. Subjects were not allowed to wear mascara, eyeglasses or sunglasses during the test-drive because they interfere with the infrared beams used by the eye tracker. Contact lenses were acceptable.

Health screening criteria included the following:

- no physical abnormality of the eyes which could affect the infrared device (i.e. cross eyes)
- no medical conditions which could impair eye movement
- no current medications that could impair driving ability.

Subjects were recruited through advertisements in newspapers and paid $75 for their participation.

Eye Movement Recording System

The equipment used was a head-mounted EL-MAR Vision 2000 eye tracking system and scene video camera, a power supply, and a VCR. This system superimposes eye movement data onto a videotape recording of the visual scene, displaying eye position as a set of crosshairs.

The focus of the driver's eyes is tracked with an infrared eye-tracking device, which shines an infrared beam, invisible to the driver, on the cornea of the eye. As the focus changes, the bulge of the cornea moves, and the reflected angle of the infrared beam moves, indicating a change in line of sight. An infrared-blocking visor is attached to the head-mounted system to eliminate outside sources of infrared glare, particularly the sun, that may wash out the eye-tracking system.

The system has been tested for loss of peripheral vision and the loss is comparable to, or less than that from wearing glasses *(1)*. Head movement is slightly restricted due to the electrical cords running from the in-car instrumentation to the headgear, but does not affect normal driving, except when reversing, which did not occur..

Vehicle

A 2001 Toyota Corolla sedan equipped with a second brake was rented from a driving-school instructor. The instructor sat in the front passenger seat and accompanied each driver during the test session. A researcher sat in the back and gave route instructions and operated the eye movement recording equipment.

PROCEDURE

The study was conducted during the summer of 2002 in dry conditions, in the daytime between the hours of 10:00 a.m. and 2:00 p.m. to avoid rush-hour traffic.

Prior to the on-road session, each subject met with the research assistant and verified screening requirements were met, reviewed the consent form and was fitted with the eye movement equipment. In order to avoid influencing eye movement patterns, drivers were not told the specific purpose of the study, but were told that it was to assess the use of an eye-tracking device to measure search behaviour while driving .

Subjects were asked to drive as they would normally, with the emphasis that they were responsible for the safety of the passengers and the vehicle. Subjects drove the test vehicle for about 10 to 15 minutes, to become familiar with the vehicle, before being fitted with the eye movement equipment. The system was calibrated by having subjects look at specific targets. The subjects drove for another 10 minutes and were then asked if they were experiencing any discomfort or were limited in any way by the eye tracking equipment. None of the subjects indicated any difficulties at this point.

Subjects then drove north on the Don Valley Parkway, where they passed the first video advertising sign. They drove in the middle lane so that they did not have to contend with merging traffic. They exited and drove through the Yonge and Bloor St. intersection. On this approach the video advertising sign could not be seen. After a series of turns, they approached the intersection again, on an approach where the video advertising sign was visible. This was repeated for the Bay and College and the Spadina and Dundas intersections. In the downtown section subjects drove in the left lane, unless a right turn was required. The portion of the session involving wearing the eye movement equipment lasted approximately 30 to 50 minutes.

ANALYSIS

Data Sample

Twelve hours of videotape were recorded, of which approximately 24 minutes were selected for detailed analysis. Each minute of videotape required approximately 30 minutes to extract the eye movement data. Our intention was to record eye movements for 16 subjects each for 4 video sign approaches and 3 non-video sign approaches, for a total of 112 approaches. Approaches were missed for various reasons: 11 due to discomfort from the heat and equipment, 6 due to glare affecting the equipment, 5 due to calibration problems, 4 due to traffic congestion, 1 due to the subject dislodging the beam-splitter, and 1 due to experimenter error. On one approach, the video sign was blocked from view by a truck. The discomfort due to heat occurred because the vehicle available with the second brake was a compact car. Its electrical system could not handle the load from the eye movement recording equipment as well as the air conditioner.

The final data sample comprised eye movement recordings from 69 intersection approaches and 14 passes of the video sign on the Don Valley Parkway. Although statistical tests based on matched samples improve power, due to the missing data, this was not possible. The best possible alternative was to use unmatched comparisons and preserve a larger sample size. Consequently, comparisons of the percent of glances, and percent glance duration related to traffic signs and signals, and to the speedometer and rear-view mirror, on the video versus the non-video approach were made using chi square tests, or where the sample size was less than 30, tests of two proportions (similar to the Chi square test with 1 degree of freedom). An unpaired t test was used to compare headway distances for glances made at static commercial versus video signs.

Number, Duration and Angle of Glances

Detailed analysis of all eye fixations, including those at the video signs, was carried out for each of the three road sections over which the downtown video signs were visible. A segment of equal length in time was selected for comparison purposes from the intersection approach on which the video sign was not visible. A total of 3840 eye glances were analyzed and classified. On the approach to the urban expressway video sign , only glances at the video sign were analyzed. When drivers are stopped, they may make glances at whatever they wish, without a threat to safety. The only glances measured were those made while the vehicle was in motion.

A glance at an object was considered to start when the cursor indicating eye position touched that object or area and ended when it moved off that object or area. By slowing the video tape, with 30 frames per second, frames per fixation could be counted and glances measured to an accuracy of 1/30 second. The angle of each glance at a video sign was measured using the method developed by Beijer *(1)*.

Video Sign Legibility Distance

Table 1 shows the times and distances over which the images on each video sign were legible (for 20/20 vision), as well as the time period based on the posted speed and on the average speed in each section. The measurements of distance are based on a single subject; there would be slight differences from subject to subject due to eye-height.

The expressway sign images were first legible about 20 seconds away, but the view was interrupted several times, reducing the available time to 18 seconds (at the speed limit). The best visibility was in the last 5 – 7 seconds.

Headway Measurements

Headway to the vehicle ahead was measured using number of lane marks to estimate distance between vehicles. A lane mark (stripe and gap) averaged 8.5 m for the downtown intersections and 12 m for the expressway. The distance from the subject's eye point to the point on the road that a lane mark would first be visible was measured at the start of the run.

RESULTS

Table 2 shows how the glances were classified and how many glances there were of each type. Figure 1 shows the locations looked at for glances classified as looking ahead (forward, left and right).

As can be seen in Table 2, the vast majority of glances were looking ahead at traffic – 76%. The next most prominent category was traffic signals and street name signs (7%), followed by pedestrians on the sidewalk who did not present a potential conflict for the driver (6%). Glances at advertising, static billboards or video signs, constituted only 1.5% of total glances. Mean glance durations were short – generally between 1/5 and 3/5 of a second.

Distribution of Glances: Video vs. Non-Video Approaches

As can be seen in Table 3, the distribution of glances and the average and standard deviation of glance durations were very similar on the video and non-video approaches. The longest mean glance durations on the non-video approach were at mirrors, billboard advertising, and pedestrians who were a potential conflict. On the video approach, the longest glances were at mirrors, video advertising, cyclists and turning vehicles.

Table 4 shows, for each sign location, the number of subjects who were tested, and the number of subjects who looked at the video sign. Of the 33 intersection approaches with a video sign, on 16 (48%) of the approaches subjects looked at the video sign. Of the 14 passages of the expressway sign, 5 (36%) of subjects looked at least once at the sign. Based on the percent of subjects who looked, the most attention-attracting sign was the one at Bay and College, and the least, at Bloor and Yonge. However, chi square comparisons showed no significant difference in percent of subjects looking by intersection. The percent of glances longer than 0.75 sec (minimum perception-reaction time to a slowing vehicle) is noted as an indicator of the severity of distraction. About ¼ were this long.

Angle Off the Line of Sight

Table 5 shows the horizontal and vertical angles at which the sign was first visible, and how far horizontally and vertically off the line of sight drivers were willing to look at the video signs. The larger the angle, the less able the driver is to detect slowing of the vehicles ahead. The largest angles were recorded for the Bay/College sign. There were too few glances to statistically compare the 4 approaches. Overall 9 of the 39 glances, or 23% were 20 degrees or greater off the line of sight; 31% were greater than 15 degrees off the line of sight.

Pedestrian Detection

One concern about video signs at intersections is that they may delay drivers in their detection of pedestrians who are entering or crossing the roadway. In total, at the 3 downtown intersections combined, there were potential conflicts with 3 pedestrians , and 1 cyclist , recorded on the video approaches and with 9 pedestrians (affecting 9 subjects) on the non-video approaches.

On the video approach, the two subjects exposed to the potential conflicts detected each one as soon as it was in view in the scene camera. The first subject had been looking at the video sign when the conflict came into view: the second did not look at the sign. On the non-video approaches, there were delayed reactions in only 3 out of the 9 cases (1.4, 1.5 and 2.0 seconds) between the appearance of the potential conflict within the camera view, and the subject fixating on it.

Distraction from the Driving Task

Video signs at intersections may distract drivers from looking at driving related objects. Table 6 shows the number and percent of glances at traffic signs, signals, speedometers and mirrors, on the video and non-video approach, as well as the percent of time spent looking at commercial signs, static billboard only on the non-video approach, and static combined with video on the video approach. On the video approach, the chi square test showed that there was a trend towards a greater proportion of glances at the speedometer and rear-view mirrors ($p<0.09$). There was no significant effect on the proportion of glances at traffic signs and signals.

Comparison with Static Commercial Signs

With respect to all types (static and video) of commercial signs, there was a significantly greater proportion of glances ($p<0.002$) on the approaches with video signs. However, this appeared to mainly be due to the lack of billboards on the non-video approaches at two of the three intersections. At the Yonge and Bloor St. intersection, a billboard of similar size had been placed on the reverse side of the video sign. On the non-video approach the billboard received more glances (10 vs. 6) than did the video sign on the video approach.

Commercial signs, especially signs with movement, may distract drivers at an inappropriate moment. However, results of an unpaired t test showed that there were significantly longer headways when subjects glanced at video signs, indicating a greater margin of safety, than was the case when they glanced at static billboards ($p < 0.02$). Headways during glances were frequently less than 1 second for both static (60%) and video (38%) commercial signs.

DISCUSSION

Despite the fact that drivers face a high level of visual demand in dense traffic, they do take time to look at video signs, which are not essential to the driving task. Considering all 4 video signs, on average drivers looked at the signs 45% of the time they were present.

A statistical analysis comparing glances at traffic signs and signals did not show any change in the percentage of such glances or the percentage of time spent glancing on the video vs. non-video approach. Similarly, glances at the speedometer and mirrors did not change. There were insufficient instances in which there was a potential conflict between the subject drivers and pedestrians and cyclists to statistically assess whether or not the video signs were associated with a delayed detection.

In some cases, glances were made in unsafe circumstances. One driver looked at a video sign an angle of 31 degrees to her left at the sign as she entered and crossed a downtown intersection. Detection of the slowing of a vehicle ahead would be delayed while looking at such an angle *(7)*. The longest glance, of 1.47 seconds, was recorded at a slow speed of 10-15 km/h (6.2-9.3 mph) in heavy traffic while a car from the right lane was merging in front of the test subject. Glances were made at short headways, in some cases with 1 second or less time headway to the vehicle in front. Since perception-reaction time to an unexpected event can take up to 1.6 seconds, long glances at such headways could result in drivers not detecting the slowing of the vehicle ahead, a frequent event in congested downtown and parkway traffic, and not stopping in time.

Subjects made a higher proportion of glances at commercial signs in general when video signs were present. However, this appeared to be due to the lack of billboards on the non-video approaches at 2 of the 3 intersections. At the intersection with an equivalently sized and located billboard on the non-video approach, drivers actually looked more at the billboard than at the video. Video signs were **not** more likely to be looked at short headways as compared to static commercial signs; in fact the reverse was the case.

Although the 4 video signs differed in size, content, legible time period, placement with respect to the driver's line of sight, background visual clutter and conspicuity, a chi square test showed no significant differences in the proportion of subjects that looked at each of them. However, this lack of difference is likely due in part to the small sample sizes when glances are considered on the basis of individual signs as well as to the particular attributes of the signs that were studied . As noted earlier, a study of video advertising on another Toronto expressway, involving more subjects, and a different set of video signs, found that one of the signs, which was close to the roadway edge, in the center of the line of sight on a curve, with no competing signs nearby, and legible for 24 seconds, received the vast majority of the glances, on average 5.1 per exposed subject *(1)*, whereas another video sign received no glances.

As noted earlier, previous on-road studies of driver eye movements have examined glances in relation to traffic signs, in rural environments. One study found that over 90% of drivers looked at each sign *(5)* . In contrast, in our study a smaller percentage of drivers looked at the video signs: 45%. This likely reflects the non-essential nature of the signs, as well as the more visually cluttered environment. When subjects did look, the average number of glances was 1.9 times, similar to the Luoma *(5)* and Zwahlen *(4)* studies. The average glance length was 0.48 sec (s.d. 0.35), also similar to these studies. Total glance times were 0.924 sec for the Luoma study, approximately 1.0 to 1.2 sec for the Zwahlen study and 0.912 sec for our study. These figures are similar to the 0.9 sec total glance duration for drivers looking at guide signs in close car-following situations *(3).* Thus when drivers did look at them, the video signs that we examined appeared to attract as much attention as traffic signs.

The distribution of glances ahead or at traffic was found to be similar to that reported by Mourant, Rockwell and Rackoff *(2)* for car-following on a highway. Approximately 70 to 75% of all glances were at the car ahead or other vehicles, or simply "looking ahead". Similarly, we found that, in a congested downtown area, 76% of all glances were so classified.

A study of the angle at which drivers detected disc targets installed along the road by experimenters indicated that most such targets were reported when they were within 15 degrees of the line of sight *(8).* Our study shows this to be similar for video signs, in that the average angle of the first glance varied between 3 and 15 degrees, depending on the sign. Only one sign (Bay and College) had an average angle for the last glance that was more than 15 degrees. The maximum glance angle recorded was 31 degrees. Compared to the other signs, this sign was small, requiring a driver to be closer to read it, and located further off the line of sight horizontally.

CONCLUSIONS

The eye movement study indicated that video signs attract driver attention, in that the probability of a driver looking at a video sign on a given approach was almost 1 in 2. In some cases glances at video signs were made unsafely, that is, at short headways (1 second or less), for long durations (1.47 seconds) and at large angles (up to 31 degrees) off the line of sight.

Although drivers looked at the video signs on almost half the occasions that they were present, nonetheless, the vast majority of glances were looking ahead at traffic – 76%. The next most prominent category was traffic signals and street name signs (7%), followed by pedestrians on the sidewalks (or distant from the road), who did not present a potential conflict to the driver (6%). While there was a greater proportion of glances at commercial signs (static billboard plus video signs) on the video approach, the percent of such glances was small – 1.8% of glances, and appears to be related to the lack of commercial billboards on the non-video approach at two of the three intersections.. No evidence was found that glances at video signs reduced the proportion of glances at traffic signs or signals. There was a trend towards a greater proportion of glances at mirrors or speedometers on the video approach. Glances at video signs were associated with longer headways than glances at billboards. Based on the few occasions when potential conflicts with pedestrians and cyclists occurred, there is no evidence that drivers on the video approach were less likely to detect them.

A comparison of our results with other studies in rural environments showed that video signs were less likely to be looked at than traffic signs (about half the time versus virtually every time), that total and individual glance durations were similar to those found for traffic signs. As in other studies, conducted on highways, approximately ¾ of all glances in urban traffic were at the road and vehicles ahead. As in a study in an urban area the majority of glances were made when signs were within 15 degrees of the line of sight.

It should be emphasized that the group of subjects selected for this experiment were in the safest age range with respect to crash rates and were aware of being observed, both by a driving instructor and by a research assistant. This is likely to have made them, if anything, more cautious about gazing too long at video signs. Furthermore, because of the expense of collecting and reducing eye-movement data only a limited number of subjects could be tested. In a larger group, more extreme behaviour, in terms of length and number of glances would be expected. Finally the results are for particular video signs in particular environments. Another on-road study of video signs indicates that a sign that was directly in the line of sight and visible for an extensive period was very distracting.

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REFERENCES

1. Beijer, D.D. *Driver distraction due to roadside advertising*. Master's Thesis, University of Toronto, Department of Mechanical and Industrial Engineering. 2002.
2. Mourant, R.R., Rockwell, T.H., and Rackoff, N.J. Drivers' eye movements and visual workload. *Highway Research Record 292*, TRB, National Research Council, Washington, D.C. 1969, pp. 1-10.
3. Bhise, V.D. and Rockwell, T.H. *Development of a driver-information-acquisition based operational tool for the evaluation of highway signs.* Presented at the Transportation Research Board Annual Meeting, Washington, D.C. January 1973.
4. Zwahlen, H.T. Advisory speed signs and curve signs and their effect on driver eye scanning and driving performance. In *Transportation Research Record 1111*, TRB, National Research Council, Washington, D.C. 1987, pp. 110-120.
5. Luoma, J. *Immediate responses to road signs of alerted and unalerted drivers: An evaluation of the validity of eye movement method*. Presented at the Transportation Research Board Annual Meeting, Washington, D.C., January 1992.
6. Brouwer, W.H., Waterink, W., van Wolffelaar, P.C., and Rothengatter, T. Divided attention in experienced young and old drivers: Lane tracking and visual analysis in a dynamic driving simulator. *Human Factors* 1991, 33(5), pp. 573-582.
7. Lamble, D., Laakso, M., and Summala, H. Detection thresholds in car following situations and peripheral vision: Implications for positioning of visually demanding in-car displays. *Ergonomics, 42(6)*, 1999, pp. 807-815.
8. Cole, B.L., and Hughes, P.K. A field trial of attention and search conspicuity. *Human Factors, 26(3)*, 1984, pp. 299-313.

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TABLE 1: Video Sign Legibility Distance

	Distance Legible	Average Time Legible at Average Speed	Time Legible at Speed Limit
Yonge / Bloor 50 km/h (30 mph)	190 m (623 ft)	20.3 sec	13.4 sec
Bay / College 50 km/h (30 mph)	125 m (410 ft)	16.3 sec	9.0 sec
Spadina / Dundas 50 km/h (30 mph)	190 m (623 ft)	23.9 sec	13.4 sec
DVP 90 km/h (56 mph)	450 m (1476 ft)	16 sec	18 sec

TABLE 2: Distribution of Glances for Downtown Intersections

%	Number of Glances	Category and definition
42%	1,596	Looking ahead (forward) –refers to looking ahead in the lane in front of the subject including just to the left or right of the vehicle ahead as well as above the horizon ahead (including the sky)
16%	604	Looking ahead (left) – refers to glances made to the left of the centerline and towards the left curb (but not including any objects on the left curb)
18%	706	Looking ahead (right) – refers to looks to the lane to the right but does not include any objects on the right curb
1%	33	Pedestrian (potential conflict) – refers to a pedestrian approaching the roadway or crossing the roadway in front of the subject while they are in motion
6%	223	Pedestrian (no potential conflict) – refers to subjects on the sidewalk or otherwise away from the roadway that do not pose any danger
1%	26	Turning vehicle – refers to vehicles that are turning onto the roadway in front of the subject
7%	267	Traffic signal and street name signs – at the intersection ahead
1%	24	Speedometer – glances inside the car under the dashboard
3%	107	Mirror – glances to either the side or rearview mirrors
0.7%	27	Video advertising
0.5%	20	Other advertising – all other billboards
5%	186	Away – glances off to the sides above the sidewalk area, and glances inside the vehicle that are not at the speedometer or mirrors
0.2%	9	Cyclists – in motion, sharing the roadway with the subject
100.0%	3,828	Total

TABLE 3: Glance Durations on Video vs. Non-Video Approaches at Downtown Intersections

Non-video approach: n = 36 Number of glances: n = 2062				Video approach: n = 33 Number of glances: n = 1766		
% of Glances	**Average Glance Duration**	**Std. Deviation**	**Category**	**% of Glances**	**Average Glance Duration**	**Std. Deviation**
43%	0.39	0.35	Looking forward	43%	0.38	0.33
15%	0.36	0.32	Looking left	15%	0.36	0.29
19%	0.37	0.29	Looking right	16%	0.32	0.28
1%	0.50	0.28	Pedestrian – potential conflict	0.4%	0.20	0.18
6%	0.37	0.26	Pedestrian – no potential conflict	5%	0.35	0.21
1%	0.32	0.14	Turning vehicle – potential conflict	1%	0.47	0.29
5%	0.27	0.16	Traffic signal	5%	0.29	0.22
0.1%	0.18	0.11	Traffic sign	0.3%	0.43	0.22
1%	0.28	0.20	Inside vehicle	0.3%	0.21	0.06
3%	0.58	0.33	Mirror	4%	0.54	0.29
			Video advertising	2%	0.48	0.35
1%	0.58	0.54	Billboard advertising	0.2%	0.27	0.17
4%	0.40	0.29	Away	6%	0.39	0.35
0%			Cyclist	1%	0.51	0.46
	0.38	0.32	Totals		0.37	0.31

TABLE 4: Average No. of Glances at Video Signs per Subject who Looked and % Long Glances

	N	Number of Subjects Who Looked at Video Sign	Number of Glances	Avg. Number of Glances per Subject who Looked	% Glances > 0.75 Sec.	Max. Glance Length (sec.)
Bloor / Yonge	13	4	6	1.5	0%	0.67
Bay / College	12	8	14	1.8	29%	1.13
Spadina / Dundas	8	4	7	1.8	43%	1.47
DVP	14	5	12	2.4	17%	1.13
TOTAL	**47**	**21**	**39**	**1.9**		
Mean	12	5	10	1.9	23%	1.10

TABLE 5: Mean Angle of Glances to Video Signs (n = 39)

	First Visible (Horizontal, Vertical)	First Glance (Horizontal, Vertical)	Last Glance (Horizontal, Vertical)	Max Angle (Horizontal, Vertical)
Don Valley Parkway	0^o, 4^o	9^o, 5^o	13^o, 5^o	28^o, 6^o
Yonge / Bloor	2^o, 5^o	3^o, 7^o	5^o, 8^o	6^o, 10^o
Bay / College	6^o, 2^o	15^o, 4^o	17^o, 5^o	31^o, 8^o
Spadina / Dundas	2^o, 6^o	5^o, 7^o	6^o, 8^o	10^o, 10^o

TABLE 6: Video vs. Non-Video Glance Behavior – Downtown Intersections

	Non-video Approach		Video approach		
Type of Glance	**# of Glances**	**% of Glances**	**# of Glances**	**% of Glances**	**P**
Traffic signs and signals	152	7.4%	115	6.5%	0.22
Speedometers and mirrors	61	3.0%	70	3.5%	0.09
Commercial advertising	15	0.7%	32	1.8%	0.002

FIGURE 1: Video Approach on Bloor St. towards Yonge St.

FIGURE 2: Video Approach on Bay St. towards College St.

FIGURE 3: Video Approach on Spadina Ave. towards Dundas St.