More Than Just A Survey

Considerations in Selecting an Integrated Approach to TAB's Expanded *Eyes-On* Out-of-Home Audience System

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Abstract

This paper provides an overview of the new *Eyes-On* Out-of-Home (OOH) Audience Measurement System currently being implemented across America by The Traffic Audit Bureau for Media Measurement, Inc. It describes the system design and the rationale for selecting an integrated approach involving traffic counts, eye-tracking research, survey research, data integration and modeling over a more tradition survey-centric approach. The important role of traffic counts and eye-tracking research has been developed in other research papers. Therefore, this paper presents a brief overview of the rationale and components of the system and focuses on the role of traffic data, surveys, data analytics and modeling in TAB's integrated system.

Background

For many years, the United States has been standing on the sidelines watching other countries innovate and implement revolutionary OOH (OOH) audience research methods. As we meet at the 2007 WM[3] symposium, the Traffic Audit Bureau (TAB)[1] is in the process of building a new OOH audience measurement system in the United States. This paper provides an overview of the American OOH measurement initiative, the rationale for selecting an integrated measurement approach, and the specific functions of travel surveys and data analytics in an integrated research system.

The majority of the media researchers at WM[3] and similar symposia generally fall into two camps. The far larger group is comprised of media research generalists or specialists in other media silos. If you fall into this camp, you are probably not familiar with the research issues surrounding the measurement of travel. As OOH neophytes, you may assume that the audiences of OOH media can be measured the same way as other media. It is only natural for the research generalists to ask: "Why isn't a survey enough?"

OOH specialists know the answer. They have seen the limitations of survey research and have been forced to find alternate solutions. Over the past several years, the American OOH media community has learned a great deal from international forums. In 2003 a review of the worldwide state-of-the-art OOH audience measurement was published (Jarvis and Eddleston). Since then, the growing body of evidence provides a clear rationale for selecting an integrated research approach.

The research architecture TAB is employing in the United States is similar to the research designs being used in such countries as the UK, Germany, and Australia (to name a few). It is founded in the acknowledgement that when measuring travel, a survey is not enough. Therefore, OOH specialists will not find the American initiative to be a new idea. Instead, it serves as another building block in a growing body of knowledge. The uniqueness of OOH has forced us to stretch our thinking about how to measure its audience. However, many of the issues and research solutions we are employing are applicable to other media in the new fragmented, portable and interactive media world.

Business Needs and Audience Research

The degree to which the advertising community is willing to support audience research for any medium is based on a number of factors, including (but not limited to):

- The relative amount of overall ad spending going to that medium
- The relative volatility of the audiences of that medium, and
- The degree to which enhanced measurement will lead to different – and better -- decisions.

For nearly a century, American OOH media have relied on a gross *opportunity to see* measure of circulation, the DEC[2]. At a recent TAB Leaders' Summit[3], buyers and sellers identified two major limitations that make the DEC a relatively *weak* media currency:

1. DECs treat all OOH formats the same way. A billboard, eight sheet, and transit shelter on the same road will have the same DEC, thus rendering intra-media OOH audience analyses impossible, and

2. DECs are large circulation measures that do not allow for their integration with the ratings of other media in general media planning systems.

Industry participants also re-confirmed the importance of the following specifications in building a new currency of OOH media:

1. The reporting of demographic audiences on a board by board basis.

2. The movement from gross circulation measures to the measures of audiences *likely to see* ads on OOH media units; in other words, the reporting of Eyes-On audiences.[4]

3. Comparable and consistent measures of audience should be available in all 200+ OOH markets, and

4. Audience data should be reported in weekly units of impressions and reach & frequency that allow for easy integration and comparison with other media options.

A Survey Is Not Enough

Having recognized the limitations of the old circulation measures and today's needs, it was time to design something better. We first turned to some of the best thinking in media research and considered a survey-centric solution. After all surveys are being used to measure TV, radio, magazines and newspapers. However, our traditional survey-centric view of alternatives proved to be incorrect. Knowledge gained at international forums would eventually point us in the right direction.

Media researchers have assumed that media selection by a member of a population within a market is a matter of random choice.[5] Random sampling procedures and a relatively small sample could, therefore, reliably measure the audiences of most media. For OOH media, this assumption simply doesn't work. We had to recognize that travel and exposure to traditional media are two very different phenomena. Travel is a non-random behavior. There in lies the problem: Where one lives and where he/she works will determine the majority of that person's travel. That, plus the large number of units -- many with small audiences (based on low volumes of passing traffic) requires extremely large samples to measure them all with any degree of stability.

Erwin Ephron (2003) first raised the sample size issue from a traditional media perspective. He pointed out that for an American OOH market the size of Chicago a sample of 16,000 would be required to get sampling error down to a manageable level (+/- 20%) and to minimize the occurrence of zero cells (panels or units with no or very small respondent coverage).

Experts in transportation research (deDios Ortuzar and Willumsen, 2001) tell us that Ephron's media centric estimate is even lower than they would use. They would recommend that a stand-alone survey in the range of 71,000 (minimum) to 285,000 (optimum) respondents would be required to measure all of the combinations of trip origins and destinations. A sample size in this range is totally impractical. Therefore transportation experts have developed sophisticated and more cost-effective alternatives.

In the measurement of OOH media there are two realities:

- *Any system that uses only survey-centric measurement (regardless of the mode of the survey – e.g. paper, CAPI, or GPS) is limited to reporting schedule or campaign level audiences, and*
- *Some form of modeling must be employed to estimate audiences where insufficient or no sample data points exist.*

While travel surveys still play a vital role in our measurement system, they do not assume the lead role as in the measurement of other media. Used alone, they are cost-ineffective and of lower quality than an integrated model.

An Integrated Research System

Given the limitations of survey research, it is clear that OOH advertising needs something more. That led TAB to a mixture of "user-centric" and "site-centric" approaches. In the United States, this distinction first emerged in measurement of the World Wide Web – another major medium with very large numbers of media units, many with small audiences.[6] Some measurement companies count page requests from Web sites' servers, and other companies recruit samples of Web users and track their click stream activity. The former has the advantage of obtaining a virtual census of a site's activity but provides only gross measures of exposure, without any profiles of users or a breakdown by reach and frequency. The latter approach does not always meet the needs of less popular sites when the numbers of their users in the sample are too small to meet minimum reporting standards. A combination of site centric and survey centric approaches allows the outdoor industry in the United States to take advantage of the strengths of each one – to provide reliable metrics of gross volume for all outdoor sites and user data on the demographic composition of those site "audiences" and their frequency of exposure.

The Board of Directors of the TAB directed us to modify the research plans outlined in the November Admap article (Philport, 2006) so we could rollout measurement in all 200+ markets as quickly as possible. To achieve that we will be conducting 45,000 Destination Reach/Frequency

surveys by mail in 15 markets and 4,200 computer assisted personal interviews in 5 markets. When combined with traffic counts, modeling and other components of the measurement system, these surveys will contribute to the calculation of reliable audience estimates in all markets by the 4th quarter of 2008.[7]

The new research program has also been designed so that the value of various components of the system (e.g. travel survey method, sample size) can be tested and modified over time. We feel this approach has three significant benefits:

1. A timely response to an urgent need: The delivery of a consistent measurement currency in all markets,

2. A 'plug and play' research design that allows for the refinement of the system using learning and best practices, and

3. A cost-effectiveness requirement so that the system is not initially over-designed, but rather, expandable based on value.

Given the significance of these issues, this paper will briefly identify the components of TAB's integrated system and then focus on the limited role of travel surveys in the system and the data analytic techniques that will be used to transform the component measures to Eyes-On demographic audiences.

In previous papers, we have identified the components and role of each component of our integrated system.

INSERT FIGURE 1 HERE

Traffic Counts.

Site-centric traffic counts (DECs) provide a credible and essential foundation for our system. These independent measures of vehicular counts are collected from departments of transportation throughout the United States and are then standardized by the TAB to provide market-level consistency for each DMA. Recognizing that a significant portion of OOH exposures are derived from pedestrian travel, the TAB is developing a pedestrian traffic model that will be tested and then rolled-out with the new service.[8]

Eyes-On Adjustments (VACs).

Ephron and Philport (2005) have identified the critical role of visibility research in an integrated measurement system. The visibility research will produce adjustment scores (VACs) for the major

OOH media formats in a variety of environmental settings. Separate VAC scores are being developed for vehicular and pedestrian audiences, as they result in very different exposure opportunities. The TAB will use these factors to build and report Eyes-On commercial ratings. This is, perhaps, the most significant enhancement of the new measurement system. It must be stressed that useful Eyes-On demographics must be generated and reported at a board-by-board level.[9]

Travel Surveys

Unlike television or print, the survey in this system is not the source of information on the size of the medium's audience. That information comes from the traffic counts done by regional transit authorities. The role of the survey is to help put outdoor measurement on an equal footing with other media by providing demographic data and reach/frequency estimates.

There are a number of different kinds of surveys that can achieve this purpose.

- A survey could measure individuals' recall of the outdoor advertising they have passed, as has been done in Germany. This would be logistically difficult in the US because of the volume and concentration of units.

- A survey could measure exactly when a sample of people pass each billboard by equipping either the respondents or the billboard with electronic transmitters and equipping the billboards or the respondents with corresponding electronic receivers. The cost of the equipment and labor to install such a system would be prohibitive.

- A survey could measure individuals' travel patterns, (by GPS, computer assisted interview source/destination diary, etc) and those travels can be mapped to the locations of outdoor inventory. This is the sort of survey done in most countries to create exposure metrics for outdoor.

There are strengths in all three kinds of surveys. In order to determine the kinds of surveys to employ in its integrated approach, there were a number of factors that the TAB and its research partners considered:

- **Mode of interview:** The mode of interview – face-to-face, telephone, mail, or Web – can affect the quality of the sample and the quality of the information obtained in the interview.

- **Respondent burden**: We in the United States are increasingly sensitive to respondent burden and make an effort to minimize it to achieve willing respondent cooperation with the tasks we ask them to fulfill.

- **Response rates**: Even though response rates all over the industrial world have been dropping, the media research community in the United States is still focused on minimizing non-response bias.

- **Sample quality:** In the US, it is essential for media currency measures to cover as much of the population as possible. A Web-only approach to Out-of-home, for example, would not be suitable for a currency in the United States because it would exclude those without ready access to the Internet.

- **Technological sophistication**: All of us sought to take advantage of the best technology.

- **Cost**.

The approach we decided on was to conduct two surveys:

1. **CAPI route tracking survey**: An area probability sample of a total of 4,200 respondents in five markets will be queried in detail about the routes they took on either the previous day or the previous seven days. Those who are assigned to be asked about travel in the previous seven days will be interviewed twice. During the first interview, respondents will be given a travel log to fill out over the following week; during the second interview, one week later, respondents will use that travel log as an aide-memoire to enable them to provide the interviewer with the details of their routes over the seven-day period.

   Interviews will be conducted using portable laptop computers with Computer Assisted Personal Interviewing (CAPI) software that automatically routes interviewers to the correct questions. In addition, the laptops will be programmed with a custom-designed Geographical Information Systems (GIS) interface through which interviewers will show respondents digital maps of the areas in which they traveled to allow them to plot out their routes with color-coded lines and electronic push pints.

2. **Mail survey on destinations**: To complement the CAPI route tracking survey, a mail survey will be conducted in 15 markets with samples of 3,000 in each market. The mail survey will be much shorter than the face-to-face route tracking survey. Instead of asking about detailed routes, the questions will focus on trips to frequently-visited destinations – work, school, major shopping malls and shopping districts, sports arenas, local airports and train stations, etc.

In our judgment, this two-survey design is the most efficient use of travel surveys for the requirement to cost-effective measurement. Together with traffic-counts and modeling it will provide audience estimates in all 200+ US markets while optimizing the factors enumerated earlier.

Sample quality: Face-to-face and mail surveys offer the best coverage of the United States population. Unlike Web surveys, they include those with and without Internet access. Unlike

phone surveys, they include households with no cell phones, households that are cell phone-only, and households with no phones at all.

Mode of interview: It is generally believed that it is easier for interviewers to establish rapport and trust with respondents when they can make a personal impression. We believe that respondents are more likely to make the effort to report all of the trips they made and all the routes they took in a face-to-face interview than a telephone interview or self-administered questionnaire.

Response rates: Moreover, face-to-face surveys continue to offer the highest response rates of all modes for general population surveys. As we all know, phone survey response rates have plummeted over the last two decades due to telephone answering machines, caller identification systems, mounting time pressure among working families, and, in the U.S. at least, the onslaught of telemarketing. While response rates for all survey modes have declined, telephone surveys have suffered the steepest declines and now tend to hover in the single-digits or high teens.

Latest technology: GPS systems, CAPI systems, and GIS systems all represent new technology. GPS systems are attractive for three key reasons: They eliminate reliance on respondents' memories, they capture very precise information on respondents' locations, and they require less effort than keeping a detailed diary. However, GPS systems remain expensive. An area probability sample in which respondents are recruited in person and equipped with GPS devices would be prohibitively expensive in the United States.[10]

It would be much less costly to recruit respondents to carry GPS devices by phone, but response rates would be much lower. And, we suspect, it would be more difficult to maintain compliance among respondents to ensure that they continue to carry the device without the establishment of a personal, face-to-face relationship between the interviewer and the respondent. Finally, though carrying a GPS device requires less effort than filling out a detailed diary, it does entail greater respondent burden than answering questions about the routes he or she took yesterday.

At the same time, digital mapping capabilities have become increasingly sophisticated, allowing users to see detailed information about major landmarks, local retail establishments, gas stations, and fast food restaurants. Scrolling and zooming features make it easier for people to navigate and to trace their routes on digital maps. Route mapping algorithms can show respondents their most likely routes, providing respondents with clues to help them retrace the routes that they took to get to their destinations. A combination of a well-programmed CAPI system and a customized GIS route-tracing program represents a technological advance over self-reports with paper maps and paper diaries.

Respondent burden: Though a travel log can be burdensome to some respondents, the log designed for our study will require less effort than a detailed travel diary. Moreover, it will be

required of less than half of the face-to-face sample. A majority will be asked only about their travels yesterday.

The mail survey we are planning to field will be no more than four pages long.

Cost: Even though gross counts of vehicular circulation remain the backbone of the system we are developing, large sample sizes are still necessary for developing robust estimates of demographic composition and models of reach and frequency. Herein lies the major drawback of in-person interviewing: Face-to-face interviewing with an area probability sample is, admittedly, far more expensive than any other survey mode in the United States. As this mode has become less common in the U.S., the labor pool that specializes in door-to-door interviewing has shrunk, boosting the wages of those who have remained. Due to the dispersed geography of the country, travel costs are extremely high, with good interviewers being flown into areas where high-quality door-to-door interviewers are difficult to recruit. Cash incentives needed to maintain strong response rates have also risen substantially in recent years. Therefore, it would be extremely expensive to field a large-scale face-to-face survey throughout the country or even in a limited number of markets.

Mail surveys, on the other hand, are among the most cost effective forms of data collection. While still more expensive than Web surveys, they do not exclude the population without access to the Internet and can be conducted with readily-available sample frames of known addresses. In addition, response rates to mail surveys, if conducted with multiple mailings, are generally higher than telephone response rates.

However, the content of mail surveys is limited by the need to keep them simple. We did not believe we would be able to obtain a full travel inventory in a mail questionnaire. It would be impossible to provide mail survey respondents with all of the maps covering all of the roads they could have taken, instructions for recording travel routes would be too complex for many mail survey respondents to follow, and many respondents would have trouble retracing their routes without the assistance of an interviewer.

Our solution, then, was to take advantage of the low cost of a mail survey with a large sample coupled with the high quality and greater detail of a face-to-face survey with a smaller sample. The CAPI survey will employ state-of-the-art digital mapping software to help interviewers obtain precise routes from respondents. The mail survey will inquire about how often respondents have gone to various major destinations and the modes of transportation they take to get to them. The mail questionnaires, which we refer to as Destinations Reach/Frequency or DRF questionnaires, will also ask respondents where they work, how often they go to work, and how frequently they make trips for various purposes. While we will not know the exact routes followed by the DRF survey respondents in their travels to each destination, the probable paths they took can be modeled through route modeling software and data from other sources on locations of businesses in the area in which the respondent travels.

Given our perspective that measures of exposure to OOH media cannot rely on a single source – that neither a survey alone nor site census data alone can provide the OOH industry with the data it needs to compete with other media – then it is natural that the survey-centric part of this edifice should be built on two surveys (see Table 1 for summary of survey alternatives). One survey will provide the large samples and the more general information about travel patterns; the other survey will provide more detailed travel information for a smaller sample.[11] These, in combination with site-centric data, data from other available sources, and the modeling addressed in the next section, serve as the foundation for the OOH measurement system being built in the US.

INSERT TABLE 1 HERE

Data Integration, Analysis and Modeling

Objectives

To recap the foregoing discussion, we define the Demographic Audience Profiling objectives in the following functional terms:

- To enable media planners to evaluate individual out-of-home panels for their audiences among selected demographics, so as to maximize effectiveness for the advertiser
- To enable out-of-home media companies to bundle panels into buys or packages that serve particular marketing needs.

The Reach/Frequency Profiling objectives are:

- To provide the basis for evaluating R&F of given out-of-home media plans
- To enable optimization of plans, whether they consist of large or small numbers of panels.

Where we speak of "reach/frequency profiles" in this paper, we mean the data from which parameters are derived for reach/frequency modeling.

Stated in those terms, the objectives have particular implications. In a nutshell, demographic and reach/frequency profiles are required of the traffic at each and every billboard location. (Locations are represented by Traffic Count Stations in the TAB database. However, there can be more than one Count Station for the same billboard if it is near an intersection, so for simplicity in this paper we will talk about billboard locations rather than Count Stations as such).

With hundreds of thousands of billboards in TAB's audience measurement system, obviously this poses a great measurement challenge. As mentioned earlier, if this was attempted with just a

survey – even one with an extremely large national sample – then only a handful of respondents would be found going past the typical location and many would have zero counts.

Therefore the survey data, alone, would enable profiles to be evaluated only for *networks* of panels and for the relatively small number of individual locations with the heaviest traffic. So, with just a survey, the great majority of locations would have to take their demographic and reach/frequency profiles from some aggregation/summarization of the data. But how can survey data be aggregated while still meeting the demand for board-level results?

Our solution is to integrate *other* information with the survey data. Examples of such information include the type of road a location is on, the mix of local and through traffic, the types of facilities that are located nearby, the census profile of the resident population from which it draws traffic, and the census profile of people who work in the vicinity. These and other variables available from the US Census Bureau and other sources can be used in conjunction with survey data to meet the research objectives. It is expensive to collect survey data, but it is relatively inexpensive to add this further information. At a certain point the incremental value of primary survey data (given the limitations of sample size) ceases to justify the cost when other information can take us further. Therefore, the sound use of available marketplace data, with data integration and modeling, will significantly enhance the return on the overall research investment.

Of the 200+ markets, some will not be surveyed for many years. However, a comprehensive database is required from the outset. To meet this need, the model that is developed from survey data and other information for the initially surveyed markets will be applied to all other markets as well. The limitations this entails will be flagged in the database and described in terms that are clear to users of the information.

The system is designed to accommodate new and better information as further research is conducted over future years. The architectural objective is 'plug and play.' That is, for example, outdoor companies might wish to commission their own research within this framework so as to provide data for possible future inclusion in the TAB database.

In short, the concept of TAB's new out-of-home audience measurement and modeling system is an evolving database, in an overall national measurement architecture, that meets needs immediately while laying foundations for future research. It is much more than just a survey; it is a sophisticated architecture and a systematic approach to constructing a statistical knowledge base for Out-Of-Home.

In this section we describe the modeling methodology and how it works with survey data analysis. First we give an overview of the role of data aggregation and modeling.

The Role of Modeling

In survey markets, the modeling can be characterized as projection *of* the survey data, and at the same time as a framework within which the greatest value can be obtained *from* the survey data. This dual role is illustrated in the following discussion.

Imagine a table of survey data presenting an analysis of trips to or through a defined area of a city. Each column represents a location where there are billboards; there are as many columns in the table as there are billboard locations in that area.

For one of the analyses we wish to perform, the rows contain the distributions of weekly passage frequencies – how many people went past a billboard location once over a 7 day period, how many went past twice, etc. The zero passages row contains people who were in the area at least once over the 7 days but did *not* pass a given location.

# of passages	Billboard Locations in Area A						Average	Total
over 7 days	a1	a2	a3	a4	a5	.....	Location	Area
0	#	#	#	#	#	#	#	-
1	#	#	#	#	#	#	#	#
2	#	#	#	#	#	#	#	#
3	#	#	#	#	#	#	#	#
.....	.....	.....	.....	.....	.....	.....	.....	.....

People who visit the area go past a number of billboards there. So, with the same people tending to go past them with about the same frequency, we might reasonably expect these billboards to have similar demographic and reach/frequency profiles. Aggregation of the survey data – which is necessary in order to accumulate an adequate number of passages – therefore would produce results that can be assumed to apply to each location.

In other words, we would summarize the survey data for these locations and then ascribe the profiles to each location in the set.

However, this raises three questions:

1. How would we know where to draw the area's boundary in the first place? If it was drawn around an arbitrary selection of street blocks then it would not be justified to apply the summary profile to all the locations in the set because we could not arbitrarily assume that they have mostly the same people going past them. Also, aggregating only by adjacent street blocks would be too restrictive.

2. Compared to the number of billboard locations in any city, only a small number of such areas would be delineated. In terms of the board-level research objectives this would represent an unacceptably high level of aggregation. It would fail to account for variability in demographic and reach/frequency profiles that may well exist *within* any such area.

3. Reliance upon surveys exclusively would mean that the great majority of the 200+ markets would be without data for many years.

It might be thought that an alternative would be to use the survey data itself to decide which locations to group together for any particular analysis. However, this would not work because too few locations have sufficient passages in the survey data to permit the use of statistical techniques such as cluster analysis.

The solution we have adopted is to integrate other information with the survey data, to model destination choices based on the survey data and that other information, and to then use the model to simulate large numbers of trips from which profiles can be estimated for individual locations. Locations can then be grouped as desired based on their modeled profiles and other stored characteristics, and their survey data analyzed. In return, the empirical results provide feedback for calibration of the modeled results.

It can be seen that ultimately the results are empirical (in survey markets) but the characteristics upon which locations are grouped for analysis come from modeled and other data. So, as this illustrates, there is a sense in which the survey analysis and modeling work in a symbiotic relationship.

This is to enable questions to be answered of the following general type: What is the audience delivery and reach/frequency profile among women aged 25-44 years, of a specific billboard location in the vicinity of a shopping mall in the city's north-eastern corridor?

As readers who are familiar with traffic/travel modeling would appreciate, modeling 200+ markets would be a huge undertaking. However, it is made feasible by approaching it in a particular way for the purposes of this project.

In markets *without* surveys, the modeling is basically the same except that survey values must be generalized from other markets. However, the other information is local. Validation and calibration of modeled results in survey markets will give confidence in using modeled results in other markets.

Geographical Units and Clusters

Different geographical scales are used for different purposes. Modeling begins on the smallest scale – the finest 'granularity' that is practical – whereas due to the necessity of aggregating data, larger scales must be used for survey analysis.

Traffic Analysis Zones (TAZ) are the base geographical units for modeling. TAZ are delineated by transportation authorities for tabulating US Bureau of Census travel data, especially journey-to-work and place-of-work statistics. Their boundaries are drawn in such a way that residents of the same TAZ tend to use the same entry and exit points to the highway system. TAZ are quite small

units of urban geography – e.g. the Metropolitan Statistical Area of Chicago has 5,986 TAZ with an average population of 1,600. (It is worth noting that the Chicago MSA has 3,360 Count Stations in the TAB database). In areas where TAZ do not exist, County Subdivisions (CSD) are used instead. CSD consist mostly of smaller towns. So the geographical units for modeling are either TAZ or CSD, depending basically on whether it is an urban or rural area. For convenience however we refer to all such areas here as TAZ.

We classify TAZ into either of two mutually exclusive domains, 'corridors' and 'sinks'. TAZ that export more trips than they import belong to corridors, while TAZ that import more trips than they export belong to sinks. This distinction is home-based; a trip from home to another TAZ is an export from the origin and an import to the destination, and only trips from home are considered. Typically then, TAZ in residential areas belong to corridors while TAZ in commercial areas belong to sinks.

Which domain a TAZ belongs to is decided by comparing its residential population to its daytime population. Daytime populations are reported by the US Census Bureau for the information of transport planning authorities. The daytime population of a TAZ is defined as its resident population *minus* the number of people who travel outside the TAZ for work *plus* the number of people who come into the TAZ for work. The ratio of daytime population to resident population is adequate for the purpose of classifying a TAZ as a member of a corridor or of a sink.

Within each domain, TAZ are clustered with reference to the major arterial roads (expressways, freeways and highways) that tend to be used. In corridors, TAZ are clustered on the arterials that their residents use on journeys to work, shopping etc. In sinks, TAZ are clustered on the arterials that bring people into their areas. So, for example, the core of a city is divided into groups of TAZ that tend to receive traffic off the same arterials. In this way, TAZ clustering breaks long traffic corridors down into more appropriate geographical units.

Trip Generation

The starting point of the classical 4-step travel modeling process is 'trip generation' – the numbers of trips generated per week by different demographics, as found by Trip and DRF surveys.

Trip generation varies between individuals in terms of sex, age, work status, household income, car usage etc. Trip generation rates that are averaged for these demographics in survey markets are then ascribed to the same demographics in non-survey markets, making due allowance for differences between the markets in the following way.

Trip rates vary between regions according to community size, population density, and proximity of shopping, leisure and transport facilities, and even climate zone. Counties are clustered on these predictive variables and the clusters are coded into the surveys so that trip rates can be tabulated against demographics within each county cluster.

Given the census population demographics of a TAZ and the county cluster it belongs to, it becomes a straightforward matter to estimate how many trips for various main purposes are generated by its residents.

Trip Destinations

The second stage of the classical 4-step modeling process is to determine trip 'distribution' – i.e. the destinations of those trips. While destinations are determined empirically in markets with Trip or DRF surveys, for the reasons explained earlier we still need the model.

One way the modeling is simplified to make 200+ markets feasible is by predicting private motor vehicles trips only. Trips by other modes of transport, while important, do not need to be modeled at this stage.

Secondly, the US Bureau of Census collects data on where people work. This shows how many residents of any given TAZ work in every other TAZ. Therefore, work trip destinations are already known, which we estimate to account for about 1 in every 3 out-of-home advertising exposures.

Destinations of non-work trips are estimated by gravity modeling. The probability of a trip being made from a specific origin to a specific destination for (say) shopping is estimated by the standard gravity function where the attraction of the destination for trips of that purpose is assumed to be proportional to the retail floor space in its immediate vicinity (adjacent census blocks). Impedance – i.e. resistance to making such a trip – is measured by travel time.

Route Assignment and Passage Simulation

The third step in the classical 4-step process is the choice of transport, but that does not concern us here. The fourth step is route assignment.

Route planning functionality in MapPoint 2006 enables the automated simulation of large numbers of trips between specified TAZ. For every TAZ there is a GIS shape file providing geo-coordinates, which are used to randomize trip start and end points. MapPoint also provides the option of routing by shortest travel time or shortest distance; trips are simulated both ways.

This process generates a large file of simulated trips which are summarized in terms of the corridors that generate trips to (or through) a TAZ, for each main trip purpose, and the probability of such trips passing by particular Count Stations in that TAZ.

Using the Model in Trip Survey Markets

The modeling outlined above can be thought of as providing an expanded set of characteristics for each and every TAB Count Station. Some of these characteristics are associated with the TAZ in which the Count Station is located, including the modeled origins and main purposes of trips to (or

through) that TAZ and the demographic and reach/frequency profiles of people making those trips. Other characteristics were mentioned earlier such as daytime population and land use features (e.g. proximity to shopping malls).

Using TAZ as the base unit of geography has the advantage of also facilitating access to metropolitan transport information systems so that transit links can be included in future, such as subway and train stations.[12]

Therefore it is possible to query the database at the Count Station level in terms of any characteristics that are stored, and to then aggregate and summarize survey data for the set of Count Stations returned by the database query. In this way, data integration and modeling provide a framework within which maximum value can be obtained from the survey data.

This is so different from how audience research is designed and analyzed for other media that it may be difficult to grasp at first. Imagine for a moment that a massive survey was conducted – one so large that every Count Station had an adequate sample base of passages. A range of analyses would be conducted for media planning purposes, even at the level of individual billboard locations. How wonderful that would be!

The concept of the modeling here is to enable the same analyses to be conducted on a large database of simulated trips. As billboard locations are grouped into sets on some such basis, the real life survey data is then analyzed to produce results that are applicable to members of the sets.

When a media planner wants to optimize an OOH plan for a particular demographic, the database is queried to return Count Stations with the greatest composition of that demographic in their modeled audiences. Then the survey data are aggregated to yield empirical results. This is the basic principle.

For the purposes of model validation, empirical and modeled estimates can be compared directly. Indeed this is part of a calibration process that is required for DRF survey data.

Using the Model in DRF Survey Markets

DRF surveys serve a number of valuable purposes, not the least being to capture recency/frequency data on major OOH venues such as airports and other transport terminals, sports stadiums, shopping malls, sightseeing and other attractions. DRF surveys also provide data on transit usage.

For trip modeling, the role of DRF surveys is to provide destination recency/frequency from larger samples than could be afforded with Trip surveys, and over longer time-frames than would be technically feasible. A destination may have no passages in a 7 day Trip survey, but may still have a measurable audience in a DRF recency question (e.g. visited in past 4 weeks).

In the first round, DRF surveys are being conducted in 5 of the markets with Trip surveys so that it can be determined how to calibrate DRF data.

DRF surveys provide basically the same information as Trip surveys in terms of destinations, albeit limited to those listed in the questionnaire. DRF surveys however provide richer data on trip generation rates by demographics.

Modeled trips provide the links between DRF origins and destinations. Using these links, the analytical procedure is basically the same as for Trip survey data but on larger sample-sizes.

Using the Model in Non-Survey Markets

Markets without Trip or DRF survey data are handled in the same way as described above except that no survey data exist to be analyzed in the final step.

In the other markets the two types of survey data can be thought of as overlays to the database of simulated trips, whereas the latter is all we have in non-survey markets. The architecture of the database system is designed to handle these different situations, and to accommodate new research findings as they come in hand. As further markets are surveyed, the results can be loaded into the database without structural changes.

Conclusion

Due to the impossibility of satisfying the research objectives with just a survey, a database solution has been adopted that is designed to evolve and accommodate additional research as it is conducted over time. The architecture enables the incremental value of each data component to be evaluated, and new research inputs can be accommodated in future without having to restructure the system. Should OOH companies wish to undertake new research within this framework, the system should be capable of accommodating it.

TAB's expanded *eyes-on* audience system is based on multiple sources of survey research and other relevant data, and now includes pedestrian traffic counts as well as vehicular. These numerous inputs are integrated in the database. We believe this is quite unique among competing media rating systems, and will serve the needs of OOH buyers and sellers well into the future.

It seems likely that at some point in the future it may become valid and cost-effective to incorporate alternative and/or additional data sources such as GPS-enabled cellphones to enhance or replace the modeled data described in this paper. Even this would not be enough on its own – it would need to be integrated with demographic and product usage profile data, which is the very kind of capability for which the system has been designed. So, as far as anyone can predict these things, the system architecture is not only 'future-proofed' it is "future friendly".

Figure 1: Components of TAB's Integrated System

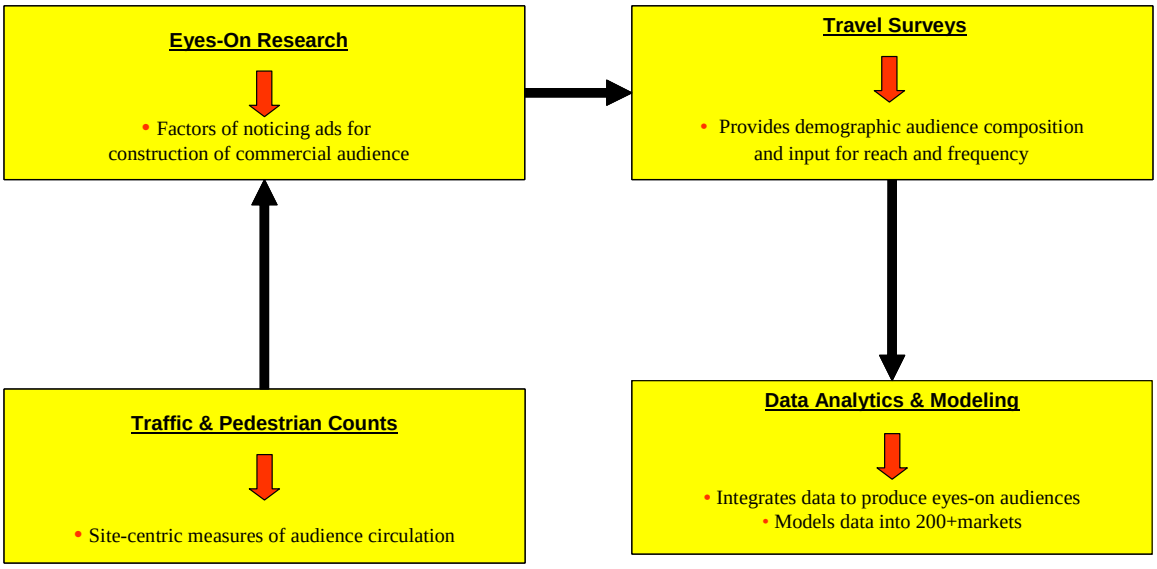

TABLE 1: SURVEY ALTRENATIVES

	FACTORS TO CONSIDER					
TRAVEL SURVEY TYPE	**Interview Mode**	**Respondent Burden**	**Response Rates**	**Sample Quality**	**Technology**	**Cost**
Face-to-face with CAPI	*Best for establishing trust with respondent*	Moderate (for single interview) to somewhat heavy (for dual interviews)	*Expected to be highest*	Best coverage of all types of households	Fairly sophisticated, esp. in combination with GIS route mapping system	High
RDD with CATI	Difficult to describe travel routes	Moderate to somewhat heavy	Expected to be low	Misses households with no landlines	Old	Moderate
Face-to-face with GPS	*Best for obtaining detailed route info*	Heavy	Expected to be high	Best coverage of all types of households	Sophisticated	Extremely high
RDD with GPS	Good for obtaining detail, potentially difficult to maintain compliance	Heavy	Expected to be lowest	Misses households with no landlines	New, sophisticated	Moderately High
Mail	Impossible to ask for routes of all trips	*Minimal*	Expected to be moderate	Superior coverage of all types of households	Low tech	*Low*
Web	Complex for respondents to show routes	Moderate	Expected to be fairly low	Unrepresentative of U.S. pop.	*Very sophisticated, but not user-friendly*	Lowest

Notes:

[1]The TAB is an industry organization that is comprised of media companies, advertising agencies and advertisers. It has been collecting measures of traffic circulation since 1933.

[2] Daily Effective Circulation, the number of persons 5+ or 18+ passing an OOH media unit (e.g. a billboard).

[3] TAB Leaders' Summit III was held in March 2007. It was designed as a dialogue between buyers and sellers of the medium and focused on identifying the major specifications required to build a viable measurement currency.

[4] The TAB currently audits nearly 500,000 units of inventory. Eyes-On demographics would be the first measure of commercial audience based on empirical research that ads are noticed.

[5] Expansions of delivery channels, interactivity, and pay per exposure are also challenging the random choice assumption for other media.

[6] Television fragmentation is rapidly creating the same problem and is pressuring TV to use set-top box "traffic counts" as the basic audience measure.

[7] The plan identified in Admap would have staged market delivery and taken several more years to complete.

[8] Individual pedestrian counts are cost prohibitive and as a subset of a larger travel universe, survey centric methods are inadequate. The pedestrian model is being developed for the TAB by the Transearch Group and the research behind the model is a topic for future conferences.

[9] Some survey-centric advocates will argue that count stations or impact zones (areas within which exposure may occur) are adequate surrogates for actual VAC studies (eye-tracking notice of ads). The operational definition of a count station or impact zone is only an operational definition of potential circulation (opportunity to see).

[10] The Italian outdoor study was conducted with GPS devices and face-to-face interviews, but labor costs for door-to-door interviewing in the United States, which is much rarer in the US than in Europe, are far higher.

[11] After exhaustive competitive review, the AB recognized the need to use two surveys methodologies to cost effectively measure travel. While we anticipate that we will continue to evaluate these and other methodologies, we do not envisage that any survey method (regardless of method) will cost-effectively replace the functions of the two surveys in our integrated system.

[12] While subway, train station and transit media are not included in the initial research program, the overall design of the architecture will accommodate their inclusion when there is sufficient demand.

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