TECHNICAL MEMORANDUM

Project BD549-29:

"Developing a Printed Transit Information Material Design Manual"

Supplementary Report to the Final Project Deliverable:

"Designing Printed Transit Information Materials – A Guidebook for Transit Service Providers"

November 2007

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16. Abstract

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At its inception, this project aimed to address these issues by developing a printed transit information material design manual capable of assisting transit agencies in the production of effective and consistent printed transit information materials. As the project progressed, it became clear that the term "design manual" was too prescriptive, and that the term "guidebook" better reflected the type of document that was being developed. As such, readers should be aware that this document includes references to both "design manual" and "guidebook". Within this document, it should be noted that these two terms are interchangeable.

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This Technical Memorandum summarizes Project Tasks 1 and 2. Task 1 was to conduct a literature review to obtain a broad knowledge of the challenges faced by customers in planning a transit trip and the importance of printed materials within the wider context of the variety of transit information aids that exist. Another important goal of the review was to obtain existing guidelines and research on the design of printed materials, both from within the United States and abroad, and to synthesize these into a cohesive list of best practice recommendations.

Task 2 was actually two sub-tasks based around a survey of transit agencies across the United States. The survey instrument was designed to obtain an understanding of the issues facing each agency in designing their materials. The other sub-task was to classify the sample materials sent by each agency in order to obtain an understanding of the designs currently employed across the transit industry. The document ends with a conclusions section.

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Developing a Printed Transit Information Material Design Manual

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METRIC/ENGLISH CONVERSION FACTORS

ENGLISH TO METRIC

LENGTH (APPROXIMATE)

1 inch (in)	=	2.5 centimeters (cm)
1 foot (ft)	=	30 centimeters (cm)
1 yard (yd)	=	0.9 meter (m)
1 mile (mi)	=	1.6 kilometers (km)

AREA (APPROXIMATE)

1 square inch (sq in, in^2)	=	6.5 square centimeters (cm^2)
1 square foot (sq ft, ft^2)	=	0.09 square meter (m^2)
1 square yard (sq yd, yd^2)	=	0.8 square meter (m^2)
1 square mile (sq mi, mi^2)	=	2.6 square kilometers (km^2)
1 acre = 0.4 hectare (he)	=	4,000 square meters (m^2)

MASS - WEIGHT (APPROXIMATE)

1 ounce (oz)	=	28 grams (gm)
1 pound (lb)	=	0.45 kilogram (kg)
1 short ton = 2,000 pounds (lb)	=	0.9 tonne (t)

VOLUME (APPROXIMATE)

1 teaspoon (tsp)	=	5 milliliters (ml)
1 tablespoon (tbsp)	=	15 milliliters (ml)
1 fluid ounce (fl oz)	=	30 milliliters (ml)
1 cup (c)	=	0.24 liter (l)
1 pint (pt)	=	0.47 liter (l)
1 quart (qt)	=	0.96 liter (l)
1 gallon (gal)	=	3.8 liters (l)
1 cubic foot (cu ft, ft^3)	=	0.03 cubic meter (m^3)
1 cubic yard (cu yd, yd^3)	=	0.76 cubic meter (m^3)

TEMPERATURE (EXACT)

[(x-32)(5/9)] °F = y °C

METRIC TO ENGLISH

LENGTH (APPROXIMATE)

1 millimeter (mm)	=	0.04 inch (in)
1 centimeter (cm)	=	0.4 inch (in)
1 meter (m)	=	3.3 feet (ft)
1 meter (m)	=	1.1 yards (yd)
1 kilometer (km)	=	0.6 mile (mi)

AREA (APPROXIMATE)

1 square centimeter (cm^2)	=	0.16 square inch (sq in, in^2)
1 square meter (m^2)	=	1.2 square yards (sq yd, yd^2)
1 square kilometer (km^2)	=	0.4 square mile (sq mi, mi^2)
10,000 square meters (m^2)	=	1 hectare (ha) = 2.5 acres

MASS - WEIGHT (APPROXIMATE)

1 gram (gm)	=	0.036 ounce (oz)
1 kilogram (kg)	=	2.2 pounds (lb)
1 tonne (t)	=	1,000 kilograms (kg)
	=	1.1 short tons

VOLUME (APPROXIMATE)

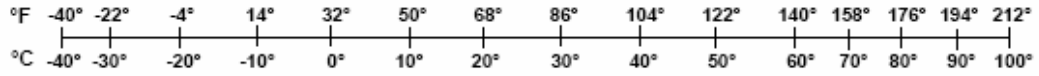
1 milliliter (ml)	=	0.03 fluid ounce (fl oz)
1 liter (l)	=	2.1 pints (pt)
1 liter (l)	=	1.06 quarts (qt)
1 liter (l)	=	0.26 gallon (gal)
1 cubic meter (m^3)	=	36 cubic feet (cu ft, ft^3)
1 cubic meter (m^3)	=	1.3 cubic yards (cu yd, yd^3)

TEMPERATURE (EXACT)

[(9/5) y + 32] °C = x °F

QUICK INCH - CENTIMETER LENGTH CONVERSION

QUICK FAHRENHEIT - CELSIUS TEMPERATURE CONVERSION



For more exact and or other conversion factors, see NIST Miscellaneous Publication 286, Units of Weights and Measures.
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Executive Summary

Previous phases of NCTR research have shown that a significant proportion of the general public is unable to successfully plan a transit trip using printed transit information materials. There is evidence that such trip planning difficulties represent a major barrier to transit use among non-users, and may also contribute to the underutilization of transit services by existing users. A lack of recognized design standards has also contributed to inconsistencies in the material designs produced by different agencies, resulting in an unnecessary source of user confusion.

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This Technical Memorandum documents the different project tasks that were conducted in order to provide input into the development of the printed information material guidebook. This document is intended to provide supplementary information for those interested in finding out how the guidebook’s recommendations have been derived, and for those wishing to learn more about the subject area.

This Technical Memorandum summarizes Project Tasks 1 and 2. Task 1 was to conduct a literature review to obtain a broad knowledge of the challenges faced by customers in planning a transit trip and the importance of printed materials within the wider context of the variety of transit information aids that exist. Another important goal of the review was to obtain existing guidelines and research on the design of printed materials, both from within the United States and abroad, and to synthesize these into a cohesive list of best practice recommendations.

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1. Introduction

1.1 Background and Terminology

Previous phases of NCTR research have shown that a significant proportion of the general public is unable to successfully plan a transit trip using printed transit information materials. There is evidence that such trip planning difficulties represent a major barrier to transit use among non-users, and may also contribute to the underutilization of transit services by existing users. A lack of recognized design standards has also contributed to inconsistencies in the material designs produced by different agencies, resulting in an unnecessary source of user confusion.

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1.2 Technical Memorandum – Purpose and Contents

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2. Literature Review

Public transit plays a crucial role in providing mobility to members of the public and ensuring that people have access to the opportunities that exist within their communities. Transit's success in providing mobility depends on people knowing that such services exist and understanding how to use them. Transit marketing focuses on making people aware of available services, while transit information media focus on providing people with the information they need to effectively use the system. Various different types of information media are available. These range from "traditional" information aids such as schedules (also known as timetables), maps and bus signage, to high-technology options like Internet trip planners and real-time information displays. Each information aid has its own strengths and weaknesses, and most agencies use a combination to cater to different customer preferences.

This section provides an overview of the field of transit information media research, while focusing on hand-held printed information materials. The section then reviews existing guidelines for the design of hand-held, printed transit information materials.

2.1 The Importance of Transit Information

2.1.1 Findings from the Research Literature

According to TCRP Report 95 (Turnbull, 2003), the primary goal of information and promotion activities is to increase ridership or net revenues, preferably both. Other secondary objectives include retaining existing riders, increasing the frequency of use among current riders, getting non-riders to try the system, and increasing general public's awareness of available service options. TCRP Report 95 discusses the importance of information and promotion and the difference between these two terms:

> *"For a person to make use of transit service, and thus become a transit rider, he or she must know of the service and understand how to use it. Moreover, the understanding of how to use the service must be complete enough to overcome the barrier to use posed by unfamiliarity. Transit information activities may thus attract potential riders to both transit in general and to particular services by informing them about the options available and how to make use of them. Transit promotion seeks to provide that extra nudge for potential riders to make the leap and actually try riding transit, and hopefully become regular users"* Turnbull (2003).

The extent of transit unfamiliarity is significant; only 55 percent of the U.S. adult population claims to be familiar with transit (Wirthlin Worldwide & FJCandN, 2000).

The TCRP-95 report describes a large variety of information sources that are available, including bus stop signage, telephone information (via call centers – either automated or manned), Internet resources such as online transit trip planners and oral instruction from transit staff or fellow passengers, as well as printed information materials, both stationary and portable. The report divided the different information and promotion options into six categories: (i) Mass Market Information, (ii) Mass Market Promotions, (iii) Targeted Information, (iv) Targeted Promotion, (v) Ongoing Customer Information Services, and (vi) Real-Time Transit Information (Turnbull, 2003). Printed transit information

materials were included in two categories. The first is the Mass Market Information category, which includes brochures, system maps, bus stop signage, telephone information systems and websites. The second category is the Targeted Information category, which consists of routes and sector specific maps and schedules.

The report noted there are relatively few published examinations of the impacts of transit information and promotion activities on ridership. This was reported to be the result of a more general problem associated with evaluating marketing impacts on ridership caused by many agencies lacking a ridership tracking database. In many cases, rider surveys are used to provide impact assessment data. However, the accuracy of these can be questionable as they track stated or intended behavior, not actual behavior, and may also suffer from self selection bias (Turnbull, 2003).

Published research on the impact of Mass Market Information programs, such as door drops of printed transit information material, showed that while such campaigns have proven to be effective in raising awareness and use of transit service support systems, they have been shown to have little impact on attracting new riders. Impacts to the frequency of use by existing riders have also been mixed. Adding incentives to Mass Market Information programs increases the likelihood of ridership gains, at least in the short-term – published results show ridership gains of between 4 and 35 percent (Turnbull, 2003). Long term ridership gains are much more difficult to achieve.

Targeted Information programs have been shown to be much more effective than Mass Market Information in generating ridership gains. These can include geographical targeting. For example, in a campaign conducted by the Niagara Frontier Transportation Authority in Buffalo, New York, the agency mailed route information materials to over 20,000 residents living within three-quarters of a mile of six bus routes. The campaign also featured socio-economic targeting, with the targeted areas selected by identifying population profiles that were congruent with those of transit riders (Turnbull, 2003). Farebox revenue analysis showed that revenues on these targeted routes had increased 1 to 3 percent on three routes and 11 to 33 percent on the other three routes (TTI, 1999). Increases of over 50 percent have been reported in the short-term in relation to other Targeted Information programs.

A British research study of transit passenger information needs emphasized the importance of being able to quantify the effects of altering the way in which information is provided to passengers (Balcombe & Vance, 1998). This study stated that the difficulty in assessing the cost effectiveness of different forms of bus information was due to the fact that information aids are often very closely associated with marketing and publicity, and that it is very difficult to distinguish between the relative impacts of each. A limited number of studies have shown that investment in information provision can be recouped several times over in increased revenue (Balcombe & Vance, 1998). However, the studies are so limited in number that their results cannot be regarded as representative of the transit industry as a whole and may indeed be biased towards the more successful initiatives. Ideally, a representative sample of “before and after” studies would be carried out, but even these suffer due to the difficulty controlling the intrusion of external factors

that may also affect ridership throughout the study period. In summary, to date it has not been possible to derive precise, quantitative estimates of the effects of information system modification on ridership, either in the short or long term.

Despite these limitations, the British study was able to draw some conclusions on the importance of information availability by asking a sample of transit users whether they would still use transit if no information was available. It was found that 75 percent of regular journeys and 66 percent of occasional journeys would still be made. The authors concluded that demand would be reduced by less than 25 percent if all passenger information was withdrawn, due to the fact that the majority of trips were made, and would be continue to be made, by regular users (Balcombe & Vance, 1998). However, 93 percent of the sample said they would require some information before making a new journey, and only 25 percent would take a new transit trip if no information was available. This confirms that information provision is much more crucial when taking new transit trips.

The study by Cain (2004) assessed the extent to which a lack of transit trip planning ability was a barrier to transit use. Non-transit users within the study sample were asked for the main reason they did not use transit. Figure 2.1 below summarizes their responses:

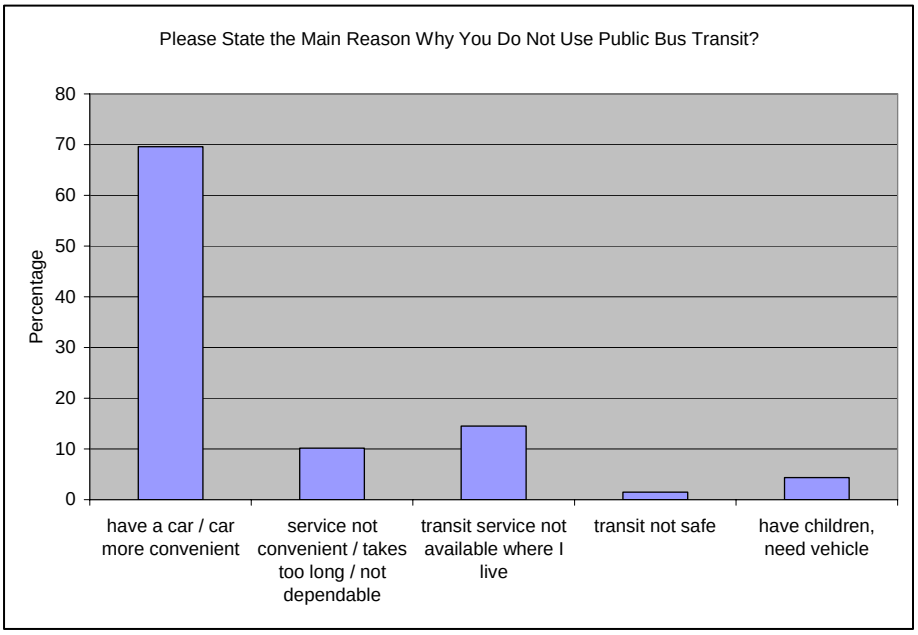

FIGURE 2.1 – Main Reason why Non-Transit Users do not use Transit

Figure 2.1 shows that the availability of a private automobile is the primary reason for not using transit (70 percent of non-transit users). Other reasons given were that transit services are not convenient enough, dependable enough or quick enough (10 percent), or that there simply is not a service available for use (15 percent). In discussions with interviewers following the survey exercise, several transit users stated that while weekday services were adequate, there was often no service whatsoever on Sundays and public

holidays. Complete lack of service is clearly a much more significant barrier to transit use. It should be noted that none of the participants cited transit trip planning problems as the reason they did not use transit. This suggests that lack of transit trip planning ability is not a major barrier to transit use. However, it still could be a factor if unusual circumstances such as vehicle breakdown forced non-transit users to consider taking transit. The British study expands on this, stating that:

> *"while in the short term, the proportion of passengers who might be deterred from using buses by lack of information is relatively small, and the number of new passengers at any one time is likely to be smaller, the cumulative, long-term effect of inadequate information provision could be quite serious, and accelerate the current rate of decline in bus patronage."* Balcombe & Vance (1998).

2.1.2 Section Summary

- Good information materials are crucial to ridership retention and attraction.
- While there is a lack of quantitative evidence for the impact of information provision on ridership, a limited number of studies suggest that a relationship does exist.
- Lack of good transit information may only be a primary barrier to transit usage for a small proportion of users or potential users, and in the short-term transit information may not be crucial to service success. However, long-term effects of inadequate information are likely to be much more critical as increasing numbers of new or occasional users are unable to determine if local transit services can meet their travel needs.

2.2 Different Transit Users and Their Information Needs

Transit users have a wide range of different information needs and preferences. Some of the different issues that affect these needs and preferences are listed below:

2.2.1 Local Knowledge

Local knowledge obviously reduces the amount of new information required to complete a trip planning task. Research shows that many individuals form a "cognitive map" of their local area, onto which they can simply superimpose the route of the trip they wish to take, using familiar landmarks to chart their progress (Higgins & Koppa, 1999). Someone that is new to the area will not have the luxury of a "cognitive map" and will require much more information on local topography, landmarks and transportation infrastructure to plan their trip.

2.2.2 Transit Experience

Does the individual have prior experience of the transit system they need to use? If not, does the individual have any prior transit experience? Clearly, an individual that regularly uses transit will have different information needs from someone who has never used transit before or that has never used that particular system, even if they are both planning the same trip. Frequency of transit use also has an influence. A regular user will be much

more familiar with service characteristics and information conventions that someone who occasionally or rarely uses transit.

Cain (2004) found there was no difference in the trip planning ability of transit users and non-users. However, there was a statistically significant difference in the time taken to complete the trip planning task. Those that never used transit took the longest to complete the task, while those that used transit four or more times a week took the least amount of time.

2.2.3 Trip Type

Has the trip been made before, or is it being taken for the first time? If the trip has already been taken, many aspects of the trip planning task will have already been completed, particularly if the trip has already been made multiple times, such as a commuter trip. If this is the case, perhaps no further information is required, or perhaps only a brief check to ensure the details have been correctly remembered. On the other hand, a trip being taken for the first time to a new location will require significantly more trip planning.

Balcombe and Vance (1998) found that 83 percent of regular passengers declared that they required no information whatsoever before boarding a bus for a regular journey. However, for new trips, only seven percent stated they would not need any information before taking the trip. When testing trip planning ability, this study found that:

> *"Infrequent bus users performed proportionately rather well […] while regular travelers seemed to have considerable problems […].This suggests that the incidence of timetable use is low among regular bus passengers, so that they are not necessarily any more practiced than infrequent travelers."* Balcombe & Vance (1998).

Thus, being a regular transit user may actually reduce trip planning ability, due to lack of need to practice the skill.

2.2.4 Physical and Cognitive Impairments

Successful transit use requires a certain array of physical and mental abilities, as does the process of transit trip planning. Transit users each have a different set of physical and cognitive attributes that influence their ability to plan a transit trip. Although each user is different, the attributes identified in Table 2.1 have been shown to influence trip planning ability.

TABLE 2.1 –
Different Physical and Cognitive Impairments and their Applicability to Transit Trip Planning

Impairment	Impairment Type	Description	Applicability to Transit Trip Planning
Visual Impairment / Blindness	Physical	Severity can vary from poor eyesight, tunnel vision and color blindness up to full blindness.	May have great difficultly, or be completely unable to read any kind of printed information material or signage.
Hearing impairment	Physical	Severity can vary from mildly deaf people who require the use of hearing aids, up to full deafness. Many hearing impaired people depend on lip reading to communicate and may depend more heavily on visual material.	May have great difficulty, or be unable to, receive any form of oral instruction or information in any auditory form.
Mobility Impairment	Physical	People with mobility problems have difficulty accessing certain locations and may have difficulty reading information placed at standing eye level or higher.	May not be able to access information if it is displayed too high or in places that require climbing stairs or walking long distances.
Dexterity Impairment	Physical	Dexterity impairment refers to reduced function in arms and hands that makes moving, turning or pressing objects difficult or impossible.	May make it difficult to use a telephone or information kiosk, or even unfold a map.
Cognitive Impairment	Cognitive	There are many different types of cognitive impairment, including dyslexia, dementia, Alzheimer's Disease and other age related cognitive limitations. Cognitive impairments can affect attention, reasoning, memory, coordination, reading communicating, social competence and emotional maturity.	Transit trip planning requires several different cognitive abilities. Cognitively impaired passengers can have difficulties with the comprehension of information and the planning process. May need personal assistance in trip planning and trip execution. Older people tend to take longer to learn new skills and can have difficulties with short-term memory.

Source: Denmark, D. (2000).

2.2.5 Demographic Factors

Gender

Wayfinding research from the field of psychology shows that there are fundamental differences in the ways in which males and females navigate (Lawton & Kallai, 2002). These studies suggest that men are more likely to use global reference points, such as cardinal directions, while women are more likely to rely on landmark-based route information. A similar observation was made by Cain (2004), who found that females had much more difficulty with travel directions provided in cardinal direction format. Cain (2004) also found that, on average, females scored lower than males on trip planning assignments and took longer to complete the exercises, and that these differences were statistically significant. However, a British study (Balcombe and Vance, 1998) found that it was "*not possible to distinguish consistently between the ability of men and women*." The landmark-based approach to wayfinding favored by women is consistent with the first stage in the development of spatial knowledge. This suggests that males are more likely to progress to the more advanced stages of spatial knowledge development that involve the formation of "cognitive maps" (Higgins & Koppa, 1999).

Age

The aging process can have physical impacts such as diminished eyesight and mobility as well as some cognitive impairment and diminished ability to learn new skills. Age can

also play a part in determining an individual's attitude towards new trip planning tools such as online trip planners. Many older people prefer human assistance to using self service terminals (Gill, 1997). One study found that younger persons were more comfortable with high-technology devices, and were therefore more likely to use them when planning and executing their transit trips (Cluett, et al, 2003). Cain (2004) found there was no difference in the trip planning performance across different age groups, but there was a statistically significant difference in the time taken to plan a transit trip, with over 50s taking longer than under 50s. The 18-34 age group completed the trip planning task in the shortest average time. A British study (Balcombe and Vance, 1998) found that the success rate for transit trip planning declined with increasing age.

Education level

Two studies looked at the influence of education level on transit trip planning ability using printed information materials. Cain (2004) found there was no statistically significant difference in ability, but a statistically significant difference was found in the time taken to complete the exercise. Those with no high school diploma took the longest, on average, to complete the exercises while those with a post-graduate degree took the shortest time. The same trend was also observed in the New Jersey Institute of Technology Study (Fallat *et al*., 2004), which found that the average time taken to complete transit planning exercises using printed materials decreased as education level increased as did the average number of errors. Another study compared the preferences for information media of people with different education levels (Cluett *et al*., 2003). This study found that those who only completed high school indicated a greater preference for trip planning services, alternate routes and stop locations, and also expressed a greater preference for obtaining information from a member of transit staff. Those with a higher level of education expressed a greater preference for using the Internet, video or kiosks to access information. Overall, this suggests that people with higher levels of education are better equipped with the cognitive processes required in transit trip planning using printed information materials and thus are more willing to take responsibility for planning their own transit trips. This may explain the preference for trip planning services among people with lower levels of education where responsibility for the trip planning task is essentially deferred to another person or interactive information source.

Language

The ability to perform the planning task obviously requires some level of proficiency in the language in which the trip planning information is presented. Although English is the official language of the United States, 14 percent of the adult population on average is unable to speak, read or write English at a basic level (Kutner *et al.,* 2003). This relates at least in part to large immigrant populations in some parts of the country, mainly from South and Central America, and the Caribbean. Transit agencies in such areas normally provide materials in the main languages spoken in the local area, but there are bound to be instances when language becomes a major barrier to information material use.

2.2.6 Section Summary

Variation in the transit user population affects both the ability of individuals to carry out the trip planning task and information aid preferences. Research suggests that females, older people, and those with lower education levels tend to have greater difficulty with trip planning using printed information materials and may prefer to defer the trip planning task to another person or information resource. It is important to note that these groups are also the ones that tend to be highly represented in transit ridership. Thus, there may be an ironic situation where the people most likely to be transit users are also the least equipped to plan their own trips. This issue is summarized in the following quotes:

> *"In general, the people who performed worst in the comprehension exercises were the very ones who comprise the core of the bus-using population, who are the most dependent on buses and have the greatest practical experience of using them. This implies that such people use the buses, not with the aid of timetables, but in ignorance of them, relying instead upon custom, experience, observation, and word of mouth."* Balcombe and Vance (1998).

> *"Information systems [...] are designed primarily for middle-class English speaking adult users who are well educated. The perceptual orientation, literacy skills and other special needs of young people, elderly, handicapped/less educated or non-English speaking people are not typically addressed in information systems. Information is not selective and oriented to the purposes and needs of users; in order to serve all users, too much information is typically presented, creating perceptual overload. Information systems are static and non-interactive; each user receives the same generic message which may not suit individual purposes. Maps and other information are poorly connected with the larger environment; the focus is on the transit system, but not on understanding the system in the urban and regional context within which the transit user navigates."*- Southworth & Isaacs (1994)

In summary, transit trip planning using printed information materials can be a highly demanding cognitive task that is beyond the cognitive capacity of large sections of the population. It appears that such people may instead defer the task to other people or interactive resources. Thus, it is important that these options are available as much as possible. However, in some cases only printed information will be available, and therefore it is important to increase the usability of this information resource.

2.3 Information Needs and the Transit Trip

2.3.1 Classifying the Different Information Media Types

What information does a traveler need in order to travel from their present origin to their desired location using transit? As discussed in the last section, information needs and information media preferences vary tremendously in relation to the type of trip being undertaken and the personal characteristics and experience of each traveler. Fortunately, there are a wide range of different information aids available, as shown in Table 2.2 below:

TABLE 2.2 – Different Types of Transit Information Aid

Information Media Genre	Information Media Type	Information Media Style	Description / examples
Printed Information materials	Hand-held printed information materials	Passive	System maps, route maps, ride guides, schedules / timetables
	Static printed information materials	Passive	Static signage at bus stops, transfer centers and elsewhere
Verbal instruction	Face-to-face communication with a person	Interactive	Receiving instructions from transit staff, vehicle operator, other passengers, friends / family
	Manned call center	Interactive	Receiving instruction from transit staff via phone
	Automated call center	Passive/Active/ Interactive	Automated instructions via phone
	PA Systems	Active	Verbal messages at station/transfer center, or in-vehicle, via internal PA system
Electronic Information	Digital signage	Active	"Real-time" Bus arrival information at bus stops/platform information at stations
	Information kiosks	Passive/active/ Interactive	Information kiosks at stations or bus stops
	Online info materials	Passive/Active	Online schedules / maps, etc
	Internet / PDA trip planners	Interactive	Online trip planners that provide travelers with travel instructions.

Table 2.2 shows there are ten basic types of information aid which are separated into one of three genres. The first of these is printed information materials which are separated into two different self-explanatory types; hand-held materials and static materials. The focus of this study, hand-held printed materials, includes system maps, route maps, schedules and ride guides. All these materials, as well as the static printed materials, are "passive" which means that it is the responsibility of the individual to interpret and use the information provided.

The next set of information aids falls within the "Verbal Instruction" genre, encompassing all forms of auditory instruction. This includes direct communication with another person which could be a vehicle operator, transit staff member, fellow passenger, or other acquaintances with prior knowledge of the desired transit trip. This type of information is clearly interactive as the act of conversation allows the passenger to request specific information and clarify the major points at the end of the process. Communication with another person could also be through a manned call center, which is similar to face-to-face communication, featuring the same interactive benefits of human contact. This genre also includes verbal information provided via an automated call center. The extent to which this type of information is interactive, or simply active, depends on the range of options that are available when the passenger calls the automated line. If the call center simply relays timetable information verbatim this information must be classified as passive. Public Address (PA) Systems also fall within this genre and can be provided in transit centers or in vehicles. This type of information is active as it is able to respond to changing conditions over time.

The third information genre is electronic information. This includes "real-time" information displays commonly featured at bus stops, information kiosks, online service information (essentially online schedules and maps), and Internet/PDA trip planners. Internet / PDA trip planners are a relatively new addition to the spectrum of information aids and thus are not covered in most 20th century publications. Real-time information is active in style while Internet/PDA trip planners are interactive as they allow travelers to interrogate a trip planning database.

2.3.2 Information Needs and Preferences at the Different Stages of the Transit Trip

The transit trip is made up of a series of discrete stages. Travelers are faced with different information needs at each stage, and different information aids are more appropriate for fulfilling these needs at each stage. Figure 2.2 shows a simplified example of this process:

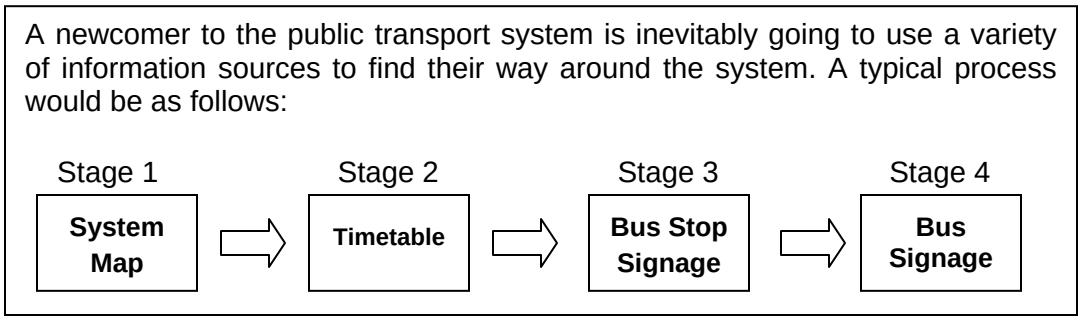

FIGURE 2.2 – Printed Information Material Use at Different Transit Trip Stages
Source: Denmark, D (2000).

The study by BMI & Multisystems (Cluett *et al.*, 2003) defined four discrete stages of a transit trip:

(i) Pre-Trip
(ii) Going to Stop or Station
(iii) Wayside
(iv) On-board transit vehicle

The study investigated the transit user information preferences at each of these stages. Sixteen different information types were separated into static information and real-time information (Table 2.3).

TABLE 2.3 – Information Types Tested in BMI and Multisystems Study

Static Information	Real-Time Information
Timetables	Arrival / departure
Route Maps	Connection time
Closest stop	Detours / delays
Transfers on route	Trip time
Trip planning	Weather
Fare	Vehicle location
Alternate routes	Parking availability
Park and ride	
Disability Info	

Source: Cluett et al (2003).

Survey respondents were asked to rate these different information types as either "essential" or "nice to have" in relation to both the planning of a familiar trip and an unfamiliar trip. Figure 2.3 shows their responses.

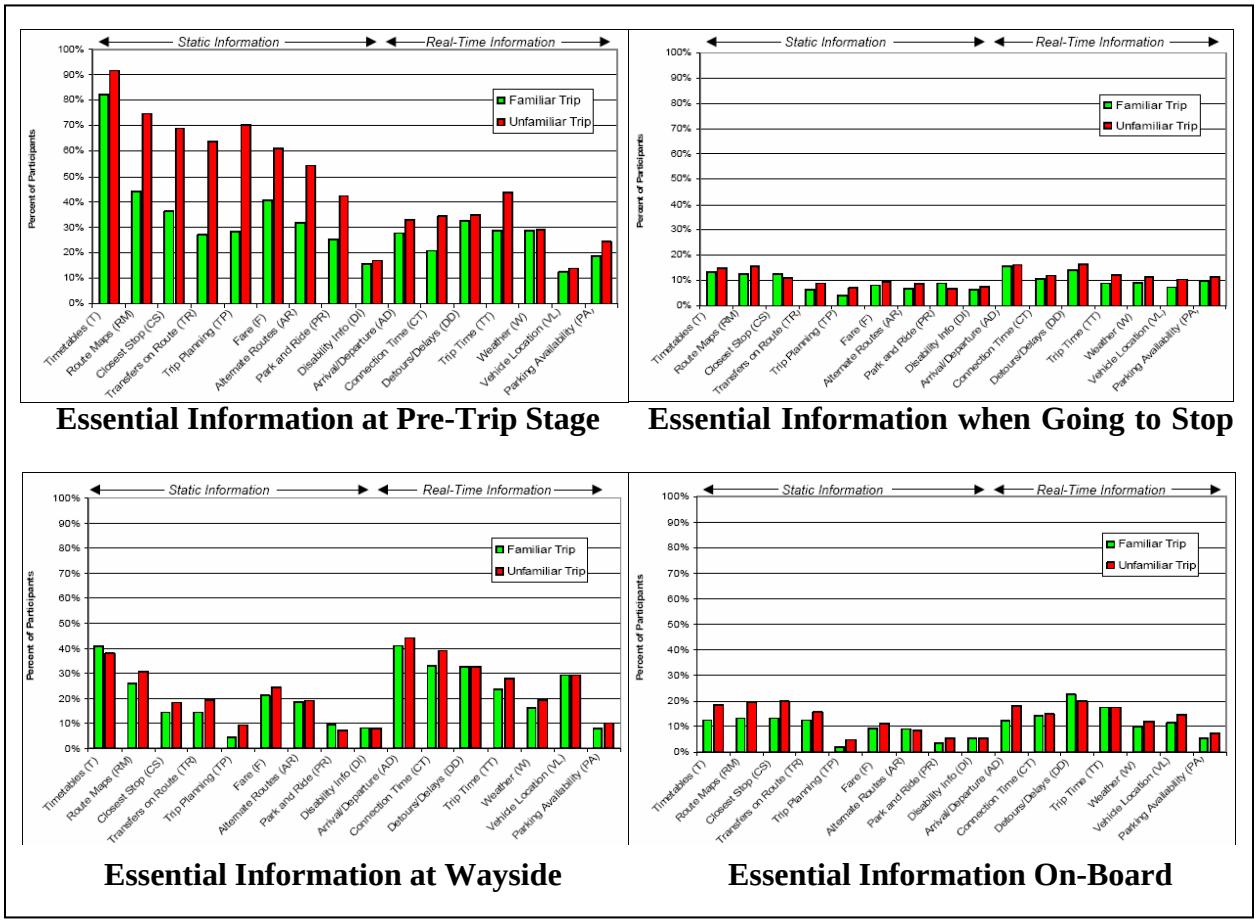

FIGURE 2.3 – Transit User Information Preferences at Different Stages of a Transit Trip
Source: Cluett et al (2003).

Figure 2.3 illustrates several important points about variation in the information needs of passengers at different stages of the transit trip. Comparing the four charts it can be seen that user's information needs are greatest at the pre-trip stage followed by the wayside stage. Information needs en-route to the stop/station and on-board the transit vehicle are much smaller in comparison (only 5 to 20 percent of the sample stated that any information was essential at either of these two trip stages). Thus, the information preferences at these two stages are discussed in more detail below.

Focusing on pre-trip information preferences it can be seen that timetables exceeded all other information types in terms of sample preference for both familiar and unfamiliar trips. Over 80 percent of the sample stated timetables were essential information. Views on the other static information types varied considerably depending on whether the trip was familiar or unfamiliar. If the trip was familiar, only around one-third of the sample stated that the other static information types were essential; however, around two-thirds of the sample thought that the same static information was essential if the trip was unfamiliar (with the exception of park and ride information and disability information, which were not highly rated for either familiar or unfamiliar trips). In general, the real-time information was given less importance relative to static information; this could be expected considering that this was the pre-trip stage. Only around one-quarter to one-half of the sample thought that any of the real-time information types were essential whether the trip was familiar or unfamiliar.

At the wayside, real-time information takes more precedence with arrival and departure times, with connection times and detour/delay information being the most popular information types. However, even these categories were only selected as "essential" by 30 to 45 percent of the sample with timetables receiving a similar rating. Whether the trip was familiar or unfamiliar did not appear to make much difference at the wayside.

The BMI & Multisystems report (Cluett, 2003) goes on to assess how the transit users wish to receive the essential information at each trip stage. It was found that static pre-trip information was preferred in printed paper form or via a computer. The telephone was the next most frequently cited media type for essential pre-trip information. At the wayside, preferred information media forms included video/kiosk and message signs for real-time information, and printed signs followed by paper printed for static information.

TCRP Report 45 (Higgins and Koppa, 1999) also discussed passenger information needs at different stages of the transit trip. This is summarized in Table 2.4.

TABLE 2.4 – Information Needs at Different Stages of Transit Trip

Pre-Trip Information Needs	In-Transit Information Needs
Location of nearest bus stop	At departure point: - identification of correct bus to board
Routes that travel to the desired destination and transfer locations	On the bus: - identification of bus stops for transfers or disembarking.
Fare	At transfer points: - how to transfer to another route, - cost, - time limits and restrictions, - identification of the correct bus to board.
Time of departure and approximate duration of trip.	At the destination: - area geography (location of final destination in relation to bus stop), - return trip information (e.g. departure times and route numbers.

Source: Higgins and Koppa (1999).

Table 2.4 includes many of the information types listed in the Cluett (2003) study, as shown in Table 2.3. Table 2.4 also includes information needs at the end of the transit trip including area geography and return trip information. The Higgins and Koppa (1999) study went on to discuss the strengths and weaknesses of the different information media types in relation to satisfying passengers' information needs. This discussion is summarized in Table 2.5.

TABLE 2.5 – Roles of Different Information Media Types

Information Aids	What They Provide	What They Don't Provide
Oral Instructions (telephone information, bus operator, other passengers)	- Straightforward and personalized information - Simplicity for new riders and for those who have difficulty reading maps - Instant accessibility	- An overall picture of the transit system - Reference material for future or continued travel - Flexibility or easy error correction; if a rider misses a step in the process, his or her frame of reference is lost unless he or she can converse further with the information source
Maps	- "Bird's-eye" view of the transit system; spatial relationships of landmarks, routes, and connections - Flexibility for changing trip plans - Supportive information during a trip - "Portable" information, useful for pre-trip and in-transit	- Instant accessibility. Not only is the map a physical object that a potential rider must obtain before trip planning can begin, but map reading presents difficulties for many people.
Signs	- Information at "decision points": bus stops, transfer points, terminals - Supportive information	- Detailed information and explanations - Portable information; no help during pre-trip planning or on-board
Timetables	- Portable information - Detailed route information	- Instant accessibility. Many riders have trouble reading and using timetables

Source: Higgins and Koppa (1999).

Table 2.5 states that oral instruction is good for providing personalized (i.e. interactive) information. This is particularly useful for new riders or those who have difficulty using printed information materials. However, oral instruction is unable to provide an overview of the entire system, reference material once the instruction is over, or correction if the instruction is not communicated, memorized or executed correctly. Maps are good at providing an overview of the entire system and allow the rider to plan their own trips and check their progress once underway, but require the rider to (i) obtain the map, and (ii) know how to use it. Signage is good for providing simple information at "decision points" but cannot provide detailed information and cannot be taken with the rider. Timetables are good for providing detailed service timing information and benefit from their portability allowing both pre-trip planning and on-route verification. However, timetables suffer in the same manner as maps in that they must first be obtained by the rider who must already be aware of how to use them.

Wickens (1992) also discusses the trade-offs between oral information and graphic (printed) information – the "automaticity and cognitive simplicity" provided by oral instruction versus the "flexibility and generality" of maps, signs and other graphic information. Expanding on this, NCTRP *Synthesis of Transit Practice 7* (Fruin, 1985) states that oral assistance provides personalized trip plans, answers specific customer questions, and quickly accommodates changes in transit service. Printed information materials "bridge the knowledge gap" for riders unfamiliar with the local area or transit system, provide a permanent reference source, and help to visualize or clarify oral instructions.

Despite these problems associated with printed information materials, these remain the dominant transit trip planning media. A study titled "Customer Preferences for Transit ATIS" found that "riders prefer traditional forms of paper-based information and traditional wayside signage (e.g. schedules, maps and fares) (Cluett et al, 2003). TCRP Report 45 (Higgins & Koppa, 1999) cited several research studies which found that schedules were the highest priority source of information (see Table 2.6 below).

TABLE 2.6 – Customer Preferences for Transit Information Media

Batelle Institute Study (1976) (transit users and non-users)	Northampton County Study (1994) (transit users only)	METRO Study (1992) (transit users and non-users)
• Pocket schedule, • Telephone, • Bus stop information, • Fold-out map, • Bus driver, • Electronic route finder, • Sign on front of bus, and • Other people at bus stop.	• Timetable leaflet/booklet, • Timetable display board, • Asking at enquiry desk, • Inspector, bus driver, etc., • Telephone enquiry, • Video monitor, and • Enquiry terminal.	Non-riders: - Bus schedules, connections, fares. Riders: - Route changes, fare purchase locations, - All reported carrying pocket schedules or keeping them at home or work.

Source: Higgins and Koppa. (1999).

TCRP Report 45 (Higgins and Koppa, 1999) stated that both transit riders and non-riders often mention timetables (schedules) as a potentially useful information aid which some riders use regularly (though occasional and new riders typically prefer oral instruction).

However, the report went on to state that many people find timetables difficult to read and understand and recommended that *"rather than print and distribute timetables, systems provide departure times or bus headways on bus stops signs, packaging the schedule information into smaller, manageable pieces"* (Higgins & Koppa, 1999).

One British study (Balcombe and Vance, 1998) looked at different information media preferences for regular, occasional and new journeys. It was found that a large proportion of transit users claimed they never checked timetables for regular trips presumably because they had already memorized schedule details. Users making "occasional" trips on transit were more likely to use timetables for such journeys, however, the majority again claimed never to use timetables. This could suggest that users are so familiar with service characteristics and confident that services run as planned that they do not need to consult schedules, or conversely, that the service is so haphazard there is no point consulting a schedule. It could also suggest that information needs may be getting met elsewhere. In general, it was found that greater confidence was expressed in information sources involving human contact such as enquiry offices and manned call centers. The study authors hypothesized that the reason for this was that such interaction evoked greater public trust and confidence. Information needs for new journeys were much greater with the majority of users stating they would require departure time, frequency and service number before setting off on a new, unfamiliar journey. Interestingly, information needs were often limited to the pre-trip stage: *"half the respondents professed to have no need of information once committed upon their journey"* (Balcombe and Vance, 1998).

The study by Cain (2004) also assessed public preferences for different information media. Study participants were asked to indicate in the post-test self completion questionnaire whether they had ever used transit schedules or maps before participating in the study. Their responses are provided in Table 2.7 separated and defined by their stated current frequency of transit use.

TABLE 2.7 – Level of Previous Experience with Transit Information Materials By Transit User Status

Whether Participant has Previous Experience with Transit Information Materials	Transit Users		Non-Transit Users	
	N.	%	N.	%
No Previous Experience	30	26.8	34	50.7
Previous Experience	82	73.2	33	49.3
TOTAL	112	100	67	100

Table 2.7 shows that the level of previous experience with transit schedules and maps is different for transit users and non-users. The majority of transit users (73.2 percent) had previous experience with transit information materials, while only around half of non-transit users (49.3 percent) had previous experience. It is interesting to note that over one-quarter of sampled transit users (26.8 percent) did not have previous experience. This suggests there are a significant number of transit users who do not use maps and

schedules to plan their transit trips. This issue was investigated further by asking the transit users in the sample to state the main method they used to plan their transit trips. Their responses are provided in Figure 2.4.

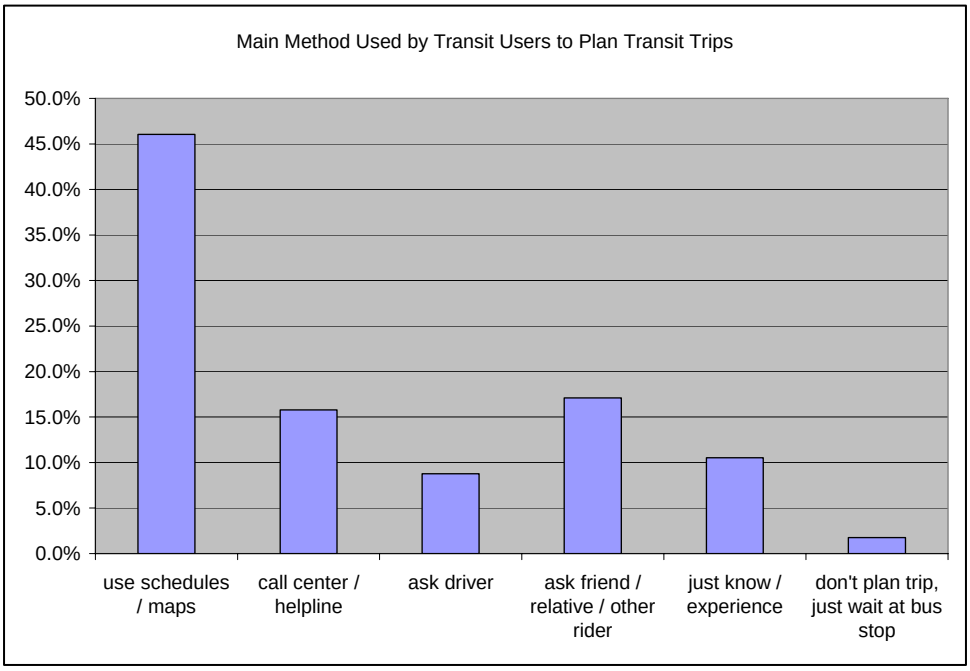

FIGURE 2.4 – Main Method Used by Transit Users to Plan Transit Trips
Source: Cain. (2004).

Figure 2.4 shows that just under half of transit users in this sample used transit schedules and maps to plan their transit trips. This means that although this was by far the most popular method overall, over half of the transit users used a different approach. Alternatives included calling a helpline (16 percent) or asking the bus driver (9 percent), both of which require transit agency resources. Thus, improving transit user ability to plan their own trips may allow drivers to complete their routes in less time and would mean that less staff resources would have to be spent answering requests for assistance from customers.

Just over 10 percent of transit users stated they did not need any method to plan their trip as they simply knew from experience where and when the transit services ran. A small proportion of the sample did not employ any trip planning and simply stood at the bus stop until a bus came. Further analysis was conducted to assess whether there was any variation in trip planning method used in relation to different frequencies of transit use. Table 2.8 provides the results of this analysis.

Table 2.8 – Main Transit Trip Planning Method by Frequency of Transit Use

Current Frequency of Transit Use	Use schedules/ maps		Call Center/ helpline		Ask Driver		Ask Friend / Relative		Just know / experience		Don't plan trip, just wait at bus stop	
	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%
less than once a month	6	11.5	4	22.2	2	20.0	3	17.6	1	8.3	0	0.0
< once a wk; > once a mth	11	21.2	3	16.7	3	30.0	7	41.2	1	8.3	1	50.0
1 to 3 days a week	15	28.8	5	27.8	3	30.0	5	29.4	5	41.7	1	50.0
4 or more times a week	20	38.5	6	33.3	2	20.0	2	11.8	5	41.7	0	0.0
TOTAL	52	100.0	18	100.0	10	100.0	17	100.0	12	100.0	2	100.0

Source: Cain. (2004).

Although the cross-tabulated cell sizes are relatively small, it can be seen that the majority of those that use schedules and maps to plan their transit trips are frequent transit users with 38.5 percent using the bus four or more times a week and 28.8 percent using the bus one to three days a week. Similar results were observed for people who call a helpline with again over half using the bus at least once a week. Frequencies are more evenly spread for people who ask the driver or ask a friend/relative while almost all those who knew the transit services from experience were also frequent transit users.

2.3.3 Section Summary

- The Pre-Trip stage is the most important stage of the transit trip for obtaining essential trip information. Once the trip has been initiated, it appears that information needs are reduced.
- At the pre-trip stage, static information is the most important form of information for unfamiliar trips.
- Among the static information types, timetables and route maps are the most frequently cited types of essential information for unfamiliar trips at the pre-trip stage.
- Real-time information is of most use at the wayside trip stage.
- At the pre-trip stage, the preferred media forms were printed materials and the computer.
- Although portable printed information is popular, it appears that a large proportion of transit users do not use it. Whether this is through inability or just preference is unclear.
- Preferred media forms at the wayside were video/kiosk and message sign for real-time information, and printed signs for static information.
- Printed information materials are a very popular information aid even though many users have difficulty using them. Oral instruction is preferred for new riders and those unable to use printed materials.

2.4 Printed Information Materials – Design Issues and Public Comprehension

The aim of the previous section was to provide an overview of different information media types and their strengths and weaknesses at different points in a transit trip. As has been shown, the pre-trip stage is the most important in terms of transit user needs for essential trip planning information. It has also been shown that the preferred media source for this type of information is hand-help printed information materials such as schedules and maps. While the previous section discussed the context of printed information materials within the spectrum of transit information provision, this section focuses on the use of hand-held printed information materials in pre-trip planning[1].

2.4.1 Stages in the Trip Planning Process

As previously discussed, in many cases, the trip planning task is deferred to a member of transit staff or other interactive resource. The strength of printed information materials is that they permit the individual to take responsibility for their own trip planning. The amount of information required to successfully plan a trip depends on the circumstances and abilities of each individual traveler. In some cases the traveler may already know the route number and destination stop and will only require the bus arrival time, while in other cases, the trip may be completely new to the traveler and a much wider range of information will be required. The following table considers the pre-trip planning task in its entirety, covering the instance where no prior knowledge is available. The task can be separated into five discrete stages.

TABLE 2.9 – Stages in Transit Trip Planning

Stage	Description	Information Materials Used
1	Locating Origin and Destination on System Map	System Map
2	Selecting bus routes and transfer point(s)	System Map
3	Locating closest time points / transfer time point(s)	System Map / Route Map
4	Identifying correct section of schedule	Route Map / Schedule
5	Using schedule to get bus times	Schedule

Stage 1 involves using the system map to identify the trip origin and trip destination. Stage 2 involves using the system map to determine which bus routes to take in order to travel from origin to destination. This task requires locating different color-coded routes

[1] The material provided in this section comes primarily from the following source: Cain, A. (2005).

in close proximity to their trip origin and destination, following the routes through the town, and deciding where to transfer. Having decided on which routes to take, Stage 3 involves using route maps to determine where to board and disembark from each bus. This involves cross-referencing between the system map and the route maps in order to locate the closest bus stops and the appropriate transfer points. Having identified closest bus stops, travelers then need to begin the task of identifying the times when they will board and disembark from each bus. The first stage in this process (Stage 4) involves determining which section of the schedule to use. This requires an awareness of (i) the required direction of travel, (ii) the required day of travel and (iii) whether the trip is in the morning or afternoon. The final stage in the trip planning process (Stage 5) involves using a schedule to identify the correct bus times for boarding and disembarking from each bus.

2.4.2 Public Comprehension at Each Trip Planning Stage

The study by Cain (2004) assessed aggregate public ability to perform each of the five trip planning tasks discussed above. The overall success rates at each trip planning stage are provided below:

TABLE 2.10 – Sample Performance at Each Transit Trip Planning Stage

Stage	Description	Information Materials Used	Success Rate (%)
1	Locating Origin and Destination on System Map	System Map	93.6
2	Selecting bus routes and transfer point	System Map	
3	Locating closest time points / transfer time point	System Map / Route Map	73.2
4	Identifying correct section of schedule	Route Map / Schedule	55.6
5	Using schedule to get bus times	Schedule	
Overall		System Map / Route Map / Schedule	52.5

Source: Cain, (2005).

Table 2.10 shows there was a 93.6 percent success rate for Stages 1 and 2. This suggests these tasks do not present significant difficulties to most people. Table 2.10 shows there was also a relatively high level of success at Stage 3, with 73.2 percent of assignments successfully completed. Table 2.10 shows that Stages 4 and 5 caused the most problems for participants, with a success rate of only 55.6 percent. This means that just under half the sample got at least one bus time wrong, while almost one fifth of the sample (17.9 percent) was unable to get any of the times correct.

Overall, only 52.5 percent of assignments were successfully completed suggesting that a significant proportion of the general public are unable to successfully plan a bus transit trip from an origin to a destination that involves one transfer. However, in dividing the trip planning task into a series of five discrete stages, this study suggests that the vast majority of public are able to successfully complete the first three trip planning stages, and that the critical problem lies at Stages 4 and 5, where people are required to use a schedule to determine boarding and alighting times. Therefore, one of the study's main conclusions is there is a critical need to improve the public's ability to understand and utilize the information presented in transit schedules.

Other research sources corroborate the above findings. The NJIT study (Fallat *et al*., 2004) found that at least 50 percent of the study's trip planning assignments were answered incorrectly. In general, transit information usefulness is affected by each potential user's knowledge of local geography, knowledge of the transit system, and ability to process different types of information, including maps and schedules. A study conducted in 1986 found that 64 percent of the U.S. population is thought to have difficulty reading maps of any sort (Streeter & Vitello, 1986). Data from the National Adult Literacy Survey found that many people are unable to successfully use a tabular bus schedule. This survey tests adult literacy levels in three separate categories: prose comprehension, document literacy and quantitative literacy. In the document literacy section only 37.6 of adults between 21 and 25 years old were able to successfully use a bus schedule to select the correct bus departure time (Kirsch *et al*., 2001). As such, using a bus schedule was rated at level 4 on a five-point scale with Level 1 being the easiest and Level 5 being the most difficult.

2.4.3 Design Issues at Each Trip Planning Stage

Stage 1 – Identifying Trip Origin and Destination

The first stage in the planning of any trip is determining trip origin and destination. For this study, this meant isolating the specified trip origin and destination from the large number of points of interest distributed around the system map. This was a straightforward task for most participants, and the two points were located either by using the street addresses provided, or simply scanning the system map at random until the points were found. However, some participants took a long time to find the points. Sources of difficulty are summarized in Table 2.11 below, along with potential solutions to each problem.

TABLE 2.11 – Trip Planning Stage 1: Problems and Potential Solutions

Problem	Potential Solution
- Font size too small	- Increase font size. - Specify a minimum font size.
- Points of interest all the same color – no differentiation	- Divide points of interest into different categories (restaurants, public buildings, hotels, malls, etc), identify each category with a different icon (different shape / different color) and provide a legend.
- Intersecting streets addresses not provided at all points of interest.	- Provide intersecting street addresses for all identified points of interest
- Difficulty locating approximate area of map where point of interest is located.	- Road map style grid. Superimpose a grid over the system map and provide co-ordinates for each point in a table at the side of the map.

Source: Cain, (2004).

Guidelines are available on minimum font sizes for printed transit information materials. Higgins and Koppa (1999) noted that elderly people and people with visual disabilities are a significant segment of transit ridership on many systems and are likely to be more transit-dependent. This report recommended a 10-point minimum font size for text on maps and other printed materials. Another report from the United Kingdom (ITSC, 2002) stated that a 14-point or larger font size was preferable, but that under no circumstances should a font size be lower than 8-point. Inspection of the system map materials used in the Cain (2004) study showed that a 7-point font size was used for landmarks and street names. Participant responses and published guidelines are in agreement that this font size was too small.

Stage 2 – Selecting Bus Routes and Transfer Point

Having correctly identified their origin and destination on the system map, participants then had to determine which bus routes to use for their trip. This involved locating different color-coded routes adjacent to origin and destination, following the routes through the town and deciding where to transfer. Despite the general level of competence on this stage, some problems were identified. These are summarized in Table 2.12 below, along with potential solutions in each case:

TABLE 2.12 – Trip Planning Stage 2: Problems and Potential Solutions

Problem	Potential Solution
- Font size too small on route numbers	- Increase font size. - Specify a minimum font size.
- Poor color contrasting on adjacent routes	- Ensure that contrasting colors are used for each route, particularly on adjacent routes.
- Identifying locations where transfers can be made between routes	- Provide an transfer icon on the system map where transfers are possible, perhaps also providing the numbers of the routes available to transfer to at each of these points.
- Following routes through "congested" areas such as transfer centers	- Where a large number of routes come together in one area, provide an inset of this area at a larger scale at the side of the main map, to allow people to follow the routes accurately through this area.

As with Stage 1, it should be noted that overall public competence at identifying the correct routes was very high, suggesting that these potential improvements are not a critical need, but may make this trip planning stage easier and quicker to accomplish.

Stage 3 – Locating Closest Bus Stops/Transfer Point

Having identified the routes required for their trip, participants were then provided with the route maps and schedules for each of these routes, and asked to use these to identify the bus stops and times for boarding and disembarking each bus (if they had not been able to correctly identify the required routes, this was explained to them before they were given the correct route maps and schedules). Table 2.13 below summarizes the main problems that were observed and the potential solutions.

TABLE 2.13 –Trip Planning Stage 3: Problems and Potential Solutions

Problem	Potential Solution
- Difficulty locating origin and destination on route map	- Provide points of interest on route map.
- Difficulty locating closest bus stops to origin and destination on route map	- Provide points of interest on route map.
- Identifying locations where transfers can be made between routes	(1) Provide a transfer icon on the route maps to show where transfers are possible. (2) Provide the numbers of the routes available to transfer to at each of these points. (3) Show other routes on route map in grayscale, to make it easy to see where routes intersect.

Problems at this stage mainly related to locating the origin, destination and transfer point relative to the closest bus stops, which was difficult when the origin and destination points were not shown on the route maps. An obvious solution to this problem would be to also provide the points of interest (landmarks) on the route maps, so that the system map would not have to be referred to during this stage.

Stage 4 – Identifying the Correct Schedule Section

Having identified the four bus stops, participants were then required to begin the task of identifying the time at which they would board and disembark from each bus. The first stage in this process was to determine which section of the schedule to use, which requires an awareness of (i) the required direction of travel, (ii) the required day of travel and (iii) whether the trip is in the morning or afternoon. Each issue affected the determination of which part of the schedule to use, and all three issues caused difficulties to different study participants. Problems observed at this stage, and potential solutions, are summarized in Table 2.14 below.

TABLE 2.14 – Trip Planning Stage 4: Problems and Potential Solutions

Problem	Potential Solution
- Difficulty with the concept of cardinal directions	(1) Provide landmark based directions. (2) Use inbound / outbound approach. (3) Use direction icon based approach.
- Difficulty matching direction of travel to the appropriate section of the schedule	(1) Better differentiation of different direction information in schedule (improved labeling or separate into different tables). (2) More concise direction labeling in cases where the route travels in more than one direction.
- Difficulty identifying correct day of travel on schedule	- Separate information for different days of travel into different tables.
- Difficulty differentiating morning and afternoon travel times	- Differentiate AM / PM information through clear labeling or separation into different tables.

A commonly observed problem was the determination of travel direction. One source of difficulty here was that some people were not used to reading maps and were not familiar with the concept of cardinal (compass point) directions. For such people, providing landmark based directions is crucial. The other source of difficultly was in applying the correct direction of travel to the schedule. In several cases, the labels used to define directions of travel were ambiguous and often counter-intuitive to the direction that participants actually wanted to travel in. In addition, lack of differentiation between the different direction sections of the schedules caused some participants to simply read the times off the wrong section.

It was found that separating the information for different travel days into different tables had a statistically significant positive impact on trip planning ability. It was concluded that it is important to separate information for day of travel as much as possible, and that putting the information in the same table introduces the potential for people to incorrectly plan their trip.

It was also found that while some form of AM/PM differentiation may make the Stage 4 trip planning task easier, this may not significantly improve public trip planning performance.

Stage 5 – Using the Schedule to Determine Boarding and Alighting Times

The final stage in the trip planning process was to use the schedule to identify the correct bus times for boarding and disembarking from each bus. Aside from the significant difficulties that the general public has in using schedules to get service timing information, there are some design issues worth mentioning. For those with prior experience with transit schedules, additional confusion was caused when the schedule was presented in a vertical alignment format (also known as the Standard Format) instead of the horizontal format (also known as the Reflected Format) that they were used to. Other studies have also found that the horizontal format performs better (Sprent *et al*.,

1980) as it is more natural for the human eye to scan in a "horizontal progression from left to right, [which is] a powerful population stereotype of motion direction" (Sollohub and Tharanathan, 2005). Despite complaints about the vertical format, the Cain (2004) study found there was no difference between the performances on the two formats. Overall, this is clearly an issue where retaining consistency has obvious benefits. A 2001 survey of transit agency materials across Florida found that the vast majority of schedules across the state were in the horizontal format (Hardin *et al*., 2001), which explains the higher level of familiarity with this format. There may, therefore, be a case for standardizing all schedules to this horizontal format. Table 2.15 summarizes the problems and potential solutions encountered at Stage 5.

TABLE 2.15 - Trip Planning Stage 5: Problems and Potential Solutions

Problem	Potential Solution
- Difficulties / unfamiliarity with tabular schedule information	(1) Present time information in an alternative format. (2) Educate users on the use of the tabular format, either by providing an explanation within the information materials, or by some other form of education. (3) Adopt a headway-based approach if service frequency permits.
- Confusion caused by different schedule alignment formats	- Standardize alignment to the - horizontal format to retain consistency.

Despite the difficulties the public has in using schedules, it is still a very popular method for obtaining transit service information. Assuming that this will continue to be the case, there needs to be serious reflection on whether there is any way to improve schedule design such that it will be understandable to a higher proportion of the population. Realistically, there will probably never be a design that every transit user can fully understand, but perhaps some progress can be made in raising the overall proportion. There are several options for approaching this:

(i) Improve tabular schedule design.

- Continue to use the traditional tabular schedule as the design template, but investigate ways of improving its design to raise the overall level of comprehension

(ii) Consider alternatives to the tabular schedule.

- One option is the headway based approach, where schedule information is limited to the service span and service frequency. Such an approach is limited to situations where service is frequent enough that riders do not need to know exactly when buses will arrive.

- Another options is the "clockface" format. One study provided anecdotal evidence that

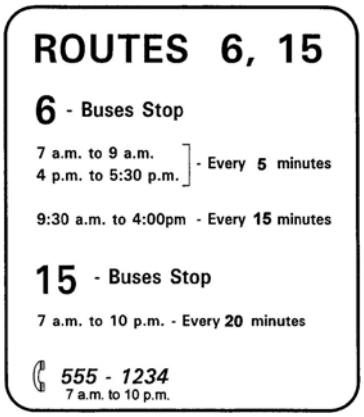

FIGURE 2.5 – Example Display of Headway Based Timing Information

appreciable gains in ridership have been made when schedules have been reorganized to a simpler "clockface" format (Webster & Bly 1980). Again, such designs tend to reduce the completeness of the information that can be presented.

- Another option would be "*providing individuals with printed timetables containing essential details for the journeys they are likely to make and no others"* (Balcombe and Vance 1998). Such "personal timetables" would contain information already provided by call centers.

- Balcombe and Vance (1998) also suggest producing more than one version of the schedule:

> *"one dedicated to conveying basic, popularly required information as simply and clearly as possible, perhaps in written statements, rather than in tabulated numerical form with a second, comprehensive edition, including the detail and supplementary information required by a* ***significant minority*** *of passengers."* Balcombe & Vance (1998).

On reflection, this suggestion is both simple and highly perceptive. The problem faced in providing timing information is that the tabular schedule is the only format that can consistently provide the full accuracy and completeness of the information – all other formats requires some form of summary, or can only be used in specific scheduling situations. Furthermore, some passengers need this accurate information for specific situations, like when their trip involves a transfer. However, many people find the tabular schedule difficult use, while others simply do not require that high level of detail. It makes perfect sense, then, to provide the timing information in two formats; the first providing the complete, accurate timing information in the tabular schedule format, and the second providing a summarized text version.

(iii) Educate transit users in schedule use.

- Results from the Cain (2004) study suggested that exposing the public to trip planning exercises increased their level of confidence in planning an actual transit trip. Perhaps providing instruction or training in the correct use of the materials would be an effective way to improve trip planning confidence and overall comprehension.

2.4.4 Schedule Use and Service Frequency

The need for a schedule is related to the frequency of the service. When very frequent services are provided, with headways only several minutes apart, there is little need to know exactly when the next bus is scheduled to arrive. Thus, the majority of passengers using these types of services tend to be "random arrivals" at the bus stop. However, many services run with headways of 30 minutes, or even one hour. Clearly, someone wishing to

use these less frequent services would like to know in advance when the next bus will arrive. The majority of these passengers would tend to be "planned arrivals". Research suggests that the "frequency threshold", at which the majority of passengers will want to consult a schedule, exists at approximately 10 to 15 minutes, see Jolliffe and Hutchinson (1975); Seddon and Day (1974); and Holroyd and Scraggs (1966). Thus, schedules are definitely required if service headways are 15 minutes or more, and not required for headways of 10 minutes or less. This finding is illustrated by the figure below, from the Balcombe and Vance (1998) study.

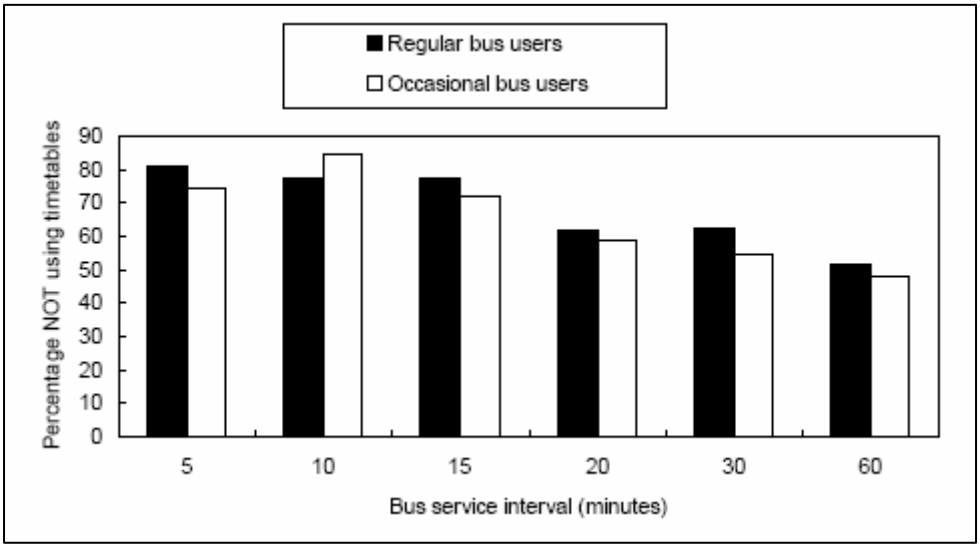

FIGURE 2.6 - Bus Service Interval and Timetable Use
Source: Balcombe and Vance (1998)

The figure shows that when bus service frequency is 5, 10 and 15 minutes, more than 70 percent of both regular and occasional bus users stated they did not need a timetable. At frequencies lower than 15 minutes, the proportion of users needing a timetable starts to increase, and at 60 minute headways, approximately half of both regular and occasional users say they need a timetable. There are a number of additional points of interest suggested by this figure:

- Even at very high service frequencies there are still a small proportion of users stating that they need a timetable – in this case around 20 to 25 percent.
- Even at very low service frequencies, around half of surveyed users stated they did not need a schedule. This suggests that a large proportion of users do not use timetables to obtain bus arrival times. Another section of the study found that around 70 percent of regular users stated that stated they never used a timetable.
- The needs of regular and occasional users were very similar, only differing by 5 or 10 percent in each case. The trend (apart from one exception) was for a slightly higher proportion of regular users to require timetables than occasional users.

The Highway Capacity Manual (2000) includes a transit level of service (LOS) table based on service frequency. LOS A is defined as a headway of less than 10 minutes, with

an additional comment that passengers do not need schedules at this LOS. LOS B is defined as a headway of between 10 and 14 minutes, with the comment *"frequent service; passengers consult schedules."* Although it is not known how these LOS thresholds were developed, this source reinforces the theory that the threshold for schedule necessity is around 10 to 15 minutes.

2.4.5 Section Summary

This section has shown that the level of service complexity affects the trip planning task, with complicated route structures and unstandardized departure times adding to the likelihood of rider confusion and affecting the selection of schedule formats.
Overall, it is clear that the great advantage of the traditional tabular schedule format is the completeness and accuracy of the timing information that is permitted. Simpler formats like the headway-based approach and clockface approach may increase legibility, but only at the expense of comprehensiveness. While frequent service (no greater than 15 mins), or services that arrive at the same time every hour, may permit these simpler formats, in many cases using them would risk the omission of information that is necessary for some service users. Whether it is better for the aggregate bus user population to prioritize legibility or completeness is unknown at this time. Balcombe and Vance (1998) suggest that this could be addressed by (i) providing personal schedules, or (ii) producing two schedule versions, one in a simplified format (legibility prioritized) and one providing the full level of detail (completeness prioritized). Clearly, further research is required on the trade-off between completeness and legibility.

2.5 Published Guidelines for the Design of Printed Information Materials

The objective of this section is to synthesize existing information on the recommended design of printed information materials. This section draws largely from three different "design guideline" publications from three different countries:

- Higgins, L. & Koppa, R. (1999). *Passenger Information Systems: A Guidebook for Transit Systems.* Transit Cooperative Research Program. Report 45, United States.
- Denmark, D. (2000). *Best Practice Manual for the Publication and Display of Public Transport Information.* Ageing and Disability Department, Australia.
- ATCO. (2002). *Printed Public Transport Information – A Code of Good Practice*. Association of Transport Coordinating Officers. United Kingdom

These three sources are supplemented by two other research studies that have assessed different information material design issues and developed design recommendations. These include:

- Fallat, G., Sollohub, D., & Jeng, O-J. (2004). *Improving Public Transit Schedules – Timetables People Can Actually Read.* New Jersey Institute of Technology, New Jersey Department of Transportation.

- Cain, A. (2004). *Design Elements of Effective Transit Information Materials.* National Center for Transit Research, Center for Urban Transportation Research, University of South Florida.

A series of design matrices have been developed to compare the recommendations of the different resources listed above in relation to each design element, in order to determine where clear consensus exists and where contrasting advice exists. A matrix has been developed for (i) General Publication Guidelines, (ii) System Map, (iii) Route Map, (iv) Timetable / Schedule.

It should be noted that the more recent publications cited above frequently base their recommendations on those of the older publications. Thus, some cross-publication duplication is apparent in the following matrices.

2.5.1 General Publication Guidelines

Design Element	TCRP 45	Australian Manual	British Manual	New Jersey Study
Typeface	Sans-serif fonts such as Helvetica and Gothic Book recommended for all signs, and for short labels on maps and other printed material. For long blocks of text, such as map instructions, serif fonts such as Times New Roman, Palatino, and Letter Gothic are recommended.	Sans serif fonts should be used in most situations. Complicated, decorative, cursive, italicized, outlined, and shadowed fonts should be avoided.	Print should be in simple upright sans serif typeface such as Gill Sans, Humanist 521 or New Johnston.	
Type Case	Use all capital letters (upper case) for stop designations, terminals, and other short labels. Use capital and lower case letters for long legends and instructions.	Using all capital letters should be avoided; text should be in sentence (upper and lower) case as this is easiest to read.	Lower case print is much easier to read and should be use almost exclusively.	
Type Size	Recommends a 10-point minimum font size for text on maps and other printed materials.	Recommends 12 point font size, and suggests that 16 points should be standard for large print. 10 point minimum font size recommended.	14-point or larger is preferred. Under no circumstances should font size be lower than 8-point.	Several studies indicate that minimum font size should be 6pt.
Contrast / Print color	Black letters on a white background provide the greatest amount of contrast, this is recommended whenever possible for text that is essential to the reading audience. Never use "reverse polarity" (light lines and letters on a dark background) for either printed materials or for route and timetable information. Such presentation results in poorer and slower reading for many people, especially under low lighting conditions. To enhance visibility under all conditions, sign characters and backgrounds must be flat, matte, or "eggshell" in finish. No glossy paint or finish should be used. Gloss produces glare points under certain types of lighting and lighting angles that will limit legibility drastically.	Use the highest possible contrast between print and background. Responses to text printed in colors other than black showed a considerably lower level of comprehension than for black printed on white. Thus, black on white should be used if possible – dark blue or dark brown are also acceptable. For some people white on a black background is easier to read than black on white. It is also acceptable for titles. Avoid using red or green print.	Print should be either black or another color that contrasts strongly with the background. Intense blue or brown are acceptable alternatives.	

2.5.2 System Map

Design Element	TCRP 45	Australian Manual	Design Elements Study (potential solutions to identified design problems)
Overlay / Schematic	Schematic is generally preferred as they provide only essential information and minimize clutter. The one drawback is they are not to scale and distance distortion can be a problem.	One problem with schematic maps is that may not provide an accurate account of actual distances between points. However, with schematic maps, it is possible to make the distances between points reflective of the actual journey time between them, which can be an advantage.	
Transit system elements	- Service routes, identified by unique color and label (route number or letter). Labels should be positioned at logical points along the route. On schematic maps, routes should appear as a series of straight lines, angles and curves. Route variations should be shown using a dotted or broken line. - Transfer points. - Transfer centers (indicate which routes converge). - Bus stop locations (if these are suitably infrequent).	Route numbers should be grouped in a logical manner based on area of operation or depot of origin. Route numbers should be indicated at the beginning and end of any major deviation or separation of the route. Route names based on streets or landmarks can cause confusion when used on maps, especially among inexperienced users or those who cannot easily read English.	
Topograph-ical Elements	- Street names for all streets that routes travel on, and other major streets. - Show landmarks served by routes, and other major landmarks in vicinity for wayfinding purposes. No standard has been universally adopted for landmark icons. Any icon may be misunderstood, so accompanying label is required. Coding landmarks by number is not recommended. - Compass directions should be provided at a prominent location. - Scale, if map is overlay map. Comment “not to scale” if map is schematic map.	Labeling next to symbols, rather than on a key, helps those who have information processing problems.	- Provide intersecting street addresses for all identified landmarks. - Divide landmarks into different categories (restaurants, public buildings, hotels, malls, etc), identify each category with a different icon (different shape / different color), and provide a legend. - Employ road map style grid. Superimpose a grid over the system map and provide co-ordinates for each landmark in a table at the side of the map.
Legend	Legend should provide the following information: - Description of symbols / conventions used in map. - Provides route names if these are available. - Scale / or “not to scale” stated if schematic. - Compass. Many users will not notice the legend, so ensure that the map can be used without having to refer to the legend.		Provide a legend.

Instructions	Instructions on how to use the map and, if possible, basic "how to ride" information.		
Information Number	- Include telephone information number.		
Insets	Use insets at a larger scale to facilitate easier understanding of high information density areas such as city centers and major transfer centers. Insets must be clearly linked to the area represent on the main map and positioned in logical manner relative to the represented area.		Where a large number of routes come together in one area, provide an inset of this area at a larger scale at the side of the main map, to allow people to follow the routes accurately through this area.
Color Coding	Research has shown that the number of different colors should be kept below nine. - Optimum nine colors are red, green, yellow, blue, orange, brown, purple, light blue, black (recommended by MUTCD). - Bus stops should be the same color as the route. - Adjacent routes should feature contrasting colors. - Streets and highways should be in medium to light grey. - Terminals and transfer points in black. Partial color coding may be used where the number of routes is greater than nine. By this method, each of the nine colors is used for multiple routes. If this method is used, the following points should be considered: - Keep the number of routes per color approximately equal. - Arrange the color coding so that the adjacent routes feature different colors. - Patterned route lines could be used to further differentiate routes using the same color.	Number of colors used should be kept below nine. If color coding is used, use of other "decorative" color should be minimized. Certain color combinations are not appropriate (see figure below). Indicate landmarks in their natural color i.e. blue for water and green for parks.	Ensure that contrasting colors are used for each route, particularly on adjacent routes.
Transfer Point Identification	The approach to transfer point identification on a system map depends on the size and complexity of the transit system. Systems with relatively few transfer points may be able to mark all such points on the map. For larger systems with numerous transfer points, it may be more appropriate to only mark major transfer points. - Large transfer centers should feature a labeled box containing all route numbers that serve the center. - Multimodal transfer points should also feature appropriate modal symbols.		Provide an transfer icon on the system map where transfers are possible, perhaps also providing the numbers of the routes available to transfer to at each of these points.
advertising		Use of advertising should ideally be avoided. If it has to be included, it should be visually separated from the map itself (i.e. on the reverse side).	

2.5.3 Route Maps

Design Element	TCRP 45	Australian Manual	British Manual	Design Elements Study (potential solutions to identified design problems)
Overlay / Schematic	Schematic maps are again generally preferred. In this case, the focus of the map is the individual route. At this much larger scale, a higher level of detail can be provided on both the route and the surrounding topography.	Schematic maps preferred over overlay maps.		
Transit System Elements	- route number. - illustration of route. - bus stops and transfer points (and numbers of intersecting bus routes); time points identified by a number or letter.	Show and label all major elements of transport system, including: - routes. - major transfer points. - Interchanges.	- bus stops and transfer points. - stop names (at least for time points). - other transportation options such as taxi ranks, and rail stations.	Provide a transfer icon on the route maps to show where transfers are possible. Provide the numbers of the routes available to transfer to at each of these points.
Topographical Elements	- major landmarks in vicinity of route. - major streets and intersecting streets in the route's vicinity.		- local features. - Interchanges. - information offices.	Provide landmarks on route map.
Route Identification	Black and white only: - route should be shown in black. - streets, street names, etc should be shown in medium to light gray. If color is available: - illustrate route in same color as shown in system map. - Bus stops consistent with the coloring on the system map. - Streets, etc should be shown as before in medium to light gray. - Landmarks and transfer points should be shown in black.	Route names should not be based on local streets or landmarks as this can cause confusion. Assign each route a unique number or letter in a logical manner based on area of operation or depot of operation		Show other routes on route map in grayscale, to make it easy to see where routes intersect.
Transfer points	If a system has few transfer points can be indicated on a map or by means of a circle or other symbol. If the system is more complicated there may be a danger of overloading the map with too much information. In this situation only mark interchanges and show individual transfer points on individual route maps. Large interchanges can be shown in an insert which can contain route numbers and information about transferring from one service or transport mode to another.			
Time points	Indicate timing points on a route map with a label that can be matched to a labeled row or column in a timetable.			
Other optional information	- Route Service hours. - Fare information. - Legend. - Compass.	- Hours of operation. - Fares. - Information number.		

2.5.4 Schedules

Design Element	TCRP 45	Australian Manual	British Manual	New Jersey Study	Design Elements Study
Title		- Could use the system map route color as the color band for the timetable. - Name routes as well as assigning them a route number. - Allocate service names that accurately describe the route. - Best format is to show start and end points in addition to one or two major destinations in between.	- Route number / name should be provided in large print at top of page. - Route heading should be confined to the two terminal points and a selection of important places along the route. - Titles may utilize reverse contrasting (e.g. white on black) as long as strong tonal contrast is provided.		
Time Presentation Format	Recommends against the use of timetables, instead proposing headway based time presentation approach using bus stop signage.		- Headway based format recommended where headways are 10 minutes or less. - Where headways are 60 minutes or less, and arrive at time points at the same minutes each hour, it may be more appropriate to show a block of "minutes past each hour".		Options for addressing the problem of schedule comprehension: - Present time information in an alternative format. - Educate users on the use of the tabular format, either by providing an explanation within the information materials, or by some other form of education. - Adopt a headway-based approach if service frequency permits.

Language / Terminology		- The "from-to" format should be used. "Inbound / outbound is confusing. - Use arrows instead of geographic terms like "north / south".	Avoid the use of technical jargon such as "alight, set down, headway, terminal point, transfer, interchange".		Options for dealing with difficulties in understanding cardinal directions: - Provide landmark based directions. - Use inbound / outbound approach. - Use direction icon based approach. Options for improving direction labeling: - Better differentiation of different direction information in schedule (improved labeling or separate into different tables). - More concise direction labeling in cases where the route travels in more than one direction.
Time point alignment	Horizontal alignment recommended	Vertical format recommended. Placing time points horizontally makes it difficult to follow route times and limits the number of timing points than can be used. Turning the time points perpendicular also adds to usage difficulties.	Vertical format recommended.	Horizontal alignment recommended.	Standardize alignment to the horizontal format to retain consistency.
Time point labeling	- Labeled with letter or number that corresponds to that shown on the system map. - Also provide street address or landmark .	- Avoid too many timepoints. - For longer routes make time points every 7 to 10 minutes apart. - Terminals and principle stopping points should be marked in bold. - If there are separate arrival and departure times, repeat the placename.	- Identify points 5 to 10 minutes apart , including all principal nodes and interchange points. - Use Title Case, with terminals and principle points in bold. - Repeat timepont name when separate arrival and departure time are shown.	- Maintain Map References. **(i.e. provide time point locations from route map)** - Display the time point location names and time points so that can be read together without rotating the schedule. This could be achieved by **placing the location names at an angle.**	

Column / row delineation	Line or space break after every three to five rows, or use shading of alternate rows.	Put guidelines every third, forth or fifth lines to assist with time identification.	- Horizontal lines should be provided below every third row to act as a guide. - Vertical columns should be clearly separated by "white space". - Vertical lines should not be used unless they have a particular purpose.	Shade alternate columns for improved distinguishability.	
AM / PM differentiation	- 12 hour clock preferred to 24 hour. - Morning / afternoon / evening designations appear to be more effective than AM / PM.	Differentiate between am and pm by putting pm times in bold print.	- 24 hour clock is recommended, along with an explanation. - Journeys operating after midnight should be shown at the end of the timetable.	Display AM and PM time points in one table but distinguish the AM and PM periods.	Differentiate AM / PM information through clear labeling or separation into different tables.
Instruction	Provide example of timetables use in the display.			A "how to use the schedule" section is recommended. Not just text bus also a graphic that emphasizes the link between the timetable and route map.	
Front / Back Layout	Keep route map and schedule on same page.				
Other information		- Operator details and contact number.	- Operator details and contact number - Time period covered by schedule (start/end date). - Indicate whether disabled access is available.	- Include zonal / fare information. - Customer service information.	
Days of operation		- Provide a separate timetable for days that differ. - Avoid confusing notes/codes. - Use "Mondays to Fridays" / "Mondays to Saturdays" / "Daily" / "Mondays and Thursdays only". Do not use "weekdays" / "weekends". - Clear distinction in the presentation of different service days. - If no service on a particular day, this should be stated.	- Use "Mondays to Fridays" / "Mondays to Saturdays" / "Daily". Do not use the terms "weekdays" or "weekends". - If there is no Sunday service (or any other day), this should be clearly explained. - Ensure a clear distinction in the way in which the different days are presented.	Maintain weekday/weekend timetables on the same side of paper with the major destination point on opposite sides of the schedule.	Separate information for different days of travel into different tables.

2.6 Synthesis of Literature Recommendations

The aim of this section is to make recommendations for the design manual to be produced by this study, using the recommendations made by the different existing resources. The matrices clearly show there are some design issues where a high degree of consistency exists between the recommendations of different resource, while in other cases the recommendations of the different publications are contradictory. This is likely due at least in part to the fact that the publications come from different countries, with different social and cultural conventions. In such cases, it seems reasonable to favor the recommendations of the U.S. publications, due to the greater likelihood that these capture the accepted cultural conventions of the country, unless there is a compelling reason for not doing so.

2.6.1 General Publication Guidelines

These are the basic format guidelines that should be applied to all the different types of printed transit information material.

Typeface (Font)
Sans-serif fonts should be used for all labeling and short word series. Recommended sans-serif fonts include Helvetica, Gothic Book and Gill Sans.

Though the TCRP 45 (Higgins & Koppa, 1999) states that serif fonts should be used for longer blocks of text, modern conventions state that sans serif fonts may also be used. Recommended serif fonts include Times New Roman, Palatino, and Letter Gothic.

TABLE 2.16 – Typeface Recommendations

When to Use	Typeface Genre	Recommended Fonts
Labeling and short word series'	Sans serif	Helvetica, Univers, Gill Sans.
Longer blocks of text	Sans serif or Serif	Times New Roman, Palatino, Letter Gothic

Type Case
- UPPER CASE or Title Case for major headers
- Title Case minor headers
- Lower case for blocks of text

Type Size (Font Size)
There appears to be two different recommendation levels: one for recommended font size and one for minimum font size. Recommended font size lies in the 12 to 16 point range, while minimum font size lies in the 6 to 10 point range. Clearly, font size selection depends on space availability. Thus, if space is not an issue, font sizes of 10 to 16 point will be recommended in this guidebook. If space becomes an issue, then smaller font

sizes are permitted, but under no circumstances should be lower than 8 point. It should be noted that transit agencies are required by ADA to provide large font printed materials if they are requested by a transit user.

Contrast / Print color
In general, black lettering on a white background is recommended. Titles may employ white lettering on a black background to enhance visibility.

Paper type
Paper should be flat, matte, or eggshell. Glossy finishes should generally be avoided

2.6.2 System Map

Objective
The primary purpose of a system map is to allow users to locate their trip origin and trip destination, and decide which route, or combination of routes, to take to reach their destination.

Description
A system map is a printed map that shows the location of all the transit routes within a given area. The system map is designed to give the transit user an overview of the complete system and its relationship to the geography of the area, building on the cognitive map of the area that the passenger may already have.

System maps should be designed to aid in the travelers' formation of a cognitive map (survey knowledge), complementing any pre-existing knowledge that the traveler may have about the local area. It should include all major elements of the transit system, including routes, major transfer points, and enough topographical and landmark information for the traveler to orient themselves.

Format: Overlay or Schematic
There are two basic system map styles—***overlay*** and ***schematic***. An overlay map is basically a road map over which transit routes are superimposed. Overlay maps provide high levels of detail and are typically to scale, but customers often complain of difficulties in differentiating the transit service elements from other map features. Schematic maps are a simplified representation of the transit service area and the transit route alignments. Although they are typically not to scale, schematic maps are useful because they maximize readability and minimize "clutter."

TCRP Report 45 (Higgins & Koppa, 1999) quotes a number of studies that conclude that passengers tend to prefer schematic maps with minimal topographical or street information, which may not be to scale. However, that report was published prior to the emergence of a new format that combines the topographic accuracy of overlay maps with the clarity of the schematic style. This full-color "***GIS Overlay***" style makes use of Geographic Information System (GIS) technology to provide the greatest level of flexibility for application to different urban and inter-urban environments, and is particularly useful for systems covering large geographic areas.

Transit agencies serving small to medium-sized urban areas often use the "***Semi-Schematic***" style, which is particularly useful in urban areas with grid-like street networks. Smaller systems with unusual geography may benefit from using the "***Full Schematic***" style more normally associated with rail systems. Applying this style of map to bus services is a relatively new concept, but has proven to be popular with customers and is being increasingly adopted by transit agencies. However, effective execution of the Full Schematic style requires a high level of skill and experience.

Use of Color

It is strongly recommended that the Full (four) Color approach is used for all system maps, as it significantly enhances clarity and readability. Further recommendations on color use are provided below (see Section 2.5.2 for references):

- The system map should be presented on a light colored background.
- Color coding should be used to identify different routes on the system map. No more than nine colors should be used.
- A maximum of nine colors is recommended, though it is possible to use as many as 13 different colors. The nine colors recommended by MUTCD are: red, yellow, green, blue, orange, brown, purple, light blue and black.
- Adjacent routes should feature contrasting colors. The figure on the right provides an illustration of acceptable and unacceptable color combinations.
- Partial color coding, whereby the nine colors are used more than once, should be employed if there are more than nine routes. If this approach is employed, the following points should be followed:
  - Keep the number of routes per color approximately equal
  - Highly contrasting colors are used for adjacent routes
  - Patterned route lines may be employed to enhance differentiation

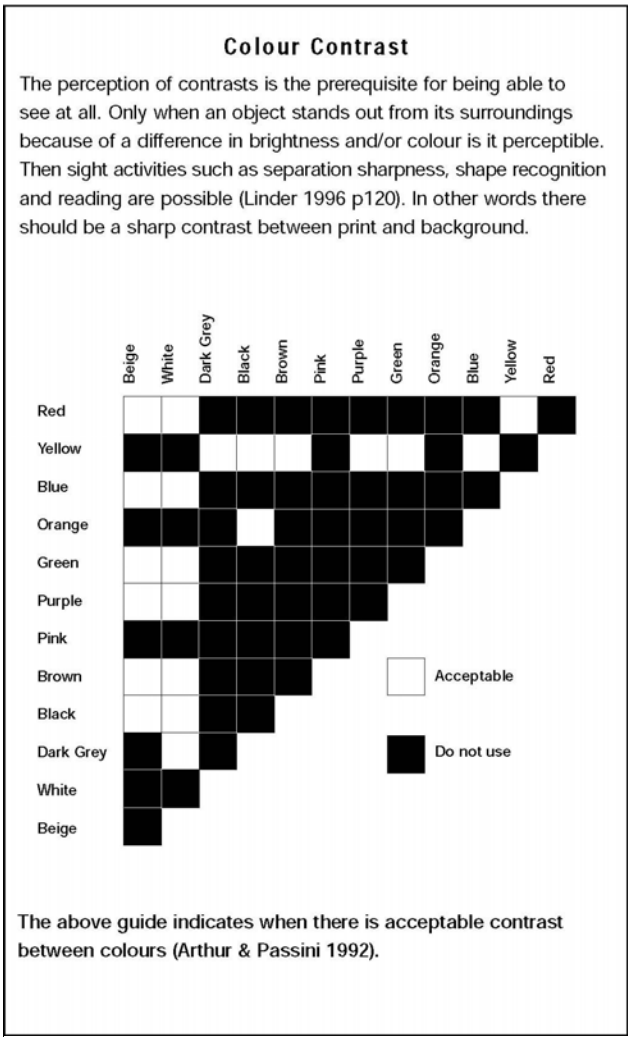

FIGURE 2.7 – Color Contrast Options
Source: Arthur, P. & Passini, R. (1992). *Wayfinding People, Signs, and Architecture.* McGraw Hill Book Company, New York,. Quoted in (Denmark, 2000).

- Indicate landmarks in their natural color, i.e. blue for bodies of water and green for parks.

Transit System Elements (see Section 2.5.2 for references)
- Identify each route by a unique color and label (number or letter)
- If schematic maps are used, route alignment should be smoothed to avoid abrupt changes in direction.
- Route variations should be indicated using a dotted or broken line.

Transfer Point Identification (see Section 2.5.2 for references)

The approach to transfer point identification depends on the level of system complexity:
- If the system has relatively few transfer points, they may all be shown on the system map.
- If the system has many transfer points, major transfer points should be identified by a symbol accompanied by a label box showing all route numbers that serve that center. Minor transfer points should be identified by a simple "dot" marking.
- Multimodal transfer points should clearly indicate the modes that are available using both a symbol and accompanying label.
- Where large numbers of routes converge (Transfer centers), route numbers should be provided in an adjacent box.
- Do not show time points or individual bus stops as they tend to make the map too cluttered. These should be featured on the route maps only.

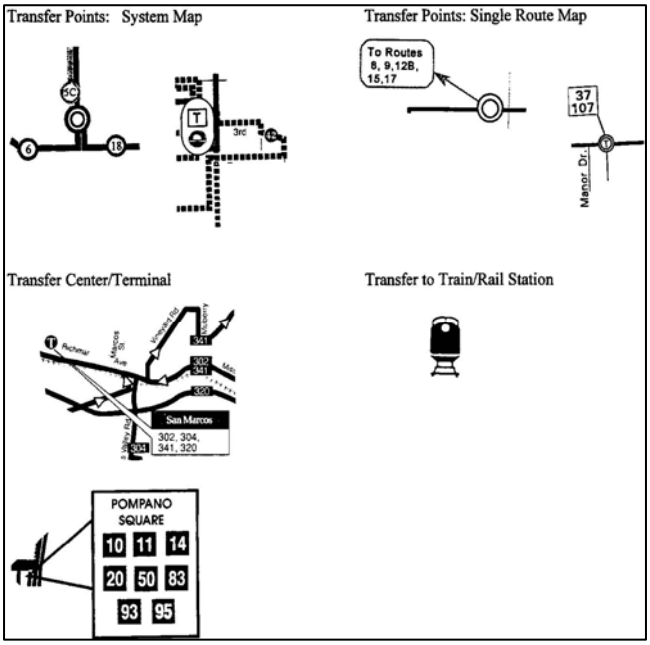

FIGURE 2.8 –
Examples of Transfer Point Identification
Source: Higgins & Koppa (1999).

Topographical Elements (see Section 2.5.2 for references):
- Provide street names for all major streets served by the routes, plus other major streets.
- Provide all major landmarks served by routes and other major landmarks in vicinity. Show intersecting streets for each landmark.
- Use standardized icons to represent different types of landmarks. Symbols should be accompanied by corresponding labels.
- A compass rose should be provided.

Legend

A legend should be provided. However, the map should be designed in such as way that it can be intuitively understood without having to refer to the legend. The legend should include:

- A description of the symbols and conventions used in the map
- A scale (if an overlay map is used). "Not to Scale" should be indicated if this is the case.

Insets

Insets should be provided for areas of high information density such as city centers and major transfer centers. They must be clearly linked and logically positioned in relation to the represented area.

Instructions

Provide brief "how to use" instructions if enough space is available, along with a helpline number to call for more information.

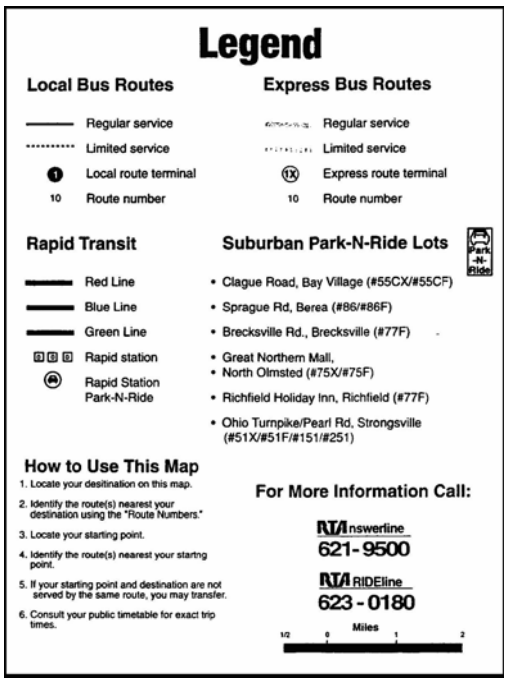

FIGURE 2.9 – Example Legend
Source: Higgins & Koppa (1999).

2.6.3 Route Map

Objective

The purpose of a route map is to provide the graphical information a traveler needs to be able to use an individual bus route effectively. This includes how it interfaces with adjoining routes, other transportation modes, and the surrounding topography.

Description

A route map is a printed map that illustrates the alignment of an individual fixed bus route, in addition to other important route information. The route map is commonly used in conjunction with a service schedule. The time points illustrated on the route map directly correspond to service timing information reflected on the schedule.

Colors and symbols used should be consistent with the system map. At this much larger scale, a higher level of detail is provided on both the route and the surrounding topography. The route map is also typically intended to be presented and used in conjunction with a schedule/timetable, thus, certain features such as time points will appear on both.

Route Map Title

The route title should be based on the area it serves, using either the area name or the route's start and end points. One or two major en-route destinations may also be added to the title if necessary. The route should also be identified by a unique number or letter. The title should be presented in bolded large font on a banner at the top of the page. If

possible, the banner background should be in the same color used to represent the route on the system map (see example below):

FIGURE 2.10 – Example Route Map Header

Format
TCRP Report 45 (Higgins & Koppa, 1999) quotes a number of studies that conclude that passengers tend to prefer schematic route maps. However, as discussed previously in Section 2.6.2., that report was published prior to the emergence of the "***GIS Overlay***" style, which combines the topographic accuracy of overlay maps with the clarity of the schematic style. In fact, both the schematic and GIS overlay styles may be successfully employed.

Since route maps are presented at a much larger scale, a higher level of detail on the route alignment and the surrounding topography can be provided, though the colors and symbols used should be consistent with those on the associated system map. Unlike the system map, it is not necessary to use full color on route maps. Three different color options are possible: ***Full (Four) Color, Two Color, and One Color***. Using full color makes it possible to use the GIS Overlay style, matching the color scheme used in the system map, but it is also more expensive. The other formats are more likely to be schematic in style, providing less surrounding area detail but maximizing information clarity. These other formats are also generally less expensive.

Transit System and Topographical Elements (see Section 2.5.3 for references):
A route map should include:
- Illustration of route, preferably in the same color used in the system map,
- Route number,
- Major landmarks in the vicinity of route, and corresponding intersecting street names,
- Major streets and intersecting streets in the route's vicinity,
- Major topographical features (rivers, lakes, parks, etc),
- Bus stops and transfer points (for both within system transfers and transfers to other modes). Provide the numbers of intersecting routes if possible.
- Time points identified by a number or letter, as well as the stop name.

Route Identification
If color is available, the route should be identified in the same color in which it appears on the system map. If color is not possible, the map may employ black and white as described below.

TABLE 2.17 – Route Identification With and Without Color

	Full (four) Color	Two Color	One Color
Map Style	GIS Overlay	GIS Overlay/Schematic	Schematic
Background color	Same as system map	White/light shade	White
Route color	Same as system map	Color used to define route alignment	Black (bolded)
Transfer points and other transit elements	Same as system map	Black/other dark color	Black
Street/road alignment	Same as system map	White/other light color	Black
Street names	Same as system map	Black/other dark color	Black/other dark color
Points of interest / landmarks	Same as system map	Black/other dark color	Black/other dark color

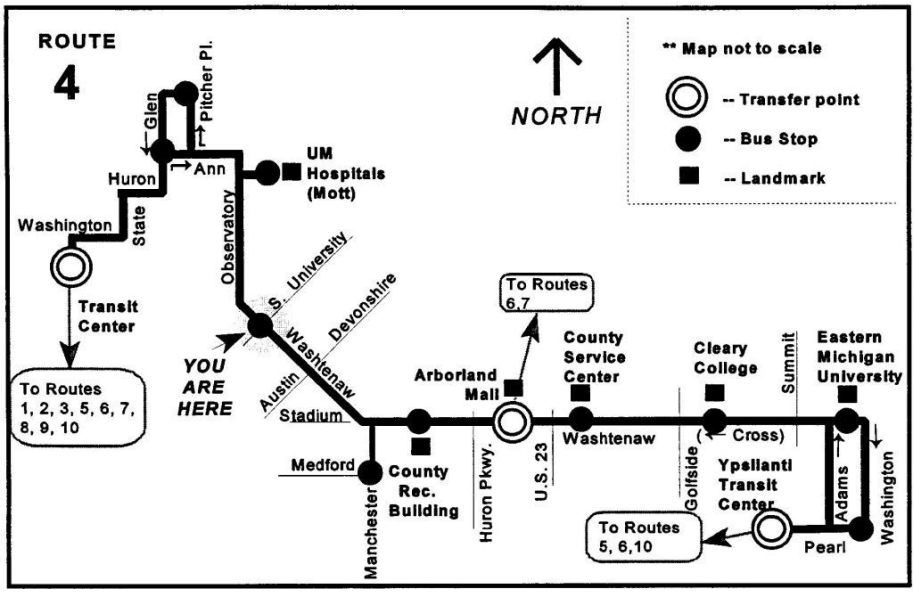

FIGURE 2.11 – Example of Black and White Route Map
Source: Higgins & Koppa (1999).

Time Points

Timing points should be spaced at 5 to 10 minute intervals and should include all major destinations and transfer points. Time points should be labeled using a number or letter that corresponds with that used in the schedule, in addition to a time point name. The time point may be named after a major destination at the stop (i.e. Springfield Mall / Eugene Station) or by the intersection at which the stop is located.

Transfer Points
Provide indication of all transfer points. If there are a large number (>5), limit the indication to a simple dot. If the number of transfer points is smaller (<5), a more substantial symbol may be used; however, ensure that this symbol is distinct from the time point labels.

Other Information
The route map should also include:
- Summarized fare information,
- Legend,
- Compass,
- Provide brief "how to use" instructions, along with a helpline number to call.

2.6.4 Schedules

Objective
Provide sufficient service timing information allowing users to understand when the bus will be at specific points along its route.

Description
Schedules are traditionally provided in a tabular format, showing the times when the service is scheduled to be at each time point along its route. Other, more simplified, formats are also available such as "headway based" and "clock-face".

Providing service timing information in the traditional tabular schedule format presents significant difficulties to a large proportion of bus users. Such difficulties mean that schedules are often dismissed in favor of other methods of obtaining service information. Indeed, simple trips on services with frequencies of 10 minutes or less typically do not require schedule consultation. However, tabular schedules are the only way in which the full complexity of the service can be conveyed to the user. There are certainly users (such as those whose trips require a transfer) who would suffer if this information type was made unavailable. Thus, tabular schedules are necessary and cannot be replaced by a simplified format. However, this it not to say that nothing can be done to address the problems identified in the review. Based on evidence yielded by prior research, this study recommends a three-pronged approach to raising user comprehension of bus timing information without forcing a choice between completeness and comprehension.

(i) Optimize Tabular Schedule Design
A large body of research exists on the optimal design of tabular schedules. However, awareness of such best practices is variable among those actually involved in schedule design. The design manual accompanying this study aims to synthesize these best practices and provide high quality examples. A more detailed discussion is provided in Section 2.6.5.

(ii) *Provide clear, easy-to-follow instructions on tabular schedule use*

High quality instructions should always be provided even if limited by space restrictions. This should feature a graphic example of the schedule with clear step-by-step instructions on how it should be used. One good example from Minneapolis is shown on the right. The design manual will provide other best practice examples.

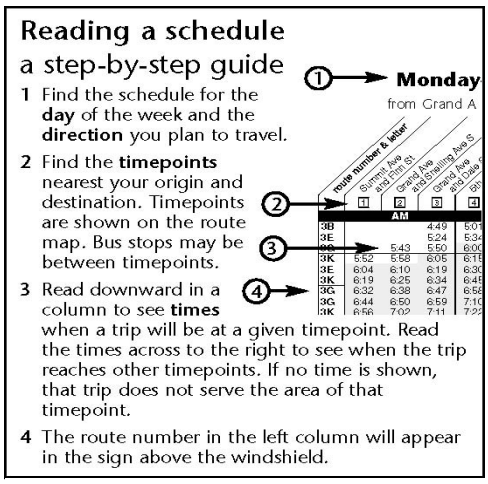

FIGURE 2.12 – Schedule Instruction Example
Source: Metro Transit, MN.
http://www.metrotransit.org/

(iii) *Provide a simplified, headway-based summary of the service timing information.*

Many riders find it difficult or impossible to utilize bus schedules while others simply do not need to know exactly when their bus leaves their origin and/or arrives at their destination. To cater to these people, it should be possible to fully utilize the route map without having to refer to the schedule. This is possible if a headway-based summary of service span and frequency is provided on the route map. Examples are provided below:

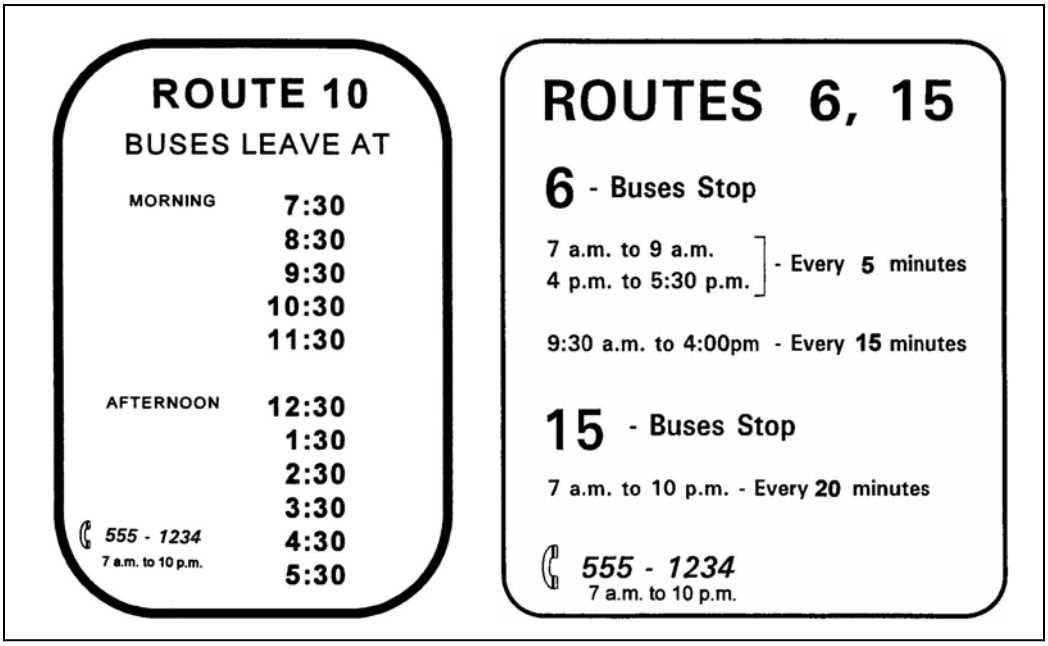

FIGURE 2.13 – Examples of Headway Based Timing Information
Source: Higgins & Koppa (1999).

Route 12 service runs between Richmond and Putney via Kingston.	
Monday to Friday:	Service every 15 to 20 minutes from 7:00am to 9:00pm
Saturday:	Service every 15 to 30 minutes from 10:00am to 6:00pm
Sunday:	No service

Insert Route 12
Tabular Schedule here

FIGURE 2.14 – Two-Tier Approach to Provision of Bus Timing Information

It is recommended that some form of basic service timing information is provided even if only simplified approximations of actual service characteristics can be offered. However, it is acknowledged that this may be difficult for some routes where frequencies and/or departure times vary considerably by time of day or by day of the week

2.6.5 Optimizing the Design of Tabular Schedules

(See Section 2.5.4 for references)

Title
Conventions are the same as for the Route Map (Route Maps and Schedules typically appear together). At a minimum, the route should be identified by a Route Number and the area served by the route (for example, the route's start and end points). One or two major en-route destinations may also be added if necessary. The title should be presented in bolded large font on a banner at the top of the page. The banner background should be in the same color used to represent the route on the system map.

Front / Back Layout
- Route map and schedule should be presented on the same page whenever possible
- All service information pertaining to a particular direction of travel should be presented on the same page. If multiple tables are required to provide service information for different days, these should all be displayed on the same page. Service information pertaining to the other direction of service can be displayed on the opposite side of the page if necessary, but it should still be accompanied by its own route map.

Time Presentation Format
Provide two detail levels for each route:
(i) Tabular schedule, providing exact, complete service timing information,
(ii) Headway-based summary of route timing frequency and service span.

If headways are very small (10mins or less) tabular schedules may not be required.

Language / Terminology
The following table summarizes recommended and not recommended terminology.

TABLE 2.17 – Schedule Terminology – Do's and Don't

	Recommended	Not Recommended
Service direction	- "from-to" format.	- cardinal directions (N,S,E,W) - inbound - outbound
Timing format	- 12 hour clock	- 24 hour clock
Daily service differentiation	Quote actual days: - Monday to Friday, - Saturdays, Sundays	- Weekdays - Weekends - Daily

Time Point Alignment
Studies have shown that the horizontal format performs better (Sprent *et al*., 1980) as it is more natural for the human eye to scan in a "horizontal progression from left to right. Also, the horizontal format is more commonly used by transit agencies across the U.S (see next chapter for more information). Thus, the horizontal alignment is recommended, and it would be advantageous for the transit industry and its users if this was adopted as an industry standard.

Time Point Labeling and Orientation
Timing points should be spaced at 5 to 10 minute intervals and should include all major destinations and transfer points (same as Route Map). Time points should be labeled using a number or letter that corresponds with that used in the schedule. In addition, the time point header should also provide the time point name (i.e. Springfield Mall / Eugene Station) and the closest intersecting streets. If the time point does not have a specific name, just provide the intersecting streets.

Column / Row Delineation
- Consider shading alternate rows to ease horizontal scanning
- Vertical columns should be clearly separated by "white space", but do not require delineation unless there are a large number of time points (approximately 15 or more).

AM / PM Differentiation
Use a 12 hour clock and apply some form of AM/PM differentiation. Options include AM/PM labeling and/or bolding PM times.

Daily Service Variation

- Service direction should take priority over service differentiation by day.
- Do not attempt to combine information on different daily services into the same table. If service differs on different days, service timing should be separated into different schedule tables for these different days.
- Use “Monday to Friday” / “Saturday” / “Sunday” to refer to the different services. Do not use the terms “weekend” / “weekday” / “daily”.
- If no service on a particular day (typically Sunday), this should be clearly stated.

Instruction

Concise instructions should be provided in close proximity to each schedule, featuring a pictorial example of schedule use accompanied by step-by-step instructions.

Other Information

- Operator details
- Helpline contact number
- Fare information
- Dates for which the schedule is effective.

3. Transit Agency Survey

3.1 Introduction

The second major task of this study was to conduct a survey of transit agencies across the country. The survey instrument (provided in Appendix I) was designed to obtain information on the issues involved in the design and publication of printed transit information materials and also to obtain example materials from each agency. Sample materials would then be classified to assess the prevalence of different design formats. This section presents the survey analysis while Section 4 presents the material classification analysis.

3.2 Survey Methodology

The sampling frame used for the survey was the American Public Transportation Association (APTA) membership directory which provides the contact details of all member agencies. This is not a complete listing of all North American transit agencies but is still a relatively comprehensive resource. The membership directory was used to identify the agency employees most likely to have first-hand knowledge of the agency's printed information material design and distribution. Thus, the marketing manager or director was typically selected. However, it was acknowledged that full completion of the questionnaire might require the input of several different staff members.

The questionnaire was sent out by mail to the identified person in each of the 371 transit agencies in October 2006. This person was also emailed to notify them that the questionnaire was being sent and to inform them they could also complete the survey online if preferred. Thus, response options included returning the completed questionnaire in the enclosed postage-paid envelope (along with examples of their agency's printed materials) or by completing the questionnaire online.

A total of 121 valid responses were received, 56 via mail and 65 via the web (some agencies could not respond as they did not have any fixed route bus services). This equated to a response rate of 32.6 percent. This compares favorably with other surveys recently completed using the same sampling frame and methodology.

3.3 Utilization of Different Transit Information Aids

The first section of the questionnaire asked respondents to select which information aids their agency provided from an extensive list including printed information, signage, verbal information, and electronic information. Figure 3.1 provides a summary of their responses.

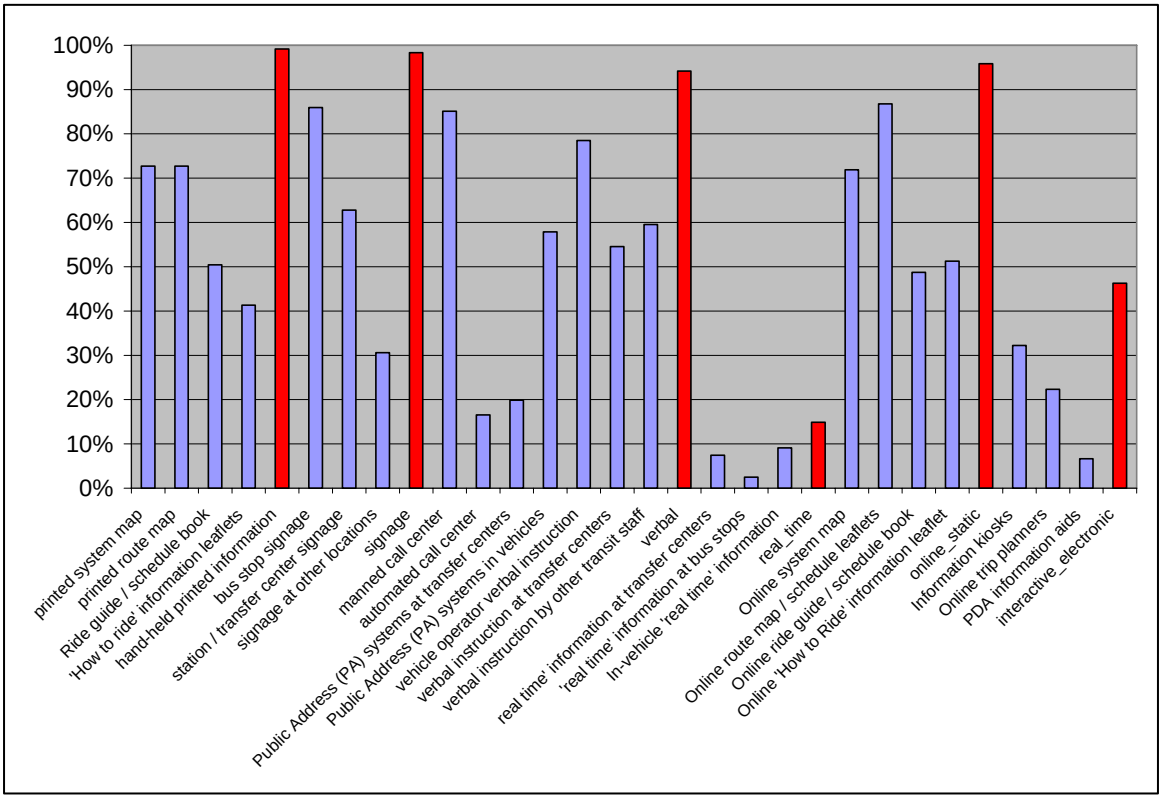

FIGURE 3.1 – Information Aids Provided

The figure shows in blue the percentage selecting each of the individual information aid options, and also shows in red the aggregate percentages for each of six different information aid sub-groups.

Looking at the aggregate percentages (shown in red) it can be seen that almost all responding agencies provide some form of printed materials (99 percent), some form of signage (98 percent), some form of verbal instruction (94 percent), and some form of static online information (96 percent). In contrast, less than half (46 percent) provide interactive electronic information and only 15 percent provide real-time information. Thus, is can be concluded that a typical transit user can expect to at least be provided with printed information, signage, verbal information, and static online information. Overall, the most common individual information aids were online route map / schedule leaflets (87 percent), manned call centers (85 percent), and bus stop signage (86 percent).

Looking in more detail at the printed information, it can be seen that the most common types are a printed system map and printed route maps, both reported by 73 percent of responding agencies. Half the surveyed agencies provided a ride guide (schedule book) and 41 percent provided separate instruction leaflets.

3.4 Cost of Information Provision

Respondents were then asked to estimate the amount of money spent in a typical year on each of the information aids they provide. Some respondents noted that it was often extremely challenging to provide such figures into such a disaggregated format – the following reasons were mentioned:

- Difficult to estimate the annual cost of longer term capital investments such as signage and electronic equipment.
- Difficult to put a monetary value on the amount of time spent by operators and other transit staff providing verbal instruction.
- Printing and distribution costs vary greatly from year-to-year depending on the number of service changes.

These reasons should be noted when reviewing the summary cost information provided in Table 3.1 below:

TABLE 3.1 – Cost of Different Information Aids

	N	% of Sample	Minimum ($)	Maximum ($)	Mean ($)
printed system map	51	42.1%	$200	$145,000	$15,300
printed route map	51	42.1%	$500	$290,000	$35,225
Ride guide / schedule book	38	31.4%	$500	$430,000	$54,904
'How to ride' information leaflets	26	21.5%	$50	$25,000	$3,902
bus stop signage	34	28.1%	$100	$150,000	$17,553
station / transfer center signage	33	27.3%	$25	$43,000	$6,495
signage at other locations	15	12.4%	$25	$5,000	$1,910
manned call center	28	23.1%	$12,000	$2,800,000	$297,385
automated call center	3	2.5%	$1,200	$25,000	$13,400
Public Address (PA) systems at transfer centers	3	2.5%	$1,000	$200,000	$77,000
Public Address (PA) systems in vehicles	5	4.1%	$300	$10,000	$6,780
vehicle operator verbal instruction	2	1.7%	$5,000	$20,800	$12,900
verbal instruction at transfer centers	8	6.6%	$5,000	$400,000	$116,375
verbal instruction by other transit staff	5	4.1%	$2,000	$27,500	$12,700
real time' information at transfer centers	2	1.7%	$7,000	$15,000	$11,000
'real time' information at bus stops	1	0.8%	$7,000	$7,000	$7,000
In-vehicle 'real time' information	2	1.7%	$3,500	$6,000	$4,750
Online system map	12	9.9%	$200	$15,000	$3,926
Online route map / schedule leaflets	16	13.2%	$30	$14,000	$2,389
Online ride guide / schedule book	5	4.1%	$600	$12,000	$3,570
Online 'How to Ride' information leaflet	4	3.3%	$150	$12,000	$3,975
Information kiosks	10	8.3%	$250	$6,000	$2,190
Online trip planners	4	3.3%	$5,000	$12,100	$8,150
PDA information aids	2	1.7%	$2,000	$5,000	$3,500

Table 3.1 shows the costs of the different aids vary significantly, with the most inexpensive forms of information generally being electronic information, including real-time information, static online information and other forms of electronic information,

with annual costs between $30 and $15,000. However, it should be noted that these ranges and means are not robust as they are often based on only a very small number of responses (less than five percent of the sample). Survey responses suggest that printed materials, signage, and verbal information are typically more expensive. Reported annual costs of verbal information were particularly variable, ranging from less than $1,000 for public address systems in vehicles to almost $3M per year for a manned call center.

Focusing on printed materials, it was found that annual costs ranged from under $1,000 to $430,000. Again, this is likely to be related to the size of the agency's ridership and thus the amount of materials printed. Ride-guides were found to be the most expensive printed material on average, with a mean cost of $55,000 per year. This may explain why agencies sometimes charge customers for this.

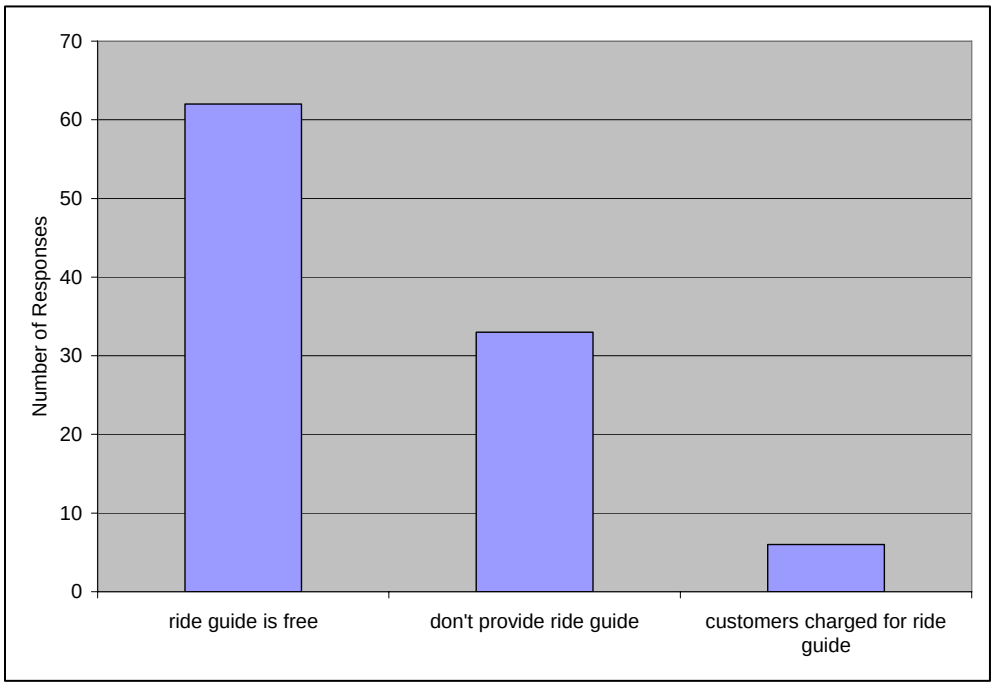

FIGURE 3.2 – Charging for Ride Guide / Schedule Book

The majority of agencies, a total of 62, who published a ride guide, provided it free to their customers. Only six agencies charged their customers for their ride guide, with charges ranging from $0.25 to $1.00.

3.5 Design Standards

Agencies were asked whether their agency had established a design standard for any of a prescribed range of printed material design elements. The following series of figures provide a summary of the responses in relation to each design standard. If no standards were established, respondents were asked to enter "none" in the response box.

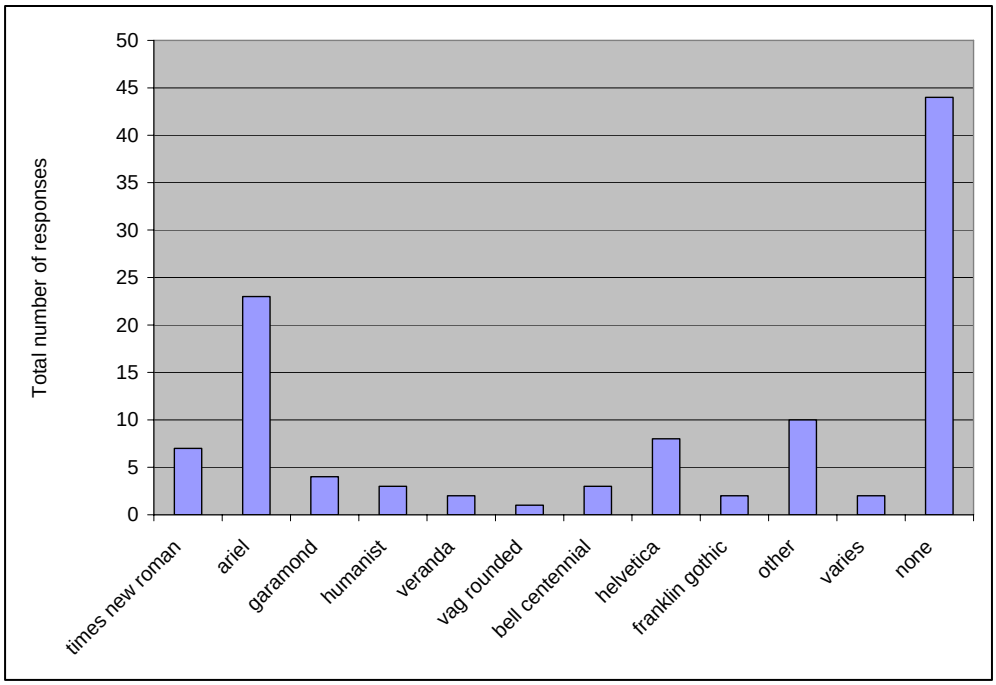

FIGURE 3.3 – Agency Standards – Type Face (Font Type)

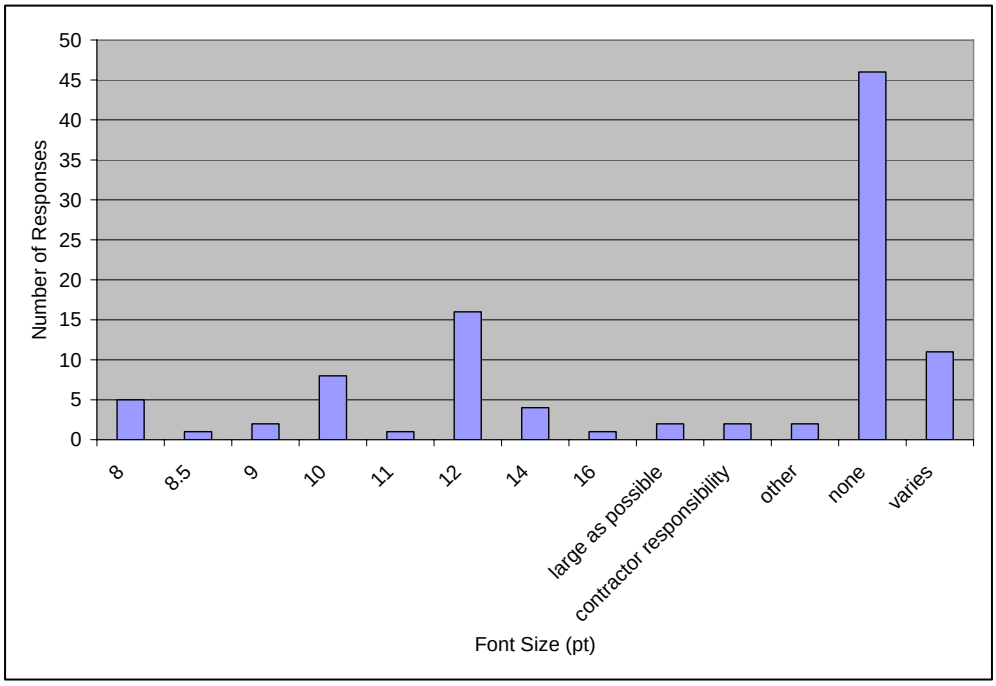

FIGURE 3.4 - Agency Standards – Font Size

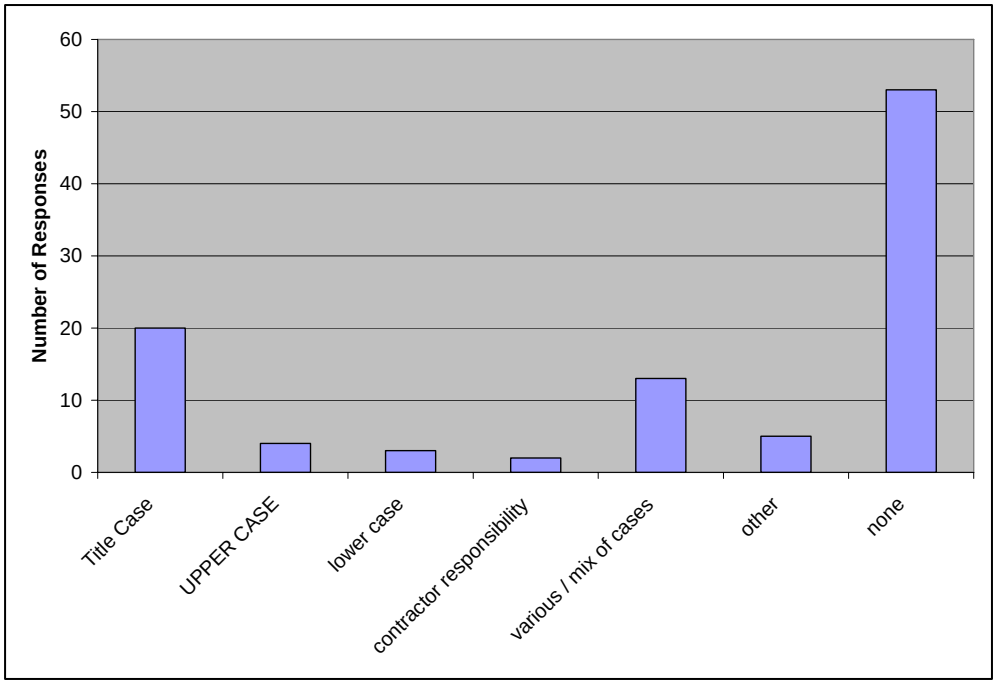

FIGURE 3.5 – Agency Standards – Type Case

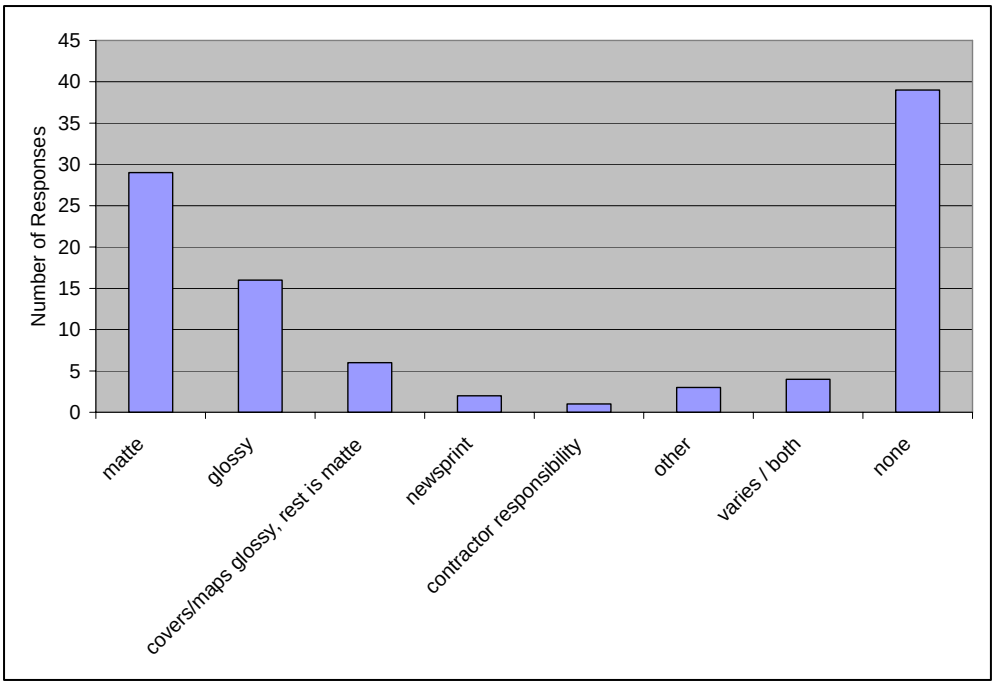

FIGURE 3.6 – Agency Standards – Paper Type

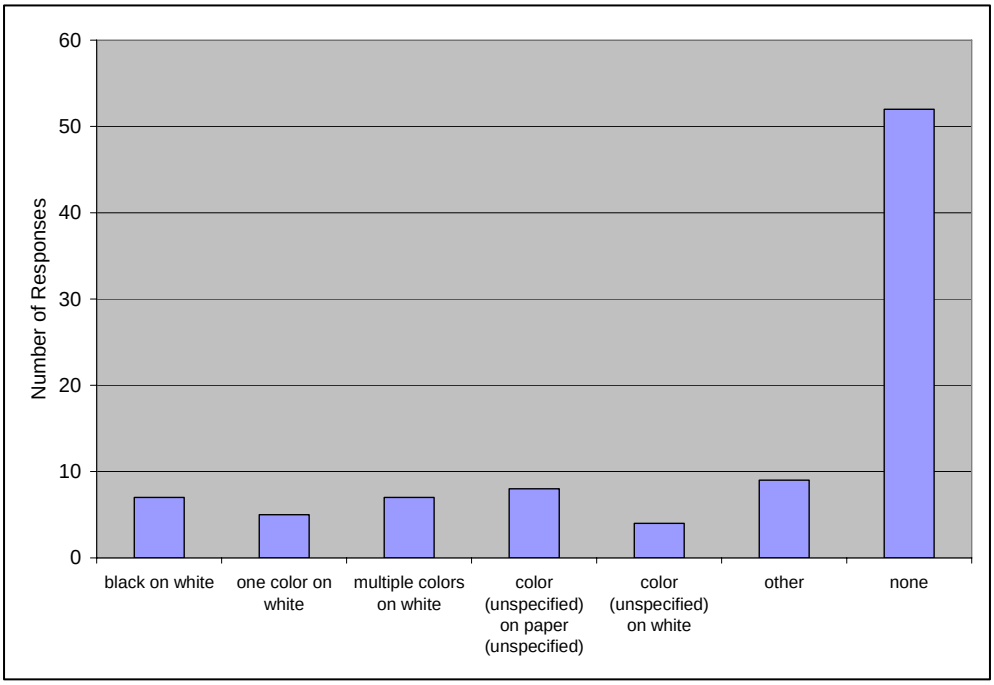

FIGURE 3.7 – Agency Standards – Contrast

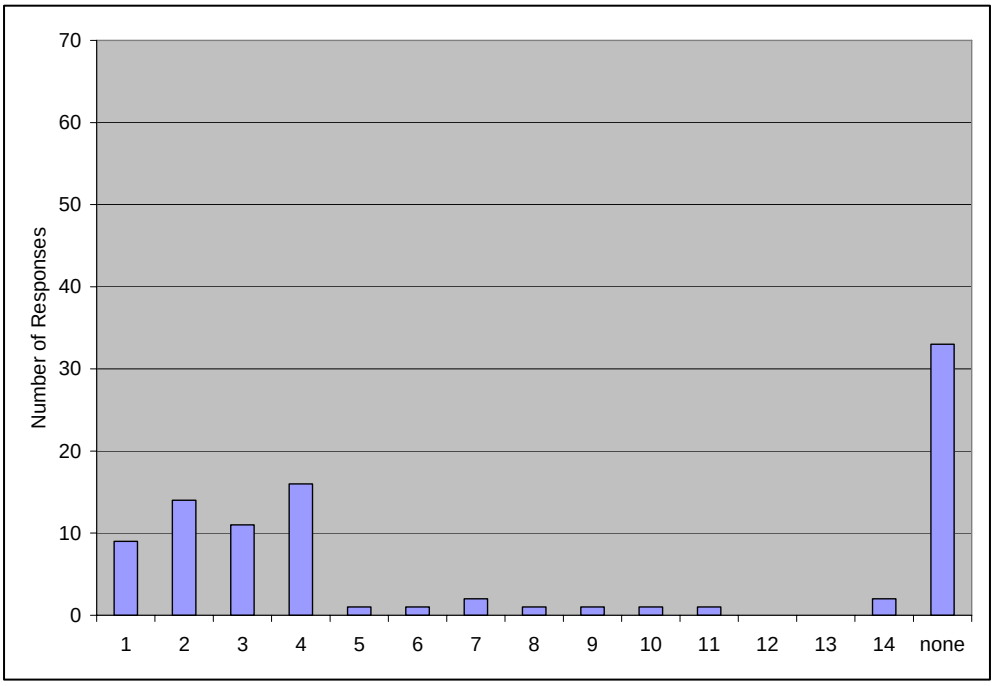

FIGURE 3.8 – Agency Standards – Number of Colors Used

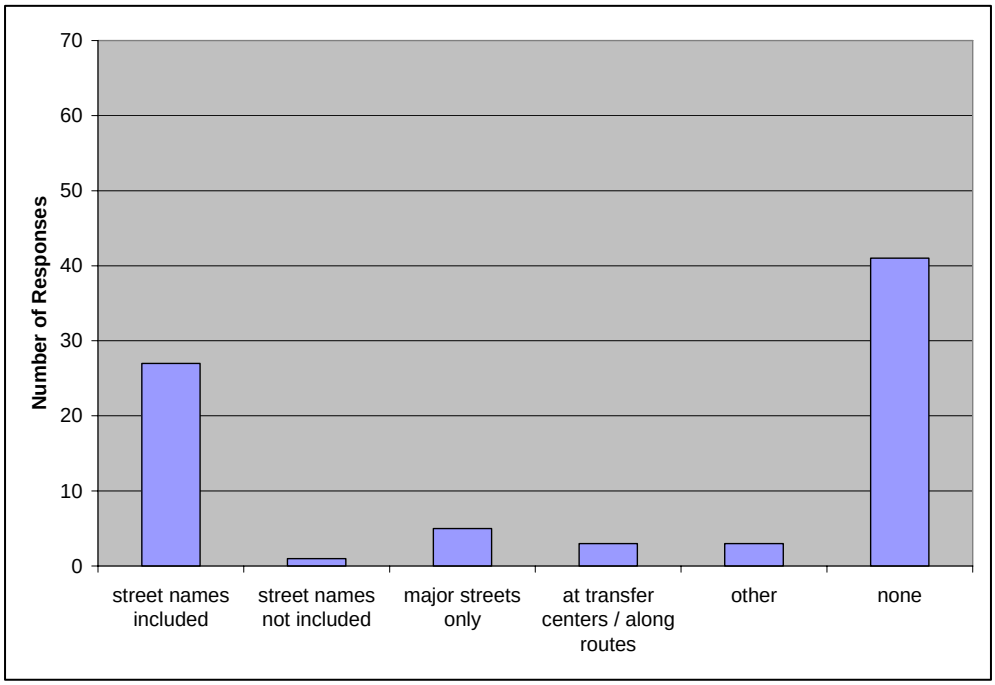

FIGURE 3.9 – Agency Standards – Street Names

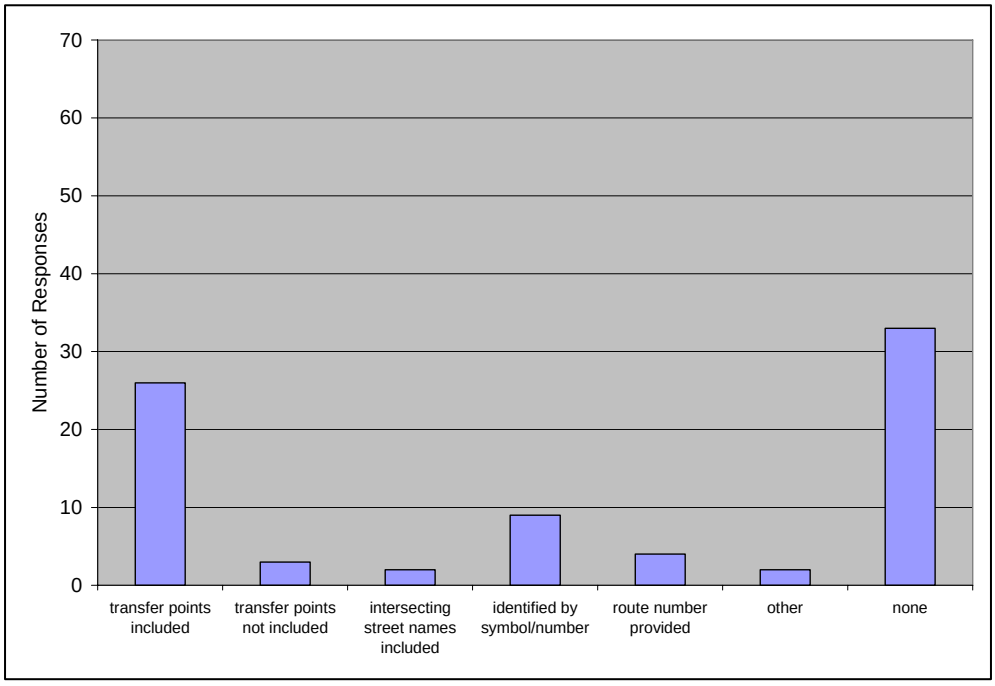

FIGURE 3.10 – Agency Standards – Transfer Points

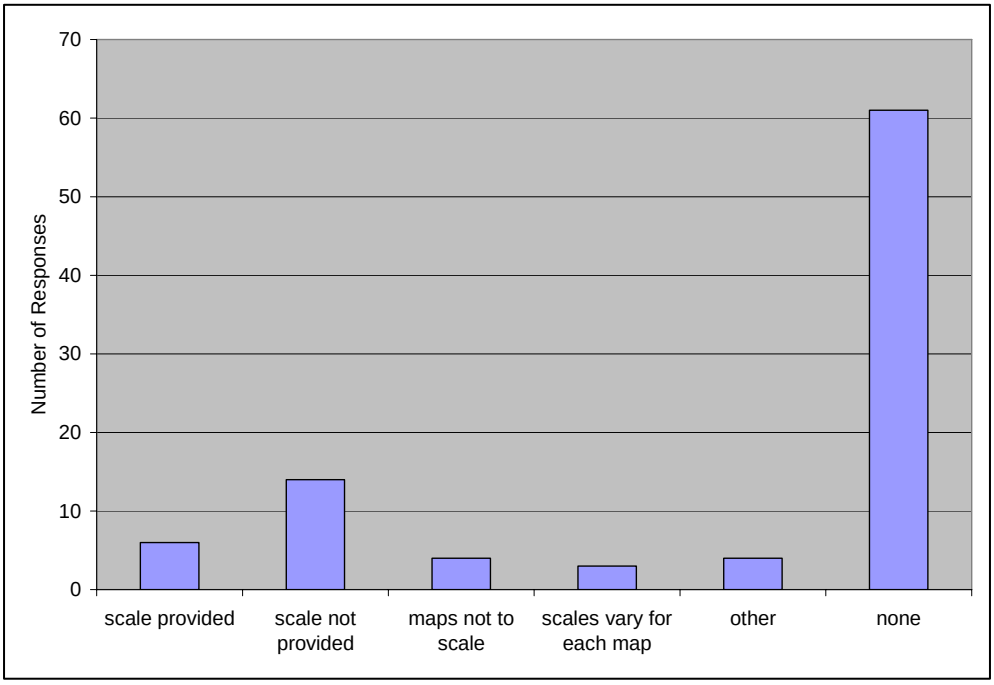

FIGURE 3.11 – Agency Standards – Scale Provision on Maps

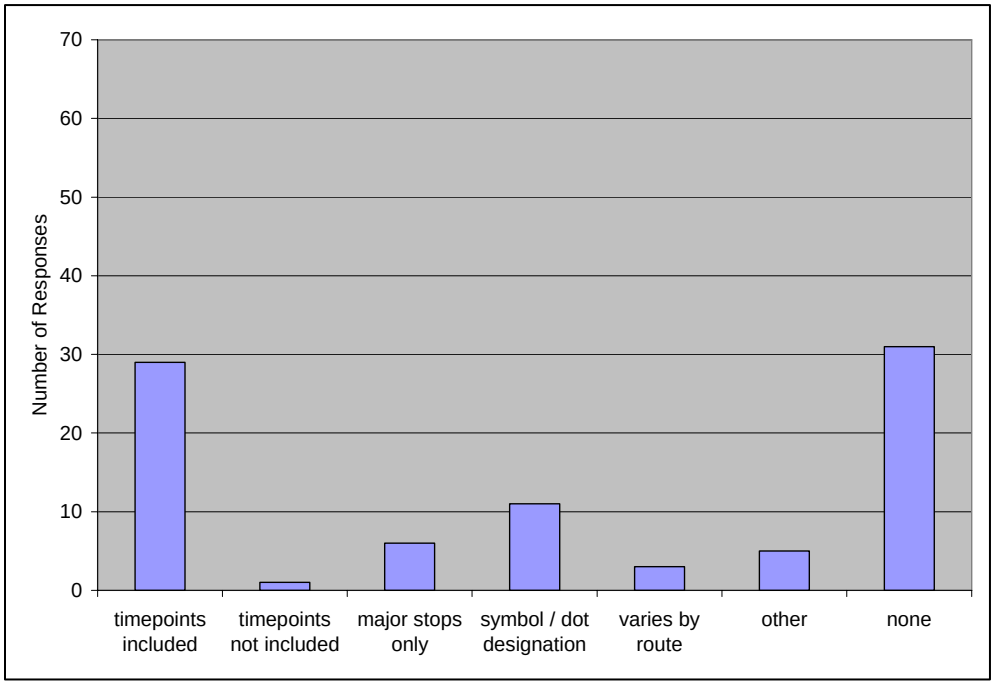

FIGURE 3.12 – Agency Standards -Time points

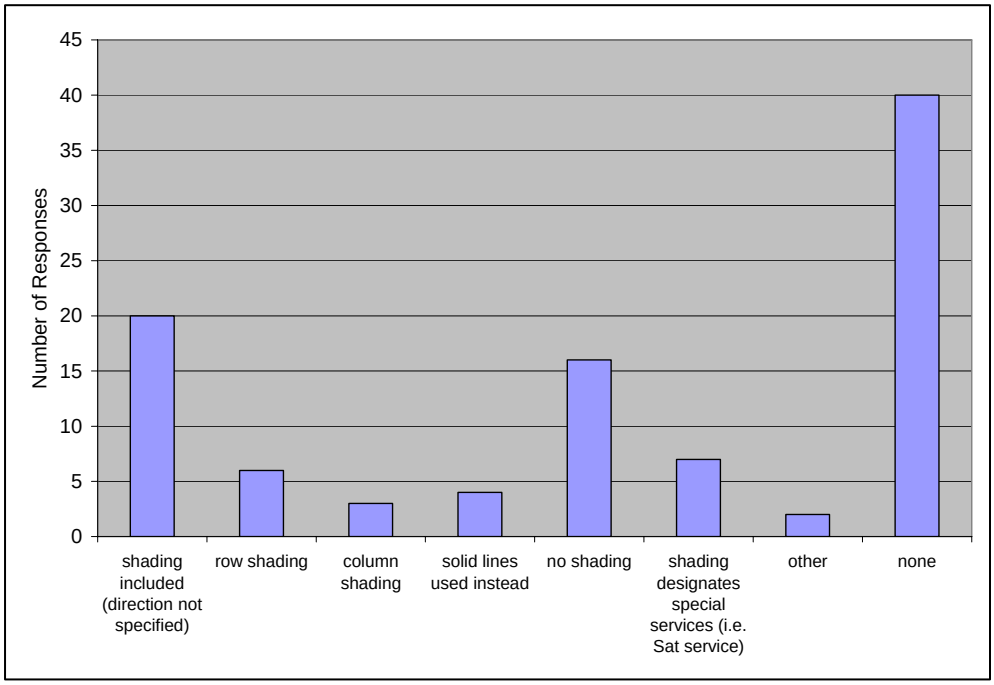

FIGURE 3.13 – Agency Standards –Column Row Delineation

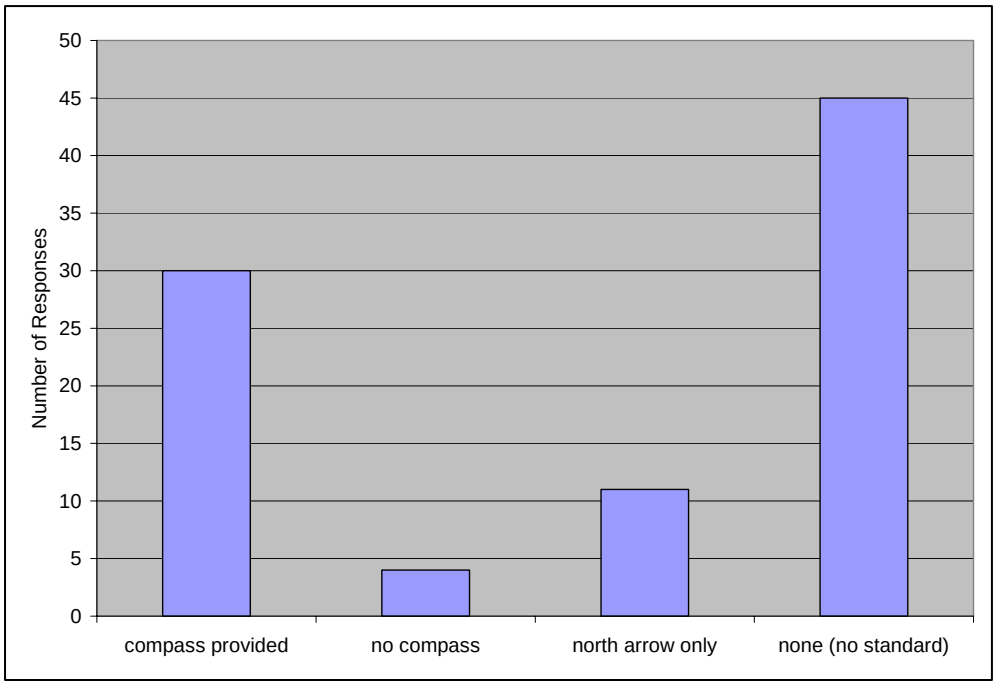

FIGURE 3.14 – Agency Standards – Compass Provision on Maps

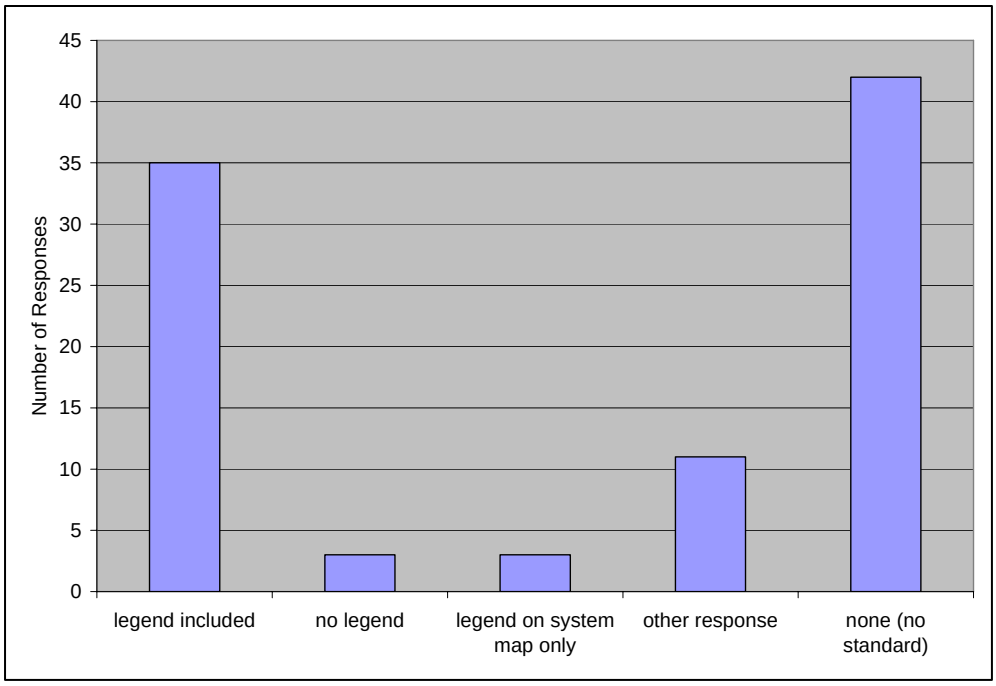

FIGURE 3.15 – Agency Standards – Legend Provision on Maps

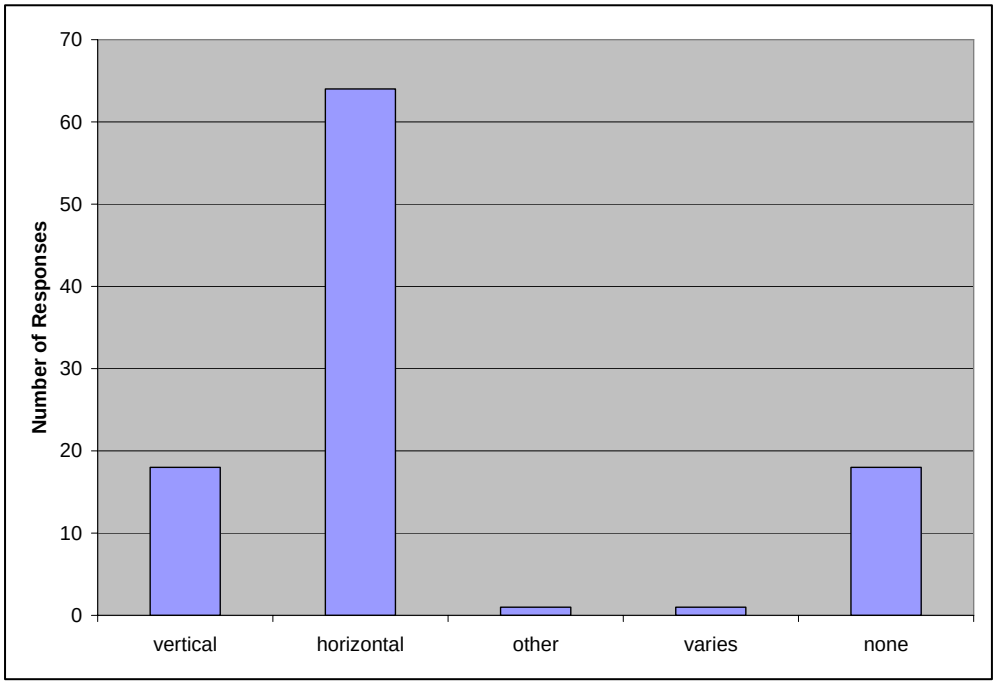

FIGURE 3.16 - Agency Standards – Schedule Alignment

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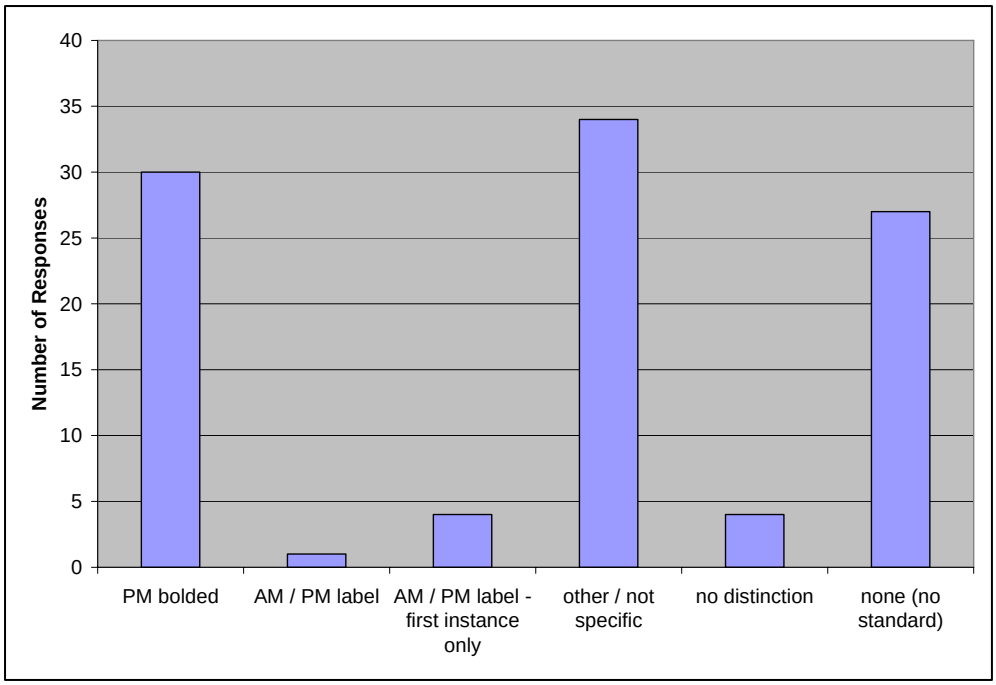

FIGURE 3.17 - Agency Standards – AM / PM Distinction

Typeface (Font)
Almost half of the 97 responding agencies (44) indicated that they did not have a standard for typeface (see "none"). For the 53 agencies that did specify a standard, the most popular font was Ariel, with 23 agencies using this font and standard. However, a wide range of other fonts were also reported, and shown below. There are both serif and sans-serif fonts within the specified typefaces. Ariel, Verdana, Franklin Gothic and Helvetica are all sans serif, while Times New Roman and Garamond are serif.

Font Size
The figure shows that almost half the agencies (46 out of 101) did not have a standard for font size. For those that did specify a standard, these ranged from 8pt to 16pt. However, it should be noted that some respondents indicated that the font size specified was the minimum permitted, while others specified this as their standard. Others still specified a range of font sizes that were permitted. The mean standard font size was calculated to be 11pt for the 38 agencies who provided quantitative responses.

Type Case
The figure shows that over half of the responding agencies (53 out of 100 responses) do not have a standard for Type Case. Of those with a standard, Title Case was the most popular, accounting for 20 agencies, while 13 agencies reported that a variety of cases were used.

Paper Type
The majority of agencies either used matte or glossy paper, with matte being the most popular (29 responses versus 16 responses). Several agencies noted they used glossy for covers and/or maps and matte for everything else. Again, around half the agencies reported they did not have a standard for paper type.

Contrast
The vast majority of agencies (52 in total) reported they did not have a standard for contrast. Reported standards varied from (a.) black on white, (b.) color on white, (c.) one color or (d.) multiple colors.

Color Scheme
Nineteen agencies did not respond to the question on color scheme design standards while 29 reported they did not have a standard for color scheme. Valid responses were highly variable; most agencies reported that a variety of colors were used, often based on the color used for the transit agency logo.

Number of Colors
Thirty-two agencies reported they did not have a standard for number of colors used. Of the agencies that did, most reported the use of one to four colors. A small number of agencies reported the use of 5 to 14 colors. Thus, the mean number of colors used was 3.75. However, it should be noted that some agencies reported different standards in relation to different materials. System maps typically featured multiple colors while route maps were often restricted to one or two colors.

Landmarks
Forty-two agencies reported they did not have a standard for landmarks. Many simply responded they did have a standard but did not specify what it was – this likely meant they were simply indicating they did provide landmarks in their maps. Others provided more detail indicating that all major landmarks were included or actually listing the landmarks typically provided including hospitals, schools, libraries, parks and shopping centers. Others mentioned the provision of transit service infrastructure including bus stops, stations and time points.

Street Names
Although a large number of agencies (41 in total) reported they did not employ an official standard for the use of street names on their maps, a total of 35 reported they did provide street names. Twenty-seven of these did not provide any further details while a small number indicated they either indicated major street names only, or they provided street names at transfer points and/or along bus routes only. Only one agency reported they did not provide street names.

Transfer Points
A total of 41 agencies reported that transfer points were included on their maps. Of these, 26 did not provide any further details. Others stated that they provided street names at transfer points; they used a specific symbol to identify the transfer point, or indicated the numbers of the buses available to transfer to. Only three agencies reported they did not include transfer points.

Scale
The vast majority of agencies indicated they did not have a standard for the provision of scales on their maps. One reason for this is that schematic maps, commonly used in

transit information materials, are not to scale. Another reason is that the scale used depends on the size of the area being mapped. Thus, only a small number of agencies reported that scales were provided. Reported scales used included “one inch = one mile”, “3/8 inch = one mile”, and “1.25 inches = one mile”.

Schedule Alignment
Most of the agencies specified a standard for schedule alignment. The horizontal alignment was the most frequently used. Still, a significant number of agencies (18) reported they used the vertical format and 18 agencies reported they did not have a standard.

AM / PM Distinction
The majority of agencies indicated they did provide some sort of AM / PM distinction in their schedule. However, 34 were not specific about what kind of distinction employed. Thirty agencies stated they bolded all PM times and five agencies used “AM / PM” labels in most cases on the first instance only. Only four agencies stated they did not employ any kind of distinction.

3.6 Awareness and Use of Published Guidelines

Agencies were asked if they were aware of published guidelines on the design of printed transit information materials.

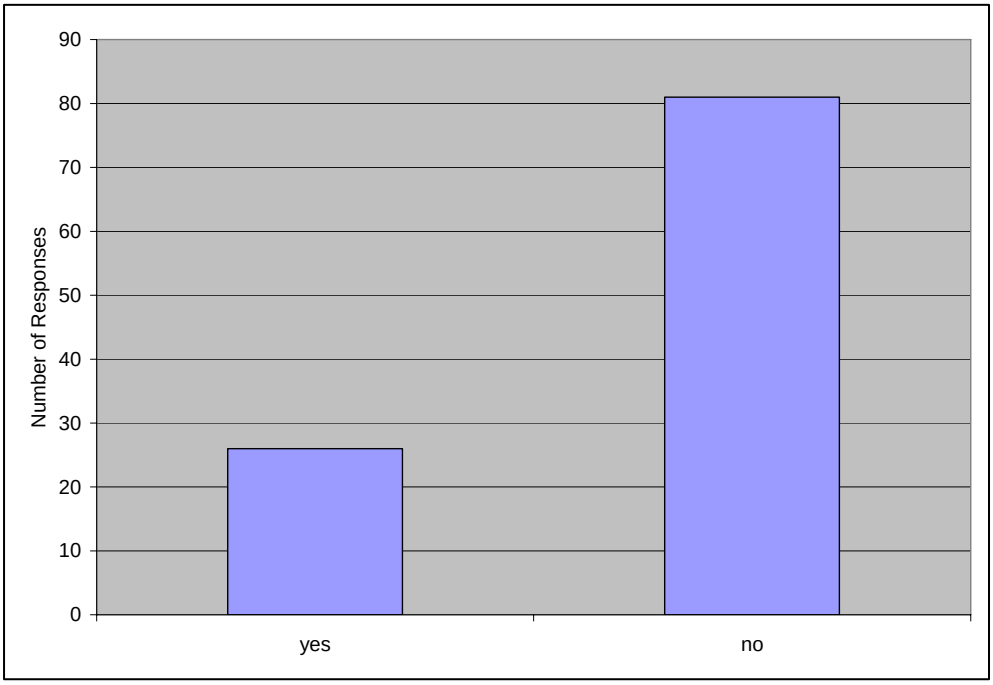

FIGURE 3.18 – Are You Aware of any Published Guidelines on the Design of Printed Information Materials?

Only 26 agencies stated they had any awareness of published guidelines on printed material design. Of these 26 agencies, only 15 stated they used published guidelines when designing their materials. When asked what published guidelines they used, five

mentioned ADA regulations and three mentioned TCRP reports (likely to be a reference to TCRP Report 45). The remainder cited the use of in-house guidelines, guidelines developed by local marketing companies, and the use of material samples from other agencies. Milwaukee County Transit provided an example of the design manual they had developed in-house. Overall, it appears that awareness of design guidelines within the transit industry is low and guideline use is even less common.

3.7 Printing Formats

Agencies were asked which print formats they used. Three options were provided: one color, four color, and black and white. Multiple responses were permitted, thus a range of different combinations were possible.

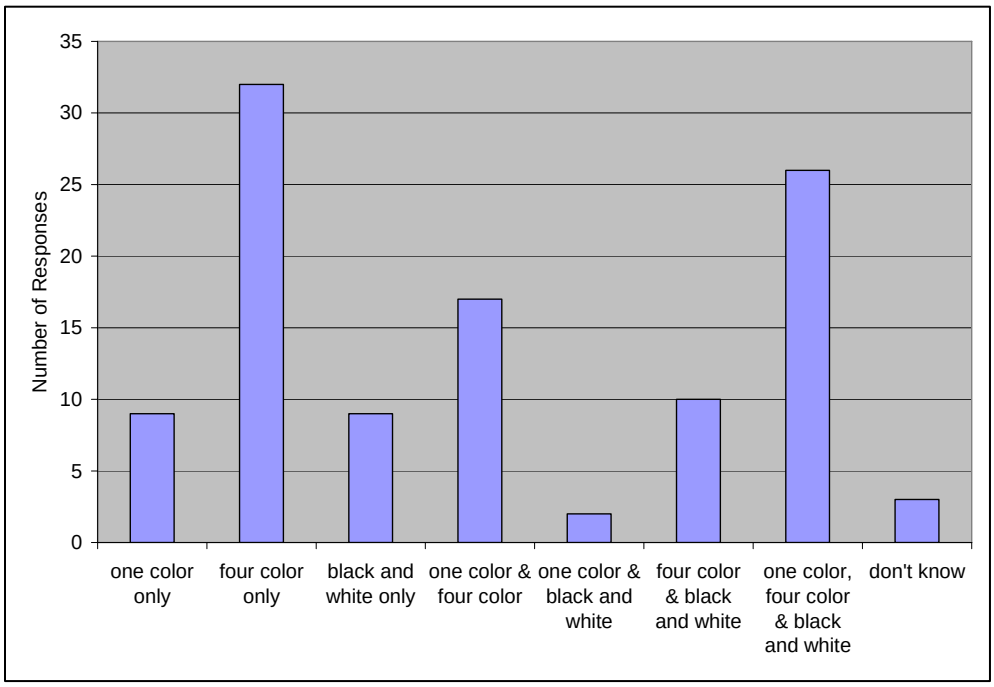

FIGURE 3.19 – Print Formats

Figure 3.18 shows the most popular option was “four colors only”, with 32 responses. The four color format was also used by a number of agencies who used other formats as well. Thus, the four color format was used by 85 agencies in total. Twenty-six agencies used a combination of all three formats.

A further question asked agencies to state whether they provided a schedule for every route or just those running above a certain frequency. Almost all responding agencies (97 percent) stated they provided schedules for all services.

3.8 Language Issues

Agencies were asked for the approximate proportion of their ridership that did not speak English – responses are provided on Figure 3.20 below.

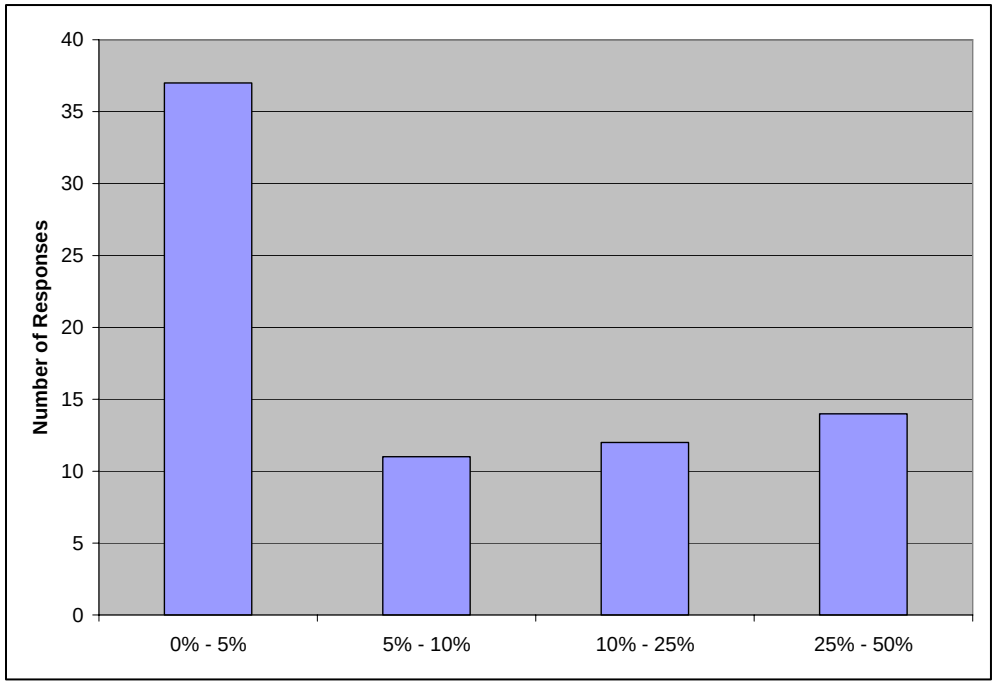

FIGURE 3.20 - Proportion of Non-English Speaking Ridership

In most cases, agencies reported the proportion of their ridership that could not speak English was relatively small – less that 5 percent in 37 cases. However, a significant number of agencies reported much higher proportions, ranging from 5 percent up to 50 percent. Most of the agencies reporting high incidences of non-English speaking riders were in the southern states (California, Texas, Louisiana, and Florida). Twenty-one agencies did not know the proportion of their ridership who could not speak English.

Agencies were then asked whether they provided printed transit information in languages other than English. Sixty-one agencies reported they did provide material in other languages, and 47 reported they did not. Table 3.2 shows how the provision of materials in other languages varies in relation to the amount of non-English speaking riders.

TABLE 3.2 – Cross Tabulation of non-English Speaking Ridership Proportion Against Whether Materials in Other Languages are Provided

	Proportion of Non-English Speaking Ridership				
	0% - 5%	**5% - 10%**	**10% - 25%**	**25% - 50%**	**Total**
English Only	22	4	1	2	29
Multiple Languages	15	7	11	11	44
Total	37	11	12	13	73

The table shows that, as could be expected, the agencies most likely to provide materials in other languages are also those that have higher proportions of non-English speaking ridership. However, two agencies only provided their materials in English even though more than 25 percent of their ridership could not speak English. It can also be seen that 15 agencies provided materials in other languages even though less than 5 percent of their riders could not speak English.

Agencies were also asked which languages they provided. In the vast majority of cases, Spanish was the other language that was offered. However, some other languages were also mentioned, including Russian, Chinese, Creole, Vietnamese, Bosnian, and Braille, reflecting pockets of local populations speaking these languages.

3.9 Instructions and Training in the Use of Printed Information Materials

3.9.1 Printed Instructions

Agencies were asked whether they provided instructions on how to use their printed information materials.

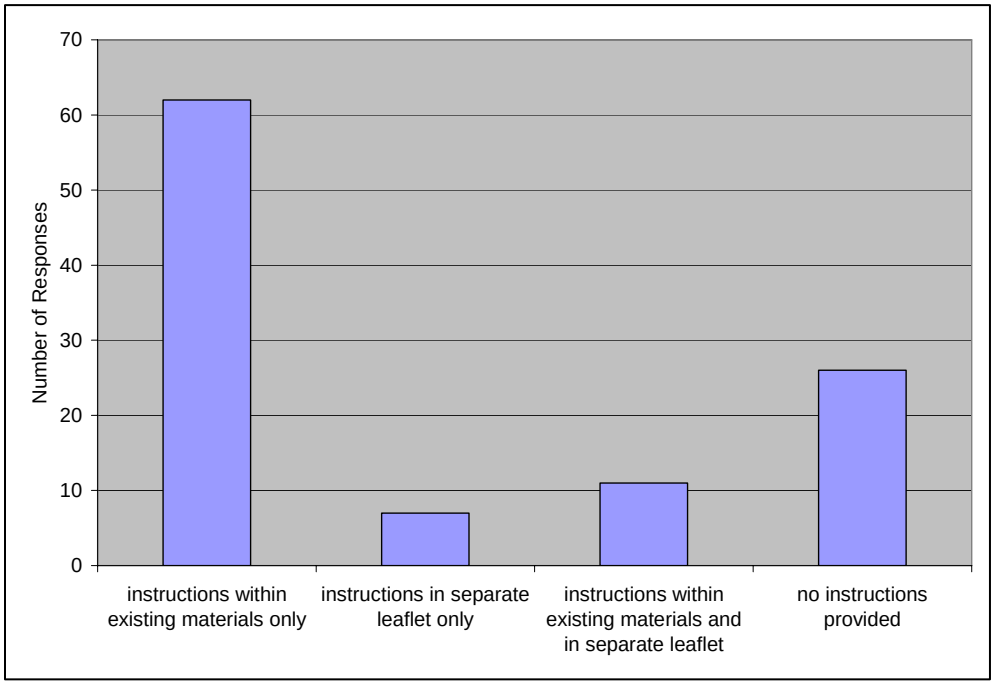

FIGURE 3.21 – Provision of "How to Use" Instructions

The majority of agencies stated they provided instructions within existing materials – 62 agencies provided instructions in this format only while a further 11 agencies provided instructions within existing materials and instructions within a separate leaflet. A small number of agencies (7 in total) only provided instructions within a separate leaflet while 26 agencies provided no instructions

3.9.2 Customer Training Events

A total of 58 agencies indicated they conduct workshops or other events to inform customers of available services and to show them how to use the system. It was common for agencies to conduct outreach at local community events and also go to senior centers, colleges and schools to educate seniors and students. Some agencies also mentioned conducting events at local companies to educate their employees. Disabled people were also targeted for special training events. One-on-one training was also available from many agencies on request. Some agencies had outreach specialists employed specifically for this purpose.

3.10 Problems with Printed Materials

Agencies were asked to list typical problems / issues / customer complaints received in relation to their printed information materials. A total of 57 written responses were received, equating to 47 percent of the sample.

To summarize these responses, it was clear the two most frequently cited problems related to customers not being able to understand how to use the schedules / timetables. Particularly among elderly riders, complaints related to the font size being too small to read. Other research studies have also found that these two problems are very common (Cain, 2004). The next most commonly cited problem involved rider difficulties experienced when using maps. Some riders apparently have problems using schematic-style maps though several published guidelines recommend the use of these instead of overlay maps (Higgins & Koppa, 1999 and Denmark, 2000). There are also differences of opinion on whether individual route maps or complete system maps are preferable. Agency comments suggested some riders prefer individual route maps while others prefer system maps. A similar issue related to views on individual schedules versus ride guides – some riders preferred a comprehensive ride guide, while others preferred leaflets for individual routes.

The amount of information provided was also cited as a problem. Some agencies reported complaints their materials included too much information, making it difficult for riders to extract essential information. On the other hand, several agencies reported complaints there were not enough schedule leaflets or ride guides available, or that they were only available on certain routes or at transfer centers. Complaints were also received that information was in English only, and the information should also be provided in other languages such as Spanish and Braille. Transit agencies acknowledged these kinds of information provision problems were often simply due to insufficient funding to print and distribute more information materials, or to print them in different language formats

More specific problems related to schedule use involved the number of time points provided – riders often wanted to know the arrival times for each bus stop, not just selected time points, or wanted to know why more time points were not included on their maps. Although in many cases it was noted the schedule was difficult for riders to use, some agencies noted that a few of their riders did not like the “consolidated timetables,”

which provided headway based information such as “every 10 to 15 minutes throughout the day.” These riders actually preferred to have all the time point information provided.

Overall, agency comments indicate different customers prefer different types of material design and packaging. This suggests that seeking one optimal design to suit all parties is perhaps not the best approach. Instead, if possible, it may be better to provide a variety of different information types and styles to ensure that different customer preferences are catered to.

3.11 Major Redesign “Overhauls” of Printed Materials

A series of questions were asked to obtain information on any major design “overhauls” conducted. Seventy-one agencies reported they had conducted a major overhaul, while 30 reported they had not. For those asked when the last overhaul was conducted, it was found the vast majority had done it within the last five years, with some currently undergoing a redesign. This would suggest significant material redesigns are quite common.

3.11.1 Why was overhaul conducted?

Responses showed there were a variety of reasons for conducting an overhaul. The most common response was that service changes, such as service expansions, system restructuring or a new fare structure, meant that a whole new set of materials were required. Also common was the response that the old materials were confusing, outdated, or generally needing to be updated, which was often reflected by customer complaints. Thus, an overhaul was required to make the materials more visually appealing, easier to understand and to improve consistency. Other less common reasons included the fact the agency itself had undergone a name change or branding change that required the materials to also be changed, or that there had been a change in funding levels. Increased funding allowed agencies to improve the quality and content of their materials, such as adding information in another language or introducing color coding. At that point the agency often took the opportunity to subcontract the design task out to professional designers. On the other hand, funding reductions meant the cheaper designs had to be used, either by changing from color to black and white, from ride-guides to individual leaflets, or by reducing the quantity of printed materials.

3.11.2 Was any market research conducted?

Agencies were asked if they had conducted any market research in the overhaul process to gain insight into customer design preferences. Thirty-six agencies stated they had not and 49 did not respond to the question, leaving a total of 36 affirmative responses. Among those stating that they had completed market research, common responses were that focus groups or customer surveys had been conducted. Others stated that “official” market research had not been conducted, but that insight had been obtained from “unofficial” feedback such as comments received at call-centers or to operators from customers. Other agencies presented prospective designs at public meetings and workshops to gauge support. Other agencies reported that they had obtained background

knowledge by soliciting samples from other agencies, published guidelines (such as TCRP Report 45), or consultants employed to aid in the material redesign. Some agencies reported they had employed market research after the new designs had been published to ensure they were positively received.

3.11.3 Did the overhaul have any impacts?

Agencies were then asked if any impacts were observed as a result of the overhaul. There were 62 responses, most of which stated there were no impacts, or that it was impossible to know. Common reported impacts included improved customer satisfaction, less complaints, fewer information requests at call centers or from operators, while other agencies reported increased use of materials. Some agencies did report ridership increases, but in all but two cases, these were not quantified. It was also noted there was no way of discerning if ridership increases were in any way related to the material design overhaul. Overall, it seems the transit industry has great difficulty in quantifying the impacts of material design changes.

3.12 Production

3.12.1 Printing Cycles

Agencies were asked how often, on average, they re-printed their schedules and system maps.

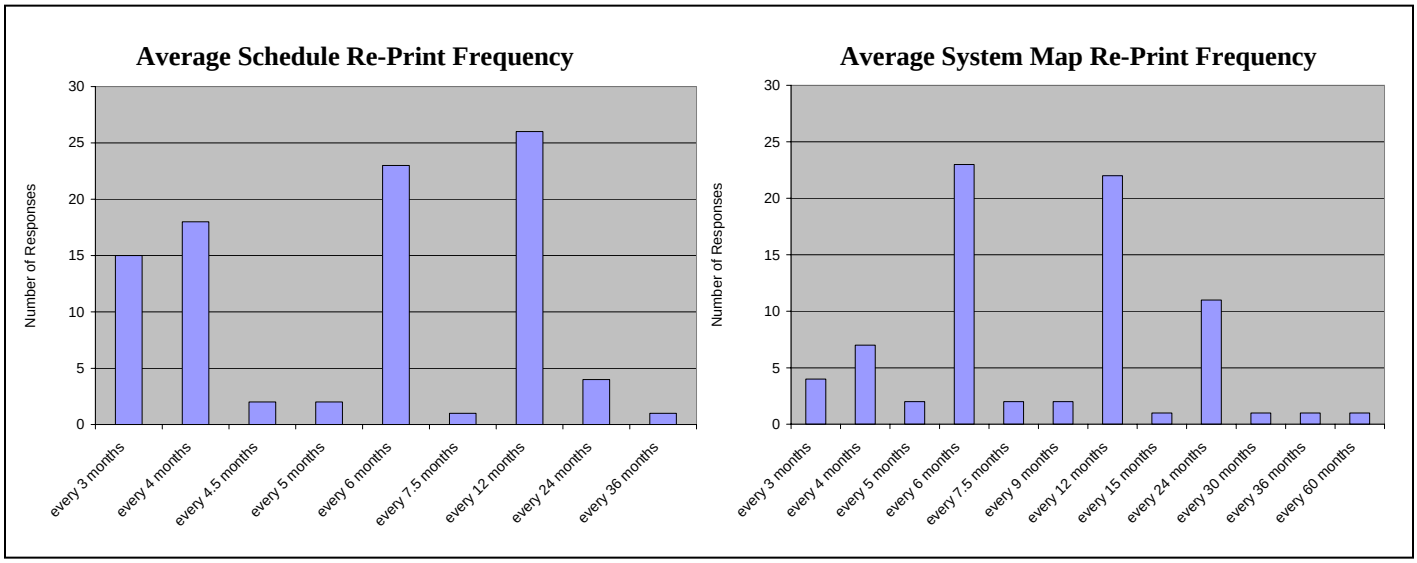

FIGURE 3.22 – Printed Materials Re-Print Frequency

Schedule re-print frequencies ranged from every three months to every 36 months with the most common frequencies being every 3, 4, 6 or 12 months. Thus, most agencies reprint their schedules at least once a year with the survey average being every 7.9 months. A number of agencies did not provide a numerical answer, and simply stated that re-prints were carried out “as necessary” or whenever there was a major service change.

As could be expected, system map reprint frequencies were generally lower than schedule reprint frequencies with reprints every 6 or 12 months being the most common. Thus, average reprint frequency was every 11.6 months. Again, a number of agencies did not provide a numerical answer and simply stated re-prints were carried out "as necessary" or whenever there was a major service change.

Agencies were asked how much time they typically had from the time Scheduling finishes the master schedule to the time the schedules have to be printed.

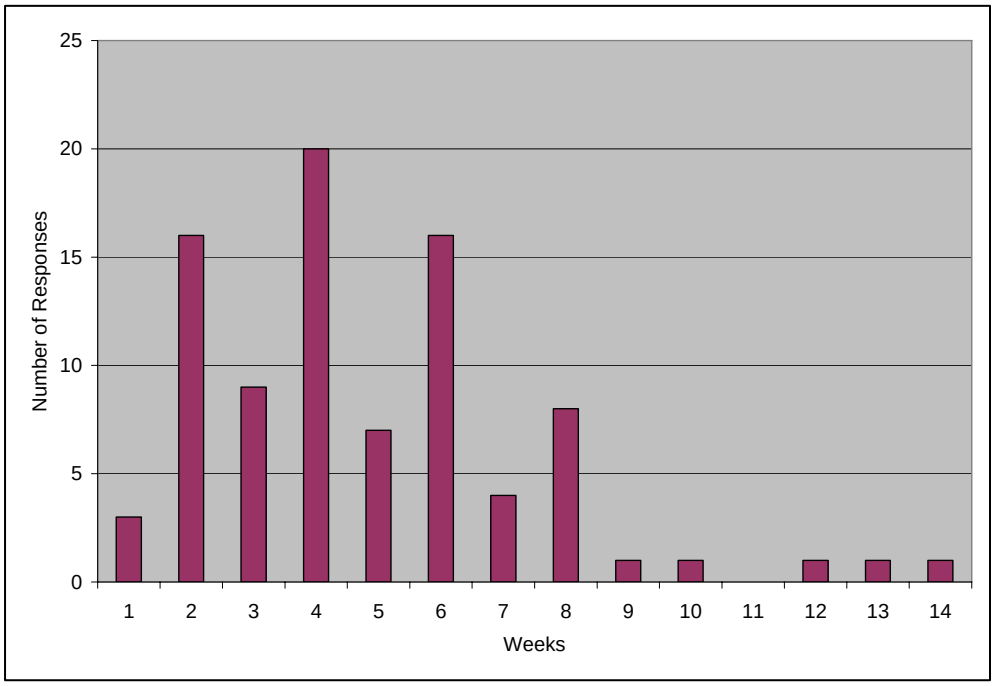

FIGURE 3.23 – Time in Weeks between Master Schedule Completion and Printing

Figure 3.23 shows that most agencies typically have between 2 and 8 weeks after master schedule completion before the public schedules need to be printed, with 4 weeks being the most common response. Thus, the overall average for the sample was a time-lag of 4.8 weeks. Three agencies reported they only had one week to prepare the public schedules, while five agencies reported they had more than 8 weeks. Overall, this figure illustrates the lack of time many agencies have to develop printed schedules once the master schedule is completed.

3.12.2 Production Options

Agencies were asked how their printed information materials were produced, either "in-house" or subcontracted to another company.

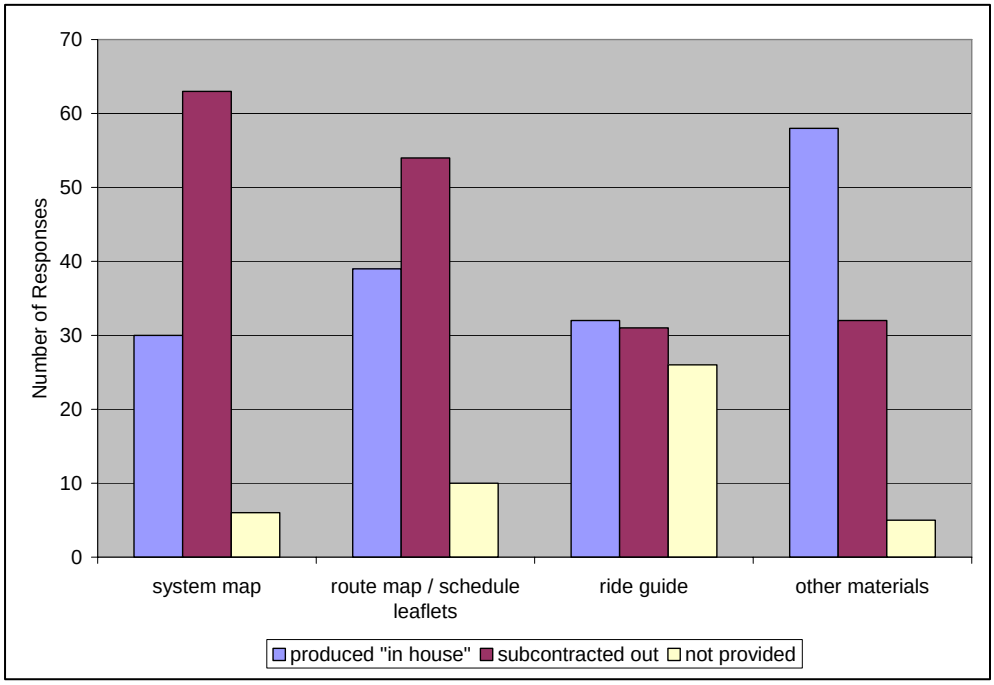

FIGURE 3.24 – Production Options

Figure 3.24 shows the most common option for system map production was to subcontract the production to an external agency. More than twice as many agencies follow this approach compared to those producing their system maps themselves (63 versus 30). The balance between in-house and subcontracted production was much closer for route map / schedule leaflets; although, subcontracting was still the more common option (54 versus 39). Almost the same number of agencies produced their own ride-guides as used subcontractors for this task, although a significant number of agencies reported that did not produce ride-guides. Other materials were more likely to be produced in-house. Overall, it appears that a significant number of transit agencies prefer to employ an external contractor to produce their printed information materials.

3.12.3 Software Packages Used for In-House Production

Agencies that produced their materials "in-house" were asked which software packages they used. Multiple responses were permitted.

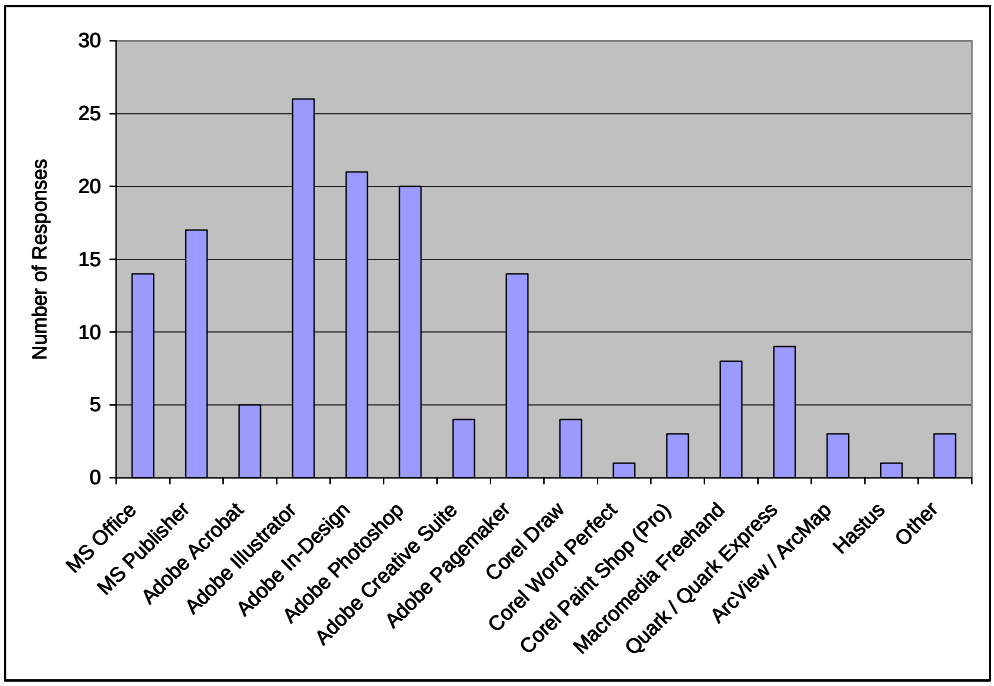

FIGURE 3.25 – Software Packages used for In-House Production of Materials

Figure 3.25 shows Adobe products such as Illustrator, In-Design, PhotoShop and PageMaker were very popular. Indeed, it was common for agencies to use several different Adobe products together to fulfill their production needs. Other less common options included Microsoft products such as Office and Publisher, Corel products like Draw and Paint Shop, Macromedia Freehand and Quark/Quark Express. Only one agency reported the use of software specifically designed for the transit industry – Hastus.

3.13 Design Manual

The final section of the questionnaire related to the design manual that this research study aims to produce. Agencies were asked whether they would like a copy of the manual once it was completed. One hundred and six agencies (88 percent) stated they would like to receive a copy; two agencies stated they would not like a copy and 13 agencies did not respond.

Agencies were then asked for comments on anything they thought should be included in the manual, or if they had any other comments on the manual content. Twenty-six comments (21 percent of the sample) were received. In summary, a large number of agencies wanted the manual to include information on compliance with ADA regulations particularly in relation to minimum font size, font type, and the use of color. Others made reference to compliance with other legal requirements such as Title 6. Another common response requested the inclusion of best practice examples or samples that agencies could use to base their materials on. More specific comments related to map design issues such as which graphic elements should be included, whether maps should be presented in the schematic or overlay style, and what size they should be. Other map issues related to the use of color, preferred color schemes to use, and how many colors to use. Other

comments focused on schedule design, requesting assistance on how to provide understandable, consistent, simplified schedules, including how the information should be categorized and which layouts to use. On the provision of materials in different languages, one agency wanted to know whether it was better to integrate different languages within the same materials or to provide them on separate documents. Another agency asked whether it was better to provide a ride-guide or to provide individual leaflets.

Overall, it was encouraging that such a high percentage of the sample stated they wished to receive a copy of the manual. However, only one fifth of the sample provided comments on what they wished to be included.

4. Material Classification

4.1 Introduction

Each agency responding to the survey was asked to provide a selection of their printed information materials. This request was included in order to obtain an understanding of the types and prevalence of different material design options employed by agencies across the country. Each of the three main printed information aid types: system map, route map, and schedule were divided into a range of different design elements and classified in terms of the design option used for each element. This section summarizes the results of the classification process and also discusses how the overall prevalence of different options compares to the design preferences recommended in Chapter 2 of this report.

4.2 Materials Provided

Of the 121 agencies responding to the transit agency survey, 97 sent copies of their printed materials as requested. The number of each of the different types provided is shown in Table 3.1 below:

TABLE 4.1 – Printed Information Aids Provided by Responding Agencies

Printed Information Aid	Percentage
System Map	82.6
Route Map / Schedule Leaflet	92.5
Ride Guide	58.2
Instruction Leaflet	51.6

The table shows that over 90 percent of the agencies provided leaflets containing individual route information. Over 80 percent also provided a system map, while 58 percent provided a ride guide and 52 percent provided a separate instruction leaflet.

Forty-seven agencies (48.5%) also provided information in other languages – in almost all of these cases the other language was Spanish. In a small number of cases, materials in other languages were provided, including Vietnamese, Russian, and Bosnian.

4.3 System Map Classification

Table 4.2 and Figure 4.1 below summarize the material classification exercise that was performed on the 76 system maps that were received.

Table 4.2 - System Map – Design Element Classification

Design Element	Design Option	Percentage (N=76)
Setting	– Separate system map	68.4
	– Within ride-guide	31.6
Format	– Overlay	15.2
	– Schematic	84.8
Paper Type	– Flat / matte	38.8
	– Glossy / eggshell	61.3
Route Identification	– Color based differentiation	52.6
	– Dotted / broken line differentiation	15.4
	– Color and line based	32.1
Route Variation	– Color based differentiation	8.1
	– Dotted / broken line differentiation	89.2
	– Color and line based	2.7
Transit System Elements	– Routes	100.0
	– Transfer points	61.8
	– Transfer centers	60.5
	– Stop locations	47.4
	– Other transportation infrastructure info	56.6
Transfer Point Identification	– Symbol Only	36.0
	– Intersecting route numbers	25.6
	– No identification	38.4
Topographical Elements	– Streets / highways	100.0
	– Landmarks	100.0
	– Natural features	80.3
	– Compass	92.1
	– Scale	30.3*
	– Legend	94.6
	– Insets	81.6
Other service information	– service hours	86.8
	– fare information	90.8
	– operator details	59.2
	– effective dates	78.9
	– disabled user info	89.5
Instructions	– text only	0.0
	– text and graphics	0.0
	– no instructions	100.0

* schematic maps not to scale

Table 4.2 shows that the majority of system maps received were separate entities (68.4%) as opposed to being contained within a ride guide (31.6%). The vast majority were of the schematic style (84.8%), which is the style recommended in existing design guideline

publications. The majority of system maps (84.8% were printed on glossy/eggshell paper, perhaps due to the greater durability of this paper type.

Most routes were identified using some form of color coding (85%), with 32.1 featuring both color and line-based differentiation. Most route variations were presented using line-based differentiation (using dotted or broken lines).

Surprisingly, only around 60 percent of the system maps included information on transfer point and transfer center location. Of those that did include transfer points, over half provided a transfer symbol only, under half also provided intersecting route numbers. Less than 50 percent included the location of individual bus stops.

Common topographical elements included street / highway identification, landmarks, a compass, and a legend (all over 90%). Only 80 percent included natural features and 30 percent provided a scale, though it should be recognized that most agencies used the schematic map style which does not require a scale.

It should also be noted that none of the system maps provided instructions on how they should be used. This is perhaps reflective of the fact that most members of the public are able to successfully complete the trip planning tasks associated with this information aid, as documented in Cain (2004). Figure 4.1 provides a summary of the minimum font sizes used on the system maps.

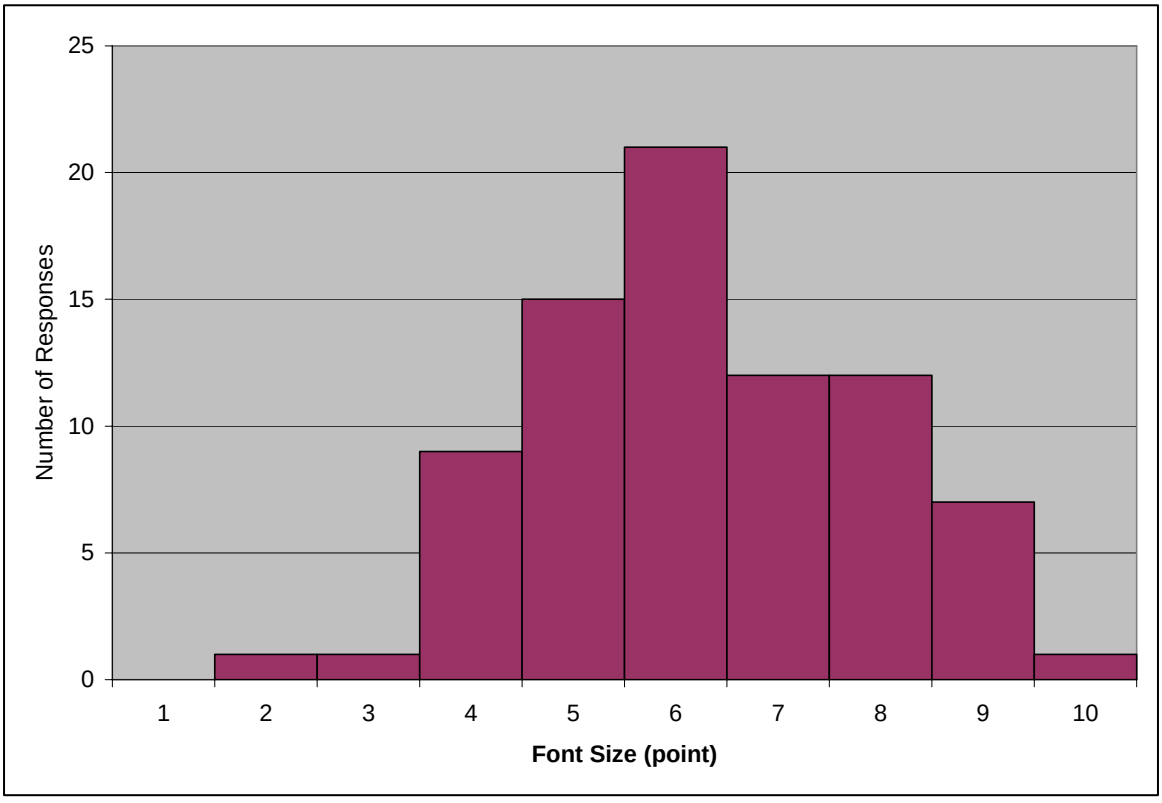

FIGURE 4.1 – System Map - Minimum Font Sizes

The analysis found that minimum font sizes ranged from 2-point up to 10-point, with 6-point being the most common font-size. The sample average was of 6.3-point.

The following figure presents a summary of the number of colors used in the sampled system maps.

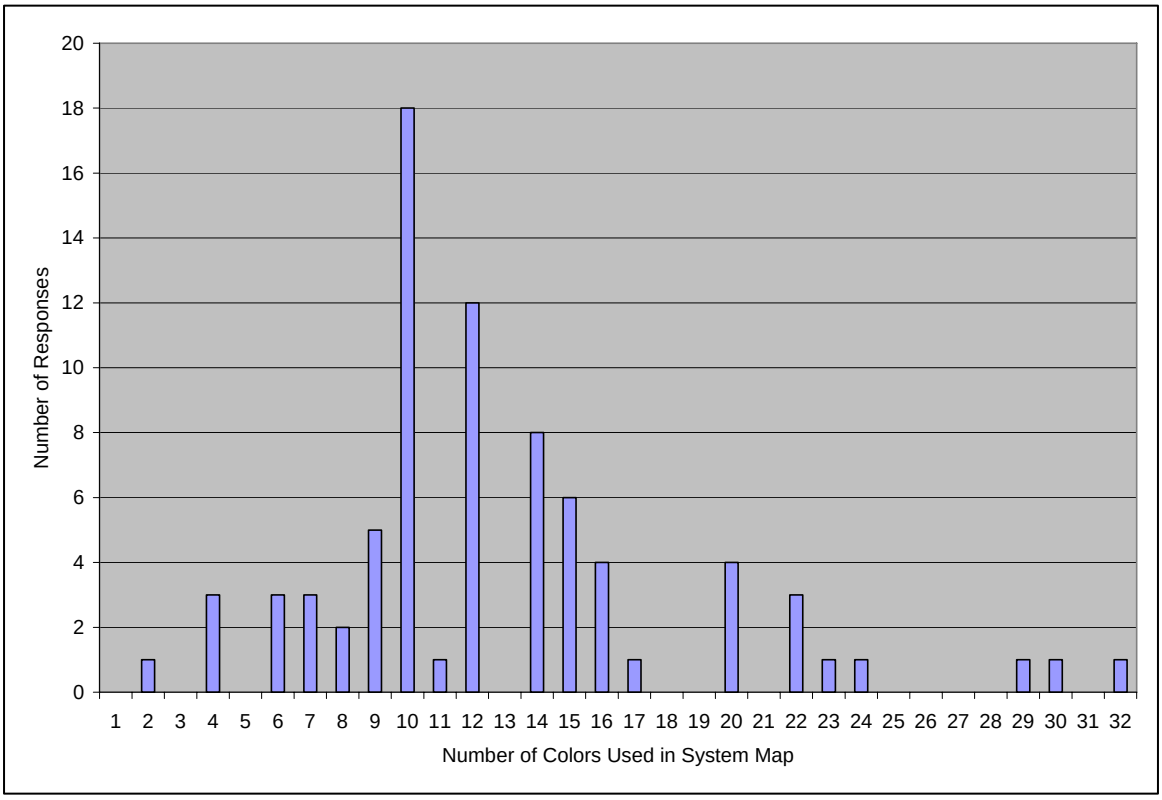

FIGURE 4.2 – Number of Colors Used in System Maps

The figure shows that the number of colors used varies widely, ranging from only two colors up to 32 colors. The sample average was calculated to be 12.9, which is higher than the maximum of nine colors recommended in the TCRP 45 Report.

4.4 Route Map Classification

Table 4.3 on the next page presents a summary of the analysis conducted on the route maps provided by a total of 86 agencies. There was no clear preference between overlay maps and schematic maps, with 43.8 percent using the overlay style and 56.2 percent featuring schematic. This contrasts with the fact that the schematic style was much more popular for system maps. Paper type was also in contrast to system map preferences, with 77.8 percent printed on flat/matte paper (77.8%), while the majority of system maps were printed on glossy paper (61.3%). Route map titles typically featured the route number/letter and the major destinations served by the route. Less common were the use of route color and the use of street names in the title (38.4% respectively).

Just over half the routes were identified by a colored line (52.9%), with almost all of the remainder (42.9%) denoted by a solid black line. Around two-thirds of the route maps showed transfer points and transfer centers. Somewhat surprisingly, only around two-thirds of the route maps (66.3%) featured time point identification (identification of the route's time points on the map, using a number or letter, so that these points could be cross-referenced to the route schedule). This is significant because one of central roles of the route map is to allow transit users to cross-reference their boarding and alighting points on the route map to the timing information provided in the schedule.

Table 4.3 - Route Map – Design Element Classification

Design Element	Design Option	Percentage (N=86)
Setting	– Separate route map	75.0
	– Within ride-guide	25.0
Format	– Overlay	43.8
	– Schematic	56.2
Paper Type	– Flat / matte	77.8
	– Glossy / eggshell	22.2
Header / Title	– Route color used in title	38.4
	– Route number / letter	84.9
	– Major destinations served by route	84.9
	– Streets	38.0
Route Identification	– Color based differentiation	52.9
	– Dotted / broken line differentiation	4.3
	– Color and line based	0.0
	– Single black line	42.9
Transit System Elements	– Routes	100.0
	– Time points	66.3
	– Transfer points	65.1
	– Transfer centers	62.8
	– Stop locations	50.0
	– Other transportation infrastructure info	29.1
Transfer Point Identification	– Symbol Only	31.8
	– Intersecting route numbers	28.2
	– No identification	40.0
Topographical Elements	– Streets / highways	87.2
	– Landmarks	89.5
	– Natural features	32.6
	– Compass	65.1
	– Scale	0.0*
	– legend	53.5
Instructions	– text only	5.8
	– text and graphics	1.2
	– no instructions	93.0
Other service information	– service hours	67.4
	– fare information	60.5
	– operator details	38.4
	– effective dates	70.9
	– disabled user info	67.4

* All route maps (except one) were schematic, and thus would not require scales

As with the system maps, the most common topographical features provided were street names and landmarks. Only around one-third of route maps included natural features and only around half provided a legend. Almost all route maps did not provide any form of instruction on how they should be used; only 5 (5.8 percent) agencies provided text-based instructions, while only 1 agency (1.2 percent) provided instructions that included text and graphics.

Figure 4.3 provides a summary of the font sizes used on the route maps. The analysis assessed the materials for both the standard/typical font size used in each agency's materials, and the smallest font size used.

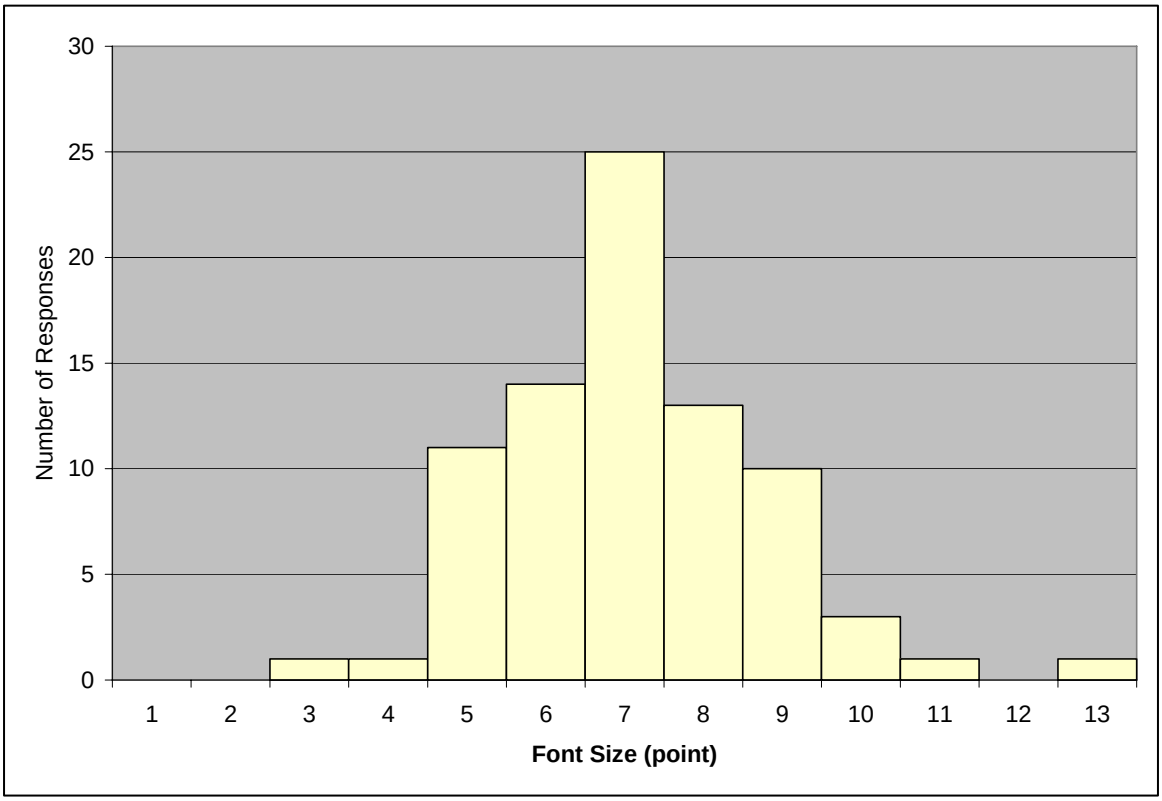

FIGURE 4.3 – Route Map - Minimum Font Sizes

The figure shows that minimum font sizes ranged from 3-point to 13-point, with a sample average of 7.1-point.

4.5 Schedule Classification

Ninety schedules were analyzed and classified – results are summarized in Table 4.4 below.

Table 4.4 – Schedule – Design Element Classification

Design Element		Design Option	Percentage (N=90)
Setting	-	Separate	72.2
	-	Within ride guide	27.8
Front / Back Layout	-	Route map provided on same page	66.0
	-	Route map provided on opposite page	28.7
	-	Route map not provided	5.3
Paper Type	-	Flat / matte	73.9
	-	Glossy / eggshell	26.1
Title	-	Route number/letter	92.2
	-	Route color featured in title	52.2
	-	list of places served by route	84.4
	-	Streets	35.6
Presentation format	-	Tabular schedule	93.3
	-	Clock face	2.2
	-	Headway based	4.4
Direction Labeling	-	“to / from”	67.0
	-	“inbound / outbound”	7.4
	-	“northbound / eastbound, etc”	25.5
Time point alignment	-	Horizontal alignment	94.7
	-	Vertical alignment	5.3
Time point labeling	-	Number / letter	52.6
	-	Landmark	96.8
	-	Street address	97.9
Time point label orientation	-	Horizontal	58.5
	-	Vertical	30.9
	-	Diagonal	10.6
Identification of transfer points	-	Symbol only	20.5
	-	Intersecting route numbers provided	31.8
	-	No identification	47.7
Column delineation	-	Shading	17.8
	-	Line separation	34.4
Row delineation	-	Shading	37.8
	-	Line separation	42.2
AM/PM differentiation	-	Bolded PM	37.0
	-	“AM / PM” header text	31.5
	-	AM / PM times in separate tables	9.8
	-	24 hour clock	1.1
	-	Color based differentiation	4.3
	-	No AM/PM differentiation	16.3
Days of Operation labeling - weekday	-	“Weekday”	46.3
	-	“Monday to Friday”	52.5
	-	“No Sunday service”	0.0
	-	“Daily”	1.3

Days of Operation labeling - weekend	-	"Weekend"	8.2
	-	"Saturday / Sunday"	86.3
	-	"No Sunday service"	5.5
	-	"Daily"	0.0
Days of operation differentiation	-	Identified within same table	22.7
	-	Separate tables on same page	38.7
	-	Separate tables on different pages	38.7
Other service information	-	Service hours	73.3
	-	Fare information	54.4
	-	Operator details	30.0
	-	Effective dates	61.1
	-	Disabled user info	56.7
Instructions	-	Text only	4.4
	-	Text and graphics	0.0
	-	No instructions	95.6

It was found that the majority of schedules (66.0%) were presented on the same side of the page as their respective route maps. This is important because published guidelines strongly recommend this approach. However, over one-quarter of the sample presented the route map and schedule on different sides of the page, forcing users to flip back and forth between the two sides to obtain the necessary information. As with the route maps, most of the schedules were printed on flat/matte paper (73.9 percent). Almost all the schedules that were assessed utilized the traditional tabular format (93.3%); thus, only a very small number of agencies (6 total) made use of the clock face or headway formats. This provides further evidence that the tabular schedule format is the standard method of providing route timing information, and also suggests that it would be difficult to implement any alternative to such a universally used and accepted format.

Just over two-thirds of sample used the "to-from" format for direction labeling, which is the recommended format. However, labeling route direction using cardinal directions (northbound / eastbound, etc) was employed in 25 percent of the schedules, and the "inbound / outbound" format was employed in 7.4 percent of the schedules.

In term of time point alignment, the horizontal format was almost universally employed (94.7%). This is important because the horizontal format is the recommended format. This finding reinforces the case for recommending that the horizontal format becomes an industry standard.

Almost all time point labels featured a combination of both landmarks and street addresses. However surprisingly, only just over half (52.6%) featured a number or letter denoting the position of the time point on the corresponding route map. This is consistent with the route map analysis in the previous section, which found that only around two-thirds of analyzed route maps included the time-point locations. Overall, this suggests that it is not common practice in the transit industry to provide the numbers or letters on both the route maps and schedules to aid in the location and use of time point information.

The most common time point label orientation was the horizontal format (58.5%). Less common were the vertical formats (30.9%) and the diagonal format (10.6%). This is a

significant finding because the diagonal orientation is the format that this study intends to recommend, due to the fact that it allows more time points to be included in the schedule without infringing on font size requirements and without requiring the user to rotate the schedule in order to read the label and the corresponding times.

Column and row delineation using lines and/or shading was found to be absent from the majority of schedule designs. This is a significant finding because column and row delineation is recommended by this study in order to aid the user in navigating around the schedule.

It was found that the vast majority of schedules included some form of AM/PM differentiation, with only 16.3 percent not providing any form of differentiation. The two most popular methods of differentiation were to bold the PM times (37.0%) or to provide "AM" and "PM" as header text (31.5%). Much less common forms of differentiation included putting AM and PM time information in separate tables (9.8%), using the 24-hour clock (1.1% -- published design guidelines recommend against the use of the 24-hour clock), and using color-based differentiation (4.3%). These observations on current practices toward AM/PM differentiation, in conjunction with the finding of published guidelines, reinforce the view that some form of AM/PM differentiation is recommended, and that either the bolding of PM times, or the use of AM / PM labels, are already standard practices in the transit industry.

Assessment of the labeling options for different days of operation was separated into labeling for weekday operation and for weekend operation. For weekday operation, two labeling options were almost equally prevalent: "Monday to Friday" (52.5%) and "weekday" (46.3%). This finding is significant because published design guidelines recommend the use of "Monday to Friday" and recommend against the use of "weekday." Thus, it appears that almost half the sample was using a labeling form that is not recommended. For weekend operation, the provision of labels based on the actual day names ("Saturday" / "Sunday") was by far the most commonly used option (86.3%). This is encouraging because this is the format recommended in the literature. Other formats such as the "weekend" label were only used by 8.6 percent of the sample.

The other issues associated with service timing differences on different days relates whether the timing information is presented. Typically, weekend services run at lower frequencies and/or spans compared to weekday services. Options include presenting information for different days of service within the same table, or separating the information for different services into different tables. It was found that the majority of agencies did separate the information for different days into different tables, either on the same page (38.7%), or on a different page (38.7%). Only 22.7 percent presented the information for different days in the same table. This observation is significant because this study recommends information separation into different tables, due to the confusion that is caused by attempting to aggregate the information into the same table.

The provision of instructions on schedule use was found to be rare; only 4.4 percent provided text based instructions, and none of the materials featured instructions that included graphics.

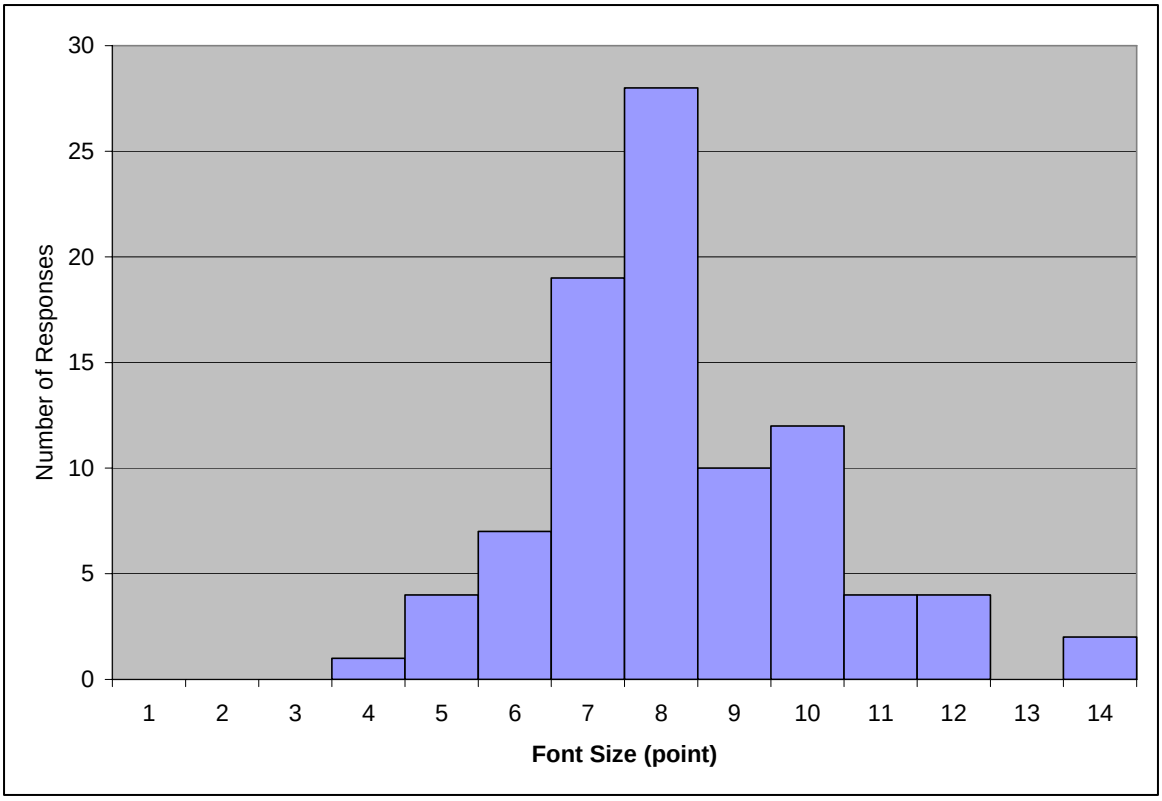

FIGURE 4.4 – Schedule - Minimum Font Sizes

Figure 4.4 provides a summary of minimum font sizes used in the assessed schedules. The pattern of font sizes used in each case is similar to the route map, with minimum font sizes ranging from 4-point to 14-point (average = 8.3-point).

Considering the font sizes observed on the system maps, route maps, and schedules (see Figures 4.1, 4.3, and 4.4), it can be seen that a large number of all three types of information aid feature font-sizes below this study's recommended minimum of 8-point. This is likely to be the source of the widespread customer complaints regarding small font sizes. Clearly, there is a need to encourage material designers to observe minimum font size recommendations.

5. Conclusions / Recommendations

5.1 Prioritization under Different Cost Constraints

It is clear that the costs of different printed material types vary considerably. This raises the question of how to prioritize the provision of different information aids given the inevitable cost constraints faced by every transit agency. As discussed in the literature review, hand-held printed materials are recognized to be extremely useful in pre-trip planning as well as during trip execution and are commonly regarded as essential to trip planning by transit users. Thus, hand-held printed materials should be given high priority in the information provision budgets of transit agencies both in relation to material design as well as material printing and distribution.

There is also the issue of how to prioritize the different printed information aid options that are available. Table 5.1 provides a suggested hierarchy of printed information material provision given different cost constraints.

TABLE 5.1 – Prioritization of Printed Information Materials

Priority Level	Materials Provided	Color Coding / Contrast
1	- System map - Individual route map / schedule pamphlets	- Black print on white matte paper - Black print on white matte paper
2	- System map - Individual route map / schedule pamphlets	- Color coded system map - Black print on white matte paper
3	- System map - Individual route map / schedule pamphlets	- Color coded system map - Color coded pamphlets
4	- System map - Individual route map / schedule pamphlets - Ride guide / schedule book - Separate instruction brochure	- Color coded system map - Color coded pamphlets - Color coded ride guide / schedule book - Color coded instruction brochure

The table shows that, with limited resources, the minimum level of information provision (Priority Level 1) would be a system map and individual route map/schedule leaflets printed in black and white. If a larger budget is available (Priority Level 2), the system map should be color coded. At Priority Level 3, both the system map and route maps should be color coded, and at the highest priority level, agencies could consider providing a ride guide and/or individual instruction leaflets.

5.2 Provide Instructions / Education

Market research studies and customer surveys have consistently shown that riders have difficulty understanding how to use printed information materials to plan their trips. Clear and simple instructions on the process are required to plan a trip and are essential (even if only helpful to a subset of users). However, this study has shown that many agencies do

not provide instructions or only provide them on a separate leaflet. It is recommended each individual piece of information include a brief set of instructions even if limited by space constraints. If possible, printed instructions should include graphical representations of material use, particularly in relation to the tabular schedule. It may also be useful to consider holding workshops or seminars featuring a section on how to use the printed materials. Many agencies currently do this, but they are often targeting only seniors and youth riders.

5.3 Design Standards

Survey responses suggest that the establishment of material design standards by individual transit agencies is relatively rare, though many agencies have developed their own consistent design formats. The survey found that only 21 percent of agencies were aware of the existence of design guidelines, such as TCRP Report 45 (Higgins & Koppa, 1999), that have been produced in order to aid them in the material design task. Furthermore, even fewer (only around 12 percent of survey respondents), actually used such resources in their material design. It is unsurprising, then, that a wide range of different design options are employed with each agency developing its own autonomous set of preferences. Overall, this suggests that transit riders in the U.S. would benefit from a more strategic, consistent approach to material design across the industry as a whole.

5.4 Variation in Customer Material Design Preferences

Survey responses reinforced the observations made in the literature review that there is a wide range of different preferences amongst transit users for the way in which materials are designed.

- Some users prefer individual route pamphlets, while others prefer ride guides.
- Some prefer overlay maps, while others prefer schematic maps.
- Many cannot use tabular schedules, but a significant number also complain if these are replaced with headway-based schedules.

Given this variation, it is clear that no single design will please everyone. However, it is also true that in most cases, one design must be selected. Thus, the one design that is selected should attempt to at least be consistent with the preferences of the majority. It may also be possible in some cases to provide two alternatives in order to raise the proportion of satisfied users. For example, providing the full, detailed tabular schedule alongside a simple, headway-based summary would provide for the information needs of a wider proportion of users.

5.5 Separating Essential and Non-Essential Information

The correct balance needs to be found in the amount of information that is included in information materials. Information deemed essential to the planning of the trip needs to be included. Information not deemed to be essential should be minimized; while information not necessary for trip planning should not be included. See Table 5.2 for more details.

TABLE 5.2 – Information Requirements for Each Printed Information Material Type

Information Aid	Essential Information(must be provided)	Useful Information (may be provided)	Unnecessary Information
System Map	- Service routes, identified by unique color and label (route number or letter). Labels should be positioned at logical points along the route. - Route variations should be shown using a dotted or broken line. - Transfer points / transfer centers. - Street names for all streets that routes travel on, and other major streets. - Landmarks served by routes, and other major landmarks in vicinity. - Compass directions. - Scale (if map is overlay map). - Legend. - Instructions on how to use system map. - Helpline phone number.	- Bus stop locations (if suitably infrequent). - Insets to show "congested area" such as downtowns in more detail. - Show intersecting route numbers at transfer points / centers. - Natural features such as lakes, rivers and parks. - Fare information. - Operator details	- Advertising.
Route Map	- route number. - illustration of route. - transfer points / transfer centers, including numbers of intersecting bus routes). - time points identified by a number or letter. - Compass directions. - Scale (if map is overlay map). - Legend. - Instructions on how to use route map. - Helpline phone number.	- Color coded routes. - Bus stop locations (if suitably infrequent). - Natural features such as lakes, rivers and parks. - Fare information. - Operator details. - Intersecting routes shown in grayscale.	- Advertising.
Schedule	- arrival / departure timing information for every time point specified in the route map. - time point labels (number or letter). - instructions on how to use the schedule. - hours of operation.	- time point labels include street names and/or landmarks.	- Advertising.
Ride Guides / schedule books	- system map. - route map and schedule information for each route. - instructions. - fare information.		- Advertising.

5.6 Design Options Used Versus Design Options Recommended

The Literature Review (Chapter 2) focused on developing an understanding of the types of material design options recommended by published guidelines and research. It was found that there is an extensive catalogue of recommendations already in existence, some produced in the United States, and others from other countries. From this catalogue it was possible to synthesize a complete listing of guidelines and recommendations for this study's design manual.

The Transit Agency Survey (Chapter 3) and Material Classification exercise (Chapter 4) focused on developing an understanding of the actual design options employed by transit agencies across the country. As expected, in some cases the design options employed by the agencies was consistent with the best practices observed in the literature. For example, color coding in system maps, streets and landmarks provided on maps, the use

of horizontal time point alignment in the schedule, etc. However, in other cases typical industry practices contradicted recommended practices. For example, a significant number of font sizes below 8-point, a lack of time point identification on route maps, a lack of diagonal time point labeling, etc. Thus, it can be concluded that in some areas of material design the majority of agencies are already using the optimum design options, and therefore the recommendations developed in this study's design guidelines document will provide these agencies with evidence that the designs they use should be retained. However, on other design issues it is apparent that the majority of the industry is not using the optimum design options. Furthermore, it is likely unaware of this problem. Thus, in these cases many agencies will need to reconsider their designs in light of the recommendations provided in the design guidelines/manual document.

References

Balcombe, R.J., and Vance, C.E. (1998). Information for Bus Passengers: A Study of Needs and Priorities. Transportation Research Laboratory – Report 330. Funded by the Department of the Environment, Transport, and the Regions. United Kingdom.

Cain, A. (2004). Design Elements of Effective Transit Information Materials. National Center for Transit Research, Report 527-12. Center for Urban Transportation Research, University of South Florida. http://www.nctr.usf.edu/pdf/527-12.pdf

Cain, A. (2005). "Design Elements of Effective Transit Information Materials". Published in the Proceedings of the American Public Transportation Association (APTA) Bus and Paratransit Conference, Columbus, Ohio. May 2005.

Cluett, C., Bregman, S., & Richman, J. (2003). Battelle Memorial Institute & Multisystems, Inc. Customer Preferences for Transit ATIS: Research Report. Federal Transit Administration, U.S. Department of Transportation. Washington, D.C.

Denmark, D. (2000). Best Practice Manual for the Publication and Display of Public Transport Information. New South Wales Ageing and Disability Department. Australia.

Fallat, G., Sollohub, D., & Jeng, O-J. (2004). Improving Public Transit Schedules – Timetables People Can Actually Read. New Jersey Institute of Technology. New Jersey Department of Transportation, U.S DOT and FHWA.

Fruin, J. (1985). NCTRP Synthesis of Transit Practice 7: Passenger Information Systems for Transit Transfer Facilities, TRB, National Research Council, Washington, D.C.

Gill, J. (1997). Access Prohibited? Information for Designers of Public Access Terminals, Royal National Institute for the Blind. London, United Kingdom.

Hardin, J., L. Tucker, L. Callejas. (2001). *Assessment of Operational Barriers and Impediments to Transit Use*. National Center for Transit Research, Center for Urban Transportation Reasearch, University of South Florida.

Higgins, L. & Koppa, R. (1999). Passenger Information Services: A Guidebook for Transit Systems. TCRP Report 45. Transportation Research Board, National Research Council, National Academy Press, Washington D.C.

Highway Capacity Manual. (2000). Highway Capacity Manual. Transportation Research Board, National Research Council, Washington, D.C.

Holroyd, E.M. and D.A. Scraggs. (1966). "Waiting Times for Buses in Central London". Traffic Engineering and Control, Vol 8, No 3, pp 158-160, July 1966

Information and Ticketing Sub-Committee. (2002). *Printed Public Transport Information – A Code of Good Practice*. Association of Transport Coordinating Officers, UK.

Jolliffe, J.K. and T.P. Hutchinson. (1975). "A Behavioural Explanation of the Association Between Bus and Passenger Arrivals at a bus stop". Transportation Science. Vol 9, No 3. November 1975. pp 248-282.

Kirsch, I et al. (2001). Technical Report and Data File Users Manual for the 1992 National Adult Literature Survey. National Center for Education Statistics, US Department of Education, NCES 2001-457.

Kutner, M., Greenberg, E., amd Baer, J. (2003). *A First Look at the Literacy of America's Adults in the 21st Century*. National Center for Education Statistics. U.S Department of Education.

Lawton, C.A. & Kallai, J. (2002). Gender Differences in Wayfinding Strategies and Anxiety About Wayfinding: A Cross-Cultural Comparison. Sex Roles, Vol 47, Nos 9/10.

Seddon, P.A. and M.P. Day. (1974). "Bus Passenger Waiting Times in Greater Manchester" Traffic Engineering and Control. Vol 15, No 9, pp 442-445, 1974

Southworth, M., & Isaacs, R. (1994). SmartMaps for Advanced Traveler Information Systems. Institute of Urban and Regional Development, University of California at Berkeley, CA.

Sprent, N., Bartram, D., and Crawshaw, C.M. (1980). *Intelligibility of Bus Timetables*. Human Factors in Transport Research. Vol. 1. D.J. Osbourne and J.A. Levis (Eds.), Academic Press, New York, pp. 319-327.

Sollohub, D., and Tharanathan, A. (2005). *A Multi-Disciplinary Approach toward Bus Schedule Readability*. Presented at the Transportation Research Board's 84th Annual Meeting, Washington D.C.

Streeter, L. & Vitello, D. (1986). *A Profile of Drivers' Map Reading Abilities.* Human Factors, Vol 28, No.2, pp. 223-239.

TTI. (1999). Texas Transportation Institute, South West Transit Association, and the University of Wisconsin-Milwaukee. A Handbook of Proven Marketing Strategies for Public Transit. *TCRP Report 50*. TRB, NRC, Washington, D.C., 1999.

Turnbull, K.F. (2003). Transit Information and Promotion. Chapter 11: Traveler Response to Transportation System Changes. *TCRP Report 95*. TRB, National Research Council, Washington, D.C.

Webster, F.V. & Bly, P.H. (1980). *The Demand for Public Transport*. Transportation Research Laboratory, Crowthorne, Berkshire, England.

Wickens, C. (1992). Engineering Psychology and Human Performance. Harper Collins. pp140-153.

Wirthlin Worldwide & FJCandN. (2000). Enhancing the Visibility and Image of Transit in the United States and Canada. *TCRP Report 63*. TRB, National Research Council, Washington, D.C.

Appendix I – Survey Instrument

SECTION A - GENERAL INFORMATION

The Center for Urban Transportation Research is conducting a research project on the design of printed information materials for fixed-route bus services. Such materials include system maps, route maps, schedules, and ride guides (schedule books). At the end of the project (Fall 2007), we plan to publish a design manual to assist transit agencies in the design of their printed information materials. This survey is being conducted to obtain a database of information materials from transit agencies across the country, and to obtain an understanding of current trends and issues in the design and production process.

The enclosed questionnaire has been designed to be completed by a staff member (or members) with first-hand knowledge of your agency's service information characteristics. If this is you, please complete the enclosed questionnaire and return it in the envelope provided, along with current copies of your printed information materials. If you do not feel that you are the right person to complete the questionnaire, we would be grateful if you would forward it to an appropriate member of staff.

This survey can also be completed online at: http://www.surveymonkey.com/s.asp?u=141652630708
If you decide to complete the survey the online, we would be grateful if you would still send us current copies of your printed information materials using the envelope provided.

A.1 Please complete the following table.

Agency name	
Agency location (Town / City, State, Zip Code)	
Your name	
Your job title	
Your phone number	
Your email address	

A.2 Please indicate which of the following transit modes your agency provides.

Mode	Mode provided by your agency? **(check box)**	Mode	Mode provided by your agency? **(check box)**
Heavy Rail	☐	Local Bus (Fixed Route)	☐
Light Rail	☐	Paratransit	☐
Bus Rapid Transit	☐	Other (write in…..)	☐
Express Bus	☐	Other (write in…..)	☐

A.3 What is the total population of the area to which your agency provides transit service?..... ☐

SECTION B - INFORMATION PROVIDED FOR YOUR FIXED ROUTE BUS SERVICES

B.1 Listed in the table below are a range of different transit information aids.
Please **check the box** for each information aid provided for your agency's **fixed route bus** services.

If you have the information available, could you please also provide an estimate of how much your agency spends on providing each information aid **in a typical year**.

Information Media Genre	Information Media Type	Description / Examples	Type	FIXED ROUTE BUS SERVICE ONLY	
				Check Box	**$ spent per year (if known)**
Printed information materials	Hand-held printed information materials	System maps, route maps, ride guides, schedules / timetables	**System Map** (map showing the routes of all the bus services provided by your agency)	☐	$
			Route Map / Schedule Leaflets (leaflets providing a route map and schedule for ***individual routes***)	☐	$
			Ride Guide / Schedule Book (a booklet providing route maps and schedules for multiple routes)	☐	$
			"How to Ride" Information Leaflet	☐	$
	Static printed information materials	Static signage at bus stops, transfer centers and elsewhere	Bus stop signage	☐	$
			Station / transfer center signage	☐	$
			Signage at other locations	☐	$
Verbal instruction	Manned call center		Receiving instruction from transit staff via phone	☐	**$**
	Automated call center		Automated instructions via phone	☐	**$**
	PA Systems	Verbal messages at station/transfer center, or in-vehicle, via internal PA system	At stations / transfer centers	☐	$
			In-vehicles	☐	$
	Verbal instruction / assistance provided by Transit staff		Vehicle operators	☐	**$**
			Information center / booth at station / transfer center	☐	**$**
			Other transit staff	☐	**$**
Electronic Information	Digital signage	"Real-time" Bus arrival information at bus stops / platform information at stations	Real-time information at station / transfer center	☐	$
			Real-time information at bus stops	☐	$
			In-vehicle real-time information	☐	$
	Online information materials	Printable online schedules, maps, etc	Online system map	☐	$
			Online route map / schedule leaflets	☐	$
			Online ride guide / schedule book	☐	$
			Online "How to Ride" Information Leaflet	☐	$
	Information kiosks		Information kiosks at stations or stops	☐	$
	Internet / PDA trip planners	New technology based trip planners	Online trip planners	☐	$
			PDA based information aids	☐	$

SECTION C – DESIGN STANDARDS

C.1 Listed below are a series of printed information material design elements.
If your agency has established a standard for any of the design elements listed, please specify the standard below. For each design element, please indicate **"none"** if your agency does not have a design standard for this element.

Design Element	Please specify the standard(s)
FONT (i.e. Ariel, courier, etc)	
FONT SIZE (i.e. 10 pt, 12 pt, etc)	
CASE (i.e. UPPER CASE, lower case, Title Case)	
PAPER (i.e. glossy or matte)	
CONTRAST (i.e. print color on paper)	
COLOR SCHEME	
TOTAL NUMBER OF COLORS	
LANDMARKS	
STREET NAMES	
TRANSFER POINTS	
MAP LEGEND / KEY	
COMPASS	
SCALE (i.e. one inch to one mile)	
TIME POINTS (i.e. points on bus route for which time info is provided)	
RATIO OF FOLDED SIZE TO OVERALL SIZE	
SCHEDULE ALIGNMENT (i.e. horizontal / vertical (**see below**)	
ALTERNATE COLUMN / ROW SHADING IN SCHEDULE	
AM / PM DISTINCTION IN SCHEDULE	

Vertical Schedule Alignment

Monday-Friday every hour.					
Eastbound					
Ⓐ	NW 83rd St. Santa Fe Ter.		7:27	8:27	9:27
Ⓑ	NW 23rd Ave 43rd St.		7:36	8:36	9:36
Ⓒ	NW 16th Ave. NW 13th St.		7:43	8:43	9:43
Ⓓ	Univ. Ave. NW 13th St.		7:48	8:48	9:48
Ⓔ	Downtown Plaza		7:55	8:55	9:55
			♿	♿	♿
Westbound					
Ⓔ	Downtown Plaza	7:00	8:00	9:00	10:00
Ⓓ	Univ. Ave. NW 13th St.	7:05	8:05	9:05	10:05
Ⓒ	NW 16th Ave. NW 13th St.	7:10	8:10	9:10	10:10
Ⓑ	NW 23rd Ave 43rd St.	7:18	8:18	9:18	10:18
Ⓐ	NW 83rd St. Santa Fe Ter.	7:27	8:27	9:27	10:27
		♿	♿	♿	♿

Horizontal Schedule Alignment

Monday-Friday every hour.			
Eastbound			
Ⓐ NW 83rd St. Santa Fe Ter.	Ⓑ NW 23rd Ave 43rd St.	Ⓒ NW 16th Ave. NW 13th St.	Ⓓ Univ. Ave. NW 13th St.
7:27	7:36	7:43	7:48
8:27	8:36	8:43	8:48
9:27	9:36	9:43	9:48
10:27	10:36	10:43	10:48
11:27	11:36	11:43	11:48
12:27	12:36	12:43	12:48
1:27	1:36	1:43	1:48
2:27	2:36	2:43	2:48

C.2 Are you aware of any published guidelines on the design of printed information materials?

Yes	□ 1	No	□ 2

If yes, do you use any published guidelines when designing your printed information materials?

Yes	□ 1	No	□ 2	Don't Know	□ 3

If yes, please provide the names of the publications you use…..

SECTION D – DESIGN ISSUES

D.1 Which of the following printing formats do you use? Please check all that apply.

One color	□ 1	Four color	□ 2	Black and white only	□ 3	Don't know	□ 4

D.2 Do you print schedules for all your services, or just the services running above a certain frequency / headway?

All services	□
Only services running above a certain frequency	□
Don't know	□

D.3 If you only provide schedules for services running above a certain frequency/headway, please specify this frequency/headway.…….. | |

D.4 Approximately what percentage of your ridership cannot speak English?..... | |

D.5 Do you provide printed bus service information materials in multiple languages?

Yes	□ 1	No	□ 2	Don't Know	□ 3

If yes, which languages (besides English)?..... | |

D.6 Do you provide instructions on "how to use" your printed information materials, either as a separate leaflet or incorporated into existing schedules / maps?
Please check all that apply.

Instructions provided within existing materials	☐
Instructions provided in separate leaflet	☐
No instructions provided	☐

D.7 If you provide a ride guide / schedule book, do you charge your customers for it?

Yes	☐ 1	No	☐ 2	Don't Know	☐ 3	Don't provide a ride guide	☐ 4

If you charge customers for it, how much do you charge?..... $

D.8 Do you provide any other information on your printed information materials such as ADA related issues / security / disclaimers / contact information for other transit providers / etc?

Yes	☐ 1	No	☐ 2

If yes, please provide details below…..

D.9 Please provide details of any workshops or other events staged to educate your users on how to use your printed information materials.

D.10 Please list any problems / issues / customer complaints experienced in relation to your printed information materials? Do you have any suggestions for addressing these issues?

D.11 Have you ever undertaken a major "overhaul" of your printed information materials?

Yes	□ 1	No	□ 2	Don't Know	□ 3

If yes, when did you last conduct an "overhaul"? (please enter year)...
Proceed to next question. (If no, please proceed to Section E).

D.12 Why was this major overhaul conducted?

D.13 As part of the "overhaul" process, did you conduct any market research such as (focus groups) to gain insight into customer preferences for the design of the materials?

D.14 Were any impacts observed as a result of the overhaul? For example, any changes in ridership or impacts on customer satisfaction?

SECTION E - PRODUCTION

E.1 On average, how often do you re-print your **bus schedules**, to retain consistency with service changes?..... ☐

E.2 On average, how often do you re-print your **system map**, to retain consistency with service changes?. ……. ☐

E.3 Please indicate in the table where each of your information material types is produced **(please check one box in each row).**

	Produced "In-house"	Subcontracted out	Not provided by our agency	Don't know
System Map	☐ 1	☐ 2	☐ 3	☐ 4
Route Map / schedule leaflets	☐ 1	☐ 2	☐ 3	☐ 4
Ride Guide / Schedule Book	☐ 1	☐ 2	☐ 3	☐ 4
Other materials	☐ 1	☐ 2	☐ 3	☐ 4

If you design any of your materials "in-house", what software package(s) do you use?

☐

E.4 On average, how many weeks do you have from the time "Scheduling" finishes the master schedule to the time public schedules must be printed?..... ☐

SECTION F – DESIGN MANUAL

F.1 Would you be interested in receiving a copy of the "Printed Information Material Design Manual" once it has been published?

Yes	☐ 1		No	☐ 2

F.2 Please list below anything you think should be included in the manual, or any other comments on manual content.

☐

F.3 Please provide us with current copies of your printed information materials, and indicate below which materials you are sending us.

System Map	☐
Route Map / Schedule leaflets (two examples)	☐
Ride Guide / Schedule Book	☐
"How to Ride" Information Leaflet	☐
Other (please specify)……	☐

RETURNING YOUR COMPLETED QUESTIONNAIRE AND EXAMPLE MATERIALS

Please return your completed questionnaire and copies of your printed information materials **BY WEDNESDAY NOVEMBER 1**, using the envelope provided.

You can also complete the questionnaire online at:
http://www.surveymonkey.com/s.asp?u=141652630708

If you have any problems completing the questionnaire, or wish to clarify any of the questions, please contact Alasdair Cain, (813) 974-5036, cain@cutr.usf.edu

THANKS FOR YOUR HELP!