Table of Contents

Key Choices ................................................................. 5

Key Choice: What is the role of the map in the public information system? .......................... 5
  Trip planning vs network awareness ................................................................................. 6
  Internal reference ............................................................................................................... 6
  Non-service information ................................................................................................... 7
  Political and public relations ............................................................................................ 8
  Transit agency priorities ................................................................................................... 9

Key Choice: What distinctions should be shown among services, and why? ......................... 12

Key Choice: How should detail and accuracy be traded-off against clarity and ease-of-use? . 21

Key Choice: Should other agencies’ services be shown? If so, how? ................................. 23

Key Choice: How should maps be published and distributed? ........................................... 26
  Interactive maps ............................................................................................................. 27
  Printed maps .................................................................................................................. 30

Emerging Best Practices .................................................. 34

Frequent Network maps .................................................................................................... 34

Design choices .................................................................................................................. 37
  Geographic vs. diagrammatic .......................................................................................... 37
  Secondary information .................................................................................................... 40

Trip Planning Tools .......................................................................................................... 41
  Agency role in ecosystem ............................................................................................... 42
  Real-time data ................................................................................................................ 42

General Web Survey Results ............................................................................................ 45

Map Testing ....................................................................................................................... 59
  Tested maps .................................................................................................................... 59
  Other cities’ maps .......................................................................................................... 59
Table of Contents

Sample AC Transit Maps........................................................................................................ 63
AC Transit Map Sample, “Grey”............................................................................................ 65
AC Transit Map Sample, “Green”......................................................................................... 66
AC Transit Map Sample, “Tan”............................................................................................ 67
Existing AC Transit Map........................................................................................................ 68
Focus Groups....................................................................................................................... 69
  Major observations............................................................................................................. 69
Web Survey........................................................................................................................... 77
  Survey participants............................................................................................................. 77
Testing the Three Map Samples............................................................................................ 79
Opinions of Map Samples...................................................................................................... 83
Favorite Map......................................................................................................................... 85
Distinctions............................................................................................................................. 86
Opinion of Current Map......................................................................................................... 90
Cross-Tabulation.................................................................................................................. 91
Open-Ended Comments........................................................................................................ 93
  Major Observations from the Web Survey........................................................................ 93
Recommended Next Steps.................................................................................................... 95
  Plan for a New System Map............................................................................................... 95
  Hold an Internal Service Categorization Workshop........................................................... 95
  Communicate Frequency and Span Information Through Service Labels......................... 96
  Identify the Affected Suite of Map Products..................................................................... 96
  Procure a New Mapping System....................................................................................... 96
  Support the Continued Development of Other Tools........................................................ 97
1 Key Choices
Key Choices

In the fall of 2015, JWA conducted a review of AC Transit’s peers, with respect to their transit map decisions, designs and practices. This involved a survey of public materials from 16 peer agencies, and phone interviews with staff members at six agencies.

As a result of this peer review, we have identified a set of key choices that are the most important and, often, the most difficult to make before redesigning a transit map. These choices are about more than just design, and relate to the role of the map in a transit agency’s public information system and to the overall goals of transit service.

None of these choices can be made without an awareness of the others. They are related to one another, and to lesser choices. However, in order to prepare AC Transit staff to make decisions about future transit information and transit maps, we have teased them apart into the following:

- What is the role of the map in the public information system?
- If distinctions among services are shown on the map, what are they, and why show those distinctions and not others?
- How should detail and accuracy be traded-off against clarity and ease-of-use?
- Should other agencies’ services be shown? How?
- How should maps be published and distributed?

Each of these key choices is described below, with illustrative examples from peer agencies. Additional choices, and technical best practices, are summarized in later sections.
from peer agency staff that past attempts to emphasize too many of these purposes at once resulted in frustration and disappointment with the product. Agencies that focused on just one or two purposes in the most recent redesign of their maps - in particularly, TransLink, WMATA, SFMTA and TriMet - have expressed satisfaction with the results.

Some of these purposes trigger certain design considerations, and difficult decisions, which we describe briefly in this chapter and in chapter 2.

**Trip planning vs network awareness**
There is a real but subtle distinction between two of these purposes. We have split them into:

**Trip planning**, which describes when a person discovers that they need to make a trip among known locations. They then seek out information on how to travel between those locations. They might pick out those locations on a map, and see which lines go between them. Or they might ask a trip planning app, or a person, for directions.

**Network awareness**, which describes general knowledge that a person holds about the transit system and how it relates to their life. Trip planning is analogous to traveling based on left-right directions, while network awareness is like having some sort of map of your city in your head. Most people use a mixture of these, but network awareness is the only way to have a general sense of how to get around a city.

People may not grow their network awareness deliberately, but rather come by it casually over time, after being passively exposed to information about the transit system. Physical cues (such as bus stops, buses, rail stations or tracks) can contribute to network awareness. An agency’s maps can contribute to network awareness, allowing a person to discover transit service in places they care about.

A system map designed to grow network awareness will inform people’s short- and long-term travel decisions (such as where to meet someone for coffee tomorrow, or look for a job, or invest in property) and allows what one peer described as “discovery.” This is different from the type of awareness that a trip planning app delivers.

A trip planner answers the question, “*How do I get from here to there?*” In order to gain awareness from a trip planner, a person must first have a certain trip in mind. A map can answer the broader question, “*How much of my city is easily accessible to me?*” A map can also build someone’s awareness before they even think to ask a question.

**Internal reference**
Many transit agencies’ first system maps were designed for staff use, and simply released to the public. Small agencies are more likely to continue this tradition than large agencies. Today, these maps tend to be published from GIS software, with little modification. They show details that are very relevant to operational staff, but less relevant (or totally irrelevant) to the public.

In the distant past, some transit system maps color-coded bus lines based on the garage that they came out of. While that service feature is obviously completely irrelevant to riders, there are a number of features that may have minor relevance to riders, or relevance to a very small number of riders, but are very relevant to staff and are therefore included on the map.

These features can include:

* the turnaround at the end of a route;
* precise lines showing circulation within transit centers;
* the vehicle size (big buses vs little buses) or type (streetcars vs buses);
* garage locations; or
* routing on freeway ramps or other roads without stops.
These details may be in GIS shapes for each route, and are therefore included de facto in public-facing maps. Some of this detail is included in the Minneapolis Metro system map, shown in Figure 1.

In regions where service areas overlap, and fares are well-integrated, one could even argue that information about which agency is operating a transit route is more relevant to agency staff than to riders!

A system map may also be used by customer service staff. Interactive maps and GIS tools have the potential to eliminate the need for printed maps to serve this purpose. Maps that can be zoomed and panned, with layers turned on or off, can be an effective way for well-trained customer service staff to identify a customer’s situation and options, and then to identify details.

Non-service information

Large transit agencies often maintain a “suite” of map products - not just a single system map, but maps whose scale and design are customized to different settings, such as stations, bus stops, trip planners and printed flyers. This suite often includes a station- or stop-area map that details the area within walking distance of that particular station or stop.

Aside from this specific map-product, which is designed for specific locations, there is a larger question of whether a system map’s purpose is to help people make the non-transit parts of their trips. Or even to aid trips that don’t include transit at all. For example, a transit system map might include:

- Lines indicating every street, major and minor
- Name labels for every street, or only certain streets
- Carpool or HOT lanes on freeways (as in VTA’s system map, in Figure 3)
- Location of car or bike parking, at or away from transit stations
- Freeways and railroads
- Points of interest, such as universities, medical centers, shopping malls, parks, etc.
- Waterways

These layers of information can help people make a walking, cycling or driving trip to or from transit, or even to make a trip that doesn’t involve transit.

There is another map design decision that relates to this purpose, and that is whether to show distances in constant proportion, or to sacrifice that type of accuracy in pursuit of some other purpose. Showing distance in constant proportion, and also showing more information about streets, makes a map a more reliable reference for walking, biking or driving.
Finally, non-service information on the map - like all other additions of detail - can contribute to “crowding” and “information overload.” Decisions about how much transit and non-transit information to include on a map will bump up against this trade-off.

**Political and public relations**
A minor consideration among some of the peer agencies we reviewed is how the system map makes service allocation look to the public or decision-makers, in a political or social context:

- Does the map show service to all neighborhoods?

  - Are differences among neighborhoods in service quality - related to speed, vehicle technology, frequency, span, or parking - made more or less obvious by the map?

  - Are politically-important buildings, businesses, organizations and neighborhoods labeled (if they want to be) or not labeled (if they don’t)?

  - Is there service in each member county, city or district?

No agency holds this as a major purpose of their map, but it was hinted at in some of our interviews, and it is surely an important but softly-spoken consideration at many agencies.
A map that makes certain service features visible will probably reveal differences that were once invisible to decision-makers. In fact, even transit service planners may be affected by such a change. A few years ago, SFMTA was simultaneously redesigning its map and working on its Transit Effectiveness Project (a network and service redesign process). Early drafts of the new map were shown to service planners, and drew their attention to now-visible differences in service allocation to different places. The planners prepared more thoughtful and well-grounded explanations for those differences than they might have, had the map not made the differences so obvious.

We can imagine that an agency whose overriding goal (stated or unstated) is to prevent accusations of unfairness from reaching its board would be much more comfortable publishing a system map that shows every transit route as equivalent, than one that reveals differences in transit usefulness or quality across neighborhoods. This may be particularly true in smaller transit systems where ridership is low and lifeline coverage to all places is important.

Agencies may also decide how prominently to show certain services based - consciously or unconsciously - on who would find them useful. The most common example of this is to show peak commuter express routes very prominently, because decision-makers can imagine themselves riding those routes. Alternately, there may be a principle at work that the more “choice” a rider is, the less effort they’ll put into figuring out the transit map. Thus the louder the map must announce certain services specifically to them. Whatever the thinking behind it, many agencies do show their peak-only suburb-to-city commuter expresses in prominent colors and lines, as can be noticed (in bright red lines) in VTA’s system map in Figure 3.

Political boundaries - such as county or city lines - are often included on transit maps. These may be useful to help people orient, or to show where an agency’s service area ends (as in Figure 4), or to make a more subtle point about the way service is allocated in a among the different political territories. They may also be included automatically, if the underlying background basemap includes such information.

Transit agency priorities
A transit agency may have future investment and development priorities, or current preoccupations, that affect the design of the map.

Most obviously, if an agency is planning a major capital investment - such as a light rail line - staff may decide to include the future line on maps
before it is usable by riders. BART maps, for example, usually show intended extensions as well as the existing system, at the expense of introducing complexity that is not helpful to someone traveling today.

More subtly, a transit agency may send signals about the priority and permanence of services through the design of the map. Capital investments in infrastructure like light rail lines and stations normally come with a long-term commitment to high levels of service. Agencies may also have a long-term commitment to high service levels on other routes, and these can be made visible on maps.

A map designed to show future priorities, and service permanence, could inform people’s decisions about where to locate a business, make a home, or develop property. Map design decisions would not just be based on where transit service is today, but also where service is planned for the future, and where the agency feels confident that useful service will operate for a very long time. In some systems, this set of routes might look very similar to the “frequent network,” or the “owl network,” or the light rail system.

If future priorities and permanence are conveyed by a transit map, it can be a great tool for transit agencies’ partners in city building:

- a housing authority has a better sense of where to locate low-income housing;
- a land use planner knows where to put higher-density uses; and
- a developer knows what parcels are truly transit-oriented, and will be for decades to come.

King County Metro’s system map calls out a future streetcar line in downtown Seattle, using a unique pale-pink badge, and a magenta note indicating when the line will be completed. This future streetcar is one of the most visible markings in the downtown area (and the competition is fierce!).

(In the cacophony of symbols, colors, lines and words on the King County map, places where ORCA cards can be purchased or given added-value feature very prominently. This may reflect a current preoccupation with ORCA, due to difficulties Metro has had in making the new farecard widely accessible to riders. It may be that as ORCA difficulties are solved with time, this particular purpose of the system map is dropped, and one element of the cacophony can be eliminated.)

Figure 5: King County Metro’s system map calls out, in unique bright pink text, a future Seattle streetcar line (“late 2015”), and places to purchase ORCA cards, among many other things.
Route Distinctions in System Maps

No Distinction
Each Route Unique Color
Destination

Frequency
Vehicle Type
Frequency and Vehicle
Key Choice: What distinctions should be shown among services, and why?

Most transit system maps make some distinction among transit services, rather than show all of them as equivalent. The major variations among AC Transit’s peer’s maps arise from this choice: Which distinctions should be made visible?

The table below lists some of the service characteristics that are often given the highest level of visibility on a map, with the brightest-colored, widest, or most permanent-looking lines.

Communicating all of these distinctions in a single system map is all but impossible in a network as complex as AC Transit’s. Based on our interviews with peer agencies, it seems that one key to success and satisfaction in map design is deciding which of these distinctions to emphasize over others, not only in map design but also in the labeling of services in other contexts.

When an agency delivers these service characteristics consistently within each service category or label, the system’s complexity is reduced, and the map designer’s challenge is smaller. For example, if all light rail lines run frequently, then there is no need to indicate different frequencies for different light rail lines. If all frequent bus routes run long daily spans, seven days a week, there is no need to indicate different spans of service among frequent bus routes.

**DISTINGUISHING INDIVIDUAL ROUTES**

One of the most common requirements put on transit maps is that readers be able to understand not just what routes are on a street in a given place, but where each route goes. In recent history, this has been accomplished by assigning each route a unique color, so that it can be distinguished from other lines on the map.

Assigning a unique color to every route is easy for small systems, but in large or complex systems, with many different overlapping routes, the array of colors can become dizzying, as in Miami (shown in Figure 6) and Minneapolis (shown in Figure 1).

Also, crucially, using color to distinguish neighboring routes means that color is not available to distinguish service characteristics. Color is an extremely impactful design motif, in any context. The human eye and brain are very sensitive to color, more so than to shapes, letters or numbers.

In addition, it is almost impossible for color to avoid suggesting some kind of hierarchy. Some colors grab attention more than others, and they send signals through qualities like “temperature.” Hot colors like red can convey excitement or danger, while cool colors like blue can mean either calm or unimportant.

These intrinsic emotional impacts of color can be misleading if the real intention is to convey that a

<table>
<thead>
<tr>
<th>Service characteristic</th>
<th>Commonly associated with...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability</td>
<td>Dedicated ROW; most rail; busways; frequency</td>
</tr>
<tr>
<td>Speed</td>
<td>Dedicated ROW; most rail; busways; freeways; HOT lanes; “Limited” or “Rapid” services</td>
</tr>
<tr>
<td>Interesting vehicles</td>
<td>Streetcars; cable cars; light rail; heavy rail</td>
</tr>
<tr>
<td>High frequency</td>
<td>“Frequent Network” or “Rapid” routes; light rail</td>
</tr>
<tr>
<td>Long span</td>
<td>“Frequent Network” or “Rapid” routes; light rail; “Owl” routes</td>
</tr>
<tr>
<td>Widely-spaced stops</td>
<td>Light rail; heavy rail; BRT; “Rapid” or “Limited” services</td>
</tr>
</tbody>
</table>
collection of different colored routes are more or less equal, and that they’re all working together.

If color is used to differentiate routes that are near one another on the map, then less-impactful motifs must be used to differentiate everything else. For example, Miami-Dade Transit uses thick orange and green lines to show their Metrorail system (as shown in Figure 6), but these thicker lines get lost in the array of colors.

Advances in both desktop publishing software and in map design thinking have made it easier to show nearby, parallel and intersecting lines clearly on a map, so that a person could follow a single route across the map without losing it among other routes. Thus the emerging best practice among large transit agencies is that color needn’t be put into service of distinguishing nearby routes, and can instead be used to show other distinctions.

WMATA’s system map (redesigned in 2012) uses a limited set of colors to differentiate among rail and bus services of different frequencies. Five different colors (red, dark blue, light blue, grey and black) represent five different types of service. This leaves the rest of the color spectrum available for differentiating something else, and WMATA has used it to show services run by other agencies - yellow, brown and green lines show buses run by the city and by neighboring counties (as shown in Figure 7).

Portland’s TriMet recently updated its system map, and moved away from using rainbow colors for bus lines. However, TriMet didn’t switch to

![Figure 6: On the Miami-Dade Transit system map, certain colors are used for light rail lines (orange and green) but they are hard to notice in the large array of colors used for all other transit services.](image)

![Figure 7: WMATA’s system map uses a limited palette for WMATA bus services, and another three colors for services run by neighboring agencies.](image)
using colors to distinguish span, frequency or other service characteristics, TriMet now uses colors just to show different light rail lines (each rail line is branded with a primary color). All bus routes are shown in the same color, blue. Line width and darkness make the frequent bus network visible.

The need for rainbow colors to distinguish adjacent or intersecting bus lines relates somewhat to service design. In places where many routes converge, but follow slightly different paths, it is harder for a person to recognize and trace those paths on a map, and notice if their bus route doesn’t go where they expect.

On the other hand, in places where many routes converge, follow major roads and serve the same set of stops, every route needn’t be drawn as unique. In the map inset shown in Figure 8, transit routes converge on the UC San Diego medical center from all over the county, but nearly every one follows a unique path through the area. This means that each route must be drawn as unique, so that people know exactly where it goes, and using rainbow colors distinguishes the lines from one another. The complexity designed into the service translates into complexity on the map. (And, often, such service complexity arises from features of the built environment, such as disconnected or unwalkable streets.)

If a rainbow of colors is not used to distinguish nearby lines from one another, and can instead be used to show some other distinction, the question then arises, Which distinctions are most important to show on a map?

DISTINGUISHING SERVICE FREQUENCY AND SPAN

There is a growing awareness in the transit industry that ridership arises from usefulness, and usefulness arises when transit is available not just where we want to go but also when we want to go. Thus frequency and span are becoming important service characteristics for transit planners, decision makers, and stakeholders. (For more about why frequency matters, see

Figure 8: TriMet’s system map uses line width and darkness to show the frequencies and spans of bus routes. Frequent routes are darkest, and peak-only routes are in thin, light, dashed lines.

Figure 9: Drawing every route in a unique colors helps distinguish services where their routing is tight and complex, as around the UC San Diego medical complex.
“Frequent Network maps” on page 34.)

For this reason, many agencies choose to show distinctions of either frequency or span (or both) on system maps. Doing so is easier when an agency’s overall service labeling is based on frequency and span, and this relates to service planning philosophies.

For example, if an agency divides its services into “Express,” “Local,” and “Neighborhood” but each label includes a mix of routes with different frequencies and spans, the translation into a classification system on the map is difficult. The “Local” service label could theoretically be divided into numerous sub-labels that are peak-only vs all day, weekday vs weekend, Saturday vs. Sunday, evening vs. late night, and more. Faced with such complexity, a map designer would have to choose between creating a dizzying, complex map and creating an inaccurate, unhelpful map.

If an agency already groups its services with some relation to frequency and span, this choice becomes much easier. For example, Portland’s TriMet has a set of bus routes that they brand and market as the “Frequent Network,” on which they maintain the bus network’s highest frequencies and longest spans. Thus when mapping bus routes, they needn’t choose between making distinctions of frequency visible, or distinctions of span visible. One category of service consistently offers the highest-levels of service in both respects.

In a predominantly gridded network, like Portland’s, most major streets are served by a single route. This means that indicating the frequency of each route almost always conveys the frequency on the street, as at top in Figure 10.

In some networks (particularly radial networks, or networks with many bottlenecks) frequency is provided not by a single route but by a combination of routes overlapping one another. TransLink uses an orange overlay to highlight streets on which one or more local buses create frequent

Figure 10: TransLink in Vancouver (middle) and TriMet in Portland (top and bottom) use two different techniques to show bus frequency.
service, as shown in the middle of Figure 10. Because TriMet uses line weight and darkness to highlight those routes that offer frequent service, branching that divides frequency can be handled elegantly: infrequent routes in thinner, lighter lines can be shown as combining into a thicker, darker line that represents their added frequencies (as shown at the bottom of Figure 10).

Whether to run a grid or a radial network, and how much to overlap routes as they approach bottlenecks or downtown...these are network design decisions that affect map design decisions. Whether to design and name the infrequent branches off a frequent corridor as unique routes, with unique names, or as branches of a frequent route with a single name...this is a service design decision that affects map design decisions.

As with many mapmaking challenges, how to show frequency - and whether it’s even feasible to show frequency, among all the other service distinctions - will depend on network and service planning and labeling decisions.

**DISTINGUISHING VEHICLE TYPE, RIGHT-OF-WAY**

Because TriMet runs its light rail lines at high frequencies, for long spans, that service type can be shown using a single type of line (though in different colors for each line, because of labeling decisions). Conveying service information (frequency and span) along with technology information (type of vehicle and ROW), without added complexity, became more difficult when TriMet opened a weekday-peak-only heavy rail line between two suburbs.

In designing their map products, TransLink and LA Metro each made certain decisions to set aside vehicle type distinctions, and focus on right-of-way and its reliability implications.

TransLink shows its “B-Line” bus lines (they are frequent and fast, with wide stop spacing and signal priority) in the same weight and brightness as its SkyTrain lines (as shown in the map legend in Figure 11). Thus frequency, speed

---

SkyTrain

- Canada Line
- Expo Line
- Millennium Line

High frequency rail service. Early morning to late evening.

Buses

- B-Line

Frequent bus service, with limited stops.

Regular Bus Service
Service at least once an hour during the daytime (or longer), all week, all year.

Limited Bus Service
Service only part of the day, week, or year, or less than once an hour.

NightBus Service
Late-night bus service (seven days a week)

**Frequent Transit Network**

Be spontaneous! There’s no need to worry about schedules when you travel on the Frequent Transit Network (FTN). Service on the FTN is every 15 minutes or better, during at least all of the following times:

- 6 a.m. to 9 p.m. on weekdays
- 7 a.m. to 9 p.m. on Saturdays
- 8 a.m. to 9 p.m. on Sunday and holidays

**FTN Services**

These transit routes provide FTN service from end to end:

- All SkyTrain lines
- B-Line bus

**FTN Streets**

On these streets, one or more bus services combined provide FTN service.

---

Figure 11: TransLink’s map shows B-Line buses in a thick orange line, similar to SkyTrain light rail lines (at top). It also highlights streets in orange when local buses provide frequent transit there (at bottom).
and reliability, which B-Lines and SkyTrains have in common, take precedence over vehicle technology.

(The orange color associated with B-Line buses is also applied, lightly, to local frequent bus corridors, as shown at the bottom of Figure 11.)

LA Metro made a similar choice with regards to its BRT lines, which are shown with the same line-weight and similar station symbols as rail lines. At the top of Figure 12, the Orange Line BRT is shown connecting with the subway, in red, at North Hollywood. The Orange Line also appears on Metro’s rail map (called “Go Metro,” in the middle of Figure 12), along with the Silver Line. The Orange and Silver lines both run in dedicated busways. The vehicle distinction (and the above-vs. below-ground distinction) is less prominent than distinctions of speed and reliability, within which BRT has more in common with rail than it does with local buses.

Figure 12: LA Metro’s BRT lines are shown in a similar manner as rail lines, based on their similar levels of speed, frequency and reliability.
Distinguishing among transit vehicles is particularly difficult in downtowns, where light rail, commuter rail, interstate rail and bus, streetcars, articulated buses, circulators, shuttles, historic streetcars and more tend to come together. Showing all of these distinctions into a small space results in a very crowded downtown in the King County Metro system map (as shown earlier, in Figure 5 on page 10).

San Francisco MTA shows the same plethora of vehicles as King County, but using just four colors: blue, red, gold and grey. To make this possible, some differences between vehicles were collapsed into larger categories:

- CalTrain and BART are shown in the same grey line;
- Historic cable cars and streetcars are both shown in gold;
- Metro (rail) and Rapid (bus) lines are the same color, though they use different vehicles and rights-of-way;
- A number of limited-use services (such as expresses and shuttles) are shown quietly, in blue, rather than in their own unique colors.

**DISTINGUISHING ROUTE ORIGIN AND DESTINATION**

Some transit agencies choose to show distinctions among routes based on where they go. The Richmond, VA, system map, shown in Figure 13 on page 19, uses line width to indicate weekday service frequency. Color is used to show which neighborhood a bus line connects to downtown.

This is no longer considered best practice, because with good map design (and good service design) the places a route serves should be easy to discover on a map, without color-coding. Colors or motifs that might have been used to show where a route goes can instead be used to show something that a person couldn’t
possibly discover from the route’s line alone.

Also, this color-by-neighborhood scheme presumes an entirely radial system, in which every route goes from Downtown to Neighborhood X. As Richmond’s travel demand patterns grow away from downtown, to the everywhere-to-everywhere patterns seen in most regions, crosstown routes become more important, but harder to color-code.

However, Richmond’s use of color does make it easier to see, in the downtown inset (shown in Figure 14), where there are concentrations of service to a given quadrant.

Figure 13: On the Richmond, Virginia, system map, lines are color coded based on where they go, though where a line goes should be easily discoverable on a well-designed transit map, without color-coding.

Figure 14: Coloring transit lines based on where they go does help show where, in downtown, service to one’s neighborhood departs from.
SamTrans uses color to distinguish between routes based on where they go (the legend and an excerpt of the SamTrans system map are shown in Figure 15).

Routes are color-coded based on whether they go to BART, or CalTrain, or both; whether they only run on school days; whether they are in the Coastside area; and whether they go to Pacifica or San Carlos. The emphasis on connections to BART and CalTrain and on school-days suggests that SamTrans thinks of their customers as either coming by rail, or riding to school.

Finally, some network maps color-code routes based on whether they go to downtown, cross-town, or in a loop (large or small).

Figure 15: SamTrans routes are color coded based on where they go - CalTrain, BART, the Coastside, and other places. This approach assumes that each route only goes to one of these places (or a special color is needed for combinations, such as dark green for routes that go to both BART and CalTrain).
Key Choice: How should detail and accuracy be traded-off against clarity and ease-of-use?

The human eye and brain are capable of very wide breadth and very deep detail at the same time - so a printed map can be large and also detailed. But when maps are displayed on screens (which have lower resolution than paper), and especially on small screens (like smartphones, or small map windows in trip planners) breadth and depth cannot be achieved simultaneously. One must be sacrificed for the other. This problem is even bigger for large systems (like LA Metro or WMATA), and for long systems (like AC Transit and Golden Gate).

When detail and accuracy are prioritized too much over ease-of-use, one potential outcome is that nobody looks at the map. This is what WMATA found, four years ago, when they examined their website page-view data, reviewed customer service requests, and conducted focus groups. They concluded that the complexity of their old map was preventing many people from taking advantage of the detail and accuracy it contained. Thus WMATA decided to sacrifice some detail, and some accuracy, in order to create a map that would be useful. This seemed especially urgent as WMATA customers began, more and more, to look for map information on small digital screens, rather than on desktop computers or on paper.

As mentioned above, mapping a transit network so that it appears simple and easy-to-use can only be done if it is actually simple and easy-to-use. Complex transit systems will force map designers to make an unfortunate choice:

1. Either leave off information that a large number of people will find very integral to a

Figure 16: The Washington, DC, system map from 2011 (at left) shows lots of detail, and draws background and foreground features at similar intensities. The 2013 map (at right) reduces detail and complexity, and also presents a clearer hierarchy of information, so that some information is visible from very far away or with only a quick glance, while other information is discoverable in the background.
transit service’s usefulness, or

2. Make a map that is so complex most people won’t succeed in reading it.

In highly complex networks, there are simply more unique routes that will cross one another, run parallel with one another, and compete with one another for space and attention on a map and in a legend. In transit network planning, complexity tends to arise from years of complaints and requests by small numbers of people, rather than from the desires of much larger numbers of (mostly silent) people. When this complexity is transferred to a map, the map is essentially showing information that is useful to very small numbers of people, at the cost of information that is useful to vast numbers of people.

When WMATA redesigned its map, one explicit goal was to reduce complexity in order to increase map “viewership.” In Figure 16, the area around the Tenleytown station can be contrasted between 2011 (at left) and 2015.

It is clear from this side-by-side comparison that maps are not to the same scale. In fact, the 2015 map is diagrammatic, rather than geographically accurate, and it does not show distances consistently. The consequences of this choice are discussed in the second chapter, below.

The 2015 WMATA map also does not show every line that every bus travels (such as in the blocks just north of the Tenleytown station, or around Friendship Heights). Also missing are the dark blue “express” labels along a single express route (the 37), minor parks, neighborhood names and, crucially, local streets. Without local streets, and without being drawn to scale, the new diagrammatic WMATA map isn’t nearly as helpful for non-transit travel (such as walking or bicycling) as the old one.

WMATA made the deliberate choice to remove this detail, knowing that some people would miss it, because the agency expects a much larger number of people to engage with a simpler, easier-to-use map. Yet the new map doesn’t just show less information; it also presents information hierarchically, so that readers can choose different “altitudes” at which to examine the map, and thereby choose how much detail they experience.
Key Choice: Should other agencies’ services be shown? If so, how?

In a region like the Bay Area, where multiple agencies provide overlapping services in many places, transit agency maps have the additional challenge of communicating how passengers can connect to other services to travel across service area boundaries.

The most common method of dealing with this issue is simply to show the other providers’ routes using one line type and color.

LA Metro has the most extensive example of this – its countywide service area encompasses more than 80 small cities that each operate their own transit services. On the LA Metro system map, the other providers’ routes are shown in a dashed grey line. (LA Metro couldn’t possibly show each neighboring system in a different color, as WMATA does, because there are so many of them.) The only way to determine which agency is operating the route is to decode the route label, which contains an agency prefix and that agency’s own number for the route. A table on the system map, alongside Metro bus frequency tables, decodes the other agency initials.

(In Figure 17, dashed grey lines in the background indicate other agencies’ routes. The label “SC757,” in the center at top, stands for Santa Clarita’s route 757.)

The smaller cities within LA County take different approaches - some show LA Metro’s network prominently, and their own alongside it. Others focus on their own network.

Figure 17: In LA Metro’s map, other agencies’ services are all shown in dashed grey lines.
Santa Monica shows only LA Metro Rail Lines (and future rail lines). Santa Monica’s map manages to look quite simple, despite showing every route in a different color, and many local streets, and copious points of interest.

Of course, once we consider that many transit trips into and out of Santa Monica surely involve LA Metro and Culver Citybus routes (which are invisible on the map) the simplicity of the Santa Monica map seems less a reflection of reality and more contrived.

Figure 18: Santa Monica’s transit system is fairly small, so the system map looks simple, despite using many colors and showing lots of detail. However, none of the transit services that connect to the city, run by other agencies, are shown, with the exception of LA Metro rail.
A transit agency could show each neighboring provider in its own color or style. As described above, WMATA’s system map uses a limited set of colors to differentiate among WMATA’s own bus services of different frequencies. Services run by other agencies - by the District, and by two neighboring counties - are shown in other colors, as in Figure 19.

Some agencies make a judgment about which are the most important neighboring services. For example, San Francisco MTA’s map shows BART and Caltrain services, but does not show the different bus services coming into San Francisco operated by Golden Gate Transit, AC Transit and SamTrans.

In places where other transit services are peripheral to the local agency’s main service goals, the other providers may not even be shown on the map at all. Three Portland suburbs have opted-out of the regional transit district and created their own small municipal networks. TriMet’s map simply adds a little text box directing the reader to visit their websites. While SamTrans shows all SFMTA routes on its map, in a single color, Golden Gate Transit shows only its own routes in San Francisco, along with BART and CalTrain. Golden Gate’s practice likely reflects its focus on getting commuters to the financial district and other major white-collar job centers in downtown, and for that purpose the local SFMTA routes are not relevant.

Figure 19: WMATA uses certain colors to show other agencies’ services in and around Washington DC. In the excerpt at right, Montgomery County routes are shown in green, though with no information about what type of service those green lines represent.
The ideal might be that one transit agency includes a neighboring agency’s services on its map, using the same service distinctions it uses for its own.

We are aware of one example of this approach, which LA Metro used in its “Every 15 Minutes” map. Because the map showed only frequent service, LA Metro was able to communicate something about neighboring services’ frequencies. In the excerpt shown in Figure 20, the routes provided by Montebello that offer at least 15 minute frequency are shown, along with Metro’s own frequent network.

This is the only example we have encountered in which multiple agencies convey something about service usefulness on a single map. For this to work on a system map (not a frequent network map), a pair of agencies would have to make their service categories line up well enough that they can use the same colors or line styles to mean the same thing. Before this is a mapping challenge for a pair of neighboring agencies, it is a service design and service labeling challenge.

Key Choice: How should maps be published and distributed?

With the enormous shift, in the past two decades, away from printed information and towards digital displays, questions naturally arise about whether and how maps should be produced. These questions include:

- With so many trip planners, should we even bother designing a system map?
- With everyone using such small screens, and their low resolution, CAN we even design a useful system map?
- If we do design a map, where should we put it?

In our review of peer agencies, we detected that those staff who had recently redesigned their system map were much more likely to think of it as a tool for network awareness than anything else. Their answer to the question, “Should we even bother?” would likely be, “Yes, because it
will show people how useful your network might be."

In the past, system maps were thought of as trip planning tools. Today we have a diverse set of tools for imminent trip planning, so that particular purpose of the system map has declined in importance. There are other purposes that can take its place, and guide the design of system maps.

Once a system map is designed for non-imminent-trip planning purposes, questions about how it will be viewed and how it should be published can be entertained with these new purposes in mind.

Interactive maps
Some agencies now offer interactive maps, which (unlike a PDF or a paper map) allow the user to increase the amount of detail, or even the type of information, displayed to them. Just as a Google map shows only the most major features when it is asked to display the entire state of California, but adds features with each successive zoom-in, an interactive map can show different levels of detail at different altitudes.

Not only that, but they also let the viewer consciously change altitude – see the big picture but then also zoom in to find the bus stop. This relieves the map designer of having to choose a balance between simplicity and clutter, making assumptions about what most viewers will be looking for. Printed maps will always be limited in their ability to do this.

Interactive maps do not yet make visible most the service distinctions discussed in this memo. They offer detail, but do not suggest any clear understanding of how the network could be useful.
In the insets in Figure 21, from TriMet’s interactive map, we see that with the broadest view - the scale at which we can see the entire network - all bus routes look the same. Only light rail lines and streetcars are made to stand out.

At a closer scale (in the middle of Figure 21), we can see some bus route badges. Zoomed in all the way, we can click on a bus stop to find out its stop ID (for real time arrival inquiries), and the routes that serve it. We can also access the kind of street and building details that are very helpful for walking trips.

Adjacent to the interactive map is a multi-modal trip planner; planned trips are shown on the interactive map, in a way that will now be familiar to anyone who has used Google directions. This style of mapping is also very useful for customer service staff, who need to be able to consciously move between big picture and detail.

Figure 21: Three screenshots from TriMet’s interactive map. While bus routes are currently shown in equivalent grey lines, regardless of usefulness, the map does allow the a person to customize altitude and level of detail based on the type of question they are trying to answer.
Minneapolis Metro was inspired by TriMet to create an interactive map, which accompanies their own online trip planner. Like TriMet’s interactive map, Minneapolis’s map shows all bus routes as grey lines. It also marks every bus stop, which makes the most transit-intensive places look cluttered with stops (as shown in Figure 22).

Other design decisions hamper the map, such as the very small size, the visual dominance of freeways (which are almost always irrelevant to a transit trip), and the lack of distinctions among services.

However, the Minneapolis interactive map integrates real time arrival information and trip planning with the mapped bus stops in a way that seems potentially very powerful. As shown in Figure 23, clicking on a single bus stop brings up real time info, trip planning links, and other helpful information. This is the type of integration between maps and real-time information that the best mobile trip planning apps offer.

At this time, none of the peer agencies’ online interactive maps or trip planners offer the functionality to show or use only frequent routes. This is partly constrained by the data source (often GTFS), in which frequency is not a required attribute of route lines. Some agencies, like TriMet, classify routes for internal purposes by frequency (which TriMet reports made its recent map redesign project much easier), but others may not have geographic data organized in a way that makes representing frequency easy in an interactive map.

The limitations of the two interactive maps described here are not inherent. An interactive map could, on a large enough screen, show meaningful distinctions among services at a citywide scale. Routes could be color-coded by frequency, span, reliability, or any other distinction the agency believes to be useful to customers. Real time information could be integrated with bus stop information.

With these improvements, can the interactive...
map replace the printed and PDF map for all purposes? Or only for some purposes?

Minneapolis Metro has decided that its interactive map will at least replace the PDF map. While Metro posts system maps at stations, and will mail people paper system maps on request, they have decided not to keep a PDF map up to date and no longer offer it online. The only digital map available is the interactive map.

Printed maps
TransLink, in Vancouver, BC, thinks of their map as a “suite” of products, rather than a single static map. The suite includes the maps that are posted at stations and transit centers (shown in Figure 24 on page 31), within vehicles, online, on timetables, and in public service announcements and advertisements. Each of these maps is scaled and detailed to the specific job at hand. The data in the system map underlies all of them.

Some agencies make even more of an effort to tailor their station maps to trip planning. LA Metro and TransLink both have very complex, large-size system maps that may be overwhelming to somebody standing at a transit station who simply wants to know where they can go from that point.

Both agencies make a suite of more specialized maps showing bus lines departing from each station, as well as nearby pedestrian destinations, which they call “Walking From [Here].” At a station, a large system map would be a poor tool because using it requires a person to first find their current position in the network, reorient themselves in their mind to reconcile the direction they are facing and “up” on the map, and then decipher a small area of the map at a smaller scale than they might prefer. What’s more, the general system map is likely to be too zoomed-out to show the pedestrian network or nearby points of interest.

TransLink also produces “Buses From [Here]” maps, which show only those transit routes that serve the particular station where each map is posted. (Examples of the TransLink “Walking from [Here]” and “Buses from [Here]” maps are shown in Figure 24 on page 31.)

(A major potential impediment to maintaining such a suite of maps is technology. LA Metro’s maps are all drawn, rather than based on imported geographic data. Every service change must be hand-corrected in every LA Metro map product. At TransLink, map data is mostly geographic, rather than hand-drawn, and so it is much more reasonable for staff to maintain a suite of maps and constantly keep them up-to-date.)
Figure 24: TransLink in Vancouver, BC, publishes and posts location- and mode-specific maps as well as a system map.
Some agencies don’t produce a suite of maps for different purposes, but do publish their map in multiple tiles. This is generally because of an irregular or enormous service area. LA Metro will soon produce map tiles, which will each show greater detail (including other agencies’ services) than can fit on their current whole-county system map.

Golden Gate Transit’s service area is very long, and the urban places are separated by big rural spaces and by the Bay. For these reasons, Golden Gate produces a map in four tiles - Sonoma County, Marin County, Richmond and downtown San Francisco. As a result, it is hard to get a big-picture idea of where one could go on Golden Gate Transit. However, the service is so thoroughly designed around travel to and from San Francisco that it may not be important to the agency to help people develop an awareness of other places they could go.

All agencies we reviewed still print a system map, not only for posting at stations but also for those customers (or organizations) who value having a printed copy of their own. The printed map is expensive to print and distribute (not to mention expensive to design and keep up-to-date, even before it is printed). The emerging best practice among large agencies seems to be to offer it for sale, or upon effortful request, but not to distribute it widely for free.
2 Emerging Best Practices
Emerging Best Practices

In order to take a map from the conceptual stage (when its purposes are defined) to a real document, it must be designed. How well a map actually accomplishes its purposes arises from the quality of the design process, and from the skill and thoroughness of the designers. Both could be described as “cartography.”

Transit maps are a difficult design task, requiring careful attention to a multitude of factors. The task of the designer is to select and represent the most important information possible at a given scale, without overwhelming the map reader. Some of the areas in which cartographic and design expertise have a very positive effect are:

- How space is represented. Many of the most famous transit maps, such as those of the London Underground or New York City subway, reduce real geographic space to a diagram. The diagram represents the structure of the transit network in a simple manner, rather than showing how the network relates to real distances.

- How lines are represented. While the classification of services will guide the color and style of lines, the designer will also need to decide how to draw parallel and intersecting services, and the level of routing detail to show. A direct import of GIS data about each route’s exact turns is not necessarily the right amount of detail for the map.

- The use of text. Insets from maps by King County Metro (shown in Figure 5 on page 10) and WMATA (before it was redesigned, shown in Figure 16 on page 21) demonstrate how cluttered a map can become with text. Decisions about what text to include and what to leave off, as well as decisions about fonts, color, capitalization and weighting will enormous impacts on the usefulness of a map.

- Non-transit information. How much secondary info about streets, points of interest, parks, hospitals, and all the other places people might want to travel is shown? What are the criteria for the selection of these elements of the map? Again, a direct import of geographic information may not achieve the desired outcomes. Details like every public right-of-way, freight railroads, the exact outlines of greenspaces, minor parks, freeway ramps and precise shorelines (especially at ports) should each be considered and sometimes simplified or eliminated in support of the map’s purposes.

Frequent Network maps

Many cities now produce a separate system map that only shows frequent services. This seems to be particularly important in places where the system map is very complex.

LA Metro once produced the “Every 15 Minutes or Better” map (referenced with regards to showing other agencies’ services, on page 26, and shown in full in Figure 27 on page 35). Service cuts in recent years have decreased the size of the frequent network in LA, so Metro no longer produces the standalone map.

A private citizen in Seattle has begun producing a similar map, that shows very little of the copious detail included on the King County Metro map. It shows only services that come every 15 minutes, or better, and also leaves off a lot of the other information included in the King County system map. The two are shown side-by-side, in Figure 28 on page 35.
Every 15 Minutes (or Less)

The service shown on this map usually runs every 15 minutes during daytime hours — and often more frequently.

Figure 28: A few years ago a volunteer began publishing a frequent network map for Seattle (at right), to supplement the system map published by King County Metro (at left). Not only his focus on frequent services, but also improvements in text, labelling, color and shapes all make the map easier to read.

Figure 27: LA Metro used to produce a standalone frequent network map.
Why does frequency matter so much that the frequent network would be drawn on its own map? In most places, frequency is the service characteristic that has the greatest positive impact on travel time and reliability, and therefore on ridership.

The higher a route’s frequency:

- the less time you spend waiting
- the sooner another bus is coming, if something unfortunate delays your bus
- the faster it is to transfer between services
- the more likely it is that you can travel when you want to travel.

The other reason that showing frequency matters so much is that it is the service characteristic that has no analogy in driving. The effects of speed, reliability, congestion, even crowding can be understood somewhat by people who mostly drive, and they can imagine how they might affect the usefulness of transit. But frequency simply does not exist for private motor vehicles.

A driving analogy for frequency would be if someone’s garage door only opened once every 60 minutes, and in order to drive to work, they had to be sitting in the car, keys in hand, ready to dash out, when the door opens. The idea that a trip cannot begin until an event that is controlled by other people allows it to begin is hard to imagine for someone who has never made transit part of their regular life.

For this reason, people who don’t use transit tend to evaluate transit proposals with far too much focus on speed, right-of-way, and vehicle type (which all have parallels in car-commuting) and far too little focus on the frequency of service the agency will be able to operate. This is a very good reason, though a rarely contemplated one, to make frequency visible to the public. Doing so teaches a large number of people – riders and non-riders alike – what makes transit useful, and therefore what they should ask for, and ask about, when considering their own community’s transit choices.

There are reasons an agency might hesitate to produce a frequent network map. Perhaps, as in LA, the size of the network is or has become smaller than the agency wishes to advertise. Or the agency may not want to emphasize how unevenly frequency is distributed across the service area – frequent services tend to be concentrated in places where density is higher, activity is higher, and walkability is better, generally in the older core of big urban areas. This isn’t very noticeable on a map that shows every line as the same, but on a frequent network map it may really jump out, and cause people in low-density suburbs (or anywhere else without frequent transit) to see what they are missing.

The other reasons an agency might hesitate to show frequency, either on a system map or a standalone frequent network map, is if they get hung up on exactly what degree of frequency and span should qualify. Should it be frequent on weekends, as well as weekdays? Does it need to be frequent until 7:00 p.m. 9:00 p.m. Midnight? Is 15-minute frequency really adequate, or should the standard be 12-minutes?

An overly-forgiving definition would mean that the frequent network map (and label) means little, and doesn’t work for the time-sensitive rider. An overly strict definition might mean that very few lines qualify.

We would advise an agency to simply start where they are. Define the frequent network in a way that is reasonable for the current system, and advertise it clearly and honestly. Show it to the public, and meanwhile, set long-term goals for the standard of service that the label represents.

It may be that producing a separate frequent network map is only an interim best practice, and that the ultimate best practice in this regard is for the frequent network to be so plainly legible in the system map that no separate map is needed.
Design choices

Geographic vs. diagrammatic
When drawing a map of a transit system, one of the first choices the designer must make is how closely to adhere to the real geography of the service area. Simplifying that geography, by adjusting area sizes and distances, can improve clarity and can also help fit the map within a desired shape or size page (Santa Monica’s map, shown in Figure 18 on page 24, shortens the distance between east and west to accomplish this).

One of the most famous transit maps of the 20th century, Massimo Vignelli’s 1972 map of the New York Subway (shown in Figure 28), created a trope that persists among transit maps to this day: the geographical contours of the system and of New York City were reduced to simple 90- and 45-degree angles. Even the land masses were broadly represented this way.

The original inventor of this style was actually Harry Beck, in a 1933 map of the London Underground that continues to inform Transport for London’s mapping style. The style is now commonly used in many rail transit systems around the world. (And now agencies like LA Metro are using it to convey the rail-like attributes of their BRT services! See Figure 12 on page 17.)

Doing away with details like the relative distance of different subway stations, or any information about the land around them, vastly simplified the look of the subway network, but sacrificed other purposes. For one, the map was not useful for estimating walking distance, so a person dealing with a service interruption couldn’t use it to decide whether to walk to another station. (In response to this, Transport for London recently created a “Walk the Tube” map, showing walking distances between each station pair.) The map also did not give an accurate sense of travel time on the subways.

Figure 29: Massimo Vignelli, and before him Harry Beck, designed subway maps that discarded geographic accuracy in favor of diagrammatic clarity.
Vignelli’s transit map has been one of the most influential in the United States. In New York, though, it lasted only until 1978, when a more geographically accurate rendering was introduced after customer complaints. Since then, however, redesigns of the New York map have continued to balance geographic accuracy with schematization and even intentional distortion. Some distortions are no longer even controversial. For example, all New York transit maps, including Vignelli’s original version, show Manhattan to be much wider than it actually is, simply because the transit system is so intense there and needs extra room to be clearly shown.

Different maps turn geography into a diagram to different extents. For example, on WMATA’s map substantial simplification has rendered many routes at 30, 45, 60 or 90 degree angles.

The images in Figure 30 compare an excerpt of WMATA’s diagrammatic map (on the left) to the actual paths of the routes (on the right, as shown by Remix).

Note the straight path drawn for routes D5 and D6 along the river, at left in Figure 30. A more geographic map, at right, reveals that these routes in fact follow a somewhat wiggly path. This type of simplification is also evident in the routing of D2 (which is revealed to be very wiggly, by the yellow line in the geographic map at right); only an approximate shape has been shown (at left), and the size and distance of each segment have been adjusted for greater clarity by increasing the separation between the route and nearby features. In places, this could potentially give someone a mis-impression of walking distance between routes D2 and D5, or other potential connections.

Another common and subtle application of diagrammatic design, rather than geographic design, is to condense routes running on one-way couplets into a single line. This improves the clarity of the map, makes the map a less-accurate aid for walking to service, especially for visitors who don’t know a city’s one-way couplets well.

Figure 30: WMATA’s new diagrammatic map of DC transit service (at left) simplifies curves, loops and angles, and changes distances, compared to the geographically accurate transit routings (at right).
Many transit maps show an extremely accurate image of the geography and network. Consider Miami-Dade Transit’s map, which includes a detailed shoreline, where every canal, dock and inlet is visible. This map also includes details of the transit information that are not useful for many passengers, such as end-of-line turnaround loops and circulation within large parking lots.

TransLink’s transit map shows all transit routes with correct proportionate distances. However, the agency recently began smoothing and simplifying the shapes on its maps. Figure 32 shows the same section of the map, in 2011 (top) and 2015 (below). Features like coastlines, the boundaries of parks, and route lines are all more precise in 2011 and more smooth and approximate in 2015.

This has the effect of reducing detail and noise in the background of the map, and allowing the
information that is most important to the greatest number of people - the transit routes - to dominate.

To be an effective way finding tool, or tool for gaining network awareness, a transit map must depict geography accurately enough so that people can orient themselves, and also show clearly the shape and usefulness of the transit network. Vignelli’s map focused to such a great extent on the second that it completely neglected the first; the result was an iconic diagram that helped you navigate inside the subway system but left people confused about how the subway related to the geography of the city.

Miami’s map, and in some ways AC Transit’s current map, are so focused on geographic accuracy that network clarity is lost. These maps work better as walking maps than as tools for network awareness or for discovery of the transit system. A successful transit map will strike a balance between the two; the correct balance will depend on the purposes of the map.

Secondary information
Careful thought should be put into how much secondary geographic information (roads, water, parks, points of interest) is presented, and how it is presented. It creates a solid base for orientation, but should not distract from the focus on transit awareness or transit travel.

ROADS
Streets and roads used by transit are a critical feature of a transit map, since they are almost always where transit operates, and they help to relate the transit service to the known geography of the city.

A hugely detailed street map, however, can be a distraction. The emerging best practice is to focus reader attention on primary and secondary arterials, and minimize or remove small residential streets. Small streets can be shown with a finer line weight, or omitted entirely. Dead end streets should probably not be shown at all, unless they lead to a major destination.

Many Bay Area maps handle roads in the same way: there is no hierarchy, so all roads are shown with the same line weight. Some are labeled, but there is no way for someone unfamiliar with a particular area to tell from the transit map which roads are major, and which are just neighborhood streets. We know that some streets are relevant to large numbers of people, for large numbers of trips, while others are relevant to only small numbers of people. (The extreme example is the tiny cul de sac, which is relevant only to the dozen people who live there.) The presentation of streets in a transit basemap should reflect these differences in relevance.

WATER, PARKS
Among many recently designed transit maps, the emerging best practice is to carefully select base map features so that major geographic landmarks, like large parks or rivers, are present, but minor features that will be useful to small numbers of people are shown subtly, if at all. This choice helps to oriented users to the large-scale shape of the city – of which water and large greenspaces are a part – without losing them in detail. This is a process of simplification similar to the one shown in TransLink’s maps, in Figure 32.

TriMet made a similar shift in its map design. Prior to 2015, every small park was shown. These numerous parks collided with place labels, route labels, lines, and other features. The 2015 TriMet map shows only the largest parks and greenspaces, and creates much more open visual space in which more relevant information can dominate.

POINTS OF INTEREST
The other common feature present on transit maps is points of interest: certain places that the map designers believe are important to the transit system. These often include major civic institutions, such as universities or city halls, as well as schools, airports, or hospitals.
Points of interest can be thought of as serving two purposes. The first is to show somebody trying to plan a trip exactly where on the map they are going. The second is to provide a general set of locational references everyone is likely to be familiar with, so that people can use them as an approximate destination or for orientation when looking at the map.

With that in mind, points of interest should be selected that are either a) important destinations accessible from the transit system or b) major city landmarks, and which are of interest to many people throughout the day. They should be symbolized in a way that prevents them from distracting from the transit services - their symbols and labels should always be less prominent than those of the transit lines, transit centers or stations.

One common danger in selecting points of interest is to inadvertently signal that transit is only useful for people with severe needs. Featuring the Social Security office, the Immigration office, workshops for developmentally disabled people, public health clinics, and the jail is considerate of those people who need to access those services, but it can also send an unhelpful signal to the larger population about who transit is useful for, especially if these points of interest dominate the map. The selection of points of interest should convey a diversity of interests and uses, for a diversity of people, to avoid giving this mis-impression.

WMATA sometimes wrestles with how many points of interest to show on DC transit maps. Foreign embassies, in particular, each have their own vocal and impassioned constituency, who hope to see themselves on the map. Similar issues arrive with houses of worship, neighborhoods and cultural institutions.

HANDLING COMPLEXITY (AGAIN)
The most important element of a transit map, and the most numerous feature type, should be the lines representing transit routes. Now that GIS and map design tools are so widespread and accessible, it is a simple matter to visualize the shapefiles of a transit agency’s routes, but it is a challenge to render them clearly. The task of the cartographer is to take the collection of undifferentiated, overlapping shapes and arrange them to accomplish these goals.

In large part, this cartographic task can be thought of as revealing useful patterns of service, and avoiding an impression of sheer complexity.

Trip Planning Tools
Google Maps transit planning is nearly ubiquitous in U.S. cities, and third-party apps are quickly catching up. The biggest question about the usefulness of trip planners today is whether they use real-time, rather than scheduled, service data.

All of the peer agencies we surveyed host trip planners on their websites, either their own trip planners or third-party planners.

Whether a trip planning app is under the agency’s control or a third-party seems to matter little to customers as long as they can easily find a good trip planner. Google Maps integrates trip planning with interactive transit maps, in many cities, which may outpace projects like TriMet’s and Minneapolis Metro’s interactive maps.

If trip planning apps are best provided by the private sector (and thus far they seem to be), it means that big agencies in big cities will probably get the latest innovations in trip planning much faster than small agencies in small towns. This is because the potential market for their use is bigger in big cities, where transit is much more relevant than in small cities, and the private sector will respond to the market. (This is the same reason Uber has been in California for a long time, but won’t get to North Dakota for a while yet.) Because AC Transit is in such a big state and big metro area, it should benefit from the eagerness of private app developers to continually innovate and improve transit-related products.
Agency role in ecosystem
When we surveyed members of the public about which apps or mobile websites people consult when planning a trip, Google Maps was the most common response, and other third-party apps commanded not-insignificant shares of the market as well. These technologies are often easier to use and more available than transit agency products.

This suggests that while many transit agencies offer their own internally-developed trip planner, they also play a crucial role in enabling the development of trip planning apps by the private sector.

The most important action an agency can take to improve the availability and quality of trip planning is to rigorously maintain their GTFS and real-time location data in such a way that developers always have access to the most accurate and up-to-date information. AC Transit, along with most other large transit agencies, are doing so.

Real-time data
Real-time data has a key role in trip planning. It is not relevant when customer is considering their options days in advance, or exploring hypothetical travel times, so the real time element of a trip planner needs to be user-enabled or disabled. But people also make travel decisions in the moment.

Using real-time data, trip planners can help customers make good decisions right then. Just as motorists use the traffic layer of online maps to select a path that will be fastest in the current situation, transit directions and maps are stronger if they help the customer figure out how to travel based on actual, rather than scheduled, times.

This functionality is also useful to the agency in managing disruptions, which is why Caltrans puts so much effort into this information for motorists. If a disruption has shut down service on a key line, only real time trip planners will immediately tell customers to route their trip a different way, or to postpone their trip, etc., reducing pressure on the disruption.

Real time info already helps people adjust their plans even after a trip has begun. Someone standing on San Francisco’s Market Street, next to a Muni station, might be asking: Should I go into the subway, or take the F streetcar that I see coming in the distance, or just walk?

Muni’s real-time information will answer that question quickly, by telling them:

- how soon a train will come underground, and
- how fast that streetcar normally (according to its schedule) travels, and
- how long it will take them to walk.

Even when someone is planning a trip that they are about to make, though, real time info gives them a higher level of certainty that the trip will go off as described, which in turn means they are more likely to trust it.

Most of the agencies reviewed provided real time data in such a way that third party apps could integrate it into recommended trips. Not all of the agencies’ own online trip planners provided this utility, including large sophisticated agencies like AC Transit and TriMet.
There is some debate at present about the usefulness of information about transit vehicles’ geographic locations (using visualization services like TransLoc, as shown in Figure 33), as opposed to their estimated arrival time.

The case for showing the location is simple: this is a fact, while arrival time is a prediction. An experienced customer’s prediction may be better than agency’s prediction, depending on the quality of the agency’s schedules and real-time model.

On the other hand, location does not give the less experienced (or less-geographically-inclined) customer enough information to know how many minutes they will wait. For these people, the more useful information is the predicted arrival time, because it accounts for not only the geographic location of the bus, but also the expected travel speed between the bus and the waiting customer.

For these reasons, current best practice is to give both types of information - the real time locations of transit vehicles, and the predicted arrival times based on those locations.
3 General Web Survey Results
General Web Survey Results

In November 2015, JWA and QMR conducted a web survey seeking information about how AC Transit customers access information about transit. The survey was publicized via social media, email blasts, AC Transit’s website, and printed advertisements on buses, and received nearly 1900 unique responses.

This section describes some preliminary results of this survey.

Note that for many of the following inquiries, respondents were able to select multiple responses. Thus the total responses add up to more than 100%.
When making a transit trip you make REGULARLY, which of the following do you consult? (Please select all that apply.)

When making a transit trip you've NEVER made before, which of the following do you consult? (Please select all that apply.)

A trip planning website was the top choice for new trips, whereas an app or mobile website was the top choice for regular trips.

The transit map is used far more for planning a new trip (40%) than a regular trip (22%). Timetables - whether print or online - appear to be equally useful for new and regular trips.

A relatively high proportion of people ask customer service personnel to help them plan their trips.
Among those who consulted a transit map, AC Transit’s map was the most frequently cited, followed by BART and Muni. Responses were very similar when we asked about new trips.

The most frequently cited trip planning websites for trips that people made regularly were 511.org, AC Transit and BART.
When using a trip planner for a regular trip, the overwhelming majority of people said that they use the real-time arrival information the trip planner providers. Only small numbers of people use the written directions or map. For a new trip, even more people use the real-time info.

Real time info doesn’t just tell people when they should plan to leave. It also helps them choose between multiple options, if there is more than one way the transit network - or the entire multi-modal transportation system - can get them to their destination.
Among smartphone and mobile apps, Google Maps is the most popular for planning both regular and new trips, with slightly smaller numbers of people saying they use 511, AC Transit’s mobile site, and the NextBus app or mobile site. All of these platforms provide real-time arrival data. (The differences between responses for regular rather than new trips, on this question, were negligible.)
When using trip planning apps, many more people consult the explanation and map features (rather than the real time information) when they are planning a *new* trip than when they plan a *regular* trip.

The map and the explanation may be more or less integrated on different apps, so for some people it may be difficult to say which piece of information is part of the map as opposed to part of the explanation.

It appears, from this pair of charts, that when people use an app for a regular trip they are more likely to focus on the real-time information, but for a new trip the other two components are more important.
82% of respondents said they had at least seen the AC Transit system map, most often on the agency’s website or posted at a bus stop.
When you have seen the AC Transit system map, what have you used it for? (Please select all that apply.)

- Nothing: 4%
- Other: 3%
- Thinking about how easy or difficult it will be to travel by transit to or from a place: 42%
- Orienting myself; to know which direction to walk or ride: 46%
- Understanding all of the transit options around a certain place: 52%
- Planning a transit trip: 46%
- Locating an important building or place: 21%
- Locating a street or address: 24%

We also asked people to tell us what they used the AC Transit system map for when they had seen it. This question offered a number of responses, that can be generally categorized into two categories:

- Imminent trip planning and navigation (planning a transit trip, locating a street or address, locating an important building, orienting myself)
- General awareness of the transit network (understanding all of the transit options, thinking about how easy or difficult it will be to travel by transit)

People definitely use the map for in-the-moment navigation and trip planning. However, its clear that the map is heavily used for improving what we call (in earlier chapters) “network awareness” or “discovery.” Of the respondents, 50% say they use the map to understand all of their transit options, and 40% use it to think about how easy or difficult it would be to travel to different places by transit. Neither of these describes the kind of imminent trip planning that is delivered by trip planning websites and apps.

By examining the data, we can see that individual people are using the map for multiple purposes. Among those who said they use the map for understanding all the transit options around a certain place, 62% of them also selected “planning a transit trip”, “orienting myself”, and “thinking about how easy or difficult it would be.”

Among those who said they use the map to plan a transit trip, more than 63% said they also use it to understand the options around a place, orient themselves, or think about the general ease of travel.

While transit maps can be designed to focus on trip planning or general transit network awareness, and to some extent these goals are in opposition, many of the survey respondents are using the current map for both purposes.
While 75% of respondents ride AC transit at least once per week, nearly as many people said they ride BART in a typical week as ride AC Transit (shown below), and 27% said they ride San Francisco Muni.

AC Transit may want to consider this when making design choices about future maps. If in a given week many AC Transit riders are already interpreting BART maps, and some are interpreting the SF Muni map, integrating the design language of the three maps could improve peoples’ experiences.
Most people who responded to the survey said that they owned a smartphone.

Curious about how smartphone ownership affected peoples’ use of transit information, we cross-tabulated smartphone ownership with responses to the earlier question, about what sources of information were used for regular and new trips. The two charts are shown on the following page.
Asked to share which type of information they would find most useful posted at transit stops or stations, the most popular response by far was a screen showing real-time arrival information.

This theme dominated the open-ended responses, with many comments focused on the need for more, or more reliable, real-time arrival information.

A majority of respondents also said that transit schedules of some sort would be useful to have at a stop or station.

People who have smartphones were not likely to state that they don’t need anything else at a transit station - only 5% of respondents said so. This suggests that people with smartphones still value some of the same sources of information - schedules, real-time displays, maps, etc - that people without smartphones depend on. This suggests that there is not much of a conflict between the needs of more affluent and tech-savvy riders on the one hand, and less-affluent or older riders on the other hand, when it comes to the public information that AC Transit could provide for them.
Smartphone owners are much more likely to use a smartphone app for information on their regular trips; correspondingly, people who do not own smartphones are much more likely to use a printed timetable. However, each group accesses online information to a similar degree. Those without smartphones are slightly more likely to use the map, call customer service, ask someone they know, or consult another source for information, for both regular and new trip planning.

Aside from smartphone apps and websites, these two groups of people do not seem to have radically different desires and needs for transit information.
When we compare the survey respondents to the current population estimate for Alameda and Contra Costa counties (ACS 2009-2014 5-year estimate), we find that the survey respondents are, on average, older than service area residents. People in their 40’s, 50’s and 60’s are over-represented in the survey respondents, while people in their 20’s are somewhat under-represented. People under the age of 18 are severely under-represented by this survey.
Map Testing
Map Testing

In spring and summer of 2016, we conducted focus groups and a web survey. This portion of the project was, in effect, a chance to “test” certain maps, design conventions and ideas for transit mapmaking.

Three of the Key Choices described in Chapter 1 were further explored in this way:

- If distinctions among services are shown on the map, what are they, and why show those distinctions and not others?
- How should detail and accuracy be traded-off against clarity and ease-of-use?
- How should other agencies’ services be shown?

Answers to these questions could establish a new visual hierarchy for the next AC Transit map. “Visual hierarchy” describes a perceived order or relative importance of objects in an image. When maps are found easy-to-read by their audience, it is generally because this huge quantity of geographic information has been organized into a visual hierarchy. The chapter starting on page 34 describes the latest “best practices” among North American transit agencies in establishing a visual hierarchy on their transit maps.

Deciding which transit services should occupy which positions in a visual hierarchy, and then choosing appropriate symbols, is one of the most important tasks in a transit map’s design process. These decisions cannot be made in the abstract, and are neither timeless nor universal across all cities, because the audience for a transit map will be influenced by changes in technology and visual communication, as well as by other transit systems in the area.

For example, for AC Transit, the mapmakers (and service planners) at SF MTA and at BART may have “trained” the region’s transit audience to respond to certain visual queues, or to seek out certain types of information on a transit map. Thus the best visual hierarchy for an AC Transit map may be different from the hierarchy used by WMATA, TransLink or TriMet.

Tested maps

To explore these questions among AC Transit’s existing and potential future riders, we conducted a web survey and a series of Focus Groups. The material used in both forums was a set of seven different maps:

- three excerpts from existing transit maps for other cities;
- three new, differing examples created for AC Transit; and
- the existing AC Transit map.

These seven maps illustrated the different ways transit-relevant information can be shown (or not shown) in different visual hierarchies.

- Information not strictly related to transit service, such as:
  - street networks and labels;
  - parks, schools and other major landmarks;
  - freeways;
  - bodies of water;
- frequency
- stopping pattern (e.g. Rapid or Express vs. Local)
- span of service (e.g. peak-only vs. all day or all week)
- destination (e.g. Trans Bay vs. East Bay)
- how to illustrate service on one-way couplets

Other cities’ maps

Maps from Madison, Spokane and Portland were chosen as examples, because of the contrast among their styles, and between them and the existing AC Transit map. These maps are shown...
on the following pages, along with their legends. The maps from Portland and Spokane use line width and color to emphasize frequent lines. Portland’s map uses a darker shade of blue and a thicker line (as well as a slightly more emphasized line symbol) for its Frequent Network. This creates a more subtle contrast than in a map like Spokane Transit’s, which shows frequent lines in bright red.

Figure 34: Spokane Transit’s map of Spokane, Washington.
The maps from Portland and Spokane share other characteristics:

- a degree of diagrammaticism, whereas Madison’s map is geographically accurate;
- the absence of a local street layer (which, for Madison, is shown in white); and
- simplified shapes for water bodies and greenspaces.

Figure 35: TriMet’s transit map of Portland, Oregon.
In contrast, Madison’s transit map does not use line color or other symbols to call out frequency. Rather, distinctions in the span of service are shown using route badges, so that peak-only routes are (subtly) distinct from all-day routes.

These three other cities’ maps were presented, with their legends, to the focus group participants (but not web survey respondents). For people participating in either Chinese or Spanish, the legends were not translated, but were presented in their original English.
Sample AC Transit Maps

In order to show participants how new visual hierarchies and design choices could affect the AC Transit map, we worked with AC Transit staff to create three different samples.

In order to show sufficient detail, a range of service types, and to explore some of the geographic challenges inherent in making an AC Transit map, we selected an area around downtown Berkeley as the center of the new examples. This area includes a downtown with many lines on single (often one-way) streets; a street grid and curving streets; local, rapid and Transbay bus lines; and another agency’s local bus line (the Emery-Go-Round). CHK America, a leading map design firm, scoped and designed each of the three samples for this area.

The many choices that were made in the design of these three samples – and that will need to be made in the design of any future system-wide map – are listed in the table in Figure 37 on page 64.

Certain choices were held constant across all three samples, especially:

- the balance between geographic accuracy and diagrammatic simplicity;
- the size of streets that appear in the background (which relates to the former distinction, since collapsing distances between points makes the accurate mapping of all small streets impossible);
- which streets are labeled; and
- the prominence of BART lines and stations, and of freeways.

These three example maps, plus the existing AC Transit map excerpted for the same area, are shown on the following pages along with their legends. (Landscape versions of these maps are also included at the end of this report, for printing.)

DESCRIPTION OF GREY MAP

On the grey map, color is the only indication of frequency. Line weight is only used to differentiate between categories of service other for the peak vs all-day distinction. Transbay services are included in the “peak” category rather than in a “Transbay” category.

Lines that don’t run all day (i.e. peak and all-nighter) are indicated by labels rather than badges.

Rapid stops are shown on the grey map.

When multiple lines within the same service category run on a single street, they are represented by a single line of the same color (rather than multiple parallel lines).

Line terminals are indicated with black badges.

All-Nighter service and the Amtrak route are included.

Lines that run onto freeways have their freeway-segments drawn (where people cannot board the bus) as well as their street-running segments.

DESCRIPTION OF GREEN MAP

The green map uses more visual cues than the grey map to categorize services. Different line weights and colors indicate frequency.

When multiple lines within the same service category run on a single street, their lines are all drawn individually.

Streets with more service on them (e.g. San Pablo or Shattuck) are labelled with larger and darker font.

All lines are identified by badges oriented parallel to the line, with these badges varying in weight by service category.

Line terminals are not indicated, nor are all night routes or rapid stations. The Amtrak route is not shown, but the station is shown as a landmark. All-Nighter service is not shown.

Lines that run onto freeways are drawn only for
street-running segments. Once the line enters the freeway, it is shown using an arrow and label (“to San Francisco”).

When lines use one-way couplets (e.g. on Bancroft and Durant south of campus), the two streets and two directions of travel are simplified into one set of lines with two street labels.

Of the three samples, the green map shows BART service most prominently. A thick black line traces the BART lines. Each station dot shows the colors of BART lines calling at that station.

Unlike on the grey map, on the green map the Emery-Go-Round local shuttle service is shown, in quiet grey. Also, Transbay service is in its own category (rather than most Transbay lines being included with other peak-only services).

**TAN MAP**
The tan map uses the greatest difference in weight to distinguish frequent and non-frequent lines, in addition to color. The weights of badges are used similarly.

As in the Grey Map, only one line is drawn for each category of service on each street. Rapid stops are shown, and line terminals are indicated. Transbay services are collapsed into the appropriate frequency and span categories, rather than being shown as a unique category.

BART lines and stations are less prominent on this map than on the green or grey maps. However, BART stations feature the “ba” BART logo, and a hover box listing bus connections available at that station.

All-Nighter routes and the Emery-Go-Round shuttle are shown. Service operating on freeways is drawn completely, with street- and freeway-running lines alike.
"Grey Map" Legend

- **BART Line & Station**: Regional rail service.
- **AC Transit Rapid & Stop**: Limited stops, every 15 minutes or better.
- **AC Transit Frequent**: Every 15 minutes or better.
- **AC Transit Regular**: Every 20-30 minutes, with additional service at peak times on some lines.
- **AC Transit Infrequent**: Every 30-60 minutes, with additional service at peak times on some lines.
- **AC Transit Peak**: Weekday peak hours. No service at other times.
- **All-Nighter**: Overnight service along key corridors.
- **Line Terminal Points**: Start and end point for some/all trips of line shown.
- **Amtrak Line & Station**: Long-distance intercity rail service.
MAP TESTING

**“Green Map” Legend**

- BART Line & Station: Regional rail service.
- AC Transit Rapid: Limited stops, every 15 minutes or better.
- AC Transit Frequent: Every 15 minutes or better on main line, less frequent service on branches.
- AC Transit Major: Every 15-20 minutes.
- AC Transit Regular: Every 20-60 minutes, with additional service at peak times on some lines.
- AC Transit Transbay: Every 30-60 minutes, with additional service at peak times on some lines.
- AC Transit Transbay Peak: Weekday peak-hours, no service at other times.
- Emery-Go-Round: Local shuttle service in Emeryville.

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[Map Image]

- Berkeley
- North Berkeley
- Ashby
- El Cerrito Plaza
- MacArthur
- El Cerrito Plaza
- Tilden Regional Park
- University of California Berkeley
- Amtrak Berkeley
- Emeryville
- East Bay Bridge Center
- San Francisco
MAP LEGEND

- **All-day Service**
  (see timetables for details)
- **Limited hours of service**
  (see timetables for details)
- **Line terminal**
- **Regular Stops**
- **Express portion of line, with stops**
- **Double lines and asterisks**
  indicate a lower level of service than on the solid route
  (see timetables for details)
- **Transbay service**
  shown by lines beginning with letters
- **Bus turnaround**
- **BART or Light Rail line, with station**
- **Other transit services**

- Park & Ride lot
- Library
- Shopping center
- Hospital
- Point of interest
- Public school
- Private school

Bus timetables are available on the AC Transit web site. Paper versions of timetables are available from the AC Transit ticket office or will be mailed by request.

Prepared by Eureka Cartography, Berkeley
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Focus Groups

With the assistance of Quantum Market Research, we held six Focus Groups in downtown Oakland during April of 2016, each attended by 9-12 people. The groups differed in the demographics of the participants:

- Two groups of English speakers who ride AC Transit regularly
- Two groups of English speakers who do not currently ride AC Transit regularly
- One group of Spanish speakers who ride regularly
- One group of Chinese speakers who ride regularly

The four English-speaking groups were diverse in terms of age, ethnicity and income level. The Spanish and Chinese groups were facilitated by native speakers, taped, and translated. All participants were given a stipend and food as compensation for their time.

In the first phase of each Focus Group, participants were asked to fill out worksheets on each of the three other cities' maps. This was intended as a test of those maps' abilities to convey certain service distinctions. The facilitator then led a short discussion about those other cities' maps.

In the second phase, participants filled out worksheets on each of the Berkeley map samples, and then the facilitator led a discussion about those three maps. At times, during this discussion, we passed notes to the facilitators to submit additional questions, or ask that participants be further queried on a certain topic.

The questionnaires given to participants asked them to do things like plot trips, identify frequent network lines, and explain elements of the map, for the three maps of other cities and for the three sample AC Transit maps. Each questionnaire asked 2-4 questions, and was handed-out to participants along with the single map to which it referred.

These questionnaires were not intended as a formal survey, but rather to supplement the discussion with responses from every participant, and to force each participant to example each map sample closely before the discussion began. It is important to note that the same questions were not asked of all three AC Transit map samples, nor of all three maps from other cities. Thus we can observe whether a certain convention succeeded or failed on a certain map, but cannot necessarily compare answers to that question from multiple, different maps.

The answers given on the questionnaires were then correlated and tallied to gain a somewhat quantitative measure of participants’ success using each map. (For the Spanish and Chinese groups, the questionnaires were presented in those languages.)

At the close of each group’s discussion, the facilitator polled participants on their favorite and least-favorite maps. Taking the combined input of all six groups, the tan map was the most favorite. (Note, however, that in a group setting, people have a tendency to accept one another’s suggestions.) Charts showing these responses are shown on the following page.

Major observations

In this section, we describe some of our observations from the Focus Groups, organized by topic. These observations were made on both the questionnaire results and the discussions observed in the groups.

LEGENDS

Legend images and definitions are very important. Many participants knew to reference the legend, in answering worksheet questions. Transit symbology that was not defined in the legend was generally not well understood by the participants. For example, color-coding of BART lines within station symbols was vaguely defined...
in the legend, and not understood by participants. A good example of this is the varying ways people understood the term “Limited Service.”

Chinese participants were thorough in referring to the legend, cross-referencing the symbols in the legend against the symbols on the map, as they worked through their questionnaires. This suggests that translating legends into Chinese may return even greater access to the information contained in the rest of the map.

The Madison map shows only two service distinctions – span and sections of limited stops. Span information is presented as three lists of route badges, in three different span categories. Asked to provide information about when a certain route on the map runs, 80% of participants were able to correctly describe it, which could only be done by referencing the legend.

**CONTRASTING LINE COLORS AND WIDTHS**

Contrasting hues and line widths seem to be the clearest way communicating discrete service categories (as opposed to name or number, badge shapes, patterns, or reference tables of route numbers in the legend). This is probably why the Spokane map made it so much easier for people to notice the differences between frequent, regular and Express (peak-only) routes than the Portland map.

Of the sample AC Transit maps, the grey map has the least variation in the hue and width of transit lines. It was also, though likely for many reasons, the least popular with focus group participants.

**FREQUENCY DISTINCTIONS**

The map on which people best-understood frequency distinctions was the Spokane map. More than 90% of people correctly identified the frequent network in this map, when filling out the questionnaires.

In the group discussions, we asked the participants to plan a trip using each of the three maps from other cities (where they had no existing knowledge of the transit network). When using the TriMet map, few participants named frequent lines that were available to make the trip, and only one person in all of the groups noted that they were frequent lines. In the questionnaire,
when asked why certain lines on the TriMet map were darker blue, about 80% of people were able to understand that darker blue lines had higher frequency or longer spans of service. It is possible that people simply forgot this information, when looking at the map during the discussion, and that the linework on the map did not remind them of it.

In contrast, when planning the trip with the Spokane map, many people very quickly noticed and vocalized that certain lines were more frequent than others, and would offer a shorter wait; and that certain lines were faster than others, but might not run all day.

On the three AC Transit sample maps, when asked to plan a trip across Berkeley, many people did recognize (often referring back to the legend) that certain routes were more frequent and offered shorter waits. Some people also pointed out, in response to a suggested transfer, that the transfer would be to a low-frequency route and therefore wasn’t a good idea.

**COMBINED ROUTES CREATING HIGHER FREQUENCY**
Few people understood the line symbology representing “routes combined for higher frequency” on the Spokane map, in which two blue lines are surrounded by red highlighting (see routes 26 and 28, to the northeast of downtown).

In addition, on the Spokane map, “routes combined for higher frequency” are highlighted in red; “express” routes are in pink. On the map, the thin red outline looked pink enough that some participants confused the two distinctions.

The Portland map uses a different convention, turning the two lines into a single, darker line, to match the line type defined in the legend as “frequent” (see routes 54 and 56, in Southwest Portland). The two badges then float on top of the single, darker line. However, the groups were not queried about this style, which could also be deployed on a Spokane-style map (in which frequent routes are a different color). In that case, a single red line would run beneath two blue badges representing the two combined lines.

**RAPID STOPS**
In conversation, many people were able to describe a Rapid’s service features (higher speed, frequency, and widely-spaced stops), and
Two maps, the grey and tan, included stop symbols showing the stopping pattern of a rapid service (Line 72R). When asked in the questionnaire which lines could be boarded at Cedar Street and San Pablo, where Line 72R does not stop, only 11% of the group correctly perceived that they could not have boarded the 72R there.

**ONE-WAY COUPLETS**

The Spokane map symbolizes a one-way couplet by placing two street names, and directional arrows, on either side of a single line representing the transit route that in fact goes down two separate streets. Only 31% of group participants expressed an understanding of this convention, in the questionnaires.

Of the AC Transit sample maps, the green map shows the Bancroft/Durant one-way couple near UC Berkeley in the “Spokane style.” There is one single line representing each route that travels on that pair of streets, with the names of the two streets on either side. The grey and tan maps showed each direction as a separate line, with the addition of one-way arrows on the grey map.

Many participants found the single-line convention, on the green map, confusing, and expressed a preference that service on two different streets be drawn as two separate lines, with arrows indicating direction. Questionnaire...
results make clear that the Spokane map failed to make one-way couplets clear, and the verbal conversations within the groups about service on Bancroft and Durant Streets confirms it.

**ONE-WAY LOOPS**
The groups’ attentions were drawn to one-way loops on the Portland map (which do not include arrows), and on the grey AC Transit sample. Only a few people articulated, in writing or verbally, an understanding that these routes go one-way, or an awareness of what it might mean for the rider.

The grey map included arrows indicating one-way loops, but people did not seem to notice these arrows until they were pointed out to them. The questionnaire for the grey map included open-ended question about Line 67, but not one of the participants volunteered the observation that it makes a large one-way loop. In discussions, when prompted to look closely at Line 52 and talk about what it does, and where they might board it, few people initially recognized that it makes a one-way loop.

**SHORTLINE/LONGLINE TRANSITIONS**
On the grey map, only 42% of people understood the longline/shortline frequency transition (when asked about Line 51B on University Ave.). If this is a common feature of the AC Transit network, it may be worthwhile defining this convention in the legend.

**LINE LABELING**
On the grey and tan maps, line labels that were not enclosed in badges were rarely recognized as line labels. (For example, Lines G and 800 on University Avenue.)

The line labels that were included in the legend, as examples, ended up confusing some people. This was especially true of the Chinese participants, who sometimes launched a diligent hunt across the map samples for whatever number or letter they saw in the legend. It was also true of multiple English participants. For example, one person understood that only Line E is a “Transbay peak” service, because it said so in the legend. She overlooked the difference in line weight and badge color that the legend was intending to display. It may be best to leave line names and numbers out of the legend, as much as possible, or to use an obviously generic symbol such as “X” or “0.”

Finally, in discussions of the variety of services on

![Figure 41: Only the grey map used arrows to indicate one-way loops (as for Line 67) but no one noticed it, or thought it worth mentioning about Line 67, without specific prompting.](image)

![Figure 42: Few people understood that the color change at this end of Line 51B represented a longline/shortline frequency transition.](image)
San Pablo, the Line 72M was massively confusing to everyone who noticed it. All of their diverse and understandable theories on what it might be were wrong.

**BART STATIONS AND HOVER BOXES**

The green map uses a subway map convention to show which BART lines serve each station, with a circle divided into colored wedges. A person navigating along a particular BART line must thus follow the colored station symbols to understand the line’s path. This appears to be a fairly effective, lightweight method of displaying this information: 73% of people were able to correctly describe the path of BART lines using these symbols.

However, this finding should be taken in context of the fact that most participants in the focus groups are already familiar with BART, the most well-known and visible transit service in the bay area.

Given the simplicity of the BART network, it may not be necessary to include this information on the AC Transit map. In addition, many people were enthusiastic (in verbal discussions) about the use of BART logos on the tan map, and said that the BART symbology on the tan map was their favorite.

The tan map also included text boxes, hovering near each BART station, listing the routes that stop there. This feature was very popular among focus group participants.

**TRANSBAY LINES**

Transbay lines were shown very subtly on the grey map. Many participants said they were too
subtle, and easily mistaken for a street (because of their grey line, and their street-like line label). They seemed to be better-understood on the tan map, even though the line and labeling were similar to that of the grey map. However, the background on the tan map is a different color, which may cause them to stand out more clearly.

The participants were very enthusiastic about the way Transbay lines were drawn in the green map, with little arrows heading onto the freeway, and the label “To San Francisco.” The freeway itself is also more prominent on the green map, which may make the Transbay lines, and their role in the network, more understandable. Finally, the disappearance of the lines on the freeway eliminated the risk that someone might think the Transbay lines are on a street next to the freeway, which one person noted and appreciated.

SHOWING OTHER AGENCIES’ SERVICES
Many focus group participants reacted favorably to the bright yellow line used for the Emeryville route on the tan map. (It was shown using a light grey line on the green map, and not at all on the grey map.) However, we know that we were designing a map for the entire AC Transit service area, including many other neighboring agencies’ services, we could not afford to use a unique bright color for every agency.

In addition, it is not clear to us that focus group participants’ enthusiasm is the best guide here. The Emery-Go-Round shuttle, because it is so incredibly circuitous, will be useful for a small number of people, compared to most of the other lines on this section of the AC Transit map. Focus group participants may have a high opinion of the EGR because it is free. Dedicating an entire separate color to the EGR may be overkill, reflecting peoples’ affection for the service but not necessarily its usefulness. At the same time, other agencies’ services, elsewhere in the county, may be more important to city- and county-wide networks, so the decision about how to show other agencies’ services should not be based on EGR alone.

NOTES ON LINGO
Few people understood what “Limited” service (on the Madison map) meant. Some thought it meant “limited trips” as in “only certain trips” or peak-only. Others thought it might be an express route, which runs non-stop. Few guessed that it indicated wider stop spacing.

The word “peak” was not at all well understood by participants. A more colloquial term like “rush hour” may be meaningful to more people.

During the Spanish focus group, we queried participants on the meanings of certain English words that describe transit service. Many of them were well understood by the Spanish speakers, perhaps because they are cognates in English and Spanish and the meaning intended in English in a transit context is maintained in the Spanish context. These include:

- “Rapid” (“Rapido”)
- “Frequent” (“Frecuencia”) and in-frequent
- “Regular” (“Regular”)

“Overnight,” while not a cognate, was also understood correctly by the Spanish participants.

An English word that the Spanish group did not understand at all was “Limited.”

A word whose cognate might not convey the right idea is “Major,” which they guessed must mean “better” or “best.” In some transit systems, “major” represents a basic level of service, certainly not the best.

USE OF MAPS
We asked focus group participants when and why they use maps. Most said “yes” or “maybe,” though often with the caveat that they use their phone or an online trip planner much more regularly. The offered a wide variety of responses, including:

- “When my phone is down”
• “When I’m in a new area”
• “When I need to go to a new destination”
• “To familiarize myself with an area”
• “When I’m just killing time”
• “For fun”
• “To know which direction to go” (whether on foot or on the bus, it was not clear)
• “To get a sense of distance, how many stops away something is”
Web Survey

Through a web survey, we gathered feedback on the three new map examples and the existing AC Transit map.

Survey participants

The survey was promoted through AC Transit’s social media feeds and website, and through QMR’s email list of transit-interested people in the area.

We received input from 904 unique people through this survey. Of the respondents, 49% told us they identify as male, 48.5% as female, and 2.4% as other or declined to answer the question.

One-third of respondents (300) said that they did not ride AC Transit in the last week, and 216 of the 904 respondents said that they do not use AC Transit regularly. Of the remainder, the majority said that they rode AC Transit at least 3 times per week, most often to travel to work, events, appointments or shopping.

Among other transit systems in the area, respondents reported riding BART, AC Transit, and Muni, most often. Just over 600 of the 904 respondents each said they ride BART and AC Transit at least once a week; around 225 said that they ride SF Muni once a week.

How many times did you ride AC Transit last week?
If you use AC Transit regularly, for what kind of trips do you use it?

- I do not use AC Transit regularly: 216
- Other: 35
- Attending events (social, music, sports, movies, etc): 306
- Appointments: 266
- Shopping: 233
- Travel to school: 99
- Travel to work: 432

In an average week, which of these transit systems do you ride?

- BART: 600
- AC Transit: 550
- SF Muni: 400
- None of the Above: 150
- CalTrain: 100
- Other: 50
- SF Bay Ferries: 20
- VTA: 10
- SamTrans: 10
- Capitol Corridor: 5
- Golden Gate Transit: 5
- Union City Transit: 5
- Wheels (LAVTA): 5
- WestCAT: 5
- ACE: 5

Count
**Testing the Three Map Samples**

At the start of the survey, each respondent was shown one of the three map samples and its legend. All respondents were then asked the same set of “quiz” questions, and asked to answer as best they could based on the map sample in front of them.

This test did not reveal large differences in performance among the three samples. However, we were not able to know or control for respondents’ level of familiarity with AC Transit’s services in the sample area. We were also not able to prevent respondents from using other sources of information, if they wished. Thus the test was not intended to be scientific, and the lack of significant results is slightly disappointing but not surprising.

In general, the results of this test show that a large majority of people were able to use any of the three map samples to identify different service types, with no large or consistent differences in the usefulness of any one map sample.

**Frequent Lines**

The first quiz question asked respondents to name up to three frequent services. More than 90% were able to name at least one frequent line, and 74%–78% were able to name at least three frequent lines. The tan map performed best, though by an insignificant margin.

![Correct identification of frequent lines](image-url)
**PEAK-ONLY LINES**
Respondents were asked to identify up to three lines that only run during peaks. These services were apparently harder to identify than frequent services.

About 60% of respondents could identify at least one peak only line; less than 50% could identify at least three peak only lines. (Thus we can also observe that once a person could recognize one peak only line, they were very likely to find at least two more.)

**OVERNIGHT LINES**
Respondents who were shown the grey or tan maps were asked to identify overnight lines. (The green map sample did not include overnight lines.)

More people were able to identify overnight lines on the tan map than on the grey map. 77% of respondents who were looking at the tan map could name at least one overnight line, compared to 70% of respondents who were looking at the grey map. The margin is similar for respondents who were able to identify 3 or more lines.

Overnight lines are shown using nearly identical lines and labels on the tan and grey samples. It may be that the background color on the tan map makes it easier for people to pick up the very quiet labels for overnight lines.
IDENTIFYING STOPS

One of the differences among the three sample maps is whether or not they show the locations of Rapid stops.

To test whether marking Rapid stops helps users identify them, we asked a question of respondents who saw either the tan map or the green map. The tan map shows Rapid stops, the green map does not.

This was, in a sense, a “trick question.” We asked respondents to name up to three lines that stop at San Pablo Avenue and Cedar Street (which was indicated with a big arrow), curious to see how many people would incorrectly assume that Line 72R stops there.

The percentage of respondents who correctly identified 1–3 lines that stop at this intersection was very similar for the two map samples.

One possible distortion of this result is the number of lines available to choose from, at San Pablo and Cedar, on the two samples. There is one additional line shown on the tan map at that location (the overnight 800), which would make it easier to name three lines without resorting to naming the 72R.

This probably explains why a higher percentage of respondents were able to identify four lines on the tan map than on the green map.
When we compare the percentage of respondents who named Line 72R as stopping at San Pablo and Cedar, we see a much larger difference between the performance of these two map samples. The tan map, on which Rapid stations are identified by dots (and defined, to a degree, in the legend) failed with 38% of respondents, whereas the green map failed with 56% of respondents.

In the focus groups, neither the questionnaires nor the verbal discussion made clear whether showing Rapid stops would be a successful strategy for communicating their location (and absence) at intersections. This result suggests that including stops on the map, and in the legend, can have a positive effect on people's awareness of stop locations.
Opinions of Map Samples

In the web survey, people were presented with the three sample maps and their corresponding legends (shown on page 65 through page 67). They were asked to rate each map, on a scale of “Not at all,” “Not much,” “Somewhat” to “Very Much,” in terms of:

- “Detail: it contains the transit information that is crucial for me to see in this area.”
- “Clarity: It is easy to look at and to find something in this area.”
- “Appeal: I like the way it looks.”

All three of the new map examples received mostly positive (“Somewhat” or “Very Much”) ratings.

All three of the new example maps received similar high rankings for their level of Detail. However, they differed somewhat in the level of enthusiasm for their Clarity and Appeal.

Overall, the green map had the largest number of strongly positive rankings (“Very Much”).

Charts showing the responses to each map are shown on this page and the following page.
Web Survey Responses to Green Map

- Detail: It contains the transit information that is crucial for me to see for this area
- Clarity: It is easy to look at and easy to find something in this area
- Appeal: I like the way it looks

Web Survey Responses to Tan Map

- Detail: It contains the transit information that is crucial for me to see for this area
- Clarity: It is easy to look at and easy to find something in this area
- Appeal: I like the way it looks
**Favorite Map**
After rating their opinions on aspects of the three maps, respondents were asked to select a favorite of the three. Over 40% said the green map was their favorite, while 33% and 25% said tan and grey, respectively.

However, each of these map samples represented many different choices of color, symbology, and visual hierarchy. Just because the green map was the most popular, overall, does not mean that all or even most of its design choices should be emulated in AC Transit’s next map. People may have been reacting very strongly to something as simple as the background color, or the BART station symbology.

For this reason, we also polled respondents on how important certain distinctions are to them. Knowing which distinctions among services people value can help AC Transit develop the visual hierarchy of its next map.

In addition, before showing respondents all three maps, we “tested” one of the three samples, by asking people to answer some questions based on the mapped information alone.

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**Now that you have seen all three map samples, which do you like best?**

![Bar chart showing the percentage of responses for each map sample. Green map is the most popular with over 40% of responses.]

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**JARRETT WALKER + ASSOCIATES**

AC Transit Map Assessment Report | 85
Distinctions
One of the choices that AC Transit must make when designing its next transit map can be thought of simply as, “How many differences among services can we show?” There are many potential distinctions among lines, and these distinctions could all be shown, or they could be collapsed into categories. This is a difficult balancing act, similar to the balancing act between showing ample street detail and showing only the streets on which transit runs.

The more service distinctions that must be symbolized, the more competing styles and symbols the users will have to recognize in order to find and discover information. At one extreme, when every service distinction is shown, the results can be dizzying and drive users away. At another extreme, if all services are shown as equivalent, the user may make travel or location choices without key pieces of information, and be frustrated by the results.

This is also a difficult decision to explain to lay-people, but we did so in the web survey. The results and the open-ended comments we received contained no hint that people did not understand this choice, thus we think AC Transit can and should take this input into consideration when designing the next system map (and perhaps when making related choices about public information displays, and even service labeling).

We asked web survey respondents to rank the ways that services can be distinct from one another, from 1 (the most important distinctions) to 5 (the least important). These distinctions were:

• Different hours of service each day (span).
• Different days of service each week.
• Different frequencies.
• Stopping patterns.
• Transbay service.
By far, the most common #1 ranking was for frequency (in blue, above), which was the top pick of 35% of respondents. Span of service each day and each week (in green and orange, respectively) were each ranked #1 by about 20% of respondents, and then were the most common among respondents’ second choices.

Transbay service (in grey) was the lowest priority distinction; about 57% of people ranked it #5, least important to them. Stopping pattern (in purple) was also less important distinction to most respondents than frequency, span or days of service.

After asking respondents to rank these general types of distinctions among services, we then asked them more specifically about degrees of difference that matter to them, within the categories of frequency and span.

Knowing that frequency and span are important distinctions to stakeholders is a good first step, but it does not tell us how to organize AC Transit’s lines into a manageable number of frequency and span categories. Another way to describe this dilemma is simply to think about how many different line types should be drawn and defined in the legend. These categories of lines must neither be so numerous that they overwhelm the user, nor so vague that they fail to tell the user important things about the frequency and span of each line on the map.

For any agency, this balancing act – between too many and too few types of lines on a map – is made easier when transit services are designed to fit distinct service categories, and have consistent frequencies and spans within each category. This is made even easier when frequency and span are linked within service categories, so that all lines with a certain level of frequency also share daily and weekly spans of service. However, the real business of providing transit in an urban area, within a constrained budget, always results in less-than-perfect adherence to service categories, so some difficult choices must...
Inevitably be made, and a map cannot describe the full complexity of transit schedules.

**FREQUENCY DISTINCTIONS**
Web survey respondents were asked to rank the differences between certain frequencies (e.g. between 15-minute as opposed to 20-minute service) as more or less important than other differences.

In the web survey, we presented these differences as tiles, arranged into lists, which users could drag up or down to change their priority order. The chart below shows the results.

The highest-ranked distinctions are those between 15-minute frequency and either 20- or 30-minute frequency (these two choices are shown in red and orange). However, there is greater interest in the difference between 15- and 30-minute services, compared to between 15- and 20-minute services, once #2 rankings are taken into account. (Note that this is not a distinction prioritized on SFMTA’s map, which shows frequency categories of 10 minutes or less, 10-20 minutes and 20-30 minutes.)

The enormous difference between 30- and 60-minute frequency (in green) was ranked #4 (least important) by a plurality of respondents; yet opinion was divided about this difference, with only slightly fewer people ranking it #2.

<table>
<thead>
<tr>
<th>Distinction</th>
<th>Percent of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>every 15 minutes vs. every 20 minutes</td>
<td>75%</td>
</tr>
<tr>
<td>every 15 minutes vs. every 30 minutes</td>
<td>50%</td>
</tr>
<tr>
<td>every 20 minutes vs. every 30 minutes</td>
<td>50%</td>
</tr>
<tr>
<td>every 30 minutes vs. every 60 minutes</td>
<td>25%</td>
</tr>
</tbody>
</table>

Rank these frequency distinctions from most to least important.
SPAN DISTINCTIONS
We also asked participants to rank three major span distinctions:

- Lines that are available all day vs. those available during rush hour only;
- Lines that run at night vs. those that run during the day; and
- Lines that run on weekdays vs. those that run on weekends.

The highest-ranked span distinctions were those distinguishing peak-only and weekday-only services (in green and yellow). Showing distinctly which lines run late at night was a lower priority for a majority of respondents, perhaps given that most people do most of their travel during the day.

For obvious reasons, none of AC Transit’s peak-only lines run on weekends, so any peak-only categories on a map will also convey weekendlessness. However, it will be challenging to divide peak-only lines into more than one category to convey their different frequencies of service, which range from every 15 to every 60 minutes.

Many lines that run all day on weekdays do not run on weekends; most of them offer hourly frequency on weekdays. These may represent another separable category, within which span of service and frequency are fairly consistent.

How late in the evening AC Transit services run varies. Two lines offering 30-minute frequency every day can differ by five hours in their daily span, one ending at 7:00 p.m. and the other at midnight. Without changing service designs to link frequencies and evening spans more consistently, it will be challenging for a map designer to convey this information either graphically or through a well-placed note in the legend.

AC Transit runs a series of “owl” lines, only at

Rank these operating–hours distinctions from most to least important.
night. These have fairly consistent frequencies and spans, and thus may be easily defined by their own line type on a map. Because so much less travel happens at night, this line type should be fairly “quiet” on the map.

Finally, there will always be a “grab bag” of services that are too few and too diverse to warrant their own line types on the map and in the legend. This may include weekend-only lines, very-low-frequency peak-only lines, and other services that just run a handful of times a day (or on certain days of the week) to meet specific needs. The complexity within this “grab bag” should not be allowed to crowd out valuable information about all of the other, more consistent (and surely higher ridership) services AC Transit provides. Thus a category for “Certain trips only” may be a helpful but unobtrusive way to include these services on the map. Alternatively, it may be wise to simply not include some of these services on the map, if they are designed for and marketed only a specific group of users.

**Opinion of Current Map**

At the close of the survey, respondents were asked to compare the three new example maps to the existing AC Transit map (using the excerpt and legend shown on page 68).

Of the 904 survey responses, 500 preferred all three of the new examples to the existing map; nearly 200 more said that they preferred at least one of the map samples to the current map. Just over 100 (11%) preferred the existing map.

![Graph showing survey responses](image-url)
Cross-Tabulation
We re-examined all of these questions by cross-tabulating responses among them, to discover whether subsets of respondents have markedly different opinions from one another.

One cross-tabulation revealed a small but potentially interesting difference how levels of AC Transit use affect people’s preferences for the map samples.

While the green map sample was most popular, by a small margin (seven percentage points), among all respondents, we see a bigger margin between the first and second most popular sample maps when we divide respondents into AC Transit riders and non-riders. Among people who said that they do not ride AC Transit regularly, the most popular sample map was the tan map (44%, compared to 36% for the second-most-popular). Among riders, the most popular map was the green map (43%, compared to 30% for the second-most-popular).

The surveyed AC Riders have, as a group, a slightly preference for the green map. Non-riders have, as a group, a slightly preference for the tan map. These preferences are somewhat muted when the two groups’ responses are combined.

<table>
<thead>
<tr>
<th></th>
<th>Gray Map</th>
<th>Green Map</th>
<th>Tan Map</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>“I do not use AC Transit regularly”</td>
<td>20%</td>
<td>36%</td>
<td>44%</td>
<td>100%</td>
</tr>
<tr>
<td>All other responses</td>
<td>27%</td>
<td>43%</td>
<td>30%</td>
<td>100%</td>
</tr>
</tbody>
</table>

% respondents who answered each map sample as their favorite, grouped by whether or not they said they ride AC Transit regularly. Percentage of group total, not total of entire survey.
How regularly a web survey respondent rides AC Transit also may influence which distinctions they feel are most important.

The results of cross-tabulating people’s levels of AC Transit use against their #1 ranking of different distinctions among transit services are shown in the table below.

More non-regular-riders picked frequency as their #1 most important distinction, compared to regular AC Transit riders (43% compared to 36%).

Slightly more regular riders selected either stopping pattern or Transbay service as their #1 distinction, compared to non-regular-riders.

<table>
<thead>
<tr>
<th>Distinction</th>
<th>All other responses</th>
<th>&quot;I do not use AC Transit regularly&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days of Service per Week</td>
<td>19%</td>
<td>21%</td>
</tr>
<tr>
<td>Frequency</td>
<td>36%</td>
<td>43%</td>
</tr>
<tr>
<td>Hours of Service per Day</td>
<td>21%</td>
<td>22%</td>
</tr>
<tr>
<td>Stopping Pattern</td>
<td>12%</td>
<td>8%</td>
</tr>
<tr>
<td>Transbay Service</td>
<td>12%</td>
<td>6%</td>
</tr>
<tr>
<td>Grand Total</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

% of respondents who ranked each major service distinction "Rank 1", grouped by whether or not they said they used AC Transit regularly. Percentage of group total, not total of entire survey.
Open-Ended Comments
At the end of the web survey, we solicited open-ended comments. As expected, people had very diverse responses, but a few key themes can be summarized:

• Numerous people emphasized the importance of designing maps that are readable by people with different levels of color perception (“color blindness”). As one person wrote regarding the green map: “[It has] very clearly-delineated colors (I’m color-blind, so PLEASE do not use dark reds and greens for lines on the same map). Also, BART stations are most clear, which is how it should be.”

• Some people responding to each map requested the actual stop locations (presumably of rapid lines) be included on the map.

• There were strong proponents for each method of symbolizing BART. However, many comments seemed to agree that BART should be drawn in a way that clearly emphasizes it as the backbone of the regional transit network, and that allows the individual line paths to be easily understood.

Major Observations from the Web Survey
From the basic survey questions, we can make these general observations:

• Most people like the new sample maps we showed them better than the existing map, suggesting that they would be amenable to a map redesign.

• A plurality of respondents said that the most important service distinction is frequency, and specifically the distinction between 15-minute and less-frequent service.

• Non-riders were slightly more likely to rank frequency as their most-valued distinction on a map, than were regular riders.

• Span, in terms of hours per day and weekday/weekend service, is also an important distinction to customers.

• The green map sample was preferred by a small margin over the other two samples. Among non-riders, the tan map was preferred by a small margin.

• Based on open-ended comments, many people valued the presence of BART lines on the map.
5 Recommended Next Steps
**Recommended Next Steps**

Based on all of the observations described earlier in this report, and on conversations with AC Transit staff, we recommend the following major steps.

**Plan for a New System Map**

At the start of this project, there was an optional question of whether or not transit agencies even need a system map anymore. Most people do their trip planning using an online tool or app. Publishing and updating printed system maps require a lot of time and effort. And the shape of AC Transit’s service area makes online map publication difficult.

Yet in our review of best practices across the country, through our general web survey, and through focus group discussions, we are convinced that a system map is an essential component of a transit agency’s public-facing information.

Transit system maps allow individuals, and organizations, to do a number of things that trip planning tools cannot support:

- They allow for *discovery* and the development of *network awareness*, in which people notice where transit goes, what kinds of services are offered, and how they relate to the city.

- People who are engaged in building the city can use a system map to see where their investments (whether in housing, business, social service, or anything else) can build on AC Transit’s investments and dovetail with AC Transit’s priorities.

- If someone wants to understand how to make a multi-destination trip, or what their choices are if they need to change plans, a system map builds understanding at a glance, rather than requiring that someone make multiple queries based on multiple origin-destination pairs.

- Maps provide a supplement or back-up to computerized trip-by-trip planning. If someone’s phone isn’t working, they can use a map instead. If someone understands the world spatially, rather than through narrative, a map can help them visualize their trip.

System maps also play more minor roles, which are described starting on page 6.

**Hold an Internal Service Categorization Workshop**

The task of transit service mapping is made much easier, and the resulting map is made more effective, when an agency designs and manages its services into a limited number of service categories. This is often called “Service Branding,” because these categories are not solely for internal use – they are also used to make service features clear to customers. To avoid confusion with the overall branding of AC Transit itself, it may be prudent to call them “categories” or “labels” in this process.

AC Transit is already on its way towards clearer and simpler service categories. We recommend that staff continue this effort, and make sure it is connected to the design of the next system map (and any derivative products). This could be done through an internal workshop for service planning, long range planning, public information and marketing staff. The task of this workshop would be to define the service categories for the next system map, and their visual hierarchy in relation to one another. Doing this work collaboratively, across disciplines, will help staff understand:

- How their work relates to the work of their colleagues;

- How long-term goals compare to short-term goals and constraints; and

- How their decisions will ultimately become visible to the public.
There will be a set of difficult questions relating to regional service mapping. AC Transit staff are already familiar with the MTC wayfinding guidelines, which express some opinions about how multiple agencies’ services should be shown on a single map. Some vocal transit stakeholders in the Bay Area have expressed a desire for a unified, Bay-Area-wide transit map, which would necessarily be built on a single set of service categories.

It may be strategic for AC Transit public information staff to meet with colleagues at other Bay Area transit agencies before and after this work-shop. This way, decisions made by AC Transit about service categories and labeling can be informed by, and can inform, decisions made by neighboring agencies. This will help with clear mapping of services in the places where service areas overlap (as well as, in the long term, a potential region-wide service map).

VTA’s services seem to have the most in common with AC Transit’s services, in terms of frequency and span. (In contrast, SFMTA offers higher frequencies and longer spans.) This suggests that if any neighboring agency could share a set of service labels with AC Transit, it would be VTA.

Communicate Frequency and Span Information Through Service Labels

From the input of current AC Transit riders and non-riders, through the web survey and focus groups, it is clear to us that frequency and span are the most important distinctions to commu-nicate through service labels, on a system map and potentially in other public information products too.

This also makes intuitive sense, because a key offering of high-frequency and long-span services is that a customer needn’t look up additional information in order to use the service. In contrast, to use a limited-span or low-frequency service a person really needs to find and check a timetable, to confirm that the service is running when they need it. Thus if high-frequency long-span services are in a clear category, and are labelled clearly on a system map (and in other places), that may be all the information someone needs.

Identify the Affected Suite of Map Products

Designing a new system map can and should trigger updates to a range of public information products, such as neighborhood maps posted at major stops and the single-line maps included in Line brochures.

How many products are affected isn’t a given, but will affect the level of effort and cost associ-ated with a new system map design and with future updates. The first step should be to identify all of the products that could potentially be linked to a new system map, and then decide whether they must or they should be linked to a new system map, in the near-term or in the long term.

That said, the system map cannot simply be re-purposed for other information products, like neighborhood maps or timetable maps.

Procure a New Mapping System

For the design of the next system map, we recommend that AC Transit procure map develop-ment services including:

• The collaborative development, with AC Transit staff, of a visual hierarchy and visual language for service labels.

  - For example, making a decision about whether AC Transit’s one “Rapid” bus line is treated with its own line type, or grouped with other frequent services.
- If one vendor can be retained to design and publish all map products, consistency among products will be better, and there are also likely to be time savings (i.e. cost savings) compared to what is required if different vendors produce different map products.

- Strategies for representing AC Transit’s long service area in a variety of media.

  - For example, perhaps only frequent and rapid services can be shown on the complete service area map. All other services, and greater geographic detail, is shown on multiple maps, each focusing on one zone of AC Transit’s service area.

- A system for updating all new map-related products.

  - A major consideration will be the degree to which AC Transit staff can make updates to all products themselves, rather than rely on a contractor for updates to some or all products.

  - When procuring a system map and any related products, AC Transit can ask bidders to propose rates for ongoing support and update services.

- New published versions of a system map, and any associated products identified as essential in the near-term.

Whatever map products are included in such a procurement, they should be listed separately and their intended use described in detail. If other agencies’ services will be included, that should be called out specifically as it increases the necessary level of effort.

AC Transit’s system is fairly complex, and part of the work of making a new map will be understanding the service and the service categories. When evaluating proposers, it may be wise for AC Transit to weight their past experience designing maps for similarly complex systems.

Support the Continued Development of Other Tools

We do not recommend that AC Transit lead the development of a custom trip planning app. The private sector has thus far been agile and responsive in developing free or low-cost trip planning tools, especially in large urban areas.

However, there may be opportunities for AC Transit to support continued development of trip planning tools, by:

- Continuing to produce the high-quality open data that is critical to good transit apps. In the future, AC Transit should avoid procuring software that makes it harder to push out good data quickly, or that otherwise inhibits third-party developers’ efforts to create new, innovative trip planning tools.

- If new standards for open transit data emerge, AC Transit should embrace them. AC Transit may also consider welcoming partnerships with tech entrepreneurs (as TriMet did with Google, to create GTFS), even if it is not always clear how the new technology will become useful.

- Be aware of opportunities to improve the quality of transit data or trip planning tools across the many transit providers in the Bay Area (such as 511.org, or private sector tools).

If a transit agency wants to be on the forefront of new developments in transit information and trip planning technology, it’s best shot is to be a large agency, in a dynamic urban area, that produces high-quality open data compliant with existing and future standards. Luckily, AC Transit is always going to be an early choice for any developer by virtue of its Bay Area location, which may benefit AC Transit’s current and future riders.

It is important that public agencies are careful
not to obstruct innovation, for example by not releasing data. We also recommend that neither AC Transit nor any public agency try to compete with the private sector in this arena.

AC Transit could certainly work on developing productive partnerships with private sector companies, in which each partner contributes its core expertise. For example, any large transit agency could invite Transit App to roll out their automatic route line mapping technology for a bus network, which would be the first time this feature would be used for non-rail transit.

From the general web survey (and from verbal conversations in the focus groups) we know that 511, NextBus, the AC Transit website and Google are the most used trip planning apps, followed by the Transit App and a few others.

Since we know that public agencies struggle to develop and maintain apps that can compete with privately-developed apps, it makes sense for AC to avoid developing its own tools for this purpose in the future. If it becomes important for AC Transit to have its logo on some trip planning technology, we recommend that the agency either integrate another party’s tool (as is done with 511.org), or purchase off-the-shelf reskins of industry leading products.