4 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.

Figure 36: Metro’s transit map of Madison, Wisconsin.
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**: Weekend peak hours. No service at other times.
- **Midnight**: 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.
“Tan 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 on main line, less frequent service on branches.

- AC Transit Major
  Every 15-20 minutes.

- AC Transit Regular
  Every 20-40 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.

- Emery-Go-Round
  Local shuttle service in Emeryville.

- Line Terminal Points
  Start and end point for some/all trips of line shown.
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
Copyright May 2015, Alameda - Contra Costa Transit District
All rights reserved.
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...
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
there was wide agreement that showing where the Rapid stops are on the map was important. Some people seemed to notice the small dots indicating stops, on two of the sample AC Transit maps, unprompted by the facilitator. However, in the questionnaires (which were given before the conversation took place), most people missed this information, perhaps since people don’t typically associate bus service with defined stops (or don’t expect it to be included on maps).

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 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 were we 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?

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

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

- BART
- AC Transit
- SF Muni
- None of the Above
- CalTrain
- Other
- SF Bay Ferries
- VTA
- SamTrans
- Capitol Corridor
- Golden Gate Transit
- Union City Transit
- Wheels (LAVTA)
- WestCAT
- ACE

Count

0 200 400 600
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.
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 Gray Map
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.

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

- **Green**: 40%
- **Tan**: 30%
- **Gray**: 20%
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 be made.

Which distinctions are most important to you?
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.

Rank these frequency distinctions from most to least important.

---

**Chart:**

- **Rank 1 (Most Important):**
  - every 15 minutes vs. every 20 minutes
  - every 15 minutes vs. every 30 minutes
- **Rank 2:**
  - every 20 minutes vs. every 30 minutes
- **Rank 3:**
  - every 30 minutes vs. every 60 minutes
- **Rank 4:**
  - every 15 minutes vs. every 30 minutes

---
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.](chart)

<table>
<thead>
<tr>
<th>Distinction</th>
<th>Percent of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>rush-hour vs. all-day</td>
<td>50%</td>
</tr>
<tr>
<td>late night vs. daytime-only</td>
<td>75%</td>
</tr>
<tr>
<td>weekday-only vs. weekends</td>
<td>25%</td>
</tr>
</tbody>
</table>
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.

Here is the same area, from the current map. Is it better or worse than the three new samples you just looked at?
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).

<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>“I do not use AC Transit regularly”</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 rapids) be included on the map.

• There were strong proponents for each method of symbolizing BART. However, many comments seemed to agree that BART 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.