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.
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.
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.

Figure 33: Some real-time data services (like TransLoc, here shown for the Yale shuttle system) include interactive maps that show both predicted arrival times and physical bus locations.