What makes transit useful?
Public transit can serve many different goals. But different people and communities value these goals differently.

Possible Goals of Transit
Understanding which goals matter most in Kansas City is a key step in designing future service as part of RideKC Next.

Possible goals for transit include:

- **Economic.** Transit can give workers access to more jobs and development opportunities, and give businesses access to more workers. Transit can also help attract certain industries, new residents, tourists, or other economic contributors.

- **Environmental.** Increased transit use can reduce air pollution and greenhouse gas emissions. Transit can also support more compact development and help conserve land.

- **Social.** Transit can help meet the needs of people who are disadvantaged or vulnerable, providing lifeline access to services and jobs.

- **Health.** Transit can provide access to healthcare, and can be a tool to support physical activity and healthy lifestyles by walking. This is partly because most riders walk to their bus stop, but also because riders will tend to walk more in between transit trips.

- **Personal Liberty.** By providing people the ability to reach more places than they otherwise would, a transit system can be a tool for personal liberty, empowering people to make choices and fulfill their individual goals.

Some of these purposes are served only when transit has high ridership. We call these ridership goals. For example, the environmental benefits of transit only arise from many people riding the bus rather than driving, taking a taxi, or otherwise getting a ride in a private vehicle. And subsidy per rider is lower when ridership is maximized.

Other purposes are served by the mere presence of transit. We call these coverage goals. A bus route through a neighborhood provides residents insurance against isolation, even if the route is infrequent and few people ride it each day.

High Ridership is Not the Only Goal
If KCATA wanted to maximize transit ridership, it would focus its service only on routes useful to many potential riders. KCATA would be thinking like a business, focusing on places where its service is competitive for a large number of people.

Businesses are under no obligation to operate where they would spend a lot of money to reach few customers.

For example, McDonald’s is under no obligation to provide a restaurant within 1/2 mile of everyone in the seven-county Kansas City region. If it were, then the company would have to add dozens of additional locations, some serving just a handful of homes, and most operating at a loss because of the few customers nearby.

People understand that rural areas will naturally have fewer McDonald’s locations than urban areas. We don’t describe this as McDonald’s being unfair to rural or suburban areas; they are just acting like a private business. McDonald’s has no obligation to cover all areas with its restaurants.

Transit agencies are not private businesses, and most transit agencies decide that they do have some obligation to cover their service area. The elected officials who ultimately make public transit decisions hear their constituents say things like “We pay taxes too” and “If you cut this bus line, I will be stranded” and they decide that coverage, even in low-ridership places, is an important transit outcome.

Transit agencies are often accused of failing to maximize ridership, as if that were their only goal. In fact, they are intentionally operating “coverage services” that are not expected to generate high ridership. Agencies must balance the competing goals of high ridership and coverage. The balance they choose depends on the values of the agency and the region.
Ridership and Coverage Goals Conflict

Within a given budget, ridership and coverage goals conflict. If a transit agency wants to do more of one, it must do less of the other. Consider the fictional town illustrated at right. The little dots are homes and commercial buildings and other land uses. The lines are roads. As in many towns, most activity is concentrated around a few roads.

A transit agency pursuing only ridership would run all its service on the main streets, since many people are nearby, and buses can run direct routes. Service would be very frequent and convenient, but only available in certain areas. This would result in a network like the one at top-right.

If the transit agency were pursuing only coverage, it would spread its routes out so that every street had some service, as in the network shown in Figure 11. Service would be available almost everywhere, but all routes would be infrequent, even on the main streets.

These two scenarios require the same number of buses and cost the same amount to operate, but deliver very different outcomes. To run buses at higher frequency on the main roads, neighborhood streets will receive less coverage, and vice versa.

An agency can pursue ridership and provide coverage within the same budget, but not with the same dollar. The more it does of one, the less it does of the other.

These illustrations also show a relationship between coverage and complexity. Networks offering high levels of coverage – a bus running down every street – are naturally more complex.

The choice between maximizing ridership and maximizing coverage is not binary. All transit agencies spend some portion of their budget pursuing on each type of goal. A particularly clear way for cities and transit agencies to set a policy balancing ridership and coverage goals is to decide what percentage of their service budget should be spent in pursuit of each.

The “right” balance of ridership and coverage goals is different in every community. It can also change over time as the values and ambitions of a community change.

Figure 11: Within a limited budget, an agency cannot both pursue high ridership and provide total coverage. A transit plan cannot optimize for these two competing goals, but it can strike a deliberate and informed balance between them.
Frequent transit is useful to more people and for more trips.

Frequency Increases Freedom
A transit network is a pattern of routes and services, where each line:

- follows a path,
- at certain days and times (its span),
- at a given average speed, and
- buses (or trains) come at a certain frequency. Frequency is invisible and easy to forget, and yet on transit it is often the most important factor determining where you can get to in a given amount of time.

More frequent service dramatically improves access
More frequent service reduces travel time by providing several linked benefits:

- **Shorter Waits.** Unless you plan your life around a bus schedule, the average wait for transit is half the frequency. If a bus comes every 15 minutes, your average wait will be 7.5 minutes.
- **Faster Connections.** To go further than the places on the line you happen to be on, you'll need to connect to another route. Frequency makes this kind of connection easy, because the next bus is always coming soon.
- **Easier Recovery from Disruption.** Frequent service is more reliable, because if a bus breaks down you don't have to wait long until the next one shows up.
- **Spontaneity and Freedom.** When transit comes every few minutes, there’s no need to build your day around a bus schedule. You can turn up at the stop and go, whenever you want.

Because these benefits are independent of each other, the payoffs are greater as frequency improves, with the highest ridership benefit usually being found in frequencies of 5-15 minutes.

The plot in Figure 12 shows all the routes operated by 24 different U.S. transit agencies. Each route is located on the plot based on its frequency and its productivity (boardings per service hour). More frequent service is to the left, and more productive service is higher up. Each hexagon is shaded by the number of unique routes in that place on the graph.

The plot shows that higher productivity is correlated with higher frequency, even though higher frequencies require more service hours. In other words, ridership appears to rise exponentially as frequency increases.

**How frequent is frequent enough?**
Frequency is expensive, so it’s important to think about just how frequent service needs to be.

A frequency of 15 minutes or better has a good chance of being useful to someone whenever they need to travel. When such high frequencies are offered in dense, walkable areas, along linear corridors, the result tends to be high productivity.

Adequate frequency depends on trip length, because it doesn’t make sense to wait long to go a short distance. For example, in most cases, it wouldn't make sense to wait 15 minutes for the downtown streetcar, because you could probably walk to your destination in that time. But it might make sense to wait that long to go across town.

Figure 12: Transit Productivity and Frequency in 24 cities across the USA. Routes that operate more frequently tend to attract a higher number of riders per hour of service. This is because frequency makes transit trips shorter and more reliable.
How Urban Form Governs Transit Outcomes
Because frequency is expensive, it can’t be offered everywhere. This means it is important to focus frequent service in the places where it can provide the most benefit. This comes down to two questions:

- **How many residents and destinations can be reached from each stop?**
  - In areas with higher density, more people are near the stop.
  - In places with better walkability, more people can actually reach the stop.

- **Can high demand areas be served efficiently?**
  - **Linearity** describes how straight a route is. On a linear route, people’s transit trips are direct, and the transit agency isn’t bearing the costs of long loops and deviations.
  - **Continuity** describes how close-together high demand areas are. On a route serving continuous development, people’s transit trips can be short, and the transit agency isn’t bearing the costs of covering long distances for few riders.

These geometric facts pose a difficult political challenge: A transit system focused on the most useful service, to generate the highest possible ridership for the lowest cost, will cover the city unevenly.

Imagine that Mrs. Smith lives in an apartment downtown (dense, walkable, linear, proximate) while Mrs. Jones lives in a large house in a suburban cul-de-sac (not dense, not walkable, not linear, not proximate).

It would cost much more to provide the same level of service to Mrs. Jones as to Mrs. Smith. But what is fair?

- Is it fair to spend more on Mrs. Jones so she and Mrs. Smith have equally useful service, even though Mrs. Jones is getting a much larger investment of public transit dollars?

- Is it fair to spend the same amount serving each of them, which would mean less-useful service for Mrs. Jones than for Mrs. Smith, because Mrs. Jones is more expensive to serve?

- Or is there some other way to be “fair” in distributing transit service, given the different costs to reach people in different places?

The built environment determines how useful transit can become.

Figure 13: The built environment impacts ridership. On balance, routes that traverse areas with more people and a better pedestrian network, and that follow straighter paths going through fewer empty areas, will attract far more riders, and at lower cost, than the opposite.
Density and walkability often go hand in hand. This is especially true in areas that were developed before car ownership became widespread.

Nonetheless, there’s nothing inherently walkable about a high-density neighborhood. There’s also no specific reason why a low-density neighborhood can’t feature good pedestrian connections.

The aerial photos at right show four different mixes of density and walkability in the Kansas City region. Specifically:

- **High density/high walkability: Vicinity of Country Club Plaza.** This area is the densest mix of commercial and residential uses outside the Downtown Kansas City. Many features make this area attractive for walking. Sidewalks and paths abound. Residential areas include large apartments, and are walking distance to retail and university space.

- **High density/low walkability: St. Joseph’s Medical Center.** This area in far south KCMO includes dense residential and employment development, but it is much harder to walk around. A combination of landscaping, ravines, serpentine roads and large parking lots makes it impractical or impossible to walk in a straight path, and access to retail requires crossing I-435.

- **Low density/high walkability: Prospect & 27th.** Like many neighborhoods on the inner East Side, this area was developed as a walkable streetcar suburb in the prewar era. However, cycles of disinvestment have hollowed out the neighborhood, to the point where many lots are empty and the population is lower than it once was. Nevertheless, it’s an easy walk from anywhere in this area to frequent bus service on Prospect.

- **Low density/low walkability: NW Corner of N 68th & Hwy 169.** This is an example of a recent suburban single-family development. These types of neighborhoods are more prevalent in the Northland. Houses are located on large lots, and subdivisions are separated by green space. Walkability is difficult; sidewalks aren’t available everywhere, and most houses are on long blocks or in cul-de-sacs. Neighborhood streets end at wide, fast main roads with few and difficult pedestrian crossings.

These four neighborhoods would generate very different levels of transit ridership, even in response to the same exact level of service.

Figure 14: Examples of Density and Walkability in Kansas City. (Image source: Google Maps)
The length of a transit route relates to its cost. The major factor governing transit operating cost is a vehicle and driver’s time on the route. Longer distances take more time to drive. For this reason, the more people and destinations a route gets close in a short distance, the less it costs to serve each rider.

As we’ve seen, different parts of Kansas City have been developed in very different ways. This impacts the directness and efficiency of bus routes. Take the following two examples, shown in the aerial photos at right:

- **High Linearity, High Continuity: Independence Ave between Monroe and Wilson.** This area is served by Route 24, one of the most frequent routes in the RideKC network; it’s also one of the routes with the highest number of riders. This is possible in large part because there is continuous development along a linear road – Independence Ave. As a result, Route 24 can get close to many people and destinations while still following a linear path.

- **Low Linearity, Low Continuity: East 63rd between Elmwood and I-435.** This area is served by Route 63, which connects residential neighborhoods with many destinations in south KCMO. However, 63rd Street east of Troost Ave has large gaps between developed areas, especially between Swope Parkway and I-435. This area includes many places that might generate demand for transit, like the Kansas City Zoo, city and federal agency offices, light industrial employment, and even the offices of two local TV stations. But the entrances to most of these places are 1/2-mile or more away from 63rd Street, sometimes up fast streets with no sidewalks. As a result, Route 63 struggles to be both direct and convenient. It gets closer to some offices by deviating on Beacon Drive and Winchester Avenue. That’s convenient for people going to those locations, but makes the trip longer for anyone riding through. All this limits the number of people who might find Route 63 convenient, and ridership is lower as a result.

It’s easier to get to a bus stop on Independence Ave than on 63rd Street, and you don’t have to ride as far to reach other destinations. That makes transit service on Independence inherently more useful than on 63rd. (It is also less expensive for KCATA to provide, because the distances between destinations are shorter.) **Even if the same level of service were offered on both streets, we would expect higher ridership on Independence.**

Figure 15: Examples of Linearity and Continuity in Kansas City. (Image source: Google Maps)
How does on-demand or “flexible” service compare to fixed routes?

The Trouble with Fixed Routes
There are obvious inconveniences in relying on fixed transit routes for your transportation:

- **Long Walks.** Depending on where you are located, it may not be easy to get to the nearest transit stop. It might be far away, or require you to walk down streets where you don’t feel as safe as you’d like.

- **Long Waits.** Even on frequent routes, you may have to wait 10 to 15 minutes to get a bus or streetcar. On some routes, you could wait an hour or longer. And you’ll wait twice if your trip requires a transfer.

- **Travelling out of direction.** Using fixed routes means staying on the bus’ path, even when it’s not the fastest way to your destination.

The Trouble with On-Demand Transit
It may seem obvious that transit would be more convenient if it were provided on-demand, precisely when and where each person wanted to travel. It would then be more like a taxi or traditional “dial-a-ride” transit. Smartphones have raised the possibility that more transit could be this responsive, with great real-time information.

But the argument that transit is better when it is provided on-demand makes sense only if we don’t account for the cost. The main driver of operating cost for transportation (fixed route, on-demand or even local freight delivery) is the time the driver and vehicle spend on the road. Neither apps nor sophisticated dispatching software change that cost.

The costs of a fixed route are fixed, so more useful services are cheaper (per rider) to operate. KCATA knows how much a bus route costs to operate, because the schedule tells us how many vehicles are needed, how many miles will be driven, for how many hours. So the more people ride, the less expensive it becomes to provide each ride.

In contrast, the costs of on-demand service tend to rise as more people find it useful. There is a low ceiling on how many rides per hour an on-demand vehicle can serve, because the schedule tells us how many vehicles are needed, how many miles will be driven, for how many hours. So the more people ride, the less useful it becomes to provide each ride.

### Figure 16: The spectrum of service, from a traditional fixed route to a fully on-demand service.

<table>
<thead>
<tr>
<th>Subsidy per ride</th>
<th>Who can ride?</th>
<th>When can you go?</th>
<th>Where can you go?</th>
<th>How much will you pay?</th>
</tr>
</thead>
<tbody>
<tr>
<td>High ($20 to $50)</td>
<td>Anyone</td>
<td>Anytime, short waits</td>
<td>Anywhere</td>
<td>Bus Fare ($1 to $3)</td>
</tr>
<tr>
<td>Lower ($5 to $10)</td>
<td>ADA Only</td>
<td>Business hours only</td>
<td>Specific locations only</td>
<td>Discounted Taxi Fare ($5 to $40)</td>
</tr>
</tbody>
</table>

The record-setting on-demand service averages just 6.5 boardings per vehicle per hour. In contrast, the average fixed-route bus in KCMO handles 23 boardings per hour. **Moving fewer riders per hour means a service is more expensive per passenger.**

Figure 17: The features that make an on-demand service more convenient for a passenger also make it more expensive to operate. Cities around the country are debating how much subsidy per ride can be justified for on-demand service, and for which groups of people.