Chapter 3: Technology Assessment

What Alternatives Were Considered?

RANGE OF MODES CONSIDERED

Open houses held in each of the 10 counties in July, 2000 focused on identifying the full range of transit modes under consideration. Figure 3-1 is a snapshot description of the modes. They include:

- shuttle/trolley bus;
- express bus;
- bus rapid transit (BRT);
- light rail transit (LRT);
- diesel multiple unit (DMU) rail;
- commuter rail;
- monorail; and
- future "out-of-the-box" modes.

The future mode was a reminder that this study has a long-range planning horizon and should not be limited to considering only modes that exist today.

The modes range from low capacity options such as shuttle buses to high capacity options such as light rail transit (LRT) and monorail. Snapshot descriptions of generalized costs as well as industry standards of typical ridership were developed.

The modes differ as to:

- **where** they can operate – whether on exclusive right-of-way (such as rail tracks or exclusive transit lanes) or on shared right-of-way (such as buses on roads with cars);
- **how fast** they can operate – vehicles on shared right-of-way travel with the speed of the rest of traffic while vehicles in exclusive right-of-way can operate at design speeds;
- **how many passengers** per hour they can carry – which is a function of the size and number of the vehicles and the frequency of trips; and
- **how much they cost –** a function of infrastructure and vehicle costs.

Figure 3-2 is a representation of how the modes are arrayed when considering average right-of-way use, operating speed, line capacity and costs. It indicates that operating speed is higher with exclusive right-of-way operation, and therefore capacities are higher than for shared right-of-way operations. Generally, as these parameters increase, so do costs.

HOW TO DETERMINE APPROPRIATENESS

These general characteristics are informative, but do not address whether these modes are appropriate for East Tennessee. Three factors are instrumental in determining appropriateness. Two technical factors are:

- the level of activity to be served (either population density, employment density or tourist activity); and
- cost.

Localized transit service that covers a small geographic area; may be a bus or trolley and may act as a collector for other higher capacity services.

Average Cost:
$65,000-$250,000/vehicle

Typical Daily Ridership:
Less than 1,000/day

Application:
Low population density

Transit line with long spacing between stops to achieve higher operating speed. Often operates on same street or right-of-way as local service.

Average Cost:
$300,000-$400,000/vehicle

Typical Daily Ridership:
1,000-6,000/day

Application:
Low to medium density

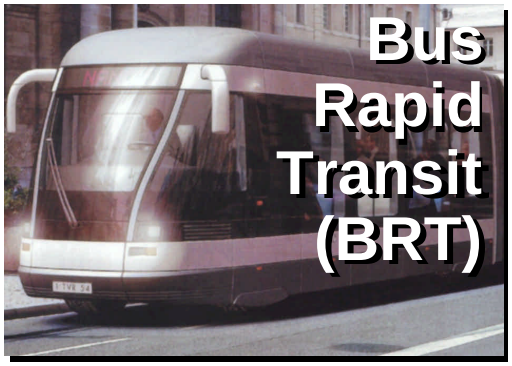
BRT combines quality of rail transit and flexibility of buses; can operate on exclusive transitways, HOV lanes, expressways or ordinary streets; in short a "train on tires".

Average Cost:
$4-$10 million/mile
$300,000 - $1 million/vehicle

Typical Daily Ridership:
5,000-15,000/day

Application:
Medium to high density

Where used:
Cleveland, Orlando, Pittsburgh



LRT is a urban electric railway system with single cars or short trains along exclusive right-of-ways; also known as streetcar, trolley car and tramway.

Average Cost:
$20-$50 million/mile
$2-$3 million/vehicle

Typical Daily Ridership:
15,000/45,000 day (1,000/route mile)

Application:
Medium to high density

Where used:
Portland, San Jose, Baltimore

Self-propelled diesel, multiple unit cars (frequently referred to as Regio-Sprinter); runs on existing double track rail lines.

Average Cost:
$1.8 million/vehicle

Typical Daily Ridership:
15,000/day (1,000/route mile)

Application:
Not certified by Federal Railroad Administration for use in the US

Portion of passenger rail operations that carry passengers within urban areas, or between urban area and their suburbs

Average Cost:
$7-$14 million/mile

Typical Daily Ridership:
1,500/day for a new start line

Application:
Low to medium with high density destination (City Center)

Where used:
Baltimore, Chicago, San Francisco, New York City, Los Angeles, Miami, Boston, Dallas, San Diego

Transit system with vehicles supported by single guideway, usually elevated.

Average Cost:
$40-$100 million/mile

Typical Daily Ridership:
15,000/day (1,000/route mile)

Application:
Medium to high density

Where used:
Resorts/airports-Disney World, Las Vegas

Future

We need to think beyond traditional modes.

How might we travel in the future?

Figure 3-1
TRANSPORTATION ALTERNATIVES

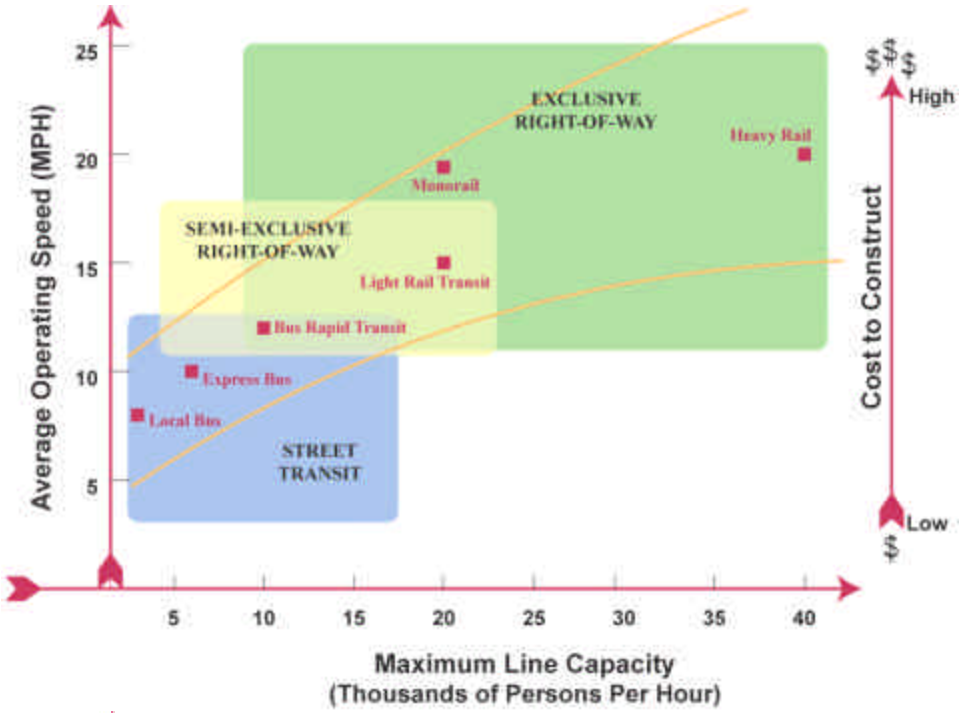


Figure 3-2
MODAL CHARACTERISTICS

The third factor is the desire of local residents as reflected through discussions and the vision for the area.

Today's planning environment stresses sustainable development. This does not necessarily mean the least costly or the most cost-effective solution, but it does suggest that it should be affordable, both now and in the future, by the local region.

Market thresholds have been developed in the transit industry to identify what transit modes are most appropriate. These thresholds are expressed as persons per square mile – either residents or employees. They reflect what amount of "mass" is needed to support various forms of mass transit.

The definition of a ***transit-supportive area*** contained in the Transit Cooperative Research Program of the Transportation Research Board's report *Transit Capacity and Quality of Service Manual* "is the portion of a transit agency's service area that provides sufficient population or employment density (or an equivalent mix) to require service at least once per hour…"[1] The minimum densities identified to support hourly transit service are three household units per gross acre or four jobs per gross acre. Assuming an average of three persons per household, the square mile equivalents of these parameters are:

- 5,760 population per square mile; or
- 2,560 employees per square mile.

the additional seats requires a greater or

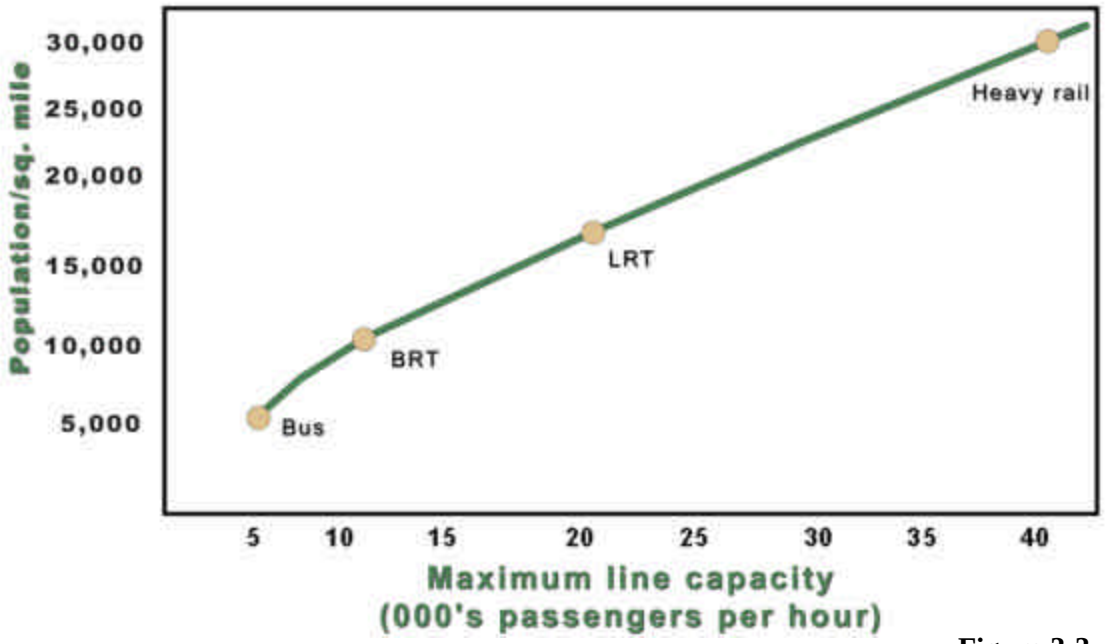


Figure 3-3
TRANSIT-SUPPORTIVE THRESHOLDS

For simplicity, these factors were rounded to 5,750 and 2,500.

These measures are thresholds for hourly bus service, and therefore become the minimum criteria for transit service. As one moves up the mode spectrum, obviously the density requirements increase. Figure 3-3 indicates the general population density threshold required by selected modes, namely bus, BRT and LRT as well as heavy rail. It is dangerous to generalize since each community is different and many factors can influence market conditions. However, this simple chart is a good gauge as to where a region falls on the spectrum and what modes can be reasonably considered.

The thresholds identified for BRT/LRT are higher than for bus service because the system capacities are greater. Filling more dense service area.

The basic bus service threshold is the product of extensive research. The location of the other modes on the curve is based on Wilbur Smith Associates experience with transit operations and planning. The relative location becomes somewhat of a non-issue given East Tennessee characteristics. As described in more detail in Chapters 4 and 5, most of the region has barely the density to support regular bus service, much less any higher capacity systems.

Thus, there is a quantitative measure for determining the appropriateness of transit modes for a specific area. Since the basic measures are population and employment densities, the next task is to determine existing as well as future densities in the region. This information is presented in Chapter 4.

[1] Transit Capacity and Quality of Services Manual, TCRP Project A-15, Transit Cooperative Research Program. Transportation Research Board, National Research Council, January 1999, page 5-22.