TECHNOLOGY

A variety of technologies are available to support use of passes in general public transportation, and most are viable for human services agency-transit system partnerships. There are two primary purposes for transit pass technology from the human services agency and transit system perspective. Those purposes are

1. Collecting fares
2. Accountability that service was provided

The appropriate technology can create a winning partnership for everyone. Pass technology that reduces the amount of cash and cards for the customer also reduces the cash accounting responsibilities for the agency and transit system staff.

This element discusses the process for evaluating and selecting an appropriate transit-related technology. An appropriate technology addresses the needs of partnerships: a pass that effectively meets the purposes mentioned above and reduces the burden on the customer of carrying cash or multiple benefit cards for public transportation.

Review the technology options offered in Step 1 of this element, and remember that there are low-cost options that do not involve computers or magnetic stripe cards. In Step 2, consider the pass technologies available in terms of the budgetary and operational realities and goals.

In Step 3, select the appropriate technology for the transit pass. Since each community and partnership has different needs, it is difficult to list all of the important considerations for the selection process. Keep in mind that some research has shown that human services agency needs can be the catalyst for exploring or even purchasing technology. In general, the considerations that are most important include

- Customer Friendliness
- Ease of Administration for Staff
- System Integration

✓ **Customer Friendliness** — If the customer is not comfortable with the pass technology because it is complicated to use or difficult to obtain (see the Distribution Element), he or she may choose not to use it.

Transit passes must provide accessible and convenient transportation options for customers so that there are no barriers to obtaining the pass, accessing the vehicles, reading schedules and managing their trip.

✓ **Ease of Administration for Staff** — Staff are the first line of contact for customers. If they consider the pass to be inconvenient or difficult to use, it is likely that their experience will be carried over to the customers. It may be worth implementing a pilot project of the technology to gauge the pros and cons of the pass before fully deploying it.

- ✓ **System Integration** — It may be desirable to integrate totally into the same technology as the larger transit system in the area. However, if there are several different fare collection systems in use by transit providers in the region, a hybrid card or even continued use of visual media, may be most appropriate. It is important to consider the issues of integrating software and hardware products from different organizations. For example, who will have responsibility for integration and cost?

Finally, Step 4 discusses incorporating the results of Steps 1 through 3 into a transit pass technology implementation plan.

The following chart is a tool for rating each technology option against general implementation factors. Refer to Step 3 for step-by-step instructions for completing the chart.

Technology Comparison Chart

Technology Application	*Technology Beneficiaries*			
	Consumer	**Human Service Agency Stafff**	**Transit Drivers**	**Transit Administrative Staff**
Accessibility				
Application Process			N/A	
Consumer Convenience		N/A	N/A	N/A
Consumer Education				
Consumer Training				
Cost				
Distribution				
Fraud/Counterfeit				
Intelectual Property Rights	N/A		N/A	
Internal Reporting	N/A			
Legal Privacy Requirements			N/A	
Maintaining a Cash Value Balance				
Similarity to Current Fare Structure				
Staff Training				
Recordkeeping	N/A			
Reconciliation	N/A			
Reporting to Partners	N/A			
Technical Risk	N/A			

Descriptions of transit passes implemented in small, mid-size and large communities using various levels of technology from Smart cards to "no fare" passes, are provided at the link to human services agency-transit pass Transit Pass Program Profiles.

STEP 1: REVIEW AVAILABLE TECHNOLOGY

First, identify technology that is reasonably available and applicable to the pass partnership. Transit pass technologies have a wide range of options to meet the needs of each provider.

The following is a very brief outline of the available technologies, as they exist in mid-2007. There is constant progress in technology and this list will change. This list addresses the list of current technologies in terms of:

- **Current Pass Technologies**
- **Current but Not Ready for Prime Time Pass Technologies**
- **Pass Technologies of the (not so distant) Future**

Current Pass Technologies

Visual Media — Fare media that is visually verified by the driver, without the aid of any mechanical or electronic devices. This is the "traditional" fare media, and can include ID cards with a picture, passes (weekly, monthly, etc.), tickets and tokens.

Magnetic Stripe Cards — Stripe cards come in several varieties (read-only and read-write) and may or may not comply with ISO or other "open" standards.

There are several standards for the data on the card, both proprietary and open; the American Public Transportation Association has published standards that are generally available to the industry.

Smart Cards — These are plastic cards that have an electronic chip embedded. These cards can process a great deal more data than magnetic stripe cards, and are largely secure from copying or fraudulent manipulation.

- E-Purse — Most often, smart cards carry an electronic purse ("e-purse" or, if it is a dedicated purse for transit only, "t-purse"). The fare is debited from the e-purse as the customer rides. Through "autoload" functions, value can be added to the e-purse through the Internet or other means without the passenger having to come to a store or other location. The smart card can also serve as an ID card. Boston, Atlanta, Washington DC, and Los Angeles use or will soon implement this technology.
- Account Based — Some smart card systems are "account based." In an account-based system there is no e-purse on the card itself. The account only reports that the ride has taken place. A separate process calculates the correct fare to be charged and debts money from the card.

  Account-Based Smart Card Examples:
  - A customer who transfers between paratransit and light rail. The rider would normally not be charged a full fare for each segment of the journey. A means must be available to automatically review transactions before the card is charged, and make adjustments.
  - A customer who qualifies for reduced fares on fixed-route transit. If the cards and readers can't support automatically charging a reduced fare for eligible consumers, the account-based system will compare the pass to a list of qualified passengers and charge the correct fare.

Smart cards can support a great number of fare policies. They collect information on each ride the passenger takes or special fares the passenger may be entitled to based on eligibility qualifications. This allows the reader device to charge the correct fare for each ride.

Current but Not Ready for Prime Time Pass Technologies

Traditional Credit and Debit Cards — Cards with magnetic stripes are commonly used on public transit rail systems that offer purchase of fare media at vending machines and sales outlets, and are less common with human service agencies and on public transit buses. Many taxi companies have credit card readers on taxis, making this an attractive alternative for human service agencies that contract service to cab companies. The technology used to read the cards and collect, process and forward data is well established and available at reasonable cost.

Note that there is a charge by the bank for clearing the transaction. These can be quite significant. Intermediary firms are emerging that can "aggregate" transactions. In these schemes, the transaction data is held and several rides by the same consumer may be submitted to the bank as a single transaction.

Contactless Bankcards — Contactless bankcards are being adopted by banks and promise to become widespread in the United States in a few years. Banks are pursuing "micropayments" (under $5) as a new market for credit cards. However, contactless bankcards are functionally similar to traditional credit cards with magnetic stripes. This technology is currently being demonstrated in Salt Lake City and a few stations in New York City.

Radio Frequency Identification (RFID) Cards — These cards (or key fobs) have limited memory and security, and do no data handling on the cards themselves. They are commonly used for building access control, but have been tried in transit on a limited basis.

Hybrid Cards — Most of the cards mentioned above can be combined. For example, a magnetic stripe may be put on a smart card; a RFID chip may be included with a smart card and/or magnetic stripe card.

Pass Technologies of the (not so distant) Future

Contactless cards don't necessarily have to be card-shaped. They can be embedded in key fobs, wristwatches or other items. Alternate shapes may make them very attractive as transit passes for persons with mobility limitations.

Mobile Phones — While not used for payments in the United States (beyond several pilot programs), mobile personal devices are used as a transit pass in several Asian and European countries, and are likely to be used in the United States in the future. These systems can take several forms:

- The consumer can use the phone to schedule or buy a ride and a "ticket" can be downloaded to the phone to be shown on the display.
- The phone is tapped on a reader, as a smart card would be. Enabled phones will be distributed in the United States starting in late 2007. The phone carries an e-purse or communicates with an account.

STEP 2: ESTABLISH NEEDS

Next, inventory the operating requirements of the partnering human services agencies and transit providers. This step requires gathering data to create a complete picture of each partner's needs and resources. Collect data related to

- Participating organizations
- Fares
- Distribution
- On-board processes
- Clearinghouse
- Office processes
- System integration
- Cost
- Legal and technical requirements

Identify potential partners early so as not to preclude later expansion of the system.

✓ **Participating Organizations —** First, identify the organizations that will participate now or may choose to participate in the future.

✓ **Fare Structure —** Inventory the fare structure, policies and fare media to be sure that the selected technology supports, or at least doesn't prohibit, their continued use. For example, a picture ID card is often used as the primary fare media for participating universities or employers, but the ID, in itself, may not be usable with a transit agency that has electronic devices for validating passes. An alternative validation process may be required (such as drivers manually counting and recording ID cards as passenger board).

✓ **Distribution —** The means for getting fare media into customers' hands can be very different between transit providers and human services agencies. These should be identified and understood, including any fees that are paid to distribution outlets. Tools for establishing the distribution method are provided in the Distribution Element of this toolkit. If the pass is to be distributed by human services agency staff only, for example, it will be important to determine how the pass will be printed, who will distribute and account for the passes, and what the reporting requirements for the transit provider involve.

✓ **On-Board Process —** On the vehicles, the customer must interact with the driver and potentially a device such as a fare box or card reader. It is important to understand the interaction. The step-by-step process for

The intent is for the driver to confirm that the customer has paid the fare and/or is entitled to take the trip.

analyzing the on-board process is provided in Appendix A at the end of this element. For example, the human services agency may have a fleet of vehicles it operates that have a farebox and mobile data terminal (MDT) with a card reader, whereas the public transportation provider has no card processing capability (or space for such a device) and collects the fare media. The technology selected, in this case, may need to be in a format that can be accepted by both partnering organizations. One alternative is for the transportation provider that does not have a card reader to permit the human services agency customer to "flash" the pass as he boards the vehicle. The driver usually records flash passes.

✓ **Clearinghouse —** Different technologies will require different levels of integration. Some require bank clearinghouses or other organizations that are prepared to comply with privacy protections. In large urban areas with many transit agencies, there may already be a service organization in place that provides transaction clearing and accounting.

✓ **Office Processes —** Fares must be collected, accounted for and reported. Step-by-step collection and accounting processes are outlined in Appendix B at the end of this element. A local goal may be to save administrative time and resources. If so, selecting the correct technology for your pass will help to achieve that goal. However, selecting the wrong technology will do just the opposite. It is important to document the administrative and billing processes of each partner to find a pass solution that will have widespread benefits. The toolkit offers more detail about back office processes in the Administration, Management and Accountability Element.

✓ **System Integration —** List the equipment and systems that would be required for integration of accounting and management. This may include

- On-vehicle (including possible integration with MDTs)
- Contractor facilities
- Communications networks and computers
- Customer service center(s)
- Reporting, including cost sharing, revenue allocation and scheduling

Find the commonalities among partners that will not require additional technology. The identification process will reveal the incompatible features of each partner's system. Investigate available technology in the industry that could be purchased to make discordant technologies compatible. For example, investigate the availability of a transit pass (card) reader that can read multiple types of cards. The Tri-reader, for example, reads three different identification card formats, thereby allowing the transit provider to accept multiple types of media for the transit pass.

✓ **Cost —** While collecting information on the participants' operations, baseline cost information should be obtained. Partners that are going to transfer information electronically should agree

The objective should be to identify the *full cost* of operating the system and the *avoidable cost*.

on a standardized technology for managing the transit pass.

Likewise, plans for transit vehicle purchases should be factored into the cost analysis. When new vehicles are purchased, the appropriate technology should, as much as possible, be built into the specifications. Utilizing the existing fleet may require aftermarket updates to the vehicles. This means augmenting the appropriate electronic capacities for the new technology to the vehicles. If the cost of technology is shared, partners will need to make a local decision about how to distribute the cost of new vehicles or aftermarket updates to the existing fleet. More information about estimating fully allocated costs and eliminating avoidable costs, to set the price for the pass, is provided in the Price Setting Element of this toolkit.

- ✓ **Legal and Technical Requirements —** In some cases, there may be intellectual property issues that govern the way data is carried on smart or magnetic stripe cards that are already used in a region. For example, the original manufacturer may consider the data scheme proprietary and even charge a licensing fee for additional participants.

  Furthermore, the human services agency and transit provider should consider whether the fare cards should support other applications, beyond transit. For example, fare cards may also be used for access control to facilities or medical or other services. Legal and privacy restrictions may apply and should be fully considered before entering into an agreement. Many transit pass technologies use firewalls to protect information. When selecting an electronic fare card system, contact the provider for information about privacy protection.

  Find transit systems and human services agencies that have implemented the technology to gather the lessons learned regarding legal and technical requirements. Some relevant system profiles offered in this toolkit include

  - MARTA, Georgia
  - CARTS, Texas
  - RIPTA , Rhode Island

Once the local technology needs have been established, prioritize the needs based on the aspects that are most important to the transit pass partnership.

STEP 3: SELECT TECHNOLOGY

Having identified the potential technologies and established the needs that the technology should serve, it is time to use the **Technology Comparison Chart** provided in the introduction of this element.

Use the chart to compare technologies.

1. Create a different chart for each technology selection.

2. For each chart, include the same list of transit pass technology applications along the side, and the technology beneficiaries across the top. The sample chart provided in the introduction lists technology beneficiaries such as customers, human services agency staff and transit system drivers. Additional beneficiaries and applications may be added.
3. Match each technology application to the appropriate beneficiary. For example, if the technology makes transportation accessible, apply a check mark to all beneficiaries because accessibility benefits everyone. Or, if the technology improves recordkeeping for the transit administrative staff but not the human services agency staff, apply a check mark only in the transit administrative staff column. Continue this process for each technology application.
4. Compare the results. Compare the charts for each pass technology that you evaluated to reveal which technology offers the most benefits to the most technology beneficiaries.

Some of the potential technologies will be discarded immediately because they lack the appropriate applications. Others will be retained for further investigation because they satisfy multiple applications and benefit the partners or lead organization.

Cost of the technology is a common decision-making factor. Therefore, it is important to consider all available options and ensure that the effort is collaborative. Mobility management options inspired by SAFETEA-LU regulations are one possible funding source.

Step 4: Develop an Implementation Plan

Steps 1 through 3 helped you identify the need for pass technology and select the appropriate one to meet the transit pass goals and objectives. Now, Step 4 puts the plan into action. Develop a short-range and long-range implementation plan that includes the changes that may be made to everyday processes; new contracts that may have to be negotiated with various parties; costs associated with managing, accounting, and administration; capital costs; training time and expense; pricing and customer service changes. Refer to the appropriate elements in this toolkit for more information about each topic.

Identify capital and operating costs in the business plan.

It is important to identify both capital and operating costs in the implementation plan. If you are receiving grant funds for the technology, it may be beneficial to consider the long-range costs of maintaining and refreshing the equipment.

It is also appropriate to include consideration of risk cost and additional cost that may result from delay. The less "history" a system has the more risk there will be and cost swings of ±20 percent may occur. Experience also shows that fare systems can require a great deal of software development and this nearly always takes longer than expected, which raises administrative cost.

Technology integration progresses slowly, and the implementation plan may be long-range. Revisit the plan on a regular basis to ensure that technology implementation continues to progress. As stated in the Marketing Element, new transit technology can take years to implement.

Summary

Transit pass technology is intended to improve accuracy and ease of transit fare collection from the perspective of the transportation provider and the customer. It can reduce the amount of cash and cards that a customer is required to carry by combining the transit fare card with another type of benefit card, or combining what used to be multiple transit passes into one. Likewise, it can improve accounting accuracy and reduce administrative time for the transit system and human services agency partners. Technology options are ever changing. Consider the steps outlined in this element and investigate new options before purchasing transit pass technology, to ensure that time and resources are appropriately applied.

TCRP Report 96: Determining Training for New Technologies: A Decision Game and Facilitation Guide is useful to transit providers who are implementing new fare technology. The report contains interview results from 14 transit industry professionals regarding decisions about training during implementation of new technology. Any new form of fare media can be applied to the suggested training tools in this document.

APPENDIX A

The data to collect to gain an understanding of the on-board processes for each type of fare technology would include

1. Step-by step customer and driver procedures required to complete a fare transaction on fixed-route vehicles.
2. Perceived problems and benefits of the technology and impacts on other parts of the fare collection process. This input is effectively gained through structured discussions with staff members who will be involved with the pass including, drivers, billing office, customers, human services agencies and program managers.
3. The number of, locations, capabilities and current use of mobile data technology (MDTs).
4. The capabilities and use of card readers. Note that card readers come in several varieties including
    - Magnetic stripe
    - Read-only — only collect the data from the card
    - Read-write — collect data from the card and may write information back to it
    - Smart cards
    - Contactless cards
5. The current and proposed on-board fare collection interfaces to the human services agency and public transportation provider's accounting system.

Appendix B

Information collected about management and accounting for the pass should include

1. Step-by-step procedures for how fares and passes that have been collected from drivers are subsequently processed and reported.
2. Step-by-step process to account for and process non-cash media (tickets, tokens or other fare substitutes). In some cases, these must be turned in to a funding organization to show that the pass was actually provided. In others, they will be recycled for re-use with other passengers, or destroyed to prevent fraudulent resale.
3. Step-by-step process for billing and reimbursement from transit pass partners. If customer fares are paid by through an agreement between the human services agency and transportation provider, define the process for billing and collecting payment.
4. Step-by-step procedures to make cash revenue deposit from the transit provider to the bank (if applicable).
5. Internal reporting requirements that might be impacted by the new technology, such as reporting human services agency customer participation.
6. Involvement of other agencies or clearinghouses. In large urban areas, interagency fare agreements and clearinghouse systems are becoming more common. These may involve third parties who provide this service under contract.
7. Computer and communications systems and software used by each human services agency and transportation provider. In human services agency transportation, it is common for fare accounting to be part of the scheduling system . . . any "hooks" in the software allowing exchange of information with other systems should be identified.
8. Privacy issues. This refers back to the legality issues of the transit pass. If using credit or debit cards, identify the arrangements necessary to comply with privacy requirements and protect against identity theft.