

# Bureau of Transportation Statistics

## Technical Report

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## The Background, Criteria, and Usage of the Intermodal Passenger Connectivity Database

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Intermodal connections, the links that allow passengers to switch from one mode to another to complete a trip, have been an important element of federal transportation policy since passage of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). Since then, the U.S. Department of Transportation has encouraged the development of intermodal connectivity. There is a general consensus that the U.S. passenger transportation system has become more intermodally linked since the passage of ISTEA, but the degree of that connectivity has never been measured. To provide a baseline connectivity measurement against which to measure future progress, the Bureau of Transportation Statistics (BTS), a component of the Research and Innovative Technology Administration (RITA), is developing the Intermodal Passenger Connectivity Database (IPCD). This report describes in detail the background for the project, the considerations that were taken into account in the development of the project, the criteria used to determine where connectivity exists, and information to help users of the IPCD understand its contents.

### Statutory Background

In 1991, the Intermodal Surface Transportation Efficiency Act (ISTEA) marked a major change in federal transportation policy. Instead of considering the needs of each mode individually, ISTEA sought to encourage the development of intermodal connections, stating that “The National Intermodal Transportation System shall consist of all forms of transportation in a unified, interconnected manner.” Interconnecting the modes would give both shippers and travelers transportation alternatives that unconnected, parallel systems do not offer. Also, with interconnectivity, the system would function more efficiently because each mode would be relied on for the transportation that it could most effectively provide. Subsequent transportation reauthorization legislation has continued to encourage an intermodal system for both passenger and freight transportation.<sup>1</sup>

<sup>1</sup> Subsequent transportation reauthorization is contained in the 1998 Transportation Equity Act for the 21<sup>st</sup> Century (TEA-21), and the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) in 2005.

### Intermodal Connectivity Measurement

The most precise measurement of connectivity in the passenger transportation system would be to measure the number of passengers who actually use multiple public transportation modes to complete their trips. It might be possible to capture these data for some services that feature through-ticketing or services that are highly coordinated by the carriers involved.<sup>2</sup> However, at the majority of connecting terminals, passengers simply make a connection themselves from one mode to the other, and the existence of an intermodal trip is not recorded.

Another way to measure the degree of connectivity in the system would be to quantify the number of possible intermodal passenger travel routings. However, due to the number of alternative mode combinations available for travel between most points, and the essentially infinite number of origin-destination itineraries, this also would prove to be an impractical measurement task.

Focusing on the existence of intermodal terminal facilities is the most reasonable way to measure the connecting opportunities and, thus, the availability of intermodal travel options in the passenger transportation system. The intermodal terminal is the key building block for developing connectivity because travelers can only transfer between modes if there is a place to do so. Federal intermodal transportation policy recognizes this, and as a result most federal programs aimed at fostering passenger intermodalism have focused on changing the historical pattern of each mode having its separate terminal. Therefore, the IPCD project focuses on identifying passenger terminals where multiple modes come together. Terminals served by multiple modes enhance the livability of the local community by offering a selection of travel options for residents at a central location.

<sup>2</sup> Examples are Continental Airlines’ Allentown, PA-Newark International Airport, NJ feeder bus; Amtrak Thruway bus service operated to connect with intercity trains at various locations around the country; and connecting transit services where passengers use a single electronic fare medium

**Table 1: Active Passenger Terminals by Mode With Intermodal Passenger Connections**

	48 states			Alaska / Hawaii			50 state total		
	Total terminals	With connections	Percent	Total terminals	With connections	Percent	Total terminals	With connections	Percent
Intercity rail stations	505	274	54.3%	22	6	27.3%	527	280	53.1%
Airports	434	148	34.1%	237	11	4.6%	671	159	23.7%
Ferry terminals	254	111	43.7%	42	10	23.8%	296	121	40.9%
<b>Total</b>	<b>1,193</b>	<b>533</b>	<b>44.7%</b>	<b>301</b>	<b>27</b>	<b>9.0%</b>	<b>1,494</b>	<b>560</b>	<b>37.5%</b>

**NOTE:** The terminals shown in this chart represent those that have been included in the Intermodal Passenger Connectivity Database as of December 2008. Some data have been updated and may differ from that in BTS Special Report SR-004, issued in September 2007. Data for rail transit and intercity bus will be added in future Special Reports.

**SOURCE:** U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, Intermodal Passenger Connectivity Database as of December 2008.

## Intermodal Passenger Terminal Database

The IPCD includes not just terminals with intermodal connectivity, but all passenger service terminals. This facilitates calculation of the percentage of terminals with intermodal links, and will also create a consolidated database of all U.S. passenger terminals<sup>3</sup>. With no such database available, development of the IPCD has necessitated gathering data from several sources. Also, with no single source of data on the modes serving existing terminals, that aspect of the project has required considerable research. There are an estimated 6,500 terminals from all modes to research<sup>4</sup>, so BTS is approaching the data gathering in phases.

Research on intercity rail stations and airports was completed and the data were made available in September 2007; ferry facilities were added to the database in January 2009<sup>5</sup>. With the addition of the ferry connectivity data, the IPCD contains 1,494 terminals, with intermodal connections at 38 percent of those facilities.

## Data Sources

The IPCD utilizes data from several databases at the U.S. Department of Transportation and also from several public information and data sources.

For the geographic coordinates of intercity rail stations and airports, BTS used latitude and longitude data in facilities

<sup>3</sup>Ferry terminals linked by ferries that primarily function as a "floating bridge" carrying vehicle traffic across a body of water between two road segments, and that do not generally serve passengers on nonvehicular trips, are not considered part of the passenger transportation system for purposes of inclusion in the database.

<sup>4</sup>The database includes 527 intercity rail stations, 673 airline airports, and 296 scheduled passenger ferry terminals; it will also include an estimated 1,100 commuter rail stations, 1,800 heavy and light rail stations, and 3,000 intercity bus terminals.

<sup>5</sup>*Making Connections: Intermodal Links In the Public Transportation System*, U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, SR-004, Washington, DC, September 2007 highlights the findings of the intercity rail and airports phase of the Intermodal Passenger Connectivity Database (IPCD). *Making Connections: Intermodal Links Between Scheduled Passenger Ferries and Other Public Transportation*, U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, SR-012, Washington, DC, February 2009, highlights the findings of the ferry phase of the IPCD.

databases that BTS received from the Federal Railroad Administration and Federal Aviation Administration. Geographic coordinates for ferry terminals were obtained from the BTS-maintained National Census of Ferry Operators.<sup>6</sup> For facilities that were found to have service but were not included in any of these data sources, BTS used various mapping websites that contained satellite or aerial imaging. Facilities were located from the images and the latitude and longitude calculated.

To ensure that all locations with service were included in the IPCD, BTS used the websites of rail, bus, air and ferry operators; local and regional transit agencies; state departments of transportation; and various sites that aggregate public transportation information. BTS also used printed public materials such as timetables, maps, and brochures issued by various public transportation providers, and facility databases provided by Greyhound, Amtrak, and the Alaska Railroad. In some cases, personal communication was used to clarify questions about the various terminal facilities.

## Data Collection

Data collection for the IPCD is being done sequentially by mode. Due to the complexity of the data collection task, available resources to complete the database, and the need to rely, at least in part, on publicly available data sources that are constantly updated (especially websites), it has been necessary to collect data on a "realtime" basis, rather than to collect data as of a specified date.<sup>7</sup> While the database, therefore, does not represent a one day snapshot of the system, it still is a highly useful picture of the overall connectivity status of the passenger transportation system. Once the initial data collection for all modes is complete, regular updating will allow analysis of the long-term progress toward increasing connectivity in the passenger transportation system. Table 2 shows the data collection schedule for the IPCD.

<sup>6</sup>The National Census of Ferry Operators for 2006 can be found on the BTS website at [www.bts.gov](http://www.bts.gov).

<sup>7</sup>Each record in the database, which represents a specific passenger transportation facility, includes the date that the record was most recently updated and includes source notes on where information was obtained.

**Table 2: Modal Data Collection Schedule for Intermodal Passenger Connectivity Database**

Terminal type	Data collected	Scheduled data collection
Intercity rail stations	2006-2007	
Airports	2006-2007	
Ferry terminals	2007-2008	
Commuter rail		2008-2009
Heavy rail (subway)		2009
Light rail		2009-2010
Intercity bus		2010

**SOURCE:** U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics as of December 2008.

## Criteria for Defining Connectivity

While simple in concept, identifying facilities that offer intermodal connections is not always straightforward. Several factors were evaluated, including proximity, scheduling/timing, whether a customer is able to make the connection without using a third vehicle, and whether information about using the connection is readily available. As BTS began to research terminal facilities to determine whether intermodal connections exist, several questions arose based on the situations observed:

- If two modes are not located in the same terminal facility but are very close together (e.g., a transit bus at the curb in front of a train station), how close is “close enough” to be considered as an intermodal connection?
- Where two modes serve the same facility but at different times of day, how close time wise must the modes serve that terminal to be considered as offering an intermodal connection? Should that vary depending on time of day or type of facility?
- Are two modes connected when the schedules allow travelers to connect from Mode A to Mode B, but not from Mode B to Mode A?
- Are two modes connected when another vehicle is needed to make that connection (e.g., an airport shuttle bus, or a transit link designed to facilitate a connection, such as the Los Angeles FlyAway bus from Union Station to Los Angeles International Airport (LAX).
- Does specific information on the availability of a connection between two modes need to be readily available to the public in order to consider that an intermodal connection exists?

To address these and other questions, an Intermodal Passenger Connectivity Team from several of the Department of Transportation modal agencies met to reach a consensus on

how passenger intermodal connectivity should be defined.<sup>8</sup> Rather than rely on federal grant program definitions, legislative language, or other existing criteria used to define projects eligible for intermodal program funding, the team took an approach based on the perspective of the traveler. The connectivity team wanted to identify as an intermodal connection, one that a traveler would likely consider using. The team did not want the guidelines to consider intermodal connectivity to exist where a traveler unfamiliar with that location would not be able to easily find their way to connect from one mode to another. At the same time, the team members did not want to create guidelines that were so restrictive that they would exclude nearby connections that most people consider usable. The team did not find already established, generally accepted criteria of what constitutes an intermodal passenger connection. Therefore, the group developed its own criteria that define situations where travelers would consider connecting between modes to be convenient enough to be utilized.<sup>9</sup>

## Proximity

When two modes use the same terminal building, proximity is not an issue. However, defining whether connectivity exists when modes are nearby but not in the same building proved to be more problematic. Some examples of the kinds of situations that needed to be addressed in developing criteria for proximity were:

- Whether connectivity exists when a public transit bus serves a rail station by stopping at the curb on the street in front of the station.
- How close a subway station entrance must be to another terminal, such as a rail or intercity bus terminal, in order to be considered as offering connectivity.
- Whether the need to cross a busy street to get from a rail station to a transit bus stop is inconsistent with connectivity.
- At what distance apart do two facilities no longer offer connectivity, and should the criteria be expressed in feet, city blocks, walking time, or some other measure.

Adding to the difficulty of defining acceptable proximity is the qualitative element. Travelers at a hub airport might walk distances in excess of half a mile within the terminal buildings to connect between flights. But a shorter walk of three blocks on a city street to get from an intercity bus terminal to a light rail station might not be considered by most travelers to be a useful connection (especially in extreme weather, at night, or depending upon neighborhood characteristics such as sidewalks, amount of street lighting, etc.) A distance that is too far to drag a suitcase might be perfectly acceptable for a person with just a briefcase. So there was considerable discussion about whether distance alone is a useful criterion.

<sup>8</sup> The team consisted of representatives of the Federal Transit Administration (FTA), Federal Railroad Administration (FRA), Federal Highway Administration (FHWA), Federal Maritime Administration (MARAD), Federal Aviation Administration (FAA), and the Office of Intermodalism of the Research and Innovative Technology Administration (RITA).

<sup>9</sup> The team developing the criteria recognizes that there is a degree of inconvenience in any connection compared to direct service.

While the ideal intermodal facility is one where both modes serve the same building, many passenger connections are made between modes in adjacent or nearby buildings, and carriers often promote connecting services with other modes that are nearby, but don't share the same terminal. To some extent, reasonable proximity is "in the eyes of the beholder." Some people may have no concerns with walking a quarter of a mile or even longer to make a connection.<sup>10</sup> Others might find such a transfer to be too inconvenient to consider. Having to leave one terminal for another adds an element of uncertainty except for travelers very familiar with that specific connection. For a traveler with disabilities, connectivity between modes may also depend upon the accessibility of the facility (or facilities) involved. After considering actual examples from around the country, the team observed that most (but not all) links regarded as intermodal connections that are not within the same building consist of modes located within about one block of each other. Based on this, and applying what the team felt were some common sense conclusions, the specific proximity criteria outlined in box A were developed.

## Box A: Proximity Criteria for an Intermodal Connection

A connection exists between modes if

- They serve the same terminal building, or
- Serve facilities that are within the same block, or
- Serve facilities in an adjacent block, but within a one block radius, as long as the traveler does not have to cross a major thoroughfare at an unprotected intersection, or cross some other physical barrier, or
- Are located in buildings that are more than one block apart but are connected by either an enclosed structure or a conveyance operated by either the facility or one of the carriers involved for the sole purpose of facilitating a connection between modes in the two buildings.

**SOURCE:** U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, March 2009.

## Timing

Even when two modes are in the same building, the timing of their services may make connectivity inconvenient despite the close proximity. This is especially relevant when one of the modes operates only infrequently or during overnight hours, creating long wait times between the arrival of one mode and the departure of the other. For example, at a rail station where

Amtrak operates two trains during the middle of the night, but the local transit bus service operates only during daytime hours, is connectivity offered between intercity rail and transit? When trying to determine a reasonable waiting time, the team concluded that there are qualitative factors in addition to quantitative factors. One such factor might be time of day. For example, a two and a half hour wait for a connection at a terminal might be reasonable during daylight hours, but a similar wait for the subway by a passenger arriving on an intercity bus at 3:30 a.m. might not be.

Another timing issue involved connecting services when modes operate less than daily service. There are many intercity travel facilities where the local transit bus operates only 5 or 6 days per week. Thus, a passenger getting off an airplane, intercity bus, or train might be able to connect to local transit as long as they don't want to connect on Sunday. Less than daily operation, or even infrequent daily operation, can create a situation where a delayed inbound trip might result in a very long wait or no alternate departure to connect with.<sup>11</sup>

The team considering connectivity criteria felt that varying service circumstances at intermodal connection locations across the country made it inappropriate to define specific scheduling criteria. Depending upon the modes and specifics of the various situations, different connecting times might be deemed appropriate and acceptable by the traveling public.

Instead of trying to define a wide range of acceptable timing criteria, the team focused on identifying a narrower range of situations where scheduling normally would deter travelers from attempting an intermodal connection. The first such situation involves locations where passengers arriving on one mode can connect to a second mode, but when traveling in the other direction, there is no connection from the second mode back to the first mode. The second type of situation is when one of the modes serves the facility only during the overnight hours (midnight-6 a.m.), and the other serves only during daylight hours. While a traveler arriving during the overnight period may be able to wait in the facility until the connecting mode's morning departure, most would not feel comfortable having to spend many hours in a terminal during the night waiting to continue their trip.

The final type of situation addressed is when one (or both) of the modes does not serve the facility on all of the days that it operates at that city. (e.g., a local transit operator provides service in the city 7 days per week, but it serves the intercity rail station only Monday-Friday) If by limiting the number of days that it operates at the facility in question, there are days when both modes operate but on some of those days they don't connect, then an intermodal connection will not be considered to exist. In that case, there will be considered to be a "near connection," a term that is explained in the next-to-last section of this report.

In summary, the situations where connectivity will not be considered to exist are highlighted in box B.

<sup>10</sup> The trip planning function on many transit agency websites allows the user to define an acceptable walking distance of up to one-half mile in order to make a connection.

<sup>11</sup> Seasonal services at a facility are considered provided that they meet the other connectivity criteria.



## Connectivity Via a Third Vehicle

In many locations, services exist to allow travelers to connect between modes serving two different terminals in the same city or metro area. For example, in Los Angeles, the FlyAway bus operating direct from Los Angeles International Airport (LAX) to Union Station provides a means for an airline traveler to reach intercity and commuter rail services. At Washington Reagan National Airport, a person arriving by air can get to the intercity rail station by using heavy rail transit that serves both locations but is not operated specifically to link the two facilities. Do these services constitute connectivity between air and intercity rail? At several airports a third vehicle is used to transfer passengers between two distinct airport facilities to make an intermodal connection. Some examples--Newark Liberty International Airport where passengers arriving by rail connect to the airline terminal buildings via a monorail, BWI Thurgood Marshall Airport where a similar connection is made via an airport operated shuttle bus, and St. Louis Lambert International and Burbank Airports where the intercity bus stop and intercity/commuter rail stations, respectively, are adjacent to an airport parking lot and the connection can be made either by walking or by airport shuttle bus. How should connectivity be defined in those cases?

### Box B: Scheduling Situations That Are Not Considered to be Intermodal Connections

- The scheduling of arrivals and departures at the facility does not permit connections both to and from each of the modes involved.
- Connecting travelers need to wait greater than two hours during the midnight-6 a.m. period in order to make a connection between the two modes.
- A mode serving the facility less than daily does not provide that service on all of the days that it operates in that city or town, and as a result there are days that the intermodal connection with the other mode is not available (e.g., the intercity rail provider serves the facility 7 days per week, but transit service is provided only Monday-Friday even though the transit agency operates service seven days per week).

**SOURCE:** U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, January 2009.

Preliminary thinking was to exclude from the definition of connectivity any transfer that required the use of a third vehicle. However, this seemed too restrictive in light of what happens at certain airports when a separate vehicle is used for a connection between flights. For example, at Dallas/Fort Worth International, Terminal E is not physically connected to the other terminals. Travelers making a connection to a flight at another terminal cannot walk. They must use the Skytrain

people mover. At Denver, passengers connecting between flights at different concourses must use a people mover as well, and passengers at Washington Dulles departing from any of the midfield terminals use a mobile lounge.<sup>12</sup> At these and other airports that use some type of people mover, the transfer vehicle is effectively part of the facility. In many respects it is not unlike an elevator, moving walkway, or escalator. It would not be logical to say that transfers between flights were not direct connections. Accordingly, the database defines intermodal connections to exist between modes requiring the use of a third conveyance to make the connection, provided that:

- the conveyance is operated by one or both of the facilities being linked for the purpose of facilitating connections between those facilities, and
- the vehicle is operated by one of the carriers serving either of the facilities for the purpose of facilitating connections between those facilities.

However, a transfer vehicle linking two facilities that is not operated by (or on behalf of) one of the facilities or one of the carriers cannot be considered to be an integral part of either facility. The FlyAway bus between the airport and rail station in Los Angeles, mentioned above, is operated by the transit agency. Because it is not part of the airport or rail station operation, nor is it operated by Amtrak, Metrolink (the two rail operators at Union Station), or one of the airlines, air and rail service cannot be considered to have a direct connection. Even though a connection between air and rail would not be considered to exist, there would be an intermodal connection between air and transit bus at LAX airport and between transit bus and rail at Union Station. Although not considered a direct intermodal connection, many air passengers would eventually end up on rail service, and vice versa.

## Information Availability

A desirable element of connectivity is information availability. A few examples of intermodal connection information availability are the Amtrak Thruway connecting bus services marketed by Amtrak, transit bus links to transit rail services that are marketed by the transit agency, and airport websites that include information on public transportation operators serving the airport. Although active promotion of intermodal connections increases the likelihood of their use, there are many connections that are not promoted but are used by travelers who learn of them through experience, word-of-mouth, or actively searching carrier schedules, websites, etc. Therefore, if the proximity criteria are met, and there are no timing issues that preclude a connection from qualifying as intermodal, an intermodal connection will be deemed to exist regardless of its promotion status.

There are some situations where intermodal connections are promoted by one or both of the carriers involved, even though the connection does not meet the proximity or timing criteria outlined here (e.g., terminals may be two blocks apart, but the connection is promoted). If the carriers have determined that

<sup>12</sup> An underground people mover at Dulles, called AeroTrain, will replace the mobile lounges in 2009.

it is reasonable for travelers to use the connection, BTS will not override their understanding of the marketplace and the specific situation even if it does not meet our criteria. When it is promoted by the carriers involved as an intermodal connection, we will treat it as such for purposes of the IPCD.

## Database Contents

The database includes one record for each passenger terminal facility. This record includes facility identification data, location

information for the terminal (including latitude and longitude), data on the modes providing services, statistical data, and supplemental data and notes. Specifically, the fields listed in table 3 are in each record.

Note that for purposes of comparing intercity vs. transit service, Rail Commuter is considered transit service. However for categorization of modes, it is considered as standard rail rather than transit rail since it operates on the standard national rail network rather than separate transit rail right-of-way.

**Table 3: Database Fields**

<b>The following fields identify the facility:</b>	
Facility ID	A unique nine digit facility identifier consisting of the state code for the facility, the zip code, and a sequential two digit number assigned to facilities within that zip code.
Facility name	Facility name
Facility type	Rail station, airport, bus station, etc.
Website	URL of website for the facility (when one exists)
Data Source	Public and other external data sources used by the Bureau of Transportation Statistics to find information on modes serving this location.
Notes	Listing of modes serving the facility and other factors relevant to the findings in regard to service status of the various modes.
Date updated	Date that this record was last updated.
<b>The following fields are included so that records can be correlated with those in other publicly available databases:</b>	
Airport code	The three-letter IATA code assigned to this facility where applicable.
Airport code2	The FAA airport code used for this facility when it differs from the IATA code.
Amtrak station code	The three-letter code used by Amtrak for this terminal.
Ferry terminal code	The terminal identifier used in the BTS National Census of Ferry Operators.
<b>The following are location information fields:</b>	
Address	Street address
City	City where the facility is located
State	Postal state abbreviation
Zip code	Postal five-digit zip code
Metro area	Name of Census Bureau Core Based Statistical Area (Metro Area) where the facility is located.
CBSA type	Indicates whether CBSA is a Metropolitan Statistical Area (population at least 50,000+) or a Micropolitan Statistical Area (population 10,000-50,000)
CBSA code	Census Bureau Core Based Statistical Area Code
<b>The following fields indicate the status of service for each of the modes at this terminal facility (see table 4 for a definition of each mode):</b>	
Ferry transit	Indicates whether transit ferry serves this facility (=1), is a "near connection" (=2), serves elsewhere in the city but not this facility (=0), or does not serve the city at all (=3).
Ferry intercity	Indicates whether intercity ferry serves this facility (=1), is a "near connection" (=2), serves elsewhere in the city but not this facility (=0), or does not serve the city at all (=3).
Bus transit	Indicates whether transit bus serves this facility (=1), is a "near connection" (=2), serves elsewhere in the city but not this facility (=0), or does not serve the city at all (=3).
Bus intercity	Indicates whether intercity bus serves this facility (=1), is a "near connection" (=2), serves elsewhere in the city but not this facility (=0), or does not serve the city at all (=3).
Bus code share	Indicates whether code share bus serves this facility (=1), is a "near connection" (=2), serves elsewhere in the city but not this facility (=0), or does not serve the city at all (=3).
Bus supplemental	Indicates whether supplemental bus serves this facility (=1), is a "near connection" (=2), serves elsewhere in the city but not this facility (=0), or does not serve the city at all (=3).
Rail intercity	Indicates whether intercity rail serves this facility (=1), is a "near connection" (=2), serves elsewhere in the city but not this facility (=0), or does not serve the city at all (=3).
Rail commuter	Indicates whether commuter rail serves this facility (=1), is a "near connection" (=2), serves elsewhere in the city but not this facility (=0), or does not serve the city at all (=3).

*(continued on next page)*

Rail heavy	Indicates whether heavy rail serves this facility (=1), is a “near connection” (=2), serves elsewhere in the city but not this facility (=0), or does not serve the city at all (=3).
Rail light	Indicates whether light rail serves this facility (=1), is a “near connection” (=2), serves elsewhere in the city but not this facility (=0), or does not serve the city at all (=3).
Air service	Indicates whether airline service serves this facility (=1), is a “near connection” (=2), serves elsewhere in the city but not this facility (=0), or does not serve the city at all (=3).

**The following fields contain statistical data based on the services provided by the various modes:**

Intercity service	Indicates whether service at this location is provided by at least one intercity mode (Rail Intercity, Bus Intercity, Bus CodeShare, Bus Supplemental, Ferry Intercity, or Air Service) (0=“no”/1=“yes”)
Transit service	Indicates whether service at this location is provided by at least one transit mode (Rail Commuter, Rail Heavy, Rail Light, Bus Transit or Ferry Transit) (0=“no”/1=“yes”)
Modes serving	Count of the number of modes
Mode air	Indicator of whether the air mode serves this location (0=“no”/1=“yes”)
Mode rail standard	Indicator of whether Rail Commuter or Rail Intercity serves this location (0=“no”/1=“yes”)
Mode rail transit	Indicator of whether Rail Heavy or Rail Light serves this location. (0=“no”/1=“yes”)
Mode ferry	Indicator of whether Ferry Intercity or Ferry Transit serves this location (0=“no”/1=“yes”)
Mode bus	Indicator of whether at least one of the four bus modes serves this location (0=“no”/1=“yes”)

**Table 4: Modal Category Definitions**

Mode	Definition	Comments
Ferry transit	Scheduled ferry service running between points within a city or the same metropolitan area.	
Ferry intercity	Scheduled ferry service running between points that are not within the same metropolitan area, or are not located in any metropolitan area.	
Bus transit	Bus service operated on a route within a city or single metropolitan area.	Most often operated by a transit agency, a private company operating under contract to a transit agency or authority, or in some cases service is operated by a private company.
Bus intercity	Scheduled bus service running on routes that are not completely within the same metropolitan area, or link locations not in any metropolitan area.	In addition to over-the-road scheduled buses, this category includes scheduled airport bus services from cities outside of the metropolitan area served by the airport.
Bus code share	A scheduled bus service that is sold as a connection by a carrier of another mode as a connection to that mode.	While this is usually a route that would be classified as “Bus Intercity”, it is operated specifically as an intermodal feeder to another mode, and as such is highlighted with a separate category.
Bus supplemental	A scheduled bus service operated along an intercity rail route to provide additional frequencies for travelers on the rail route	While the trip on a supplemental bus may not involve a connection to another mode, it is a service that is operated as an additional frequency in conjunction with another mode. As such it is highlighted with a separate category.
Rail intercity	Scheduled rail service operated by either Amtrak or the Alaska Railroad, running on routes that are not confined to a single metropolitan area	
Rail commuter	Scheduled rail service operated by a commuter railroad, on the national rail network, usually within a single metropolitan area.	
Rail heavy	A transit rail service such as a subway or elevated train that operates on a dedicated right of way within a city or metropolitan area.	
Rail light	A transit rail service such as a light rail vehicle, streetcar or trolley car operating on a right of way that includes street running and may also include running on dedicated trackage.	
Air service	Served by scheduled airline service that is open to public sale.	

## Additional Detail Concerning the Modes

Although the modes can be classified into five broad categories (air, bus, ferry, rail transit, and standard rail), six additional categories are used to draw distinctions that might be useful for research and analysis. The terminal records in the database include a field for each of the 11 modal categories so that each type of service at the terminal is identified. The modal categories used, the definition of each category, and comments on the rationale for using each of those categories are shown in table 4.

In addition to the 11 modes listed in table 4, there are also several groupings of modes, once again for the purpose of various analyses. These groupings are each shown as a field in the record of each facility. The modal groupings and the modes that they include are listed in table 5.

## Quantifying Intermodal Connectivity

Initially the intention was for each mode and modal grouping at each terminal to simply indicate whether or not service is provided. Based on that data the percentage of terminals that offer intermodal connectivity could be quantified and statistics compiled by mode. However, as data collection began it became evident that for analytical purposes more detailed categorizations were needed.

To simply report (yes/no) as to whether a mode serves a particular terminal does not take into account whether there is any service from that mode in the particular city or town where the terminal is located. In quantifying, for example, what percentage of intercity rail stations are served by ferries, it would present a somewhat misleading picture to include all Amtrak stations, because most are in cities that do not have any ferry service. To permit more meaningful analyses, for each mode or modal grouping at a facility, one of the following is indicated:

- 0 = Service not provided at this facility but elsewhere in the city.
- 1 = Service provided at this facility.

- 2 = Service provided but does not qualify as a connecting mode because proximity, timing, or bidirectional service criteria are not met. These are categorized as “near connections.” (See next section of this report)
- 3 = Service by this mode not offered in this city.

These categories allow analyses to take into account whether two modes are present in the same city so that data developed on how well the modes are connected can be based on whether there is a realistic possibility of intermodal connectivity. This data is used for example, in the special reports on the IPCD done by mode. See footnote 5 for a list of those reports.

## Near Connections

In some cases the definition of connectivity would have been met, except that the two modes were located just slightly further apart than the one block proximity criterion, or the timing/scheduling precluded a finding of connectivity. In those cases, rather than simply report that there is no connection, it seemed useful to classify the connection as a “near connection,” indicating that with a small adjustment to either route or schedule (or both), connectivity could be created. Analyzing “near connectivity,” in addition to existing connectivity, shows the number of potential additional connections that could be established in the passenger transportation system by small service adjustments.

## Adjacent Terminals

In many instances there are two terminals that house different modes of transportation that are located adjacent to each other, and are often physically connected. For example, at O’Hare Airport, Chicago, IL, there is heavy rail transit system station adjacent to the airport terminal building that is physically connected to the public areas of the airport. At O’Hare, and at many other similar facilities, the two facilities served by the two modes might be considered to be a single terminal. However, we will show adjacent terminals as separate facilities within the database, with the modes serving each terminal being indicated as available at the adjacent terminal as well as

**Table 5: Modal Groupings for Analytical Purposes**

Grouping	Description	Modes included
Mode, air	Air service is provided at the facility	Air service
Mode, bus	Bus service is provided at the facility by at least one of the bus modes	Bus intercity, bus transit, bus code share, bus supplemental
Mode, ferry	Ferry Service is provided at the facility by at least one of the ferry modes	Ferry intercity, ferry transit
Mode, rail standard	Facility is served by at least one of the rail modes that operates over the national rail network	Rail intercity, rail commuter
Mode, rail transit	Service is provided by at least one of the rail transit modes.	Rail heavy, rail light
Intercity service	Facility is served by at least one of the intercity modes.	Rail intercity, bus intercity, bus code share, bus supplemental, ferry intercity, air service.
Transit Service	Facility is served by at least one of the transit modes.	Rail heavy, rail light, rail commuter, bus transit, or ferry transit



## Box C: Sample Data Elements for Separate but Linked Facilities (General Mitchell International Airport and Airport Rail Station, Milwaukee, WI )

Data field	Airport terminal record	Explanatory notes	Airport rail station terminal record
Facility ID	WI5320701	Separate facility ID's	WI5322101
Airport code	MKE	Airport code shown for both rail and air facility since both modes are considered to serve both facilities.	MKE
Airport code2		No secondary airport code for General Mitchell Int'l	
Amtrak station code	MKA	Amtrak city code shown for both rail and air facility since both modes are considered to serve both facilities.	MKA
Ferry terminal code		Not applicable	
Facility status	1	1=active	1
Date updated	3/2/2007		9/25/2006
Address	5300 S. Howell Ave.		5601 S. 6th Street
City	Milwaukee		Milwaukee
State	WI		WI
Zip code	53207		53221
Metro area	Milwaukee--Waukesha, WI		Milwaukee--Waukesha, WI
Facility name	General Mitchell Int'l		General Mitchell Int'l
Longitude	-87.897		-87.925
Latitude	42.947		42.931
Facility type	1	1=Airport; 10=Intercity Rail	10
Ferry transit	3	3=Mode does not serve this locale	3
Ferry intercity	3	3=Mode does not serve this locale	3
Bus transit	1	1=Served by this mode (note--transit bus actually serves airport terminal, but because rail terminal and air terminal are linked by airport shuttle bus, connecting mode is available at both facilities.)	1
Bus intercity	1	same as BUS_TRANSIT	1
Bus code share	3	3=Mode does not serve this locale	3
Bus supplemental	3	3=Mode does not serve this locale	3
Rail intercity	1	1=Served by this mode (note--actually serves rail terminal, but because rail terminal and air terminal are linked by airport shuttle bus, mode is considered available at both facilities.)	1
Rail commuter	3	3=Mode does not serve this locale	3
Rail heavy	3	3=Mode does not serve this locale	3
Rail light	3	3=Mode does not serve this locale	3
Air service	1	1=Served by this mode (note--actually serves air terminal, but because rail terminal and air terminal are linked by airport shuttle bus, mode is considered available at both facilities.)	1
Website	www.mitchellairport.com		www.dot.state.wi.us/travel/rail/mars.htm
Notes	Served by Amtrak (via airport shuttle bus), Badger bus, Milwaukee Transit System	Provides details of actual	Served by Amtrak, and airlines, Badger bus, Milwaukee Transit System via Airport Shuttle bus.
Data source	Amtrak file, www.ridemcts.com, www.mitchellairport.com, www.badgerbus.com,	Lists data sources other than DOT facility databases and web mapping sites where data was obtained to validate particulars of connecting modes.	Amtrak station file, www.ridemcts.com, www.mitchellairport.com, www.badgerbus.com,
Intercity service	1	0=no, 1=yes	1
Transit service	1	0=no, 1=yes	1
CBSA code	33340	Five digit Census Bureau code for micropolitan or metropolitan area (CBSA=Core Based Statistical Area)	33340
CBSA type	1	1=Metropolitan Area; 2=Micropolitan Area	1
Modes serving	3	Count of transportation modes serving using the mode groups which follow in this record.	3
Mode bus	1	Groups all four types of bus service. Used for count of modes serving.	1
Mode air	1	Used for count of modes serving.	1
Mode railstd	1	Includes intercity and commuter rail. Used for count of modes serving.	1
Mode railtrt	0	Includes light rail and heavy rail transit. Used for count of modes serving.	0
Mode ferry	0	Includes intercity and transit ferry. Used for count of modes serving.	0

the terminal served.<sup>13</sup> This will still accurately indicate the availability of connecting services without introducing the complexity of trying to develop additional criteria for determining when two connected facilities are a single terminal and when they are not. Therefore, at O'Hare there is an airport in the database, and it shows heavy rail transit as serving the airport. There will also be an O'Hare heavy rail transit station shown, which will have air service available.<sup>14</sup> All adjacent terminals (whether physically connected or not) will be shown separately. Showing adjacent facilities separately allows for more accurate statistical analysis of the extent of each mode's network.

## An IPCD Record

Records in the IPCD can be downloaded into an Excel spreadsheet in the CSV data format. Two records from the database are shown in box C to demonstrate the type of data that can be obtained and to highlight certain features of the database. For purposes of the printed page in this technical report, the records are being arrayed in columns instead of rows (they are arrayed as rows in the IPCD) These two records are for

<sup>13</sup> Adjacent terminals meet the criteria that were discussed earlier in this report for modes being connected.

<sup>14</sup> At this time heavy rail transit has not yet been added to the database so the Chicago O'Hare heavy rail transit station is not yet listed.

the airport facility and the rail station at the General Mitchell International Airport in Milwaukee. Therefore, they also demonstrate the treatment of two separate terminals for different modes that are considered as one as discussed above in the sections on "Connectivity Via a Third Vehicle" and "Adjacent Terminals".

## Current and Future Project Status

To date, the IPCD contains data on 547 intercity rail stations, 673 scheduled airline airports, and 296 scheduled passenger ferry terminals. Future additions to the database will add the following types of terminals to the database:

- commuter rail,
- heavy rail transit,
- light rail transit (including street car, trolley, etc.), and
- intercity bus.

The next mode to be added to the database will be commuter rail facilities, and the next report to be issued during 2009 will detail findings for that mode. 🔄

### About this report

This Technical Report was prepared by Bruce Goldberg, Transportation Specialist, in the Bureau of Transportation Statistics (BTS). BTS is a component of the Department of Transportation's Research and Innovative Technology Administration.

This report provides technical background on the background for the BTS Intermodal Passenger Connectivity Database, and the considerations which went into developing the criteria for defining connectivity in the intermodal passenger system.

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### Data –

- Intermodal Passenger Connectivity Database
- National Census of Ferry Operators

- National Transportation Atlas Database: Intermodal Terminal Facilities—the freight counterpart to the Intermodal Passenger Connectivity Database.

### Publications –

- *Making Connections: Intermodal Links in the Public Transportation System*, Bureau of Transportation Statistics, Special Report SR-004, September 2007.
- *Making Connections: Intermodal Links Between Scheduled Passenger Ferries and Other Public Transportation Modes*, Bureau of Transportation Statistics, Special Report SR-13, January 2009.
- National Census of Ferry Operators, Bureau of Transportation Statistics, updated 2006.
- National Transportation Atlas Database: Intermodal Terminal Facilities—the freight counterpart to the Intermodal Passenger Connectivity Database, Bureau of Transportation Statistics, updated 2008.