Rail (re) Connection

Benton J. Cooper

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Rail (re) Connection
by
Benton Cooper

A Terminal Project
Presented to the Faculty of
The College of Architecture at the University of Nebraska
In Partial Fulfillment of Requirements
For the Degree of Master of Architecture
Major: Architecture

Under the Supervision of Professor Nate Krug
Lincoln, Nebraska
May, 2012
The primary goal of this project is understand why the passenger rail industry in the United States has fallen short of the rest of the world over the last several decades and to promote the revitalization and re-connection of the passenger rail industry within the United States, with the focus starting in the Midwest. The overall scope of the project is to use existing rail infrastructure, track and existing smaller depots, and new hub terminals to integrate passenger traffic back into the rail industry. As the existing infrastructure becomes outdated and/or worn new infrastructure to support new rail technology will be added. In addition to the phased infrastructure changes and additions, new larger hub terminals will be constructed in key cities that will serve as the major connection points of the system. The hub terminals themselves will be used as the catalyst to re-invent the image of rail travel and regain public interest and support. The goal of the terminals is not to simply build a rail terminal but create a civic space that is connected to the fabric of the city and gets people who are not currently using the system into the space and excited about rail travel. In addition to being the hub for regional rail, the terminals will also serve as hubs for local transit systems as well. Proper connection of buses, light rail, taxies, bicycles, and access (through the other systems) to the local airports, will allow the terminals to function more efficiently on a local level. In addition the design of the terminals will not only facilitate them serving as a physical connection point for transit, but as aesthetic and emotional connection to the heritage of rail travel in the United States. In all this will accomplish creating new an updated image of American rail travel, while maintaining a connection to its heritage, and creating efficient physical connections to greater percentage of the population.
“No improvement can equal in utility the railroad”
-Abraham Lincoln
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“The United States as we know it today is largely the result of mechanical inventions, and in particular of agricultural machinery and the railroad.”

- John Moody
Why has passenger rail been unsuccessful in the US (Specifically the Midwest), while succeeding in most other developed parts of the world, and how can it be improved and used to re-connect cities in the Midwest?
*Understand why the passenger rail industry in the United States has fallen behind the rest of the world

*Promote a revitalization and re-connection of the passenger rail industry within the United States, starting in the Midwest

*Initial re-use of existing infrastructure and addition of new infrastructure when old infrastructure becomes worn

*Creation of hub terminals in key cities to serve as primary connection points of new system

*Connect the terminals themselves to the existing fabric of the city they occupy by creating new urban spaces centered around the transit system

*Terminals will serve as connection points for not only the regional rail but as connection points for all local forms of transit, light rail, buses, bicycles, and motor vehicles

*Terminals will serve not only as a physical connection to the transit systems, but also the design should form an emotional and visual connection to the heritage of rail travel in the United States
Over the last several decades the American passenger rail industry has been in decline, while rail systems throughout the rest of the world have evolved and flourished. Today rail travel in the United States has begun to regain popularity, primarily at an urban commuter level, but at the national level Amtrak has seen significant increases in ridership as well. Even with this new interest in rail travel the U.S. is still decades behind countries such as Germany and Japan in rail technology and passenger usage. The key cause for the decline of passenger rail in the U.S. is the lack of government involvement. In 1971 the U.S. government took over control of the passenger rail industry from the private companies due to declining ridership and the private companies’ lack of desire to continue service. From this Amtrak was born. Initially small investments were made in Amtrak to purchase equipment, such as locomotives and rail cars, but very little has been done since. A majority of Amtrak’s fleet of rail cars were built in the 1970’s and are worn out and/or damaged. Many of Amtrak’s cars and locomotives have been damaged in minor accidents over the years, but due to lack of funding the equipment sits unable to have simple repairs performed. In addition to Amtrak’s equipment problems, the company itself owns almost no rail infrastructure. They do possess some small lengths of track, as well as the track for the Acela high speed train, but the majority of the trains must run on rented track owned by the private freight companies. This in turn causes scheduling and dispatching conflicts for both systems, with two different rail companies attempting to utilize the same infrastructure. In addition, Amtrak has no priority over freight trains, and passenger trains must pull off the main lines and wait for other trains to pass, thus slowing passenger service and creating an inefficient system. The common factor in all these issues is Amtrak’s lack of funding. Amtrak has never turned a profit, although this is not uncommon for a passenger rail system anywhere in the world. Due to the capital investment and operating costs of a railroad, making a passenger service profitable is next to impossible, and no national rail system has found a method of doing it. On the surface this may seem odd, but other modes of transit ran by federal governments work in a similar way, the interstate highway system for example. Roads cost more to operate and maintain than rail systems do, only the costs are more difficult to see, since they are paid for through taxes instead of fares. Only recently has the U.S. federal government realized the need to re-invest in its passenger rail system, and with the state of the system currently it will take more than the 20-30 years that have been wasted already to get America’s system up to the same level as other developed countries.

To remedy these issues with America’s passenger rail system five aspects of it need to be addressed: **GOVERNMENT POLICY, SYSTEM INFRASTRUCTURE, TRAINS AND RAIL CARS, TERMINALS AND DEPOTS, AND THE PUBLIC IMAGE OF RAIL TRAVEL**.

**Government policy** is the first and most crucial issue to be dealt with, without it to set change in motion nothing else can take place. The focus of the federal policy must be to create a better sense of cooperation between Amtrak and the freight companies. This will allow for better use of infrastructure and a more efficiently run system. The most logical way to accomplish this is through subsidies and tax credits to the private companies that assist with the evolution and operation of the passenger rail industry. In addition much greater capital investment is needed in Amtrak, this would allow them to purchase new equipment as well as begin to develop their own infrastructure and be less dependent on the private companies. Also, additional investment in rail technology development would aid in creating new types of rail technology and infrastructure to serve the new system. This could take the form of government contracts to current producers of rail technology and/or investment in or creation of rail technology programs at academic institutions.
The next issue to be addressed is the system infrastructure itself. The U.S. currently has extensive rail infrastructure, so a completely new system will not be required initially. At first existing track can be used, but as it wears and new technology becomes available, the old system can be replaced and upgraded. This will allow for a smooth transition to new technology, as well as spreading the costs of a new rail system out over a long period of time. In addition upgrading the infrastructure in this manner will allow for time to develop new ways of operating a passenger system, due to the fact that how the U.S. uses and operates rail is very different that other countries due the size of the country and the distances that must be traversed. The tracks themselves will not be the only part of the existing system re-used at first, existing terminals and depots will also be restored and re-fitted to serve the new system as well. In addition to the restored local depots, large new terminals will be placed in key cities to serve as the hubs of the systems, as well as creating urban spaces within the cities focused around transit. The system will operate on two levels; the regional level, and the local level. At the regional level larger, higher speed trains will run between the hub cities transporting people over the longer distances much more quickly. These trains will also run more frequently, 3-4 trains a day, contrary to Amtrak's current schedule which is typically one train a day. Once in a hub city passengers can board smaller local trains (that will run less frequently) to travel to or from small towns within the region that particular hub serves. As an additional source of income to the system, these local trains would have the ability to carry small freight loads as well as mail, as passenger trains once did.

In addition to the infrastructure the trains themselves also need to be addressed. With the current fleet of Amtrak passenger cars being built in the 1970’s, and update in design and technology would greatly improve the experience of riding the train. The new types of trains will need to be designed to fit the needs of the contemporary American traveler. This could take the form of completely new types of rail cars to fit new user needs, to more simple ideas such as new materials and basic technology upgrades. The rail car is where the rail user spends a majority of their time, and should be a pleasant environment to be for both brief and extended periods of time.

The key part of integrating rail travel back into American society will be the rail terminals themselves. The terminals will not only serve as hubs for the regional system but they will also serve as hubs within the city for all local transit systems. The terminals will also be used to create large civic spaces within the urban environment of the cities they occupy. This will help to reconnect the urban environment of large cities in the Midwest as well as allowing the terminals to be used for more than just a transit hub, and creating exposure of the rail system to people who are not currently using the system, and in turn gaining public interest and support for rail travel.

The final aspect of America’s rail system that must be addressed is the overall image of rail travel. This will primarily be accomplished through the methods already mentioned, such as new trains and terminals. How the system is advertised and promoted will have a profound effect on how successful it is and what its future will be. Currently, the image of rail travel in America is of a slow, outdated system. This needs to be changed to a much more modern and high tech image. Having modern trains and terminals that reflect the technology and trends of current society while at the same time having timeless design aspects to them, will allow the image of the new rail system to remain relevant over the service life of the new infrastructure as well as showing what the future of rail travel can be.
Creating a modern and exciting image for rail travel while at the same time making it integral part of urban and rural environments through the use architecture will help to bring the United States passenger rail system up to and beyond the level of other rail systems throughout the world.
Deutsche Bahn (DB) was created in 1994 by combining the previous state railroads of Germany. The company itself (Deutsche Bahn AG) is a private joint stock company, but continues to serve as the national railroad for Germany as its predecessors did. DB is broken up into over 500 subsidiaries that include moving both passengers and freight primarily on rail but also by road. The company is headquartered in Berlin and employs approximately 276,300 people. Their most recent business year produced around $4.9 million in revenue for the company, with 84% of that business being passenger based. The rail system itself consists of over 20,000 miles of track and roughly 5,700 stops and depots. DB’s fleet of locomotives is made up of both full electric and diesel electric units, with the full electric units being used primarily for passenger service. DB’s passenger service carries over 1.9 billion passengers per year and runs over 26,000 trains per day. The freight service carries over 400 million tons of cargo per year and runs approximately 5,100 trains per day. DB is also in the process of creating systems and practices for more sustainable rail travel and transport; this includes both infrastructure and technology changes as well as education to help the communities DB services.
Japan Railways Group (JR Group) is made up of seven companies that took over the previous primary rail company in Japan, Japanese National Railways. Six of the companies are entirely passenger service, with a majority of the service being intercity and commuter rail service. The seventh company solely a freight transport service. The six passenger service lines each serve a different region of the country, each of which has a hub that is centrally located within the region. Although JR Group is the parent company each of the seven subsidiaries function as a separate company tailored to the needs of the region and type of service they provide. Overall JR Group employs over 149,000 people and maintains 11,700 miles of track. Their locomotive fleet is made up primarily of electric units, but the freight company does use some diesel electric units. In recent years JR Group trains have carried over 22 billion passengers per year and around 51 million tons of cargo.
Burlington Northern Santa Fe (BNSF) is the second largest rail company in the United States. It is based out of Fort Worth, Texas and serves the Midwest and the West Coast. BNSF was created in 1995 by a merger of the Burlington Northern Railroad and the Santa Fe Pacific Railroad, and is currently owned by Berkshire Hathaway Inc. Although the roots of the company go back much further, the original rail company that is now BNSF was originally founded in 1849 in Illinois and was called the Aurora Branch Railroad. BNSF is a freight only company, but does co-operate five commuter rail lines in urban areas. The trains and rail is owned by the local companies but the crews are BNSF. These companies consist of BNSF Railway Line, Metrolink Southern California, New Mexico Rail Runner Express, Northstar Commuter Rail, and Sounder (Puget Sound). BNSF owns and maintains roughly 32,000 miles of track and 110 depots, switching and maintenance yards. Their locomotive fleet is made up entirely of approximately 6,000 diesel electric units. Over 40,000 people are employed by BNSF at their service and office facilities as well as train crews. In recent years BNSF has had over $18 billion in revenue per year and in turn re-invested $2.6 billion per year back into the rail system infrastructure.
Union Pacific Railroad (UP) was founded in 1862 and is currently headquartered in Omaha, Nebraska. UP serves the Midwest and the West Coast. UP currently owns and maintains over 32,000 miles of track and 39 freight facilities, and switching/maintenance yards. This includes the Bailey Yard in North Platte, Nebraska which is the world’s largest rail switching yard. UP’s locomotive fleet is made up of approximately 8,200 diesel electric units for its freight service. UP does also maintain two steam locomotives and several vintage diesel electric units for executive trains and recreational excursions. These locomotives are all based out of UP’s Cheyenne, Wyoming facility that serves as base of operations for its steam program, which also includes a fleet of vintage passenger cars stored in Council Bluffs, Iowa. UP employs over 50,000 people all over the country in a wide variety of job types. Over the last few years UP has had over $16 billion in revenue per year with $2.5 billion per year being re-invested into the rail system. UP serves over 25,000 customers in a wide variety of fields including, agriculture, vehicle manufactures, steamship lines, chemical manufactures, and energy companies. Union Pacific also operates the Metra Commuter System in Chicago.
The Portland Street Car system was opened in 2001 and is owned and operated by the City of Portland. It consists of eight miles of track with 46 stops. The street cars themselves were built by Skoda-Inekon in the Czech Republic and are designed to fit the scale of the neighborhoods they service. They created minimal disruption of the existing environment and the small size of the cars allowed them to move through the dense urban environment with ease. The fleet of ten street cars is powered by overhead electrical lines and can hold carry 140 people each. The system has GPS trackers embedded in the cars allowing riders to determine through the reader board at the stops or the internet when the next car will be arriving. The system cost only $2 a day for riders to use and over 2.9 million people ride the Portland Street Car each year.
Portland MAX

Metropolitan Area Express (MAX) began service in 1986 in Portland, Oregon. The system is made up of 52.4 miles of track, 85 stops, and 127 rail vehicles. The MAX system operates primarily on its own right of way, but on Portland’s transit mall it shares space with the bus system, although the trains maintain priority. The rest of the system runs alongside highways, in road medians or on existing railroad tracks. The cars themselves are powered by overhead electrical wires and operate in groups of one or two due to the short length of city blocks in Portland. The daily rider cost for use of the system is $4.75 and roughly 32 million people ride the system each year.
The Chicago “L” system was first constructed in 1892 but has expanded greatly since then. It is operated by the Chicago Transit Authority and serves as a subway style commuter train for urban Chicago. The system consists of 224.1 miles of track with 144 stops spread across eight lines. The cars themselves are powered by electricity from a third rail, and can reach a speed of 55 miles per hour. A majority of the track located within downtown Chicago is elevated above grade to prevent interference with street traffic, but the lines that reach further out into the suburbs have track on grade. The system costs approximately $5.75 a day to ride, but cost be reduced by purchasing passes for longer periods of time. In recent years The “L” has carried approximately 162 million riders per year, and ridership is still rising.
Minneapolis/St. Paul Metro Transit operates a single light rail line dubbed the Hiawatha Line. It went into operation in late 2004 and consists of 12.3 miles of track with 19 stops. It runs from downtown Minneapolis through the Minneapolis/St. Paul International Airport and terminates at the Mall of America. The cars themselves are powered by overhead electrical wires and run on their own right of way with a top speed of 55 miles per hour. In downtown the trains slow to 40 miles per due increased pedestrian and car traffic around the tracks. Each train typically is made up of two cars, and each car can hold 66 seated passengers as well as 120 standing passengers. In addition all cars have hangers for commuters with bicycles. Fares are for periods of 2.5 hours and are the same as bus fares, $1.75 for non-rush hours; $2.25 for rush hours, and passenger can transfer between busses and light rail. Yearly ridership has been rapidly increasing since the system opened and is now over 10 million riders per year.
<table>
<thead>
<tr>
<th>Rail System Statistics</th>
<th>Standard Rail</th>
<th>Deutsche Bahn</th>
<th>JR Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miles of Track</td>
<td>20,995</td>
<td></td>
<td>11,700</td>
</tr>
<tr>
<td># of Passengers Per Year</td>
<td>1.95 Million</td>
<td></td>
<td>22.24 Billion</td>
</tr>
<tr>
<td>Locomotive Types</td>
<td>Electric &amp; Diesel Electric</td>
<td>Electric &amp; Diesel Electric</td>
<td></td>
</tr>
<tr>
<td># of Employees</td>
<td>276,310</td>
<td></td>
<td>149,860</td>
</tr>
<tr>
<td># of Stops/Depots</td>
<td>5,700</td>
<td></td>
<td>6,000+</td>
</tr>
<tr>
<td>Revenue</td>
<td>$4,956,413,521 (2010)</td>
<td></td>
<td>-------</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Light Rail</th>
<th>Portland SC</th>
<th>Portland MAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miles of Track</td>
<td>8</td>
<td>52.4</td>
</tr>
<tr>
<td># of Passengers Per Year</td>
<td>3,963,368 (2011)</td>
<td>32,037,600 (2011)</td>
</tr>
<tr>
<td>Locomotive Types</td>
<td>Electric</td>
<td>Electric</td>
</tr>
<tr>
<td># of Stops</td>
<td>46</td>
<td>85</td>
</tr>
<tr>
<td>Ticket Cost</td>
<td>$2.00 Per Day</td>
<td>$4.75 Per Day</td>
</tr>
</tbody>
</table>
Of the rail systems researched the ones that were successful had several common themes. The first being that if the system ran both freight and passengers, both were operated by the same company. This allows for more efficient train scheduling and use of infrastructure.

In addition the systems had multi-modal access. This applied to both the passenger and freight components of the systems. The ability to access different types of transit systems to and from the rail system appeared to have a positive effect on the rail system itself.

The final common element is a recent increase in ridership. This applied to all the passenger systems researched from the urban commuter systems to the nation wide systems. In addition Amtrak has also had an increase in passenger over the last several years, proving that there is interest and demand for a more extensive passenger rail service.

<table>
<thead>
<tr>
<th>Union Pacific</th>
<th>BNSF</th>
</tr>
</thead>
<tbody>
<tr>
<td>32,012</td>
<td>32,000</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Diesel Electric</td>
<td>Diesel Electric</td>
</tr>
<tr>
<td>50,000+</td>
<td>40,000+</td>
</tr>
<tr>
<td>39</td>
<td>110</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chicago “L”</th>
<th>Minn. Light Rail</th>
</tr>
</thead>
<tbody>
<tr>
<td>224.1</td>
<td>12.3</td>
</tr>
<tr>
<td>162,700,000 (2006)</td>
<td>10,500,000 (2010)</td>
</tr>
<tr>
<td>Electric</td>
<td>Electric</td>
</tr>
<tr>
<td>144</td>
<td>19</td>
</tr>
<tr>
<td>$5.75 Per Day</td>
<td>$1.75 Per 2 Normal Hours</td>
</tr>
<tr>
<td></td>
<td>$2.25 Per 2 Rush Hours</td>
</tr>
</tbody>
</table>
## Energy Costs

<table>
<thead>
<tr>
<th>Vehicle (Gross Weight)</th>
<th>Rail (18,500 Tons)</th>
<th>Airplane (255,000 Lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPG (Avg)</td>
<td>.14 (GE Diesel Electric)</td>
<td>.2 (Boeing 747)</td>
</tr>
<tr>
<td>MPG Per Pound</td>
<td>1,669,512,195,122</td>
<td>1,275,000</td>
</tr>
<tr>
<td>Fuel Type/Cost Per Gallon</td>
<td>Diesel $3.38</td>
<td>Jet Fuel $5.50</td>
</tr>
<tr>
<td>Cost to Move 1 Ton 500 Miles</td>
<td>$0.65</td>
<td>$107.25</td>
</tr>
<tr>
<td>Top Speed</td>
<td>80 MPH</td>
<td>565 MPH</td>
</tr>
<tr>
<td>Cost Per Mile</td>
<td>$24.14</td>
<td>$27.50</td>
</tr>
<tr>
<td><strong>Semi-Truck (80,000 lbs)</strong></td>
<td><strong>Car (3,995 lbs)</strong></td>
<td><strong>Bus (36,200 lbs)</strong></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>---------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>7 (Kenworth T700)</td>
<td>26 (Pontiac G8)</td>
<td>9.2 (Thomas HDX)</td>
</tr>
<tr>
<td>11,428.58</td>
<td>153.65</td>
<td>3934.78</td>
</tr>
<tr>
<td>Diesel $3.88</td>
<td>Gasoline $3.60</td>
<td>Diesel $3.88</td>
</tr>
<tr>
<td>$6.92</td>
<td>$34.61</td>
<td>$11.60</td>
</tr>
<tr>
<td>70 MPH</td>
<td>75 MPH</td>
<td>75 MPH</td>
</tr>
<tr>
<td>$0.55</td>
<td>$0.14</td>
<td>$0.42</td>
</tr>
</tbody>
</table>

**Cost to Move 1 Ton 500 Miles ($)**

**Top Speed**

**Cost Per Mile ($)**
### INFRASTRUCTURE COSTS

<table>
<thead>
<tr>
<th></th>
<th><strong>HIGHWAY</strong></th>
<th><strong>STANDARD RAIL</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost Per Mile</td>
<td>$30 Million</td>
<td>$2 Million</td>
</tr>
<tr>
<td>Right of Way Cost Per Mile*</td>
<td>$60,600 (12.12 acres)</td>
<td>$6000 (1.2 acres)</td>
</tr>
<tr>
<td>Right of Way Size (width)</td>
<td>100’</td>
<td>10’</td>
</tr>
<tr>
<td>Service Life</td>
<td>20 Years</td>
<td>50+ Years</td>
</tr>
</tbody>
</table>

*land cost based on average cost of irrigated farm ground - $5000 per acre

---

**Cost Per Mile($)**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Highway</th>
<th>Rail</th>
<th>Electric Rail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>35,000,000</td>
<td>5,000</td>
<td>40,000,000</td>
</tr>
</tbody>
</table>

**Right of Way Cost Per Mile ($)**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Highway</th>
<th>Rail</th>
<th>Electric Rail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>70,000</td>
<td>10,000</td>
<td>60,000</td>
</tr>
</tbody>
</table>
Both the operating costs and infrastructure costs of rail fall below those of road and air travel. Rail can carry more pounds of cargo or people on a gallon of fuel than any other system by a large margin. The actual cost per mile of rail is comparable to air travel, until the amount of weight carried is factored in, a train can carry almost 150 times the cargo of an airplane for essentially the same cost. The infrastructure costs are also less than other modes of transit. Roads can cost around $30 million to build per mile and require around 12 acres of land per mile to build, while rail only requires around 1 acre and cost approximately $2 million per mile. The service life of a rail system is almost double that of a road in most cases. There are specific portions of track that do have shorter life spans, such as sharp curves and switches, but as a whole rail systems last much longer.

In addition electric rail systems have similar life spans, but do cost significantly more due to the addition of high voltage electrical infrastructure. In addition to the lower financial costs of rail, the environmental costs are much lower as well. When comparing rail, air, and road travel, rail uses less energy and expels less environment harming elements than any other mode of transit.
Environmental Impact - Long Distance

Chicago, IL to Los Angeles, CA
Distance (Kilometers):
Road - 3,267  Rail - 3,500  Air - 3,034

Primary energy consumption
Energy resource consumption

<table>
<thead>
<tr>
<th></th>
<th>TC Truck</th>
<th>TC Train</th>
<th>TC Airplane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truck</td>
<td>14.098</td>
<td>0</td>
<td>213</td>
</tr>
<tr>
<td>Train</td>
<td>0</td>
<td>3.921</td>
<td>0</td>
</tr>
<tr>
<td>Airplane</td>
<td>0</td>
<td>0</td>
<td>83,648</td>
</tr>
<tr>
<td>Sum</td>
<td>14.098</td>
<td>3.921</td>
<td>83,861</td>
</tr>
</tbody>
</table>

Carbon dioxide
Greenhouse Gas, climate changes

<table>
<thead>
<tr>
<th></th>
<th>TC Truck</th>
<th>TC Train</th>
<th>TC Airplane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truck</td>
<td>33.2</td>
<td>0</td>
<td>0.5</td>
</tr>
<tr>
<td>Train</td>
<td>0</td>
<td>9.2</td>
<td>0</td>
</tr>
<tr>
<td>Airplane</td>
<td>0</td>
<td>0</td>
<td>198.8</td>
</tr>
<tr>
<td>Sum</td>
<td>33.2</td>
<td>9.2</td>
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Particulate matter
Combustion related

<table>
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<tbody>
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<tr>
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<tr>
<td>Sum</td>
<td>12.7</td>
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</tbody>
</table>

*Data Created Using EcoTransIT
CO2-Equivalents
Climate changes

Nitrogen oxides
Acidification, overfertilization, smog

Nonmethane hydrocarbons
Smog, damage caused to so.'s health

Sulfur dioxide
Acidification, damage caused to so.'s health

Distances
Distances for each transport mode
**ENVIRONMENTAL IMPACT - Short Distance**  
**Chicago, IL to Omaha, NE**  
**Distance (Kilometers):**  
**Road-768  Rail- 781  Air-808**

### Primary energy consumption

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<tbody>
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<td>152</td>
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<tr>
<td>Train</td>
<td>0</td>
<td>875</td>
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<tr>
<td>Airplane</td>
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<td>0</td>
<td>49.394</td>
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<tr>
<td><strong>Sum</strong></td>
<td>3.315</td>
<td>875</td>
<td>49.546</td>
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### Carbon dioxide

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</tr>
<tr>
<td>Train</td>
<td>0</td>
<td>2.1</td>
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<tr>
<td>Airplane</td>
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<td>117.4</td>
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<tr>
<td><strong>Sum</strong></td>
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### Particulate matter

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<td>0.89</td>
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CO2-Equivalents

- **Climate changes**
  - [Tons]

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<tbody>
<tr>
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</tr>
<tr>
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<td>0</td>
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<tr>
<td>Airplane</td>
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</tr>
<tr>
<td><strong>Sum</strong></td>
<td>8,0</td>
<td>2,1</td>
<td>120,4</td>
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Nitrogen oxides

- Acidification, overfertilization, smog
  - [Kilogramme]

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<td>29</td>
<td>356</td>
</tr>
<tr>
<td>Train</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Airplane</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Sum</strong></td>
<td>38</td>
<td>29</td>
<td>356</td>
</tr>
</tbody>
</table>

Nonmethane hydrocarbon

- Smog, damage caused to so.’s health
  - [Kilogramme]

<table>
<thead>
<tr>
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<th>TC Airplane</th>
</tr>
</thead>
<tbody>
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<td>0</td>
<td>0,2</td>
</tr>
<tr>
<td>Train</td>
<td>0</td>
<td>3,5</td>
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<tr>
<td>Airplane</td>
<td>0</td>
<td>0</td>
<td>74,4</td>
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<tr>
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<td>5,1</td>
<td>3,5</td>
<td>74,6</td>
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</table>

Sulfur dioxide

- Acidification, damage caused to so.’s health
  - [Kilogramme]

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<th>TC Airplane</th>
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<tr>
<td>Truck</td>
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<td>0</td>
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<tr>
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<td>9,5</td>
<td>2,5</td>
<td>173,1</td>
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Distances

- Distances for each transport mode
  - [Kilometer]

<table>
<thead>
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<th>TC Truck</th>
<th>TC Train</th>
<th>TC Airplane</th>
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</thead>
<tbody>
<tr>
<td>Truck</td>
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<td>781</td>
<td>808</td>
</tr>
<tr>
<td>Train</td>
<td>0</td>
<td>761</td>
<td>0</td>
</tr>
<tr>
<td>Airplane</td>
<td>0</td>
<td>0</td>
<td>759</td>
</tr>
<tr>
<td><strong>Sum</strong></td>
<td>768</td>
<td>781</td>
<td>808</td>
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</tbody>
</table>
The United States already has an extensive rail system. Currently all the infrastructure is owned by private freight companies, with exception of a few small commuter systems. Through better cooperation with the private companies this infrastructure can serve as the base and initial infrastructure for a new passenger rail system.

**EXISTING RAIL SYSTEM**

- Miles of Rail: 32,012
- States Served: 22
- Depots: 39
Miles of Rail: 32,000
States Served: 26
Depots: 110
**Combined Rail Network**

- Miles of Rail: 64,012
- States Served: 26
- Depots: 149
**Criteria for Hub Selection**

*Each state served must have a minimum of one hub*
*City must have 250,000 residents or be the largest city in the state*
*Access to an medium to large scale airport*
*Must have existing rail infrastructure*
*Must have existing urban transit system of potential to implement one*

**Potential Hubs by State**

**Montana**
- Billings

**Kansas**
- Wichita

**Iowa**
- Des Moines

**Wyoming**
- Cheyenne

**Oklahoma**
- Oklahoma City
- Tulsa

**Missouri**
- Kansas City
- St. Louis

**Colorado**
- Denver
- Colorado Springs

**Texas**
- Houston
- San Antonio

**Arkansas**
- Little Rock

**North Dakota**
- Fargo

**Louisiana**
- New Orleans

**South Dakota**
- Sioux Falls

**Minnesota**
- Minneapolis/
- St. Paul

**Wisconsin**
- Milwaukee

**Nebraska**
- Omaha
- Lincoln

**New Mexico**
- Albuquerque

**Illinois**
- Chicago
POTENTIAL HUB CONNECTIONS

- Straight Corridors
- Omaha Hub
- Chicago Hub
- Kansas City Hub
Regional Hubs

Radial Corridors

Max Interconnectivity

Based on Existing Rail Lines
Regional Line Routes
Amtrak was created in 1971 to serve as a national passenger rail service for the United States, due to the lack of privately owned passenger rail companies. The controlling shares of the Amtrak company are owned by the US Government, but the railroads that originally provided rail and equipment do own parts of the company. Although these shares provide almost no benefits to their owners. Amtrak still comes up short in ridership compared to other passenger services around the world, but there has been a significant increase in recent years that continues to grow.

- Miles of Rail: 21,000
- States Served: 46
- Depots: 527
- Employees: 19,000
- # of Passengers: 28.7 Million (2008)
- Revenue: $1.7 Billion (2008)
How can a new types of rail terminals alongside a new rail system be used to facilitate connections within and between cities in the Midwest?
**Transbay Terminal**

**San Francisco, CA**

Date Built: 2017  
Square Footage: 1.5 million  
Total Cost: $170 million  
Per SF Cost: $113.33  
Transit Modes Served: Regional Rail, Light Rail, Bus  
Owner: Transbay Joint Powers Authority  
Architect: Pelli Clarke Pelli

The Transbay Transit Terminal located in downtown San Francisco is scheduled for completion in 2017, and will serve as the new multi-modal transit hub for the city. It will serve a new Caltrans regional rail line as well as existing urban transit systems such as BART, the historic street cars, and buses. The primary entrance to the terminal is located on Mission Street and takes the form of a public plaza that leads into the building. The main space in the terminal is the grand hall that is lit primarily with natural light. In the center of the grand hall at 120’ tall light column opens the space to the park above and lets additional light into the interior of the building. The roof of the terminal is 5.4 acre public park. The park is designed to be part of the daily experience of the people who use the terminal. It includes multiple gardens showing different types of environments, walking paths, a performance venue, cafes, and playgrounds. In addition there is a 1,000 foot long fountain with water jets triggered by the movement of the busses below. Overtime bridges from the park to adjoining buildings will be added to further integrate it into the urban fabric of the city. In addition to the terminal itself the area surrounding will be redeveloped adding over 2,600 new homes, retail spaces and a high-rise tower.
The Tempe Transportation Center is the first building of its kind in Arizona. It was designed to serve as a transportation hub for the City of Tempe, serving pedestrians, cyclists, buses, and a new light rail system. The original plan for the facility was intended to serve as a small bus plaza with a ticketing area and restrooms. With the addition of the light rail system and additional construction in the area the program of the facility grew to include more space to serve the transit systems as well as offices for the transit system, a community space, a bike garage with showers, and leasable commercial space. The facility serves over 300 buses per day along with trains arriving every 10 minutes during rush hours. Fulfilling these needs proved to be a challenge for the design team, being given only a 2.7 acre site to work with. The buses were accommodate by creating a 52 foot wide curved driveway with 13 bus shelters. The rest of the program was fit on to the site by stacking it in separate overlapping floors as wings. A great deal of consideration was given to the sun while design the facility. Due to the bus shelters the building could not be oriented in the optimal direction, so low-E glass and retractable screens help to control solar gain the structure. The facility is pending a LEED Platinum certification, and contains many sustainable technologies such as a green roof, under floor air-distribution, and a graywater recycling system.
Omaha Union Station
Omaha, NE

Date Built: 1931
Square Footage: 124,000
Total Cost: $3.5 million
Per SF Cost: $28.22
Transit Modes Served: National Rail
Owner: Union Pacific Railroad
Architect: Gilbert Stanley Underwood

Construction on the Omaha Union Station began in 1929 and was completed in 1931. It was designed by Gilbert Stanley Underwood, who was well known for his work on lodges for the National Park Service. The station was one of the first Art Deco style rail stations and is still considered one of the best examples of Art Deco in the country. Underwood’s explanation of his concept for the station was, “It breaks away from the acceptable classical standard, and I believe it more honest and sincere than passenger stations clothed in garb of Roman temples.” The exterior is clad in terra cotta and contains six carvings of railroad employees each holding the tools of his profession. Over each entrance a quote is inscribed into the facade. The first by Abraham Lincoln reads,” No other improvement... can equal in utility the railroad.” The second, which became a motto for the employees of the station reads,” Dedicated by the railways of Omaha to the service, comfort and convenience of the people.” In the peak of its service the station served over 10,000 passengers riding 64 trains a day. The station remained open until 1971 when Union Pacific ceased passenger service. Two years later the station was given to the city of Omaha, and soon became the Western Heritage Museum. Over the years the station has been renovated to preserve it as well as allow it to serve the needs of the museum. The exterior and great hall have remained unaltered and preserved.
The Cincinnati Union Terminal was created to combine all of the city’s rail lines into one terminal to allow them to be more easily accessed. It became a hub for passenger and freight operations for all the rail companies that passed through the city; New York Central, Pennsylvania, Chesapeake & Ohio, Norfolk & Western, Southern, Louisville & Nashville, and the Baltimore & Ohio. The terminal was built in the Art Deco style as many other terminal of the period were, but the initial design was for a neoclassical building. But, due to the Great Depression it was deemed to expensive to build the terminal in a neoclassical style, and it was redesigned in Art Deco. The approach to the terminal is made by a quarter mile long plaza that terminates with an illuminated fountain in front of the building. The entrance of the terminal enters into a large rotunda, decorated with murals around the perimeter. Decorative paintings appear throughout the rest of the terminal as well. The terminal served as a major transfer station during World War II, serving over 34,000 passenger per day. In the 1950’s usage diminished, due to interstate car travel. The terminal closed in 1972 when passenger train service stopped. Today the terminal is part of the Cincinnati Museum system, and many of the public spaces have been restored to their original condition. The terminal does still serve passenger trains in a much smaller capacity as the local stop for Amtrak.
Cologne-Bonn Airport Railway Station
Cologne/Bonn, Germany

Date Built: 2003
Square Footage: 753,473
Total Cost: $-
Per SF Cost: $-
Transit Modes Served: National Rail, Local Rail, Air
Owner: Flughafen Köln/Bonn GmbH
Architect: Murphy/Jahn

The Cologne-Bonn Station project began in 1992 with a competition. The goal was the enlargement and modernization of the passenger rail facility at the existing airport. Along with the modernization of the station, the goal was to bring new economic activity to the area. The rail line also hoped that local and long distance passenger would utilize train travel more, thus reducing parking problems. The new station was designed to be more coinvent to passengers and airport personal, be more reliable, and deal with ecological issues. To have as little impact on the site as possible one third of the station is below ground. It runs from the existing Air Terminal 2 to the proposed Terminal 3. The station serves two high speed trains and three local trains running in both directions. The overall form of the station is two portions of a concrete tunnel with the center covered with a glass roof. This allows daylight into the mostly underground station and highlights the visible structure inside. The interior of the station is completely open, and is only divided up at the ends where it intersects with the air terminals. From the street the station functions as route directing passengers to the airport, and with the lighting of the 150 m glass roof at night allows the landscape to glow.
The design for the Stuttgart Station was chosen by competition from 126 designs. The station serves new high speed rail tracks that run 12 meters below the city street, so the land above is available for development. The new design keeps the existing historic station, but eliminates the existing train shed and tracks. The new entrance to the underground station takes the form of a large glass dome that leads to the upper concourse of the station. From there passengers continue down to the five platforms. The platforms are lit from above by several skylights in the roof. The roof creates a new public square above the station, with the sculpted skylights puncturing through it. With the station being located below grade much of the noise typical created by the trains will be eliminated. In addition with the roof being covered in soil the interior of the station is predicted to not go above 25 degrees Celsius in the summer or below 14 degrees in the winter without any additional environmental control.
The original Kyoto Station was used by over 200,000 passenger daily and served several of Japan’s national and regional rail lines. In 1987 when Japan’s rail lines were re-organized into private companies, the station’s new owner JR West made the decision to construct a new larger station with commercial and cultural space. The design of the station was restricted in part by the historical nature of the city around it, being over 1200 years old and having primarily three to six story buildings. The goal of the project was to create large multi use space, but have the building’s true function, transportation, be evident throughout the structure. Hara designed a building that fit within the 60 meter height limit and created the largest commercial development in the city. The building itself is 470 meters long and allows access to a broad range of transportation services. The central design element of the station is a V shaped atrium, dubbed a “geographical concourse” which is wider at the upper levels and narrower at the lower ones. The entrance of the station leads into a commercial area with a department store, cafes, a theater, and other smaller retail spaces. Glass is one of the key materials used in the station design. Different types are used to accent different program types throughout the station, as well as let as much daylight in as possible. As much glass as the allowed by the budget was used, in the attempt to reduce the massiveness of the structure, but the station still dominates its surroundings.
The Yufuin Station is located in a resort town a rural portion of Japan. The station itself sits in a very natural environment, that contrasts the typical urban environment of Japan. This station was constructed due to the increase in tourists coming to the area. One the key points that the design addressed were that it should not just be a passing through point for passengers, it should be a place for visitors and locals alike to enjoy the environment and culture of the area. Also, the station need to represent the town Yufuin symbolically and fit within the town’s codes. The design of the station is nothing more than simple geometry. It is a rectangular structure that sits parallel to the train tracks, with an square entrance that rises above the rest of the station. The upper portion of the entrance concourse is glass, which allows daylight into the space. The waiting room of the station was design to serve multiple purposes. I can be used simply as a place for passengers to gather or it can be used as a gallery space for local exhibitions. Across the entrance concourse from the waiting room the station offices and restrooms make up the rest of the station. The building itself is made entirely of wood. Large engineered wood beams were used to create the large open spaces. The building is heated with sub-floor heating using hot water from local springs. The exterior of the building is clad in natural wood and a colonnade.
The precedent buildings researched ranged from large scale terminals to small local depots and were located around the world and built over a long time period. On the surface one would expect these buildings to have significant programming differences, that is not the case. There are minor differences in the designs, taking into account local culture and the time period in which the stations were constructed, but the overall design concepts are similar. The first being that they all have multi-modal transit access. Even in the case of the older terminals, which don’t have accommodations for bikes and modern light rail, they do allow for street cars, buses and pedestrian traffic. As for the more modern terminals multi-modal transit is an integral part of the design. The next common theme is a minimal program, several of these terminals are little more than a large waiting room that provides access to the rail platforms, and a place to purchase tickets. The terminals with additional program, have flexible spaces that can be rented by a variety of clients and are still beneficial to the terminal as a whole. This promotes a mixed-use type of environment that allows people not actually using the rail systems into the space and thus creating potential new rail users. This concept translates into the final common design concept which is the public plaza. Having a large outdoor public space helps to integrate all of these terminals into the urban fabric of the city, and in turn gaining additional public interest in the space, and providing another space that can be used for a variety of activities beyond the basic function of a train station.
Omaha, Nebraska
*City is centrally located within system
*Under used railroad owned land is located within city center
*Access to existing and potential transit infrastructure; bus, street car, bike trail, airport, river
*Site is in proximity to support infrastructure for system; rail yard, dispatch center, corporate offices
*Omaha is the world of headquarters of both Union Pacific & Berkshire Hathaway (owner of BNSF)
Site Photos
EXISTING CONDITIONS
**Issues:**

**Circulation:** How people and the transportation infrastructure circulate through the building is important in respect to allowing the terminal to be an efficient and profitable transit hub.

**Coordination:** How the transit systems are coordinated together is also a key factor in the design, having local transit system schedules set up to work in coordination with regional and national system schedules to receive and deliver passengers is key.

**Transit Nexus:** For the terminal to function properly it will need to be set in a place that can be a transit nexus for the city and the region, allow for easy integration with existing transit infrastructure.

**Architectural Context:** Aesthetically the terminal will need to fit in with in the architectural context of its site and with the idea of a transit terminal, this will allow for easier integration into the city in which it is located.

**Profitability:** Making the terminal profitable for the owner is potentially the most important issue for the owner, addressing the issues of circulation, coordination, transit nexus, and architecture context properly will be the key in making the terminal profitable.
**Users:**

**Business Travelers:** Business travelers could be the most prominent users of the terminal. They tend to travel at all times of the day, particularly early mornings and during the week. Business travelers would require fewer types of facilities primarily food service, internet access, and waiting areas, but these areas may need to be larger to accommodate the large amount of travelers, but could re purposed on the weekends for other uses.

**Tourists:** Tourists would primarily use the terminal on the weekends and during the day. Since this is the time not used by the business travelers, some of the program areas for them could be re purposed at these times to serve tourists, thus conserving space. Tourist would require many of the same facilities as the business travelers, such as food service and waiting areas. But, they would also require entertainment and retail facilities.

**Local Workers:** Local workers would be another key user of the facility, they would be using the terminal on a daily basis, but unlike the other business travelers they would not spend much time in the terminal, since they would most likely just be switching from one local transit system to another. To accommodate them the types of transit the local workers use should be easy to reach from one another.

**Students:** Students could potentially be traveling at anytime, due to scheduling and travel costs. They require primarily the same facilities of the business travelers and the tourist, but potentially in a more student friendly price range.

**Terminal Employees:** Employees of the terminal would require their own areas separate from the public parts of the terminal. These would primarily consist of offices, break rooms, storage, rest rooms, and possibly simple sleeping quarters for train crews.
Waiting: Many occupants of this facility throughout the whole week will have a period of waiting, so it will be important to have a place for people to sit. Also if people are waiting for more than a few minutes they may need a source of entertainment so this would suggest there should be food and items for purchase near these areas of waiting. Important would also be rest rooms. These waiting areas should be placed in relationship to the different transportation options such as the bus, taxi pick up, and train. There will need to be separate waiting areas depending on location of transportation types and these areas will be different sizes depending on the amount of people that type of transportation is expected to serve.

(40,000 People Daily)
Fixed seating (serve 5% of daily capacity at one time or 2,000 people)*(18" per person in seating length plus 42" aisles or approximately 5.25 square feet per person) = 10,500 sf.
Standing waiting area (serves 15% of total daily capacity at one time or 6,000 people)*(5 square feet per person)=30,000 sf.

Rest rooms: Public rest rooms will be located throughout the facility so that users will be able to find them easily. The majority will be located in and around the waiting and platform areas. Any retail and speculative spaces will provide their own rest rooms if necessary.
(according to IBC 1 toilet per 500 passengers or 200 toilets and 1 sink per 750 passengers or 134 sinks)=700 sq ft.

Ticketing: A ticketing area will provide to allow passenger to purchase and alter tickets in addition to checking any bags they do not wish to carry on themselves. This area will also serve as an information desk for the terminal
(60 total employees daily)*(25 square feet per person)=1,500 sf.

Baggage: There will need to be an area where people can check their baggage for their trip. They will also need someplace to go to collect it at the end of a trip.
(40,000 People Daily)
(10% of daily capacity or 4,000)*(15 square feet per person) = 60,000 sf.

Platforms: To board the trains boarding platforms will be required for each track. Each platform will have the ability to serve two tracks, one on each side. Length of the platforms will be determined by the maximum length of trains serving the terminal.
A total of seven tracks will serve the platform area. The two main line tracks will not pass through the terminal to allow freight and other trains not stopping at the terminal to pass through without stopping. Longer platforms are provide for the regional trains, with shorter ones serving local trains. Space will be allotted for additional platforms to be added as demand grows.
(10 Car Train)(Standard Car Length 85’)=850’ Platform Length; Rail ROW Width=12’; Platform Width=15’
(Platform Area( 7 Platforms)=102,000 sf)+(Rail ROW Area=91,800 sf)= 193,800 sf.
Working (offices): Railway employees that are essential to the daily operation of the terminal, administrative workers, dispatchers, IT personal, etc will require spaces to work that are out of view of the passengers, but still have immediate access to the primary terminal spaces and other back of house operations.
(250 People Daily) (15 square feet per person) = 3,750 sf.

Working (Support): Terminal employees as well as train crews will require space for lockers as well as a break room. The terminal employees will have their own space close to their work area, and train crews will have a space in the lower level that is larger to accommodate larger numbers of employees.
(250 People Daily) (5 square feet per person) = 1,250 sf.

Security: A facility with this much public access will need large amounts of security. This will require a room to monitor security cameras as well as house personal for security checks and inspecting baggage. In addition this space can serve as an area to run the facilities computer systems from.
(50 People Daily) (50 square feet per person) = 2,500 sf.

Retail: A small amount of leasable retail space will be provided to accommodate needs of users. These spaces could include dining, banking, and general retail. These spaces will be designed as shell units with the end users providing interior fit-outs.
(1 Large Units 20’x25’) + (2 Small Units 18’x25’) = 1,400 sf

Mixed Use Speculative: Space will be allotted for expansion of a mixed use space that could house a range of functions, including office, residential, and hotel. These spaces will be created out of existing buildings or in new buildings that will sit within the civic plaza that will extend out from the terminal into the fabric of the city.

Outdoor Plaza: The outdoor plaza space will be an extension of the indoor waiting area. It will serve as a link between the terminal itself, the surrounding area, its local transit systems, and other new mixed use development. It will also have the potential to be used as a public space for community events outside the typical operation of the terminal. The size is flexible and will depend on the location of the terminal within the site.

Parking: The site already has a large surface parking lot and parking structure adjacent to it, additional parking will be required since these areas also serve the commercial buildings adjacent to the site. This will be accomplished by creating a new parking structure adjacent to the surface parking lot. The new parking structure will also contain both long and short term bike storage and shower/changing facilities, as well as a ticket and baggage check counter for passengers parking in the structure. It will also include a shuttle bus stop to transport passenger from parking and other adjacent areas to the terminal.
Terminal Program Massing

- Platform: 193,800 sf
- Baggage: 60,000 sf
- Waiting: 30,000 sf

Program Size Comparison
Ticketing: 1,500 sf
Security: 2,500 sf
Retail: 1,400 sf
Working Support: 1,250 sf
Rest Rooms: 700 sf
Offices: 3,750 sf
In the program adjacency and user flow of the terminal the public plaza and the waiting room become the hubs of activity for the building. This in turn makes them the key spaces in the building, and they should be used to express the key ideas of the design itself.
The progression through the terminal should be controlled, users should not be shocked when disembarking a train by entering a large space, but should be moved through a series of progressively larger spaces until they enter the waiting room and then the open plaza. This also works inversely for a user boarding a train, allowing them to adjust slowly from the large open space of the plaza, to the enclosed space of the train.
The program of the terminal will be broken up into three levels, the upper two are public the lowest being for back of the house function. The Plaza level will contain a majority of the program and be the primary space used by the public, the Platform level below will provide access to trains. The lowest level will provide space for baggage handling. All the levels will be connected by vertical circulation in the form of stairs and elevators.
Existing Canopy
The butterfly canopy that remains on the site is the only remnant of the former passenger service that existed on the site aside from the stations. In addition this type of platform canopy was a common sight at most Midwestern passenger terminals. Using the form in an abstracted way both pays tribute to the heritage of passenger rail and provides a modernized form for both the platforms and the terminal.
Portions of the canopy roofs have the potential to be replaced with green roof panels that can function as filter system for the emissions from the diesel locomotives moving through and idling at the platforms. These panels would be placed over the track area only do to the fact that they are permeable (to allow fumes in) and do not prevent rain water from passing through. Fans would be used to draw the fumes into the filter panels and aid in pushing the air through the system. The filter panels themselves would be made up of fans (to move the air), mesh panels to support the system, charcoal to filter the air, soil, and low intensity plants. Roof panels not containing the green roof filters will have the potential to be fitted with solar panes, since the slope of a majority of the panels is within the optimum angles for sun capture in this area.
How can a new types of rail terminals be used to create public urban spaces within cities that serve as social and physical connection points for the city itself as well as a connecting point to the rest of the region?
The new form of the building took the concept of the roof canopies and used them as a way to make a visual connection from the rail platforms themselves up to the public plaza. The form chosen uses two separate lines of flow, the first comes from the platforms and disappears into the terminal and then reappears as it enters and moves through the plaza. The second form creates the roof of the terminal, it appears to flow up out of the platform canopies, and then peels open on the plaza side to allow light in and to give the impression of the building opening up into the plaza itself.
new mixed use development
6th street
APPROACH FROM NORTH
APPROACH FROM SOUTH
The lower level of the terminal provides space for mechanical equipment as well as parking, office space, and locker rooms for railroad employees. In addition all baggage handling is done at this level out of view of the passengers, after baggage is sorted it is raised to platforms by elevators. The lower level of the parking structure provides a secondary ticket counter/baggage check, as well as bike storage and locker rooms for passengers with bikes. A bus stop is provided to allow for a shuttle to take passengers from the parking structure to the terminal itself.
As a passenger moves from the platforms (1) to the public plaza (5) the spaces become progressively more open, allowing for a smooth transition from the compact space of the train to the openness of the plaza. The roof canopies themselves all serve as a way finding device (3) drawing the user through the space and out into the plaza (4). This works in the inverse direction as well, drawing people into the plaza and terminal and allowing them to slowly progress to the more compact space of a rail car.
PLAZA APPROACH FROM PARKING
MIDWESTERN STREAMLINER

EXCITING TRAVEL FOR AN EXCITING FUTURE
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