Using BART for Goods Movement

February 19, 2006

Introduction

The San Francisco Bay Area has one of the most congested metropolitan corridors in both California and nationwide, with very high demand for both passenger and air-freight transport. It is also a main entrance to the United States for the huge Asia market, and thus critical for the United States to play a leading role in the global economy. On one hand, traffic congestion in the main corridors through the Bay Area is severe and is becoming worse with the rapid increase of population and the development of the local economy, in which truck-related activities such as the ever increasing integrated air freight business (performed by companies such as Federal Express, UPS, DHL, CNF, etc.), makes a substantial contribution. On the other hand, Bay Area Rapid Transit (BART) as a regional, environmentally-green transit system that has much excess capacity during non-commute periods and lines in some reverse-commute directions. If the BART system were to be used by the air-freight delivery service providers, BART could probably provide reliable and frequent service to integrated air freight carriers to meet their high quality limited-time window delivery service needs. This would naturally lead to extra revenue generation for BART and reduce truck activity, and its corresponding traffic congestion and pollution relieving, driver safety and public security improvement and economic land use. Using BART for air freight movement as a model for combined goods and passenger movement can be generalized to other critical corridors nationwide to effectively relieve corridor congestion problem. Improving movement through these critical metropolitan corridors could yield significant benefits in terms of reduced travel time and delays and increased reliability and predictability of travel of both passenger and freight.

Using BART Extra Capacity

San Francisco Bay Area Rapid Transit (BART) is a regional rail transit system that serves approximately 330,000 passenger trips per weekday. Despite BART’s excellent track record in moving people, system utilization was at 29.3% in 2004. This statistic indicates that although many passengers use BART, they do so during periods of peak demand in certain directions, leaving much unused capacity during off-peak hours and in some reverse-commute directions during peak hours. Although BART continues to aim for increased usage of the remaining 70.7% of its overall capacity through marketing and other strategies to bring in more riders, the newly added role of moving goods could also count towards significantly increased system utilization, or at the very least generate additional revenue.

Integrated Air-Freight Delivery

Air freight delivery in the US has been dominated by a few integrated carriers such as FedEx, UPS, DHL and CNF. The services are not just restricted to air-freight in practice, as some land delivery services are also provided with trucks. A primary interest of the air-freight transportation industry is to develop seamless transportation chains to provide intermodal door-to-door service. The main characteristics of these integrated carriers are: (a) package/goods size/amount are relatively small but of much higher value than those of land/sea goods movement; (b) the packages/goods need to be delivered to end-users within a limited time window (a narrow period, especially with regards to express services); and (c) the ground transportation in the air-freight door-to-door service chain usually involves trucks traveling from: airport ⇔ airport/off-airport sorting site(s) ⇔ local distribution/collection center(s) ⇔ end-users. The features of the door-to-door service chain are:

(1) Sorting sites and local dispatch centers are generally located near airports along a hub-and-spoke network configuration, so goods movement is closely tied to airport ground traffic patterns;
(2) Trucks/vans are tracked and monitored in real-time by a centralized dispatch control;

Future BART extensions could in concept extend the reach of frequent and reliable transport for integrated air-freight carriers to increasingly congested corridors in the Greater Bay Area that are currently underserved by public transportation.

Integrated carriers need more reliable, frequent, and congestion-free transport modes to improve their ever-expanding, limited-time window services.
Carriers employ an aircraft fleet for moving freight between airports, generally at night; long-haul truck fleets are used for moving freight between terminals, and may be used also for sorting and processing freight; a fleet of trucks/vans are used for local pickup and deliveries; trucks are used for long distance haul.

Each respective integrated carrier operates hundreds of trucks daily to stations for all day operation, and retain empty containers, which generates large amounts of VMT/VHT (Vehicle Miles Traveled /Vehicle Hours Traveled).

Integrated carriers such as FedEx are very interested in looking for effective new alternatives which can provide reliable, secure, and timely transportation means to improve their current service quality, to reduce cost, and to expand their businesses in the future. FedEx considers the BART system to be a promising alternative in the long run.

**Benefit of Using BART to Reduce the Number of Trucks**

As indicated in the research results of MTC's Regional Goods Movement Study (2004), air cargo business in the Bay Area at 1998 levels will double by 2010 and triple by 2020, due to the increase of the U.S. economy and global economy. Trucks are the primary ground mode for air-freight door-to-door service delivery for all the integrated/non-integrated carriers connecting airport/sorting and customers. However, trucks have significant impacts on four areas of public interest: safety, traffic congestion, air pollution and security.

**Limited-time Window Delivery and Traffic Congestion:** More trucks need to be on the road during peak periods to meet delivery commitments, particularly in the evenings in the West Coast according to FedEx. Truck movements experience significant roadway congestion on the way to/from, and in the vicinity of, major airports as well as moving back and forth across the San Francisco-Oakland Bay Bridge. The two challenges with time-sensitive intermodal service under congested traffic are:

- Overall time limitations in delivery – re-dispatching is necessary if it has been subjected to time delay of air cargo's arrival (subject to the impact of air cargo operation), which results in more trucks on the roads and further impacts general traffic;
- Limited time window at each step along the delivery chain: missing one window may cause the missing of the following windows in the chain, which will create an adverse domino effect for the carrier.

Delivery delays will directly affect the service quality and cause a loss of revenue. Using the BART system away from the congested traffic will significantly improve the service.

**Safety:** As reported in previous research, 80% of the victims killed in crashes involving trucks are occupants of smaller vehicles. Reducing trucks on busy highways can reduce such fatalities.

**Security:** Due to its size and potential destruction capability, terrorist might use trucks as weapons to attack. To reduce truck activities to/from the airport is to improve the security of airports and bridges across the Bay.

**Air Pollution:** Truck activities have a great impact on the environment. Ground level ozone, the main ingredient smog, is formed by complex chemical reactions of Volatile Organic Compounds (VOC) and Nitrogen Oxides (NOx) in the presence of heat and sunlight. Particulate Matter (PM), a diesel engine pollutant, is easily inhaled and disposed in lungs. Goods movement generates emissions both during on-roads activity (truck driving) and non-roads activity (cargo loading/unloading and idling). The reduction of pollution is proportional to the reduction of truck activities.
Preliminary Findings

Several activities have already been conducted for preliminary feasibility considerations focusing on infrastructure and operation, which include team pre-proposal meetings and on-site facility tours. Some key findings are as follows:

- **FedEx:**
  - Container size is the critical factor for trans-shipment between FedEx and BART system; FedEx is willing to use containers of appropriate dimensions for fitting inside/onto BART’s cars and through BART facilities, which would not cause extra work to FedEx since all the product to/from local distribution/collection centers need to go through FedEx Western Hub at Oakland International Airport (OAK);
  - FedEx has several types of products: High, medium and low priority. FedEx is willing to use BART system to deliver some low priority products first. If this scenario proves to be successful and reliable, medium and high priority products could then be delivered through the BART system;
  - BART lines between Lake Merritt Station (Oakland) and Concord, and between OAK and San Francisco International Airport will be considered the first candidates for FedEx to use for preliminary delivery services.

- **BART:**
  - Extra Capacity: On average, the BART system has 70% unused capacity. Even in peak hours, lines in some reverse-commute directions generally have extra capacity. During commute hours/directions, there are some trains that are not at full length, thereby leaving space to add more cars to the consist for goods movement;
  - Potential access points for loading/unloading within the BART system include yards, shops or service access points for large containers; if container sizes can be reduced, many BART station could potentially be used for loading/unloading;
  - BART may be willing to explore minor car modifications (e.g., removing seats) or major conversions (e.g., superstructure conversions) for goods movement;
  - BART may be willing to operate dedicated train consists for freight movement if demand is large enough.

Other information including meeting minutes and presentations is available at: [http://path.berkeley.edu/~xylu/data/BART_Freight/](http://path.berkeley.edu/~xylu/data/BART_Freight/)

Participants:

**Caltrans:**
- Mr. Matt Hanson, Division of Research and Innovation
- Mr. Tom Messer, Chief of Goods Movement
- MS. Colette Armao, Aeronautics
- Mr. Terry L. Barrie, Chief of Aeronautics Planning

**Federal Express:**
- Mr. Michael Graham, Manager, Regional Sort Operations, Planning and Engineering

**Bay Area Rapid Transit District:**
- Mr. Eugene Nishinaga, R&D Manager
- Richard Lu, R&D Engineer

**California PATH:**
- Dr. Xiao-Yun Lu, Associate Research Engineer
- Dr. Yuwei Li, Assistant Research Engineer

Contacts:

Dr. Xiao-Yun Lu, California PATH,
University of California, Berkeley,
Tel: 1-510-665 3644;
Email: xylu@path.berkeley.edu
Homepage: [http://path.berkeley.edu/~xylu/xyl_home.html](http://path.berkeley.edu/~xylu/xyl_home.html)

Mr. Matt Hanson, Caltrans Division of Research & Innovation (DRI)
Tel: 1-916-654 8171;
Email: matt_hanson@dot.ca.gov