Feasibility of Using BART for Regional Air Freight Movement

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Outlines

• Literature Review
• Potential Social Impact
• Emission Cost
• Energy Efficiency
• BART System Access Points
• Transshipment Considerations
• Towards Demo or Small Scale Ops
• Next Step
Literature Review

• Maes and Vsnelslander (2009) analyzed the feasibility of utilizing the rail transport as part of the supply chain in an urban logistic context in western Europe;

• Nozzolo et al (2007), a methodology presented for metropolitan freight distribution in railway in Italy with technical and economic feasibility analysis; freight demand modeling ➔ new distribution system is consistent with practical operation ➔ needs public authority to cover the extra costs;
Work by Bozicnik (2007) studied the Light-combi project in Sweden or Cargo Sprinter in Germany, and the Mobiler system in Switzerland:

- Analysis proved that success of intermodal transport can be achieved
- Going through certain barrier and provided that interdisciplinary support can be assured
- Concluded that the ideal freight transport technology for small shipments and/or short- and medium distances would be a combination of a truck (high flexibility) on the rail (mass production).
Literature Review

• The study of Paaswell (2009) focused on the elaboration of the potential benefit of transporting freight with rail, aiming at convincing the government and stake-holders of the importance of the mode conversion;

• K. Sivakumaran, X. Y. Lu, and M. Hanson (2010), considered economic analysis in detail based on demand and forecasted demand of two major integrated carriers (FedEx and UPS).
Potential Social Impact

- To better use the already built and costly infrastructure (with 70% capacity unused) for transportation;
- To reduce impact on road traffic cased by air freight movement;
- To use energy and land more efficiently
- To reduce emission cased by trucks for air freight collection and distribution
- To benefit all the stakeholders if demand is high enough
  - Increasing BART revenue and relieve government subsidy
  - Improving service quality (reliability) of integrated air freight carriers
  - ...
- To extend to similar systems in D. C., Chicago, ...
Emission - Factors

- Nitrogen oxides (NO\textsubscript{x}): smog and acid rain
- Carbon monoxide (CO):
- Particulates matter (PM\textsubscript{10}): respiratory health effects;
- Sulphur oxides (SO\textsubscript{x}): smog and acid rain
- Volatile organic compound (VOC): atmospheric and health effects.

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>PM10</th>
<th>SO2</th>
<th>Nox</th>
<th>VOC</th>
<th>CO</th>
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<tbody>
<tr>
<td>Emission Factor (lbs/hp-hr)</td>
<td>0.0022</td>
<td>0.00205</td>
<td>0.031</td>
<td>0.002514</td>
<td>0.00668</td>
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## Emission – Scenarios Considered

<table>
<thead>
<tr>
<th></th>
<th>1</th>
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<tbody>
<tr>
<td>A</td>
<td>Little capital investment</td>
<td>Little capital investment</td>
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<tr>
<td></td>
<td>CTV5 Trucks for local transshipments;</td>
<td>Electric trucks for local transshipments;</td>
</tr>
<tr>
<td></td>
<td>Existing BART yards and maintenance</td>
<td>Existing BART yards, stations and</td>
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<tr>
<td></td>
<td>areas for access point;</td>
<td>maintenance areas for access point;</td>
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<tr>
<td></td>
<td>Dedicated freight train</td>
<td>Dedicated freight train</td>
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<td></td>
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<tr>
<td>B</td>
<td>CTV5 Trucks for local transshipments;</td>
<td>Electric trucks for local transshipments;</td>
</tr>
<tr>
<td></td>
<td>BART connection between OAK and</td>
<td>BART connection between OAK and</td>
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<td></td>
<td>Coliseum Station;</td>
<td>Coliseum Station</td>
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<tr>
<td></td>
<td>Certain capital investment for</td>
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<tr>
<td></td>
<td>retrofitting of existing BART stations</td>
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<td></td>
<td>for goods movement;</td>
<td>for goods movement;</td>
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<tr>
<td></td>
<td>Dedicated freight train</td>
<td>Dedicated freight train</td>
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<tr>
<td>Emission</td>
<td>Ambient Pollutant</td>
<td>Health ($/lbs Emitted)</td>
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<tr>
<td>----------</td>
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<td>------------------------</td>
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<tr>
<td></td>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>CO</td>
<td>CO</td>
<td>0.00</td>
</tr>
<tr>
<td>NOx</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nitrate</td>
<td>0.46</td>
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<tr>
<td></td>
<td>PM10</td>
<td></td>
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<tr>
<td></td>
<td>NO2</td>
<td>0.07</td>
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<td></td>
<td>0.53</td>
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<td>PM2.5</td>
<td>PM2.5</td>
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<tr>
<td>Total for PM10</td>
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<tr>
<td>SOx</td>
<td>Sulphate</td>
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<tr>
<td>VOC</td>
<td>Organic</td>
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<tr>
<td></td>
<td>PM10</td>
<td></td>
</tr>
<tr>
<td>VOC+Nox</td>
<td>Ozone</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
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Emission – Cost Comparison

Cost vs. Year Graph:
- Status Quo-High
- Status Quo-Low
- A1-High
- A1-Low
- B1-High
- B1-Low
- A2-High
- A2-Low
- B2-High
- B2-Low
## Energy Resources and Efficiency Factors

<table>
<thead>
<tr>
<th>Energy Resource</th>
<th>BART</th>
<th>Truck</th>
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<tbody>
<tr>
<td>Renewable Resource</td>
<td>Electricity 53%</td>
<td>Fuel Combustion 0%</td>
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<tr>
<td>Fossil Fuel</td>
<td>47%</td>
<td>100%</td>
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<tr>
<td>Energy Efficiency</td>
<td>1</td>
<td>0.3</td>
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BART System Access Points: eBART Extension

![eBART Route Map]

- Richmond
- El Cerrito del Norte
- El Cerrito Plaza
- North Berkeley
- Downtown Berkeley
- Ashby
- Richmond
- Pittsburg/Bay Point
- Railroad Ave
- Hillcrest Ave
- North Concord/Martinez
- Concord
- Pleasant Hill/Contra Costa Centre
- Walnut Creek
- Lafayette
- Orinda
- Rockridge
- MacArthur
- 19th St/Oakland

Current BART Service:
- Current Transfers
- Current Stations

New eBART Service:
- New Station
- Planned Station

EAST BAY
BART System: Extension to San Jose/Milpitas in 2018
Transshipment Considerations

- Containers Fitting BART Car
- Vehicle for Freight Movement
- BART Cars
- Equipment for Container Movement at Platform
- BART Aerial Station Access Cost
Containers Fitting BART Cars

USPS Containers used by FedEx, small enough to fit in BART car
Vehicle for Freight Movement

- Flatbed dedicated freight cars

- Retired BART Cars
  - Over 300 BART cars to retire in the next 3~5 years starting from next year, which could be recycled;
  - Remove seats and air conditioner for dedicated freight movement;
  - Or keep the air conditioner for airborne exported agricultural products movement;
Vehicle for Freight Movement - BART Car without Seats
FedEx EV for Collection/Distribution and Transshipment
Equipment for Container Movement at Platform
Equipment for Container Movement - Flexible Platform
Equipment for Container Transshipment

- **Solution 1**: Directly pushing over the roller-mat; suitable for flatbed car, or BART car with doors
Equipment for Container Transshipment at Platform

- **Solution 2.** Using a Flexible Hydraulic Crane; suitable for flatbed cars and BART car if container is not too large
BART Aerial Station Access Cost

- Cost (in $) of dedicated freight lift for accessing BART aerial station(s)

<table>
<thead>
<tr>
<th>Height (ft)</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
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<tbody>
<tr>
<td>3,000lb</td>
<td>55,900</td>
<td>61,300</td>
<td>65,900</td>
<td>69,800</td>
<td>73,400</td>
<td>76,666</td>
<td>79,500</td>
<td>82,200</td>
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<tr>
<td>5,000lb</td>
<td>61,900</td>
<td>67,900</td>
<td>72,900</td>
<td>77,300</td>
<td>81,200</td>
<td>84,700</td>
<td>88,000</td>
<td>91,000</td>
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<tr>
<td>10,000lb</td>
<td>82,500</td>
<td>90,500</td>
<td>97,200</td>
<td>103,000</td>
<td>108,000</td>
<td>112,900</td>
<td>117,300</td>
<td>121,300</td>
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</tbody>
</table>
Towards Demo or Small Scale Ops

- California’s Airborne Agricultural Products for Export
  - Demand is Critical
- BART Access Points in Contra Costa County and Near SFO
  - Concord Yard
  - Pittsburg / Bay Point Tail Track
  - Millbrae Tail Track near SFO
CA Exported Airborne Agricultural Products

- California’s airborne agricultural export was over $800 million in 2008;
- Large portion of the exported products are fresh fruit, veritable, and meat which are time critical;
- Growth trend has been steady with demand increasing from the Asian and European markets (particularly China) since then;
- Traffic congestion ➔ ground access to SFO increasingly;

- Jock O’Connell, and B. Mason, *The Role of Air Cargo in California’s Agricultural Export Trade*, CATI Pub. #070801, Center for Agricultural Business, California State University, Fresno, Aug. 2007
- Jock O’Connell, *Taking the Fast Plane to China: An Expanded Role for Air Freight in Increasing California’s Fresh Fruit and Vegetable Exports*, Report prepared for the California Department of Food and Agriculture, Apr., 2008

- Website: [http://jockoconnell.tripod.com/articles.html](http://jockoconnell.tripod.com/articles.html)
CA Exported Airborne Agricultural Products

- Costs of maintaining freight-forwarding and air-freight consolidation facilities on valuable real estate near SFO are rising;
- Consequently, a growing volume of farm exports is being diverted to LAX, unnecessarily adding to the cost and complexity;
- Potential solution:
  - Relocating staging operations adjacent to BART Yard/Tail Track in eastern Contra Costa County and utilizing specially configured BART trains for transshipment directly to SFO;
  - FedEx and UPS can act as consolidated agency for the product directly to their aircraft(s), or other cargo aircraft;
CA Exported Airborne Agricultural Products

• Potential benefits including

  – to reduce ground transportation cost of agricultural producers ➔ competitive in the international market;
  – to feed to airport with required demand in time to reduce truck dwell time and idling;
  – to reduce truck trips to/from airport ➔ energy use and emission reduction ➔ more sustainable air cargo movement;
UPS Office and Millbrae BART Tail Track near SFO
BART Millbrae Tail Track: Share Station with Caltrain
BART Millbrae Tail Track:
BART Millbrae Tail Track: Entrance for Truck Access
BART Concord Yard
BART Pittsburg / Bay Point Tail Track
BART Pittsburg / Bay Point Tail Track
Next Step

- Logistics for Combined Passenger and Goods Movement with BART System
- Considering Liability Issue between Public and Private Sectors
- Finding Fund to Support a Demo or Small Scale Ops
  - FedEx willing to give low priority products for shipping on BART as a start
  - BART prefer to use the demo as the start of small scale operation and to continue afterwards
  - Funding necessary for
    - Retrofitting of platforms for loading and unloading
    - Retrofitting of BART car or Purchasing flat freight car
    - Purchasing transshipment equipment
    - Building storage at access points
    - Relocating air freight screening system
- Federal Government Needs to Step in.
Main References

• Maes, J., and Thierry Vanellander, J., (2009), The use of rail transport as part of the supply chain in an urban logistics context, METRAN National Urban Freight Conference


• Bozicnik, S., (2007), New Innovative Intermodal Rail Freight Paradigm, Proc. of 11th World Conference on Transport Research, Berkeley, June 24-28

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  BART Engineers:
    Richard Lu, Emery Mandel