# Feasibility of Using BART for Regional Air Freight Movement

## 2011 NUF

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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;**

## Literature Review

- **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 ($NO_x$): smog and acid rain
- Carbon monoxide (CO):
- Particulates matter ($PM_{10}$): respiratory health effects;
- Sulphur oxides ($SO_x$): smog and acid rain
- Volatile organic compound (VOC): atmospheric and health effects.

| Pollutant | PM10 | SO2 | Nox | VOC | CO |
|---|---|---|---|---|---|
| Emission Factor (lbs/hp-hr) | 0.0022 | 0.00205 | 0.031 | 0.002514 | 0.00668 |

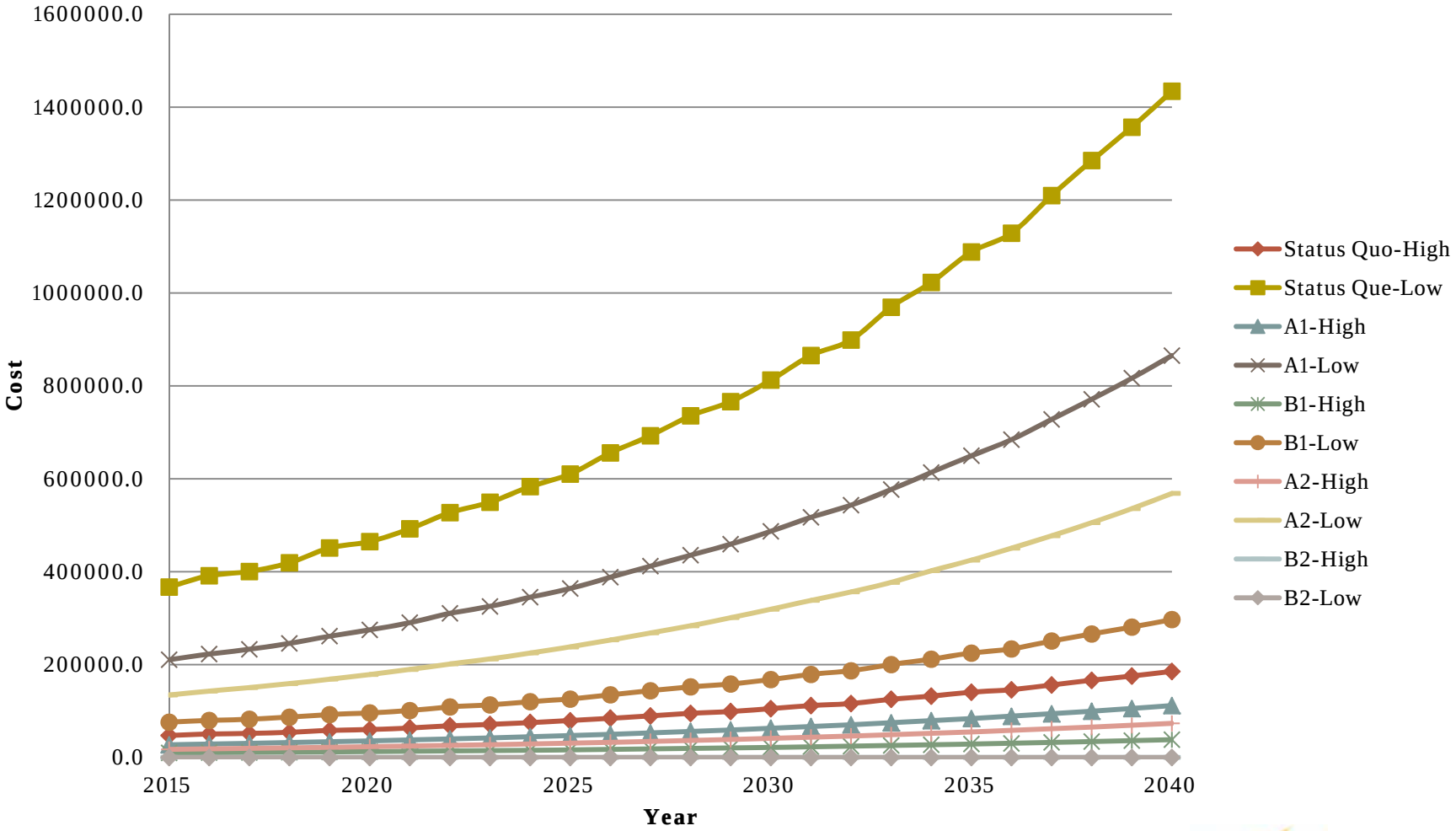
# Emission – Scenarios Considered

| | 1 | 2 |
|---|---|---|
| A | Little capital investment<br>CTV5 Trucks for local transshipments;<br>Existing BART yards and maintenance areas for access point;<br>Dedicated freight train | Little capital investment<br>Electric trucks for local transshipments;<br>Existing BART yards, stations and maintenance areas for access point;<br>Dedicated freight train |
| B | CTV5 Trucks for local transshipments;<br>BART connection between OAK and Coliseum Station;<br>Certain capital investment for retrofitting of existing BART stations for goods movement;<br>Dedicated freight train | Electric trucks for local transshipments;<br>BART connection between OAK and Coliseum Station<br>Certain capital investment for retrofitting of existing BART stations for goods movement;<br>Dedicated freight train |

# Emission - Emission Unit Cost Factor (Delucchi, 2000)

| Health ($/lbs Emitted) | | | | Visibility ($/lbs Emitted) | | Crop Loss ($/lbs Emitted) | | Total($/lbs Emitted) | |
|---|---|---|---|---|---|---|---|---|---|
| Emission | Ambient Pollutant | Vehicle emissions, US | | Vehicle emissions, US | | | | Vehicle emissions, US | |
| | | Low | High | Low | High | Low | High | Low | High |
| CO | CO | 0.00 | 0.04 | | | | | 0.00 | 0.04 |
| NOx | Nitrate PM10 | 0.46 | 7.51 | | | | | 0.46 | 7.51 |
| | NO2 | 0.07 | 0.33 | | | | | 0.07 | 0.33 |
| Total for NOx | | 0.53 | 7.84 | 0.09 | 0.50 | | | 0.62 | 8.35 |
| PM2.5 | PM2.5 | 4.73 | 72.21 | | | | | 4.73 | 72.21 |
| PM2.5-10 | PM2.5-10 | 3.04 | 8.02 | | | | | 3.04 | 8.02 |
| Total for PM10 | | 4.42 | 60.68 | 0.18 | 1.77 | | | 4.60 | 62.45 |
| SOx | Sulphate PM10 | 3.13 | 29.72 | 0.40 | 1.80 | | | 3.53 | 31.52 |
| VOC | Organic PM10 | 0.05 | 0.52 | 0.00 | 0.02 | | | 0.05 | 0.54 |
| VOC+Nox | Ozone | 0.00 | 0.05 | | | 0.10 | 0.15 | 0.00 | 0.05 |
| CO2 | | | | | | | | 0.00 | |

# Emission – Cost Comparison

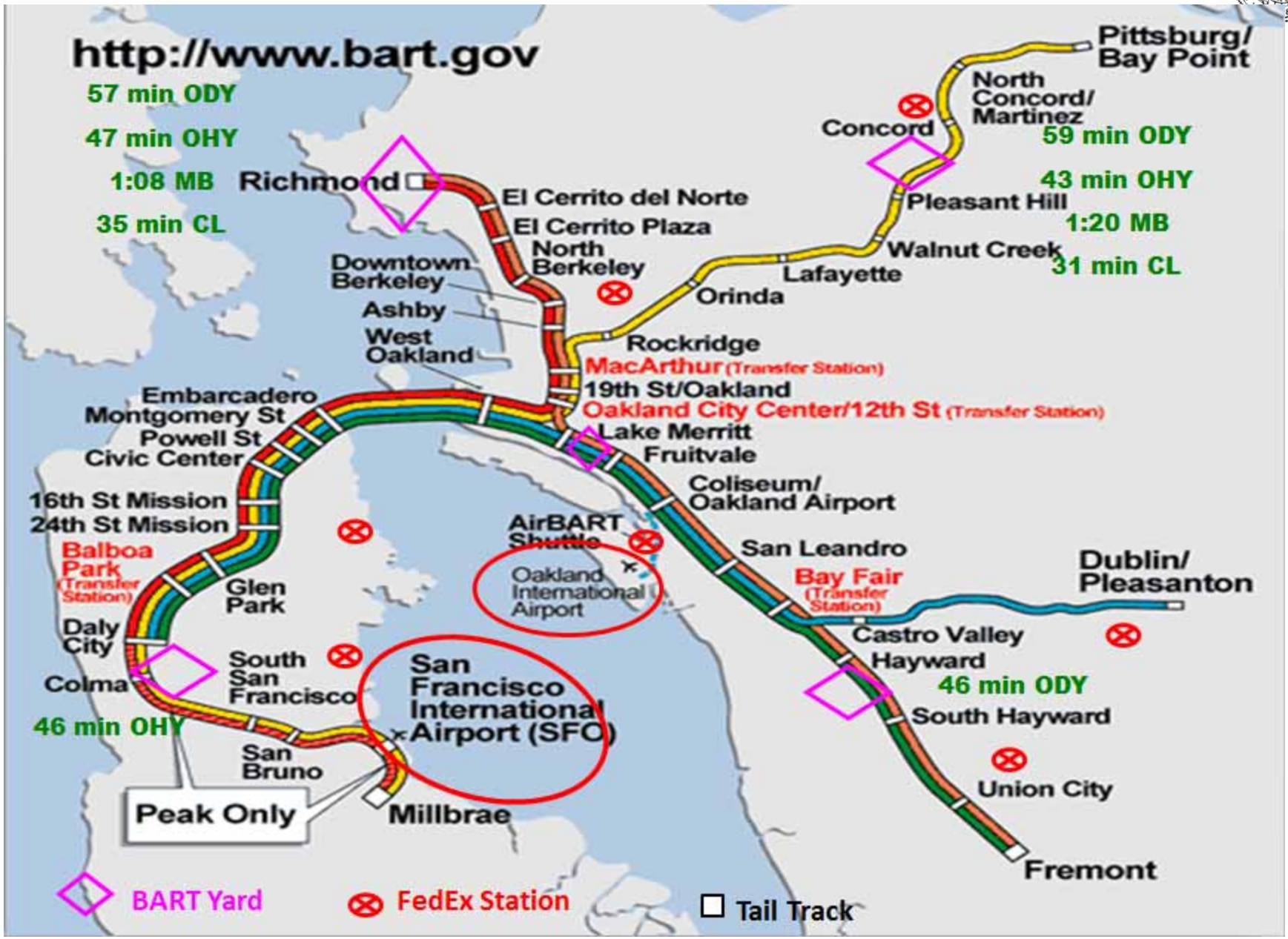


# Energy Efficiency

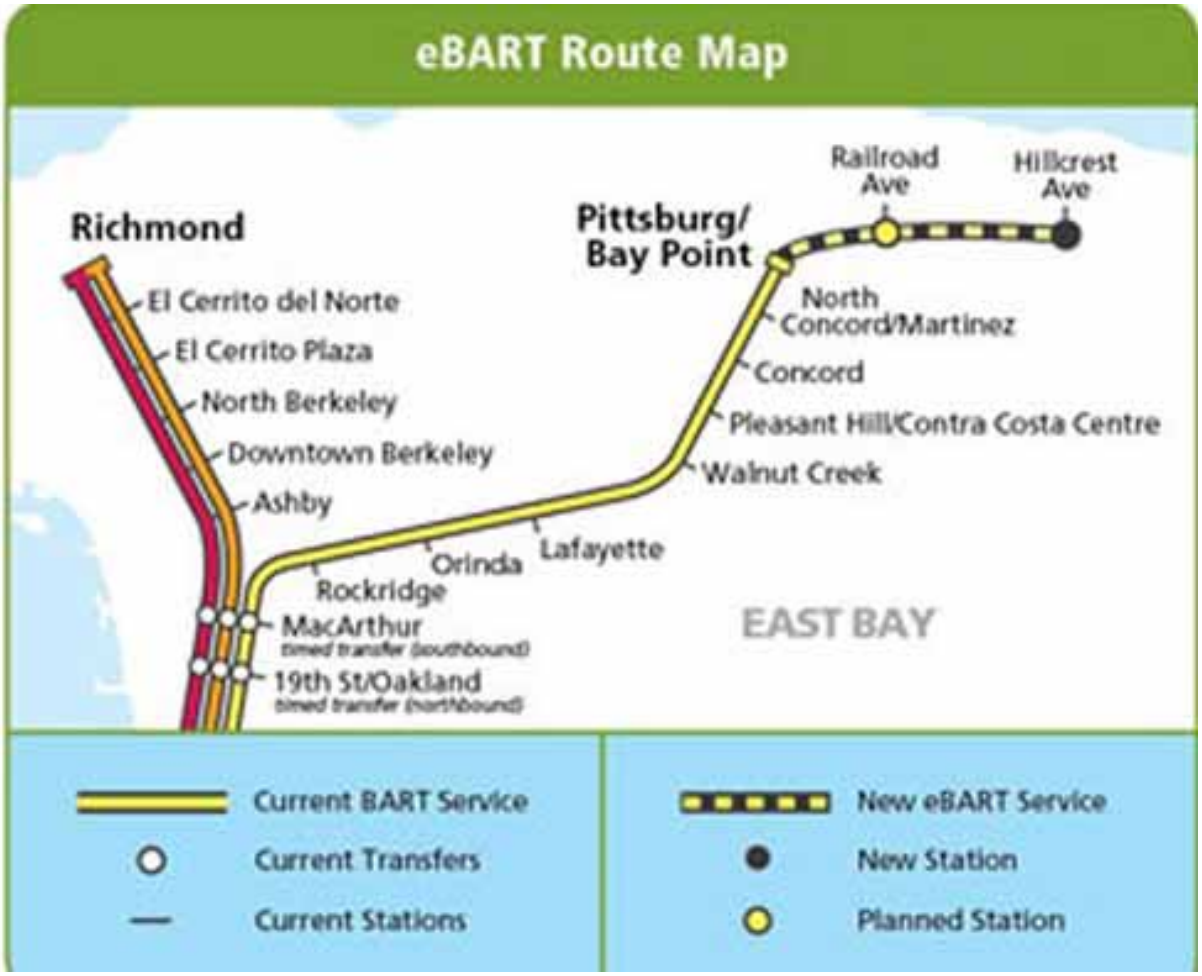
Energy Resources and Efficiency Factors

| | BART | Truck |
|---|---|---|
| Energy Resource | Electricity | Fuel Combustion |
| Renewable Resource | 53% | 0% |
| Fossil Fuel | 47% | 100% |
| Energy Efficiency | 1 | 0.3 |

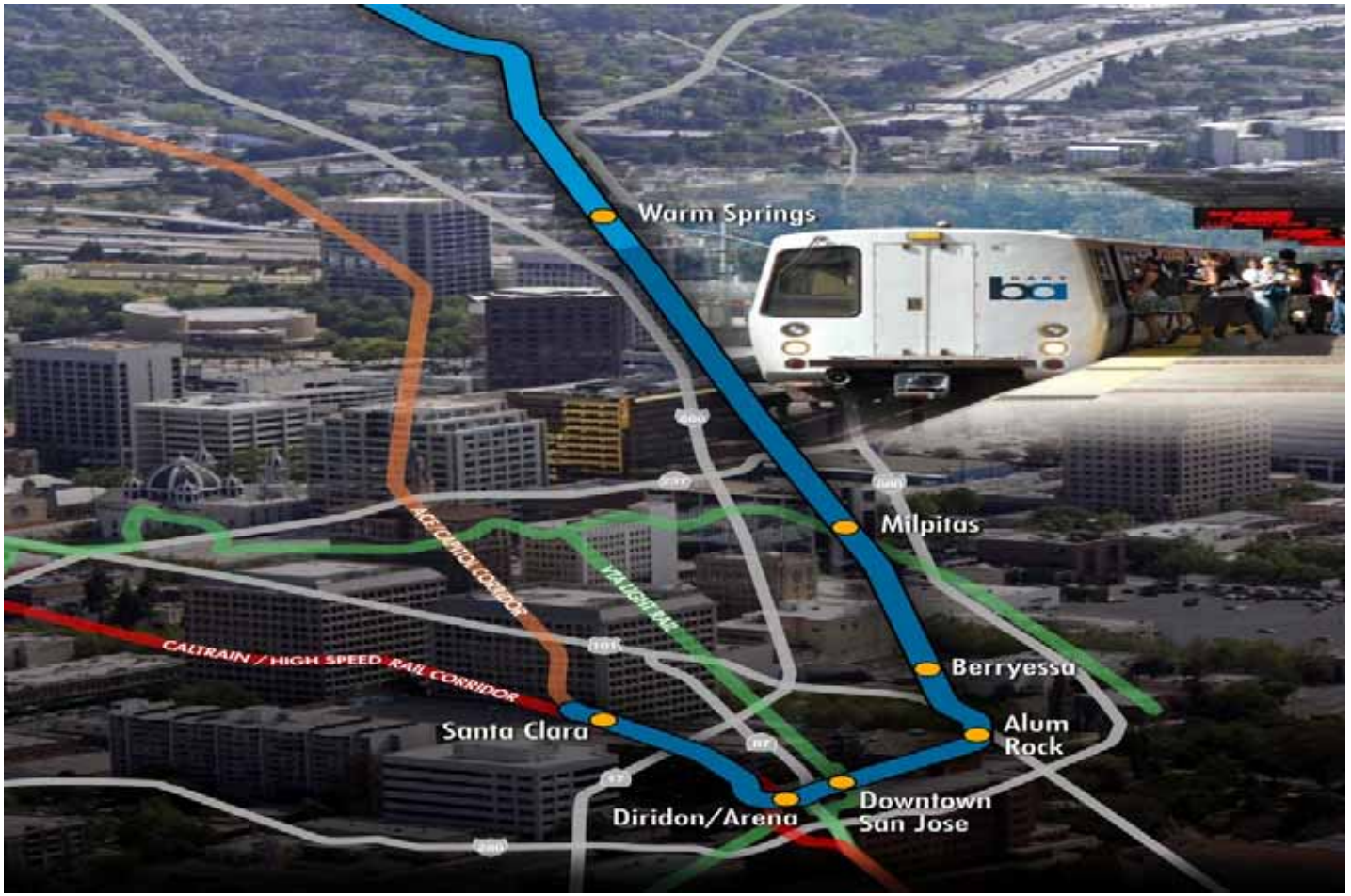
# BART System Access Points



# BART System Access Points: eBART Extension



# 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

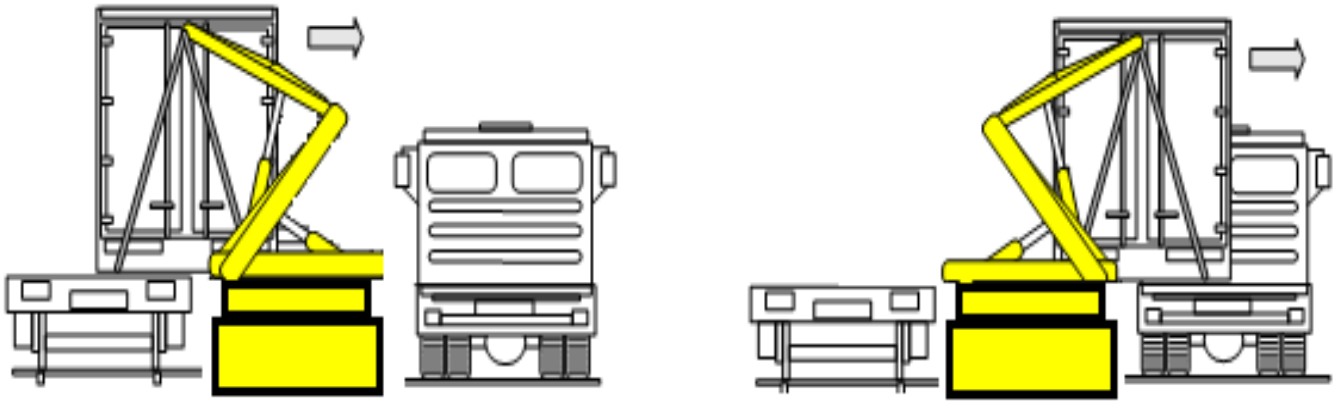
# Equipment for Container Movement - Flexible Platform

# 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)**

| Height (ft) | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
|---|---|---|---|---|---|---|---|---|
| 3,000lb | 55,900 | 61,300 | 65,900 | 69,800 | 73,4000 | 76,666 | 79.500 | 82,200 |
| 5,000lb | 61,900 | 67,900 | 72,900 | 77,300 | 81,200 | 84,700 | 88,000 | 91,000 |
| 10,000lb | 82,500 | 90,500 | 97,200 | 103,000 | 108,000 | 112,900 | 117,300 | 121,300 |

# 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

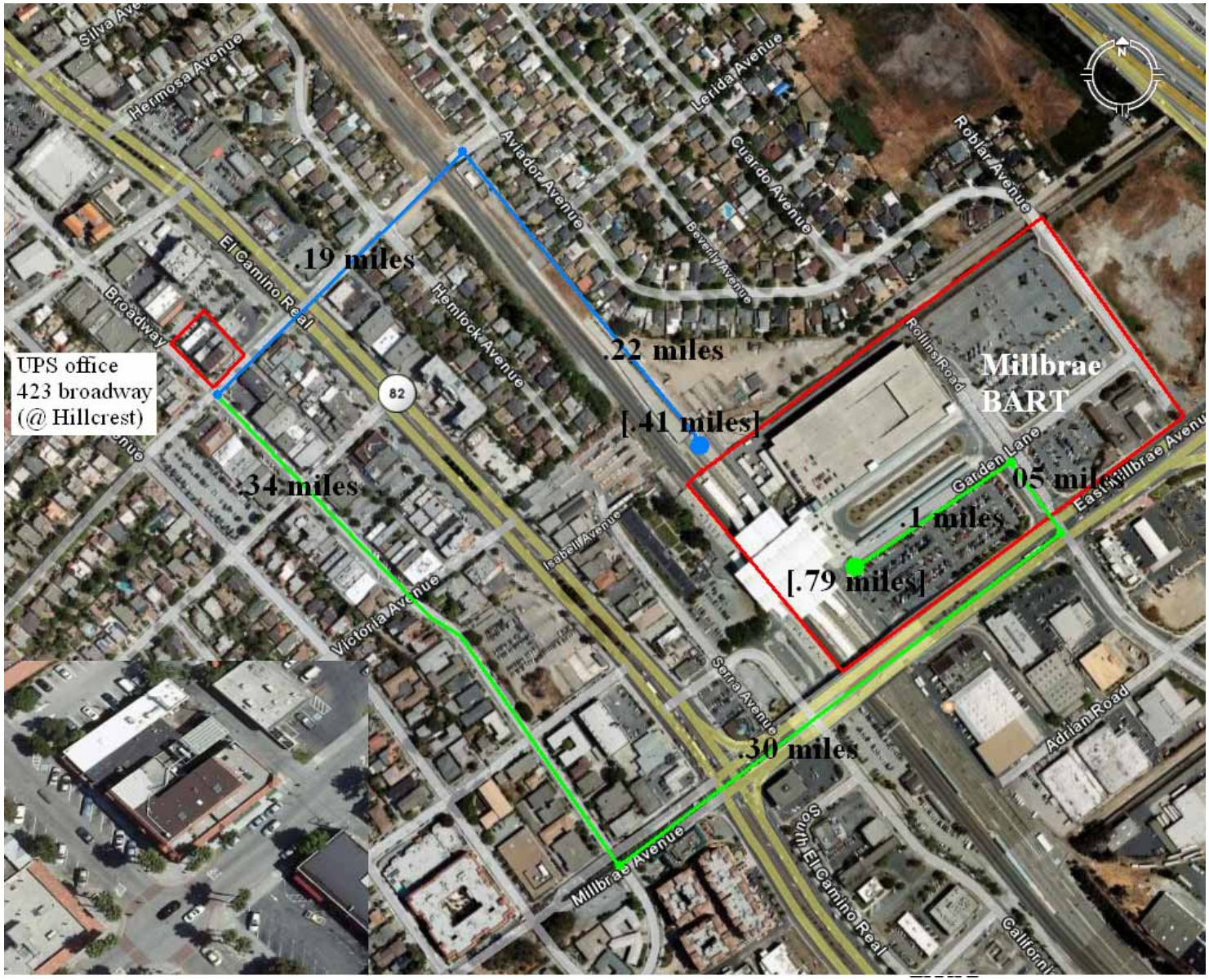
# CA Exported Airborne Agricultural Products

- **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 Vanelslander, J.,(2009), The use of rail transport as part of the supply chain in an urban logistics context, METRAN National Urban Freight Conference
- 
- Nuzzolo, A., Crisalli, U., Comi, A., and Sciangula, F., (2007), Metropolitan Freight Distribution by Railway: A Methodology to Support the Feasibility Analysis, METRAN National Urban Freight Conference B3-886;

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

- K. Sivakumaran, X. Y. Lu, and M. Hanson, The Use of Passenger Transit Infrastructure for Goods Movement: A Bay Area Economic Feasibility Study, 89th TRB Annual Meeting, Jan.10-14, 2010; *Transportation Research Record*, No. 2162, *TRB, p.44-52*

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