COMPARATIVE IMPACTS OF RAIL NETWORK CONFIGURATIONS ON JOB ACCESSIBILITY IN THE SAN FRANCISCO BAY AREA

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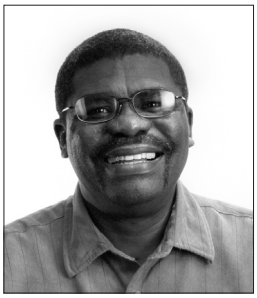

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The authors present a digest of Kevin Fang's Master's thesis, supervised by Dr. Cornelius Nuworsoo, which dealt with the potential locations for transit-accessible development based on accessibility to jobs, in the San Francisco Bay Area. The methodology involved the use of employment as a measure that captures access to work and other trip purposes that typically involve employment at the trip ends

Transportation is a great consumer of energy, particularly of non-renewable and polluting forms, which leads to an inordinate release of climate-altering carbon dioxide into the atmosphere. This realization has led many groups to seek a paradigm shift away from automobile-accessible transportation and land use to transit-accessible transportation and land uses. In similar vein, this study evaluated the accessibility impacts of four proposed extensions to the intra-regional commuter and heavy rail network in the San Francisco (SF) Bay Area. The extensions include: (a) BART to Silicon Valley; (b) eBART; (c) Caltrain to Downtown San Francisco; and (d) Dumbarton Rail. See Figure 1 for a skeletal network and Figure 2C for mapped extension corridors.

The study purpose was to identify locations with relatively advantageous potential for transit-accessible development using job accessibility as a surrogate for opportunities for transit-accessible development. The assessment identified locations that would be highly accessible without the deliberate creation of additional job centers. Effectively, findings would answer the question: what locations will be immediately most accessible upon completion of the extensions? The study question is consistent with findings in the literature, which show that many more residents prefer pedestrian and transit-accessible neighborhoods than those that actually live in them. For instance, Levine, Inam and Torng (2005) found unmet preference for alternative land use.

Methodology

The methodology involved the use of employment as a measure that captures access to possible work trips and other trip purposes (e.g., social/recreational trips) that typically involve employment at the trip ends. The importance of employment is manifest in the fact that work trips are projected to account for 46 percent of regional vehicle miles traveled by 2035 (SF-Metropolitan Transportation Commission).

The method calculates the accessibility index of a station to be proportional to the number of jobs that can be reached (US Census 2006), and inversely proportional to distance, which is expressed as a time-based friction factor in the SF-Metropolitan Transportation Commission's travel model. The accessibility index quantifies transit-accessible development opportunities. The conceptual function is: Accessibility = f (Employment, $Distance^{-1}$)

Accessibility indices were calculated under three alternative network configurations that constitute various combinations of the proposed extensions. See Figure 1 for the resulting configurations that are labeled as: A) Existing Trunk and Branch Layout; B) Potential Future Loop and Branch Layout; and C) Potential Future Loop and Branch with Cross-Link.

***Note**: This article is based on Kevin Fang's thesis Accessibility of Bay Area Rail Transit Stations: An Evaluation of Opportunities for Transit Oriented Development presented for Cal Poly's joint degree MCRP/MSE Transportation Planning. The thesis can be retrieved from Cal Poly's Kennedy Library at: <http://digitalcommons.calpoly.edu/theses/221/>*

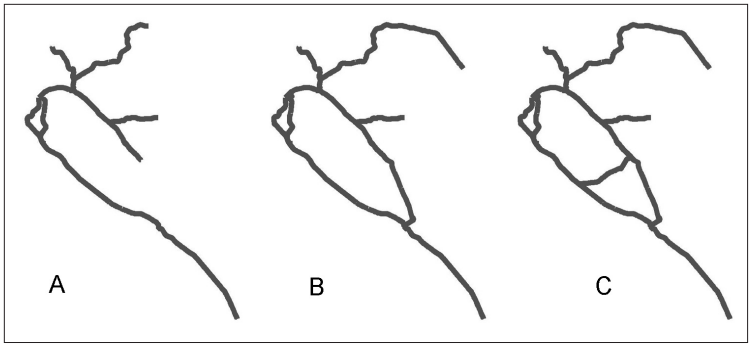


Figure 1
Skeletal network intra-regional commuter and heavy rail network in the San Francisco Bay Area.

Accessibility Indices

Figures 2A, 2B, and 2C illustrate the accessibility indices by station under the three alternative configurations, respectively. Under configuration A, the highest accessibility stations are generally in San Francisco and Oakland, the second and third largest cities in the region. The next highest accessibility stations are generally in locations close to San Francisco and Oakland, with accessibility tapering down with increasing distance away from these cities. There is some fluctuation in this trend with moderately high accessibility at stations nearby satellite job centers. Stations along the extensions are generally less accessible than existing stations. Almost one third of existing stations experience double-digit increases in accessibility when the network is changed from Alternative A to Alternative B.

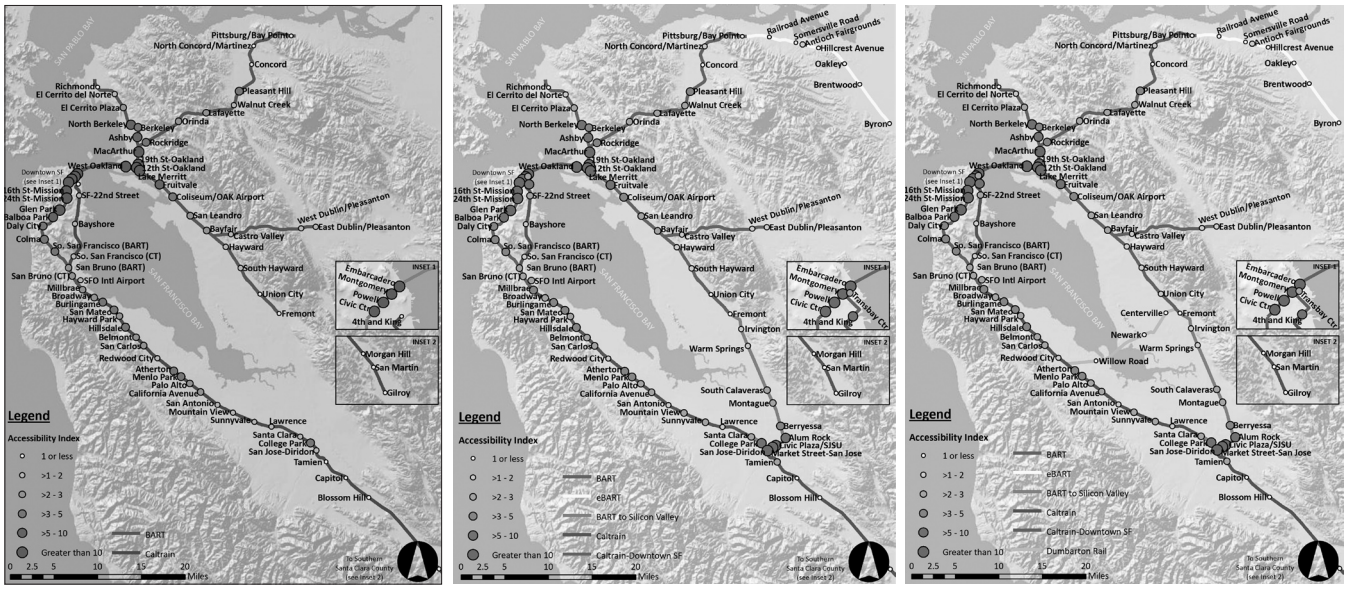
Regionwide Accessibility

The four proposed projects would increase regionwide rail job accessibility by 18.5 percent compared to 2009 levels; see Table 1 and Figure 1. The largest impact would come from extending BART to the Silicon Valley; see Table 2.

When results are viewed at the subregional level by area type, growth in accessibility appears focused in central cities and inner-ring suburbs. See Table 3.

The type of land use surrounding station areas can be favorable (through zoning or amenities) or not favorable (through non-compatibility of uses) to transit-accessible development (TAD). In California, Proposition 99 (2008) restricts the taking and conveyance of owner-occupied housing to private entities (as for private redevelopment projects). Once good accessibility is established for a location, this issue must be tackled to pave the way for TAD.

Figures 2A, 2B and 2C
Accessibility indices by station under the three alternative configurations.



Conclusions

Accessibility is one, very important, factor for transit-accessible development. Using accessibility as a measure, the four proposed extensions may be prioritized as shown in Table 4

Proposed extensions promote most accessibility growth when they encompass or add connectivity to large activity centers. Although each extension can enhance accessibility, these extensions need to provide clear travel time savings to be noticeably impactful. Large accessibility gains come along with the completed loop in Network B, but minimal gains come with the added cross-link in Network C.

Stations with low accessibility index values can still offer opportunities for transit-accessible development. They can be improved with concerted effort to focus more job growth at specific locations along the rail system as noted for the Walnut Creek and Pleasanton station areas.

***Table 1**: Increase in Regional Accessibility due to Network Configurations*

Extension	Growth in Accessibility
From configuration A to B	17.8%
From configuration B to C	6.0%
From configuration A to C	18.5%

***Table 2**: Increase Accessibility by Line*

From existing Network A to full-build Network C	New stations	Share of growth	
		Benefiting each line	Generate by each line
BART	---	4.04%	4.20%
eBART	5	3.44%	3.16%
BART to Silicon Valley	8	50.73%	59.82%
Caltrain	---	37.04%	19.36%
Caltrain to Downtown SF	1	2.49%	12.41%
Dumbarton Rail	3	2.27%	1.04%

***Table 3:** Increase in Accessibility by Subregional Area Type*

Subregional Area Type	Accessibility Growth
Central City CBD	36.1%
Central City Non-CBD	31.6%
Inner-Ring Suburbs	28.4%
Outer-Ring Suburbs	3.8%

***Table 4:** Job Accessibility-based Priority for Proposed Rail Extensions*

Priority	Proposed Rail Extension	Features and Effects
1	BART to Silicon Valley	Has highly accessible stations Makes other stations more accessibile
2	Caltrain to Downtown SF	Connetcs with major activity centers Makes other stations more accessibile
3	eBART	Low accessibility stations Promotes little additional accessibility
4	Dumbarton Rail	Low accessibility stations Promotes little additional accessibility

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