Developing a Decentralized Investment Strategy for Central/Southern Marin County Transit

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Abstract

The Central/Southern Marin Transit Study was commissioned to develop a program of feasible and fundable improvements to the US 101 truck-line bus service, as well as to identify additional programs to develop a better feeder system for Bay Area regional bus and ferry services. The major challenges in the corridor included difficulty of serving stops inside freeway interchanges, park-and-ride space shortages and congestion near current freeway bus stops, and the "built-out", hilly study area geography. An original vision to create a new, major hub was identified as unpopular, expensive, difficult to access, and inducing more VMT and related more green house gas emissions.

The study creates an alternative, decentralized investment strategy with five programs. The first program is to create multi-modal green hubs – a more context-sensitive, transit-friendly facility that has limited park-and-ride spaces, drop-off and pick-up areas, and bicycle and pedestrian amenities. The second – to enhance the freeway interchange bus stops or "pads" – would upgrade these stops to be more accessible to pedestrians and bicycles. The remaining programs included focusing on faster bus speeds on arterials, improving other local stops, and improving some local routing.

Using available rider data and surveys, DKS estimated the benefits of the combined programs. If fully implemented, 3.6 million boarding riders a year would benefit. There would be a reduction in annual vehicle miles traveled of over 3.8 million miles. Finally, there would be over 1,300 tons of greenhouse gas emission reduced annually.

Project Setting

Marin County, California is a slow-growing, suburban county of approximately 270,000 residents located immediately north of San Francisco, across the Golden Gate Bridge. The designated study area, located in east central and southeast areas of the county are dominated by large hills and mountains, with most development following along narrow valleys and coastal areas that run through the study area. There are also large areas in the study under public ownership as parks or open space. Most privately-held land has been developed with most occurring over 20 years ago; there is little vacant land remaining.

The primary roadway facility that runs north-south through the study area is U.S. Highway 101, which serves both as a regional freeway and the "main street" that connects the various communities with each other as well as the region. This primary route is augmented by arteries that connect the various community neighborhoods. There are five corridors that were identified as operating through the study area.

The study area features many single-family homes in densities associated with more suburban areas. The proximity to San Francisco has resulted in stronger transit use than is typical for suburban areas. The lower residential densities have resulted in the transit access mode chosen by riders users to be more likely to be driving (park-and-ride or drop-off/pick up) as opposed to walking or bicycling.

The transit service that operates in the study area was conceived several decades ago in response to providing commute options into and out of San Francisco. The initial impetus was congestion on the Golden Gate Bridge. The transit service, both offered as bus and ferry, has been operated by the Golden Gate Bridge, Highway and Transit District since 1970. The bridge service concept consisted of providing all-day base service, with additional commute hour service. Additional local service has been provided as another service type, through an arrangement with the Marin County Transit District, which was created in 1971.

Study Purpose and Conceptual Recommendations

The adopted purpose of this study was to:

- Develop an incremental program of feasible and fundable improvements to the U.S. 101-oriented trunk line bus service.

- Identify opportunities for transit to serve as effective feeders for both ferry and regional commute bus services.

The types of improvements that meet this purpose are generally associated with facilities where riders access the transit system. The existing transit facilities can be defined as freeway ramp loading areas (known as “bus pads”), several off-freeway transit transfer centers including ferry terminals, and bus stops. The study area bus pads are designed for buses to quickly exit the freeway at an off-ramp, load passengers at a stop, the re-enter the freeway at a downstream on-ramp. These are located along U.S. 101 at Lucky Drive, Paradise Drive, East Blithedale Avenue, Seminary Drive and Spencer Avenue. There is also a large park-and-ride lot on U.S. 101 at the State Route 1 junction at Manzanita but buses cannot directly load and unload at the stop at this location. The off-freeway transit transfer centers are located in Downtown San Rafael, Marin City, San Anselmo and Strawberry Village. The ferry terminals are located at Larkspur Landing, Downtown Tiburon, and Downtown Sausalito.

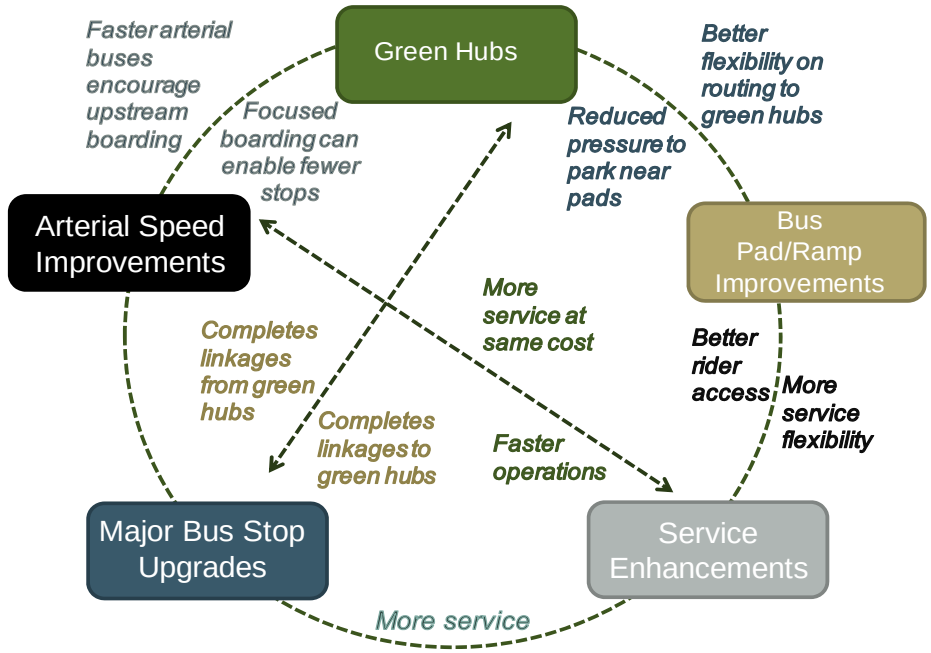
The concept of a potential large transit hub service the study area was an early premise o the study. The subsequent travel demand and transit service analysis concluded that a program of localized transit infrastructure investment, widely distributed at multiple sites on all of the study corridors, would yield more effectively mobility benefits for Marin residents.

The program consisted of five elements: **Multi-modal Green Hubs** are strategic transit stops designed to collect and distributed passengers in a way that promotes transit efficiency, service quality at a scale compatible to local communities. These hubs are to have enhanced pedestrian access, improved waiting area comfort and information, bicycle amenities, drop-off and pick-up areas (including potential areas for taxis and shuttles), some park-and-ride capacity, and

environmentally sustainable amenities. **Key Bus Pad and Ramp Enhancements** are to be improvements intended to improve safety, access and convenience to these locations. These conceptual improvements could involved ways to improve pedestrian and bicycle access to these stops so that they would no longer be in locations that are both difficult to ready on foot or bicycle, and are adjacent to the noisy freeway. **Arterial Speed and Reliability Improvements** are both service and bus stop improvements intended to promote limited-stop routes, strategic geometric changes and potential transit signal priority in order to improve the operating speeds of buses on the corridors. Additionally, **Bus Stop Quality Enhancements** and **Key Bi-Directional Corridor Enhancements** complete the proposed study recommendations.

Analyzing Study Recommendations

The overall program would significantly improve the environment which local bus riders experience in Marin County. The benefits are synergistic, as shown in the study diagram.



However, to present the cumulative benefits of the program, each element needed to be evaluated separately with the understanding that the other components would be in place. The criteria identified to estimate included total annual boardings benefited, annual trips benefited by mode – walk, bicycle, park-and-ride, drop-off/pick-up and transfers, annual trips benefited by safer at-grade crossings, annual auto driver/passenger minutes saved, and annual greenhouse gas emissions reduced.

Analysis Techniques Used

To provide an analysis of these various elements, a combination of both rider surveys, boarding information, and national research. The methods applied include:

Annual Walk to Transit Trips Benefited. There are several sources available to provide the appropriate data. Data provided by the transit operators on the number of boardings of routes in the study area formed the basis of the analysis. The number of annual passengers who walk to transit was estimated from mode-of-access responses from on-board surveys conducted for Marin Transit and Golden Gate Transit to determine the proportion of persons who walk.

Annual Bicycle to Transit Trips Benefited. The number of annual bicycle to transit trips benefited was estimated according to the annual ridership by line, the proportion of bicyclists that ride to a transit route, and the proportion of overall transit boardings that occur at the proposed hub locations. Data on the number of boardings of routes in the study area formed the basis of the analysis, as provided by the transit operators. The number of annual passengers who bicycle to transit included the existing, reported bicycle users, determined from recent mode-of-access responses to surveys conducted for Marin Transit and Golden Gate Transit. In addition to the existing users, new bicycle users were estimated to be also able to use transit as a result of the improved parking capabilities and overall improvements to access. The benefits from new bicycle trips were assumed to be directly related to the number of increased secure bicycle parking facilities provided. The benefits assessment presented here assumed 85 new secure bicycle parking lockers to be distributed in the green hubs program.

Annual Transit and Auto Trips that Park-and-Ride Benefited. To assess the benefits, separate calculations were made for those who will relocate their park-and-ride location closer to their homes, and new riders who will be attracted to the bus system. For example, there is an estimated 850 parking spaces that would be created in the aggregate for the Multi Modal Green Hubs program. Of these, an estimated 500 of these spaces are intended to accommodate overflow parking that occurs on neighborhood streets and in other areas. These spaces were assumed to be used once a day, and each space is assumed to replace two auto trips. The remaining 350 parking spaces were assigned to new riders that are estimated to instead drive today (because they cannot find parking and because the bus speeds are less desirable); each space was assumed to replace two daily auto trips. All of the trips are adjusted to an annual condition.

Annual Drop-Off, Pick-up and Transferring Passengers Benefited. The estimate of benefiting passengers was developed by applying the current proportion of people who use these modes of access to reach the transit system (as determined by mode of access responses to on-board surveys conducted for Marin Transit and Golden Gate Transit in 2008) to the overall ridership by line and stop in the study area.

Annual Boardings Benefited. The number of annual boardings was estimated according to the annual ridership by line, and the proportion of transit boardings that

occur at the proposed hub locations. In addition, new riders anticipated from shifting bicyclists, shifting pedestrians, shifting park-and-ride users and shifting drop-off/pick-up users were also added. There were several sources available to provide the appropriate data. Data on the number of boardings of routes in the study area formed the basis of the analysis. The numbers of persons who board at these locations today are anticipated to benefit. In addition, the number of shifting passengers determined from other modes is added.

Annual Pedestrian Trips Benefiting by Safer At-Grade Crossings. For this assessment, it was anticipated that every rider must cross the street either when boarding or leaving a bus. Thus, half-of the overall walk-to-transit stop trip activity (discussed above) was estimated to benefit from safer crossings.

Annual Auto Driver/Passenger Minutes Saved. As noted in the above improvements to modes of access, the programs are anticipated to reduce the amount of time that drivers are spending in their vehicles. The reduction was assumed to be gained from ways in which the various programs attract people to either not drive at all, or drive shorter distances. The industry standard service elasticity of 0.3 (a one percent change in travel speed results in a 0.3 increase in mode share) was applied to develop the general statistics. This is based upon international research reported in the TCRP (Transit Cooperative Research Program) 95 Report: *Traveler Response to Transportation System Changes, Chapter 9, entitled "Transit Scheduling and Frequency*.

Annual Greenhouse Gas emissions reduced (tons). There is considerable research on the relationship between greenhouse gas emissions and vehicle miles of travel, with the speed profiles and vehicle mix having a variable affect on each new trip that is no longer made by driving the full distance. The amount of reduction is ultimately related to the type of driving, the type of fuel, the gasoline efficiency of the vehicles, and other technological assumptions. For this assessment, an average benefit method was applied to generally demonstrate the benefit. This benefit relationship (determined by the Regional Planning Partnership examined this relationship for Mercer County, New Jersey in April 2006), showed a reduction of 1.413 pounds of CO2 for each daily vehicle mile. With 2000 pounds in a ton, it was estimated that each weekday trip mile reduced would yield 0.18 of annual tons reduced. An inverse of that is that an annual ton of CO2 is reduced for every 5.5 weekday vehicle miles of travel if the ratio was annualized.

An example table from the analysis, shown for the multi-modal green hub program is shown as Table 1.

Table 1
Estimated Annual Benefits of Green Hubs

Category of Benefit	Typical Weekday	Annual
Overall Program (17 Green Hubs Example):		
Bicycle to Transit Trips	830	211,600
Walk to Transit Trips	5,770	1,471,300
Park-and-Ride Transit Trips Shifted to Hubs (Overflow parking from neighborhoods)	500	127,500
Previous Auto Trips Shifted to Park-and-Ride at Hubs (Parking made available)	350	89,300
Other Types of Transit Trips (Drop-off/pick-up/transfer from other buses and shuttles)	2,938	749,200
Trips Benefited at Green Hubs	10,388	2,648,900
Pedestrian Trips Benefiting by Safer At-Grade Crossings	4,779	1,218,700
Auto Driver/Passenger Minutes Saved	12,500	3,187,500
Greenhouse Gas emissions reduced (tons).	4.42	1,100
Single Typical Hub:		
Bicycle to Transit Trips	49	12,447
Walk to Transit Trips	339	86,547
Park-and-Ride Transit Trips Shifted to Hubs (Overflow parking from neighborhoods)	29	7,500
Previous Auto Trips Shifted to Park-and-Ride at Hubs (Parking made available)	21	5,253
Other Types of Transit Trips (Drop-off/pick-up/transfer from other buses and shuttles)	173	44,071
Trips Benefited at a Green Hub	611	155,818
Pedestrian Trips Benefiting by Safer At-Grade Crossings	281	71,688
Auto Driver/Passenger Minutes Saved	735	187,500
Greenhouse Gas emissions reduced (tons).	0.26	64.71

The benefits listed here provide an illustrative picture of the various components of the program. Table 2 compiles these findings into a summary table. As this table shows, the annual benefit will accrue to almost 3.6 million passengers a year. About 1.5 million passengers a year will benefit from safer crossings. There was expected to be a significant savings in auto driver minutes resulting from shifts to transit use. The estimated benefit is almost 4 million minutes a year, resulting in an estimated savings of 1,337 tons of greenhouse gas emission reduction.

Table 2
Aggregated Benefits

Category of Benefit	Green Hubs Program	Ramp TSP/ Bus Pads Improvement Program	Arterial Speed and Reliability Program	Enhanced Local Stops Program	Total Benefit
Bicycle to Transit Trips	211,600	8,500	23,600	NA	243,700
Walk to Transit Trips	1,471,300	106,600	296,000	189,200	2,063,100
Drop-Off/Pick-Up/Transfer Transit Trips	749,200	22,200	61,700	0	833,100
Total Transit Trips	2,648,900	170,800	474,300	303,100	3,597,100
Pedestrian Trips Benefiting by Safer At-Grade Crossings	1,218,700	170,800	NA	94,600	1,484,100
Auto Driver/Passenger Minutes Saved	3,187,500	205,600	465,400	NA	3,858,500
Greenhouse Gas emissions reduced (tons)	1,100	73	164	NA	1,337

The same data can be examined on a typical improvement basis. This summary information is shown in Table 3. This shows that each improvement individually yields benefit in a number of areas, and that the reduction in auto driver trips and greenhouse gas emission reduction are more comparable on a unit basis. The lowest cost benefits – the local stop enhancements – benefit the least people on a per installation basis, while the green hubs and the arterial speed and reliability improvements programs tend to benefit the most. While the bus pad improvements do not show as much of a benefit on a unit basis, it is noted that they do provide a significant benefit to safety and security – key issues which both policymakers and the public alike have identified during the Study as important non quantifiable benefits resulting from the improvements program.

Table 3
Summary of Benefits by Typical Individual Site

Category of Benefit	Typical Green Hub	Typical Ramps/ Bus Pads	Typical Arterial Speed Improvement	Typical Enhanced Local Stop
Number of Sites in Program	17	4	2	22
Bicycle to Transit Trips	12,447	2,125	11,800	NA
Walk to Transit Trips	86,547	26,650	148,000	8,600
Drop-Off/Pick-Up/Transfer Transit Trips	44,071	5,550	NA	0
Total Transit Trips	155,818	42,700	237,150	13,777
Pedestrian Users Benefited by Safer At-Grade Crossings	71,688	42,700	NA	4,300
Auto Driver/Passenger Minutes Saved	187,500	51,400	232,700	NA
Greenhouse Gas emissions reduced (tons)	65	18	82	NA

In conclusion, measures and techniques can be developed which can describe the potential benefits of implementing transit stop strategies at a planning level. These methods provide a framework by which local decision-makes can embrace a program to improve the environment in which transit operates. Applying methods such as these are important, as many of the improvements are not generally represented in the inputs associated with transit service in travel forecasting models.

Author Information

Joseph Story, AICP, is a Principal with DKS Associates in Oakland. He was the project manager for the DKS assignments on the Central/South Marin Transit Study. He has 26 years of experience in transportation planning including travel demand forecasting, corridor studies, transit planning and long-range transportation planning. He has a Master of City and Regional Planning from the Ohio State University.