Chapter 3

PRELIMINARY DECISIONS

INTRODUCTION

The Commission made some preliminary decisions on service options in June 1999, which set the stage for more detailed analysis. These options included route, service pattern, and station spacing, rolling stock and track upgrade alternatives. The Commission evaluated these options in terms of capital costs, operating costs, ridership and revenue, environmental impacts, compliance and safety issues, implementation time, and phasing. In summary, the Commission:

1. Focused on five service options within a study area bounded by Cloverdale in the north and downtown San Rafael in the south.
2. Opted for a start-up service pattern including comparatively frequent peak-period service and comparatively infrequently mid-day service. Weekend service would be excluded from a start-up plan.
3. Selected a wide station spacing pattern, with a station every six miles, on average. The pattern is consistent with other commuter rail operations initiated on the West Coast since the early 1990s.
4. Determined that the service would employ either conventional rolling stock (diesel electric locomotives and cars) or diesel multiple units (DMUs are self-propelled rail cars) compliant with federal regulations pertaining to crashworthiness.
5. Chose a higher level of "utility" for the track upgrade: to build the system for flexibility by opting to upgrade track and bridges to handle maximum speeds of 79 mph.
6. Opted to provide a seat for each passenger.

Appearing below is a discussion of the various service options, along with the analysis of the key considerations that factored into the Commission's preliminary decisions. The analysis was aimed at identifying any potential fatal flaws that might disqualify options from further consideration.

STUDY AREA AND ROUTE OPTIONS

The rail plan territory evaluated in the study encompasses an area generally defined by the US 101 corridor between Cloverdale in the north and San Rafael in the south. Within this corridor, five discrete options were analyzed. Preliminary assessments of general cost effectiveness and utility for the major commuter markets were the primary criteria in selecting the options.

Five Service Options Selected for Further Analysis

Each option would serve specific commute markets. For example, the Healdsburg – Petaluma Option would serve commuters heading to work in Santa Rosa from their homes at or near the northern and southern endpoints. Healdsburg – San Rafael would serve the traditional southbound morning commuters as well as commuters from northern and southern Sonoma County heading to their jobs in Santa Rosa. The five commute options were:

- Healdsburg – downtown San Rafael
- Cloverdale – downtown San Rafael
- Healdsburg – Petaluma
- Cloverdale – Petaluma
- Petaluma – downtown San Rafael

Healdsburg – Downtown San Rafael: This 51-mile route would serve commuters traveling to jobs in all major job markets in the study area. This would include traditional southbound commutes from Sonoma County to Marin County. It would also include a growing intra-Sonoma County commuter population. Santa Rosa is the major job center for the county, drawing workers from the north and from the south.

Cloverdale – Downtown San Rafael: This 68-mile route would have a northern terminus at Cloverdale. In addition to providing a rail alternative for traditional southbound commuters and a growing intra-Sonoma commuter population, this option would also present opportunities for recreational use of the system. Bicyclists might take the train from more urbanized areas in the south to more bucolic surroundings in the north. Also, it would make use of a new rail station in Cloverdale, which is now used only as a transit center (park-and-ride and bus transfer point).

Healdsburg – Petaluma: Located entirely within Sonoma County, this service option would span 29.5 miles between Healdsburg in the north and Petaluma in the south. Its focus would be the expanding intra-Sonoma County commute. Downtown Santa Rosa is virtually equidistant from both endpoints. Assuming trains left the northern and southern endpoints at the same time and traveled the same rate of speed, they could meet in Santa Rosa before completing their routes. This service would be well suited for the commute patterns in the county, where significant numbers of people travel into Santa Rosa for work from northern and southern parts of the county.

Cloverdale – Petaluma: Like the Cloverdale – downtown San Rafael route, this 46.7-mile route offers a commute alternative for residents of northern and southern Sonoma County only. Given its northern terminus, it would provide enhanced potential for recreational use of the service. It would also make use of the underutilized Cloverdale station facility.

Petaluma – Downtown San Rafael: While this option extends into the southern Sonoma County, the majority of its route lies within Marin County. The route is 21.5 miles long, and runs between Petaluma in the north and downtown San Rafael in the south. The primary morning home-to-work pattern in this market would be southbound from Petaluma and Novato to San Rafael.

No Build to Larkspur – at least for Now

Given considerations of cost effectiveness in particular, one routing alternative quickly dropped out of further consideration. This was making the southern rail terminus the Larkspur Golden Gate Ferry Terminal. Reaching the terminal would require approximately $36 million in construction costs:

λ Elevated structure through downtown San Rafael	$12 million
λ Anderson Drive grade separation	7 million
λ Reconstruction of the Calpark Hill Tunnel	4 million
λ Elevated structure at the Ferry Terminal	13 million
λ Total	$36 million

The calculation above assumes an elevated structure in downtown San Rafael. Such a structure would be a means of mitigating delays to traffic on 2nd, 3rd and 4th Streets due to trains. However, it is not known if in fact an elevated structure is needed, as the delay potential to downtown traffic resulting from commuter trains has not been thoroughly assessed. Whether or not an elevated structure would be necessary could be confirmed with traffic modeling. Modeling would be part of an environmental assessment conducted during a subsequent phase of this project. Also, the California Public Utilities Commission (PUC) has required the grade separation of Anderson Drive for safety reasons. Situated between southern San Rafael and Larkspur Landing, Calpark Hill Tunnel is caved in at its southern portal. As the Ferry Terminal is substantially below the rail grade at the tunnel's southern portal in Larkspur, an elevated structure would be necessary to bring trains to the nearby Ferry Terminal.

At $36 million, the capital cost price tag to reach for the 2.7-mile distance from downtown San Rafael to the Ferry Terminal would amount to more than $13 million per mile. This appeared as a prohibitively high figure, especially in light of track upgrades north of Ignacio that would average less than $1 million per mile. Additionally, a "first-cut" of potential ridership indicated that, conservatively, four times the commuters would ride service between Cloverdale and downtown San Rafael than would ride the trains to and from the Ferry Terminal. Clearly, building to the Ferry Terminal would neither be cost effective nor serve the greater number of riders. However, the Larkspur extension should be more thoroughly evaluated after the start-up system begins operations.

At the same time, the potential closing of the California State Prison at San Quentin argued against building Larkspur in the short-term. If the prison were to close, in time the Ferry Terminal could move to that site. The justification for the move is straightforward. A ferry landing at Point San Quentin would have greater water depth than the existing Larkspur site. As a result, it would provide for shorter ferry trips to San Francisco, as ferries would not be required to proceed at reduced speeds as they do now to and from Larkspur in order to prevent damage the fragile wetlands. Not building an expensive rail-ferry connection to Larkspur avoids the possibility of an obsolete terminal, should the ferry move to Point San Quinten.

Should ferry service one day become available in Sonoma County, the rail service should be integrated with it and all other transit modes.

Capital Cost Implications

Longer route options predictably are more expensive to build in absolute terms. However, this is not always the case when viewed on an apples-to-apples basis. Such a basis for this study is capital cost per route mile. These figures appear in Chapter 5 of this report.

Operating Cost Implications

These costs typically include labor, fuel, maintenance of facilities and rolling stock, and general administrative expenses. For the most part, these costs are variable. That is, they increase or decrease in relation to the crews required, hours worked, train sets required, and train-miles traveled (a train-mile equals one train moving one mile). For example, a service option involving a longer distance route may trigger a need for an additional train set (a locomotive and coaches or a DMU) to protect hourly headways. In this case, the longer distance will either demand crews work more hours, or require an additional crew. The added rolling stock will mean additional equipment maintenance expenses. For one reason or another, the longer-distance service option will represent greater operating costs on an absolute basis. However, an apples-to-apples basis of comparison is operating cost per train-mile. Operating cost per train-mile calculations appear in Chapter 7.

Ridership and Revenue Implications

Generally speaking, the more markets that a service option reaches, the greater its potential for ridership. Also, since fare revenue is a function of ridership, the greater the ridership, the higher its potential for revenue. The longer distance route options, serving more markets, have higher revenues in absolute terms. The apples-to-apples comparison basis, however, for the route options is revenue per train-mile. These calculations appear in Chapter 7 as well.

Environmental Impacts

Different service options have different environmental issues. These include:

- Land use
- Parklands
- Cultural resources
- Station accessibility
- Transportation/traffic safety
- Hydrology
- Wetlands
- Hazardous materials

The Commission felt that none of these factors proved a fatal flaw that would to exclude any of the five route alternatives from further analysis. A more detail analysis of these impacts was conducted subsequently. The analysis determined various issues of significant impact, and others of less than significant impact relative in the study area. The impacts appear in Chapter 6.

Implementation Time

No one route appeared to present significant challenges in terms or upgrading relative to another. In fact, all options would require major upgrades of the route for commuter rail. Work for all options would consist of improvements to the track, installation of new sidings, signalization, grade crossing improvements, repairs to bridges, and construction of stations and a maintenance facility. These requirements appear in greater detail in Chapter 4.

Compliance and Safety Issues

As compliance and safety relate to rolling stock, track conditions and signaling, they are not strictly pertinent to the discussion of service options here. These issues will be dealt with in subsequent sections.

Phasing Potential

A phasing opportunity may present itself, in part as a consequence of the improvements relative to service to the Larkspur Ferry Terminal. Implementing a later extension to Larkspur or Port Sonoma would provide extra time to make the incremental improvements for the San Francisco-bound commuters. In the interim, the rail service could focus its operations on the significant Sonoma – Marin and intra-Sonoma commute markets.

It should be noted that such phasing does not preclude any options. This issue is simply one of timing. Conceivably time may play to the service's advantage. That is, other less costly options than Larkspur may present themselves during the intervening period. For example, ferry service might be relocated from Larkspur to Point San Quentin (assuming abandonment of the existing prison), and building to San Quentin would likely require a less capital intensive investment than would a Larkspur extension as a tunnel may not be needed. Indeed, building to Larkspur, concurrent with the start-up of service elsewhere on the route, may in and of itself preclude taking advantage of such an opportunity.

Commission's Position

The Commission supported a recommendation for exploring the five route options outlined above and in deleting the service to Larkspur from further analysis. In setting a Larkspur terminus aside, the Commission noted that not building to Larkspur in the short term does not preclude an extension to the Ferry Terminal in the future. To the extent that San Francisco-bound commuters want a rail-ferry connection in the short-term, this could be provided by a shuttle service from downtown San Rafael to Larkspur.

SERVICE PATTERNS

Two service patterns underwent evaluation in the study. These were:

- Peak period only (usually peak-direction only, but could also include "reverse-peak"); and
- Peak and off-peak (mid-day and weekend service).

As implementation would focus primarily on the commuter market, the study did not include an analysis of weekend service opportunities.

Option Definitions

Peak period only is a traditional commuter service pattern. Trains would leave suburban endpoints at such times as to serve the major commuter flows during the early weekday morning and late afternoon/early evening hours. A typical example of such service is Altamont Commuter Express (ACE), which at present has two morning trains running westbound from Stockton to San Jose. The first train to arrive reverses direction for a run to Pleasanton, where it picks up more southbound riders for another westbound morning run to San Jose. The two train sets "lay over" or remain idle mid-day at San Jose, before returning to Stockton in the late afternoon and early evening. Service is offered Monday through Friday only.

The peak and off-peak pattern combines traditional commuter service with mid-day period (generally from 9 a.m. to 3 p.m.) service catering to non-work related trips. Weekend service could also be included. Typical examples of this kind of service are provided by Caltrain locally, Metrolink in the Los Angeles Basin, and the Coaster service between Oceanside and San Diego. It can be noted that, in some cases, development of peak/off-peak service is evolutionary. That is, some services may start-up in peak-only mode. After the service becomes more widely known, it may begin limited off-peak operation, which can be expanded to weekends as demands for the service dictate.

Capital Cost Implications

Generally speaking, the difference in capital costs for the two service patterns is minimal if the desired service scenarios cause no additional incremental costs for track improvements and rolling stock. For example, the same equipment used to cover peak commuter runs may be employed to offer mid-day service with comparatively infrequent headways. In this case, additional requirements for rolling stock and track improvements would be nil. On the other hand, should all-day service and comparatively frequent headways be desired, capital costs would be much greater due to the requirement for incremental rolling stock as well as sidings to handle train volumes.

Operating Cost Implications

As mentioned before, these costs typically include fuel, labor and maintenance for rolling stock. All three are variable. More trains will cause higher levels of all three costs for peak plus off-peak service as compared to peak only service. More trains will naturally consume more fuel. Labor costs also likely will increases given a peak plus off-peak service pattern. ACE's current operation demonstrates these cost dynamics.

ACE runs two trains in the morning to San Jose from Stockton, plus a morning roundtrip from San Jose to Pleasanton and back to San Jose, as previously discussed. These trains subsequently lay over at San Jose until the late afternoon and early evening when they return to Stockton. The same crews who bring the morning trains into San Jose take them on the return trips in the afternoons. As a result, they have a minimum of 4 hours of rest in San Jose, which do not count toward their maximum allowable 12 hours of service[1]. If mid-day trains were added to the service, the westbound crews might have no rest time in San Jose. They would consume their maximum allowable hours at a faster rate and thereby would not be available for the afternoon and evening runs. As a result, more train crews and the associated costs would be required to cover the late afternoon and evening trains.

On the other hand, running trains mid-day would provide opportunities for revenue from non-work related trips. These are discussed below. The larger point is, with train crews already on duty, they might be better put to use running trains serving existing demand. As crews already would be on duty for the commuter runs, having them run mid-day runs likely will not prove that much more expensive, since the contribution of the mid-day revenue to operating costs typically would be high. The bottom line likely would be a minor increase in net operating costs.

Ridership and Revenue Implications

A peak-only service will support mostly commuters. However, commuters are not the whole universe of potential riders. Non-work related trips are also a market. These would include school field trips, other student trips, shopping trips, and recreational trips (special event and/or excursion trips), which could be candidates for off-peak or mid-day service.

To understand how significant the non-work related trip market may be in Sonoma and Marin Counties, off-peak services of Metrolink in Los Angeles were reviewed. Metrolink operates 44 weekday round trips, of which 29 or 65 percent are peak-hour, peak-direction trains. These are the traditional commuter service trains, which account for 78 percent of weekday ridership. The remaining 35 percent of weekday trains are off-peak or reverse-flow trains, which account for 22 percent of ridership. For this study, it was estimated that peak trips would amount to 80 percent of total trips, and off-peak mid-day trips would account for 20 percent. Off-peak riders on average pay fare more per trip, as commuters tend to buy monthly passes at discounts from cash fares.

Environmental Factors

Peak Only Service: Generally speaking, if service is limited to peak hours only, the access to and from the stations will be focused on the peak commute periods. Provision of parking will be confined to supporting those regular commuters who do not use local transit to access the train station. The noise associated with train operation will be confined to a limited number of hours

[1] The Federal Hours of Service Law limits train crews to 12 hours of continuous service without rest. The targeted work pattern for ACE is 4-5 hours on (westbound to San Jose, a minimum 4 hours rest in San Jose), and 4-5 hours on again (eastbound to Stockton). However, using only two crews (same crews working every day) would not allow for the required 8 hours off (home overnight at Stockton) between assignments if a train is late. Therefore, ACE uses a third crew. Each crew works 2 days on, 1 day off.

in the morning and afternoon. Freight operations could continue to operate during the mid-day or non-peak hours. With fewer trains operating, fewer opportunities for conflicts with vehicles or pedestrians at grade crossings will likely occur.

Peak and Off-Peak Service: Increasing service to include the off-peak hours may require the expansion of parking facilities at train stations in outer years. Increasing the number of commuter rail trains operating throughout the day would increase the number of hours that residents are potentially exposed to the noise of train operation, particularly if freight operations were moved to evening, night time, or early morning operation. The number of daily occurrences of trains operating through grade crossings would increase, thereby raising (1) the potential for traffic conflicts and (2) the noise associated with train horns and gate bells.

Compliance and Safety

These issues are not applicable to service patterns.

Implementation Time

Neither service pattern presents any significant obstacle in terms of time required for implementation.

Phasing Potential

Start-up could include comparatively infrequent off-peak or mid-day service along with frequent peak period commuter service. This would enable the service to tap the biggest markets first and minimize operating costs. Once the service becomes established and more widely known, it can expand to pursue other markets through more frequent mid-day service. This scenario matches the experience of Metrolink, which has gradually increased off-peak service over time. Once the system reaches maturity (for example, after 10 years), weekend service options might be added.

Commission's Position

The Commission supported a recommendation to implement limited mid-day service along with commuter rail service. The recommendation was based three points. One, a mid-day market likely exists for mid-day trains. Two, employing trains and crews for mid-day revenue runs would represent a better utilization of resources. Three, a comparatively small increase in overall net cost could be expected.

STATION SPACING OPTIONS

The Commission evaluated two station spacing options. These were:

- Wide spacing
- Close spacing

A wide spacing pattern might call for stations stretched between comparatively longer distances such as five miles or more. The pattern is consistent with more recent commuter rail implementations on the West Coast. Metrolink and ACE systems typify a wide station spacing pattern.

A close spacing pattern might call for stations less than five miles apart. This pattern is consistent with more urban rail transit, such as light rail. Caltrain is an example of a commuter rail service that holds to a close station spacing pattern.

Capital Cost Implications

With close spacing, there will be more stations. In the 1997 Calthorpe study[2], 19 different stations were identified. Nine of these were considered primary stations to be constructed during a first phase. Four more primary stations would be build during the first part of a second phase build-out. One primary and five secondary stations would be added later. Phase 1, with nine stations, would more generally fit the profile of a wide spacing pattern. The full 19-station scheme would reflect a close spacing pattern.

Capital costs per station will vary directly the facilities that the stations include. For a minimum design including of a platform, a simple shelter and some parking, construction cost might total $1 million. If land needs to be acquired and more parking added, the costs accordingly costs would be higher.

Beyond construction costs, station spacing may have other capital cost consequences. For example, frequent stops dictated by close spacing will lengthen transit (or travel) times. At the same time, if the maintenance of relatively frequent headways is a fundamental service parameter, close spacing that results in longer transit times may trigger the need for additional rolling stock.

Operating Cost Implications

Spacing patterns can have similar effects on operating cost. For example, if close spacing indeed triggers additional capital costs for extra equipment, it may also trigger additional operating costs for crews to run the equipment.

Ridership and Revenue Implications

Station spacing options present rail system planners with a classic tradeoff. Specifically, the ridership gained through increased access to the system via close spacing will be at cost of transit time. Increases in station stops result in increased transit time. Increases in transit time on the train may in turn dissuade riders from using the system. On the other hand, wide spacing restricts access. Potential riders may be dissuaded from using the system simply because they cannot get to it conveniently enough.

Environmental Factors

[2] *Sonoma/Marin Multi-Modal Transportation and Land Use Study,* Study Report #3, page.41.

If stations are spaced widely apart, the service area for each station will expand. With fewer stations, the demand for parking at each station could increase. On the other hand, if stations are spaced closer together, the number of parking spaces and other support services at each station may be less. More closely spaced stations would also increase the opportunities for pedestrian, bicycle, and "kiss-and-ride" access and potentially increase the overall ridership.

Regardless of the spacing pattern, each station will have its own environmental concerns, which must be explored and addressed individually. These may include queuing of automobiles due to stopped trains at stations where major streets cross the rail line.

Compliance and Safety

In and of itself, the issue of either wide or close spacing raises no particular concern here with regard to regulatory compliance and safety.

Implementation Time

Time to implement a spacing pattern is not a critical variable arguing in favor of one pattern or another. All stations, regardless of number or location, can be constructed concurrently.

Phasing Potential

There is an inherent phasing potential with station spacing that could be explored with this service. That is, the service could open with wide station spacing aimed at attracting the comparatively large traditional commuter markets. Over time, intermediate stations could be added with the aim of providing increased access and attracting additional ridership. Where service is frequent, transit times for commuters can be protected by "skip stop" service, whereby some more closely spaced stations may be missed on express endpoint-to-endpoint runs.

The Commission's Position

The Commission supported a recommendation for wide station spacing, consistent with other recently initiated commuter rail services on the West Coast.

ROLLING STOCK

The initial evaluation of potential service options in the Sonoma – Marin rail corridor focused on three basic technology groups. These were:

- Conventional diesel locomotives and passenger coaches;
- Two types of self-propelled, diesel-powered train sets called diesel multiple-units (DMUs) and Budd Rail Diesel Cars (RDCs), also

Conventional Diesel Locomotive

known as “Budd Cars”; both types are “FRA Compliant”; and

- Self-propelled, diesel-powered train sets called light diesel multiple units (Light DMUs); these are non “FRA Compliant”.

Only new or completely rebuilt equipment was studied. Used equipment may be available at lesser cost than new equipment. However, this equipment likely will have higher maintenance costs than new equipment.

Locomotive-Hauled Equipment

Locomotive-hauled trains are the traditional and most common type of equipment used for railroad passenger services. These services include both intercity service, and, in the case of its shorter-distance variants, “commuter rail” or “regional rail.” The latter are essentially transit services within an urban or suburban area, or between adjacent urban areas. For all of these applications, which typically involve freight service on the same tracks, equipment that is fully compliant with Federal Railroad Administration (FRA) safety guidelines is used.

Compared with the self-propelled alternative, locomotive-hauled technology offers a wide variety of equipment types, manufacturers, and options of new or used equipment. In modern commuter service, the most common recent “new start” commuter services have tended to use “bi-level” commuter cars. Bi-level cars have two floors, each with its own aisle; seating generally is two abreast on either side of the aisle on each floor. The three new systems in California (Metrolink in the Los Angeles Basin, the North San Diego County Coaster, and the Bay Area’s ACE service) all use this type of equipment. Originally designed for the Toronto’s suburban “GO-Transit”, it has proven itself to be passenger-friendly in several ways:

- It has a bright, open layout that lends itself to attractive interior design, and accommodation of amenities such as an espresso bar, or modern requirements such as ADA (Americans with Disabilities Act) compliant restrooms.
- It has a low initial boarding step, which makes for easier boarding and alighting, particularly when combined with slightly raised platforms.
- It has excellent internal circulation, with full walk-through characteristics on both levels, so that passengers do not walk into internal cul-de-sac like situations when looking for seats.
- It combines high capacity with low weight.

Bi-level Commuter Car

Operationally, this kind of equipment is also associated with two "innovations" which, although now decades old, have made progressive rolling stock design possible. The first is proof-of-payment fare collection, which has made unnecessary the continuous monitoring of every fare check by conductors passing through standard single-level coaches or "gallery cars" (in use on Caltrain) to inspect every seat on with a single "pass-through." The second is "push-pull operation", in which the "last car" of the train is equipped with a full locomotive cab, connected to the locomotive itself by control cables passing through the train. This technology enables trains to be operated with equal facility from either end, and makes it unnecessary for the locomotive to "run around" the train at then end of the line in order to return in the opposite direction. If a railroad's operations department is sufficiently adroit, trains can be prepared for return trips in a matter of a few minutes.

FRA Compliant DMU

The operation of DMUs in a time period when freight or mainline passenger (or excursion) equipment is also in service means that this service's equipment will have to meet Federal Railroad Administration (FRA)[3] standards for crashworthiness. Although several manufacturers have stated an ostensible willingness to build new DMUs, it is an unfortunate fact that no such equipment has been manufactured new in North America in several decades. FRA Compliant electric multiple units (EMUs) have been built for several systems, and their builders have expressed interest in a diesel version. But no order large enough to cover the engineering and retooling cost has come along. Also, despite much interest expressed in several places, no order for 30 or so cars (said to be the threshold for real-world interest by car builders) has yet materialized.

Absent the development of a new vehicle, the only apparent option is a rebuild of the last FRA-compliant car built, the Budd RDC (Rail Diesel Car), or, colloquially, the "Budd Car." Manufactured from the late 1940s through the early 1960s, Budd Cars were once widely used in this country. Interestingly enough, one of the longest lived in California actually operated on the NWP, providing tri-weekly service between Willits and Eureka until the advent of Amtrak in 1971. Large numbers of the cars ended up in the service of Canadian railways. A number of them remain there today: some in operation, and some in semi-derelict storage in Toronto and Montreal.

RDC Budd Car

During planning for a starter commuter rail service in suburban Dallas six years ago, relatively low initial ridership figures (in advance of the opening of through service to Fort Worth) provided the impetus for a DMU option. Faced with the conundrum of no FRA Compliant

[3] The FRA is the federal agency charged with oversight with regard to safety issues for US railroads.

DMUs in production, the "Trinity Rail Express", operator of the new service, contracted for acquisition and reconstruction of retired Canadian Budd Cars for use on the new suburban Dallas operation. Thirteen of the "pick" of the mothballed fleet at Montreal were selected for rebuilding. In the end, an almost entirely new car, including ADA compliance, was produced. However, the car represented essentially a new example of a 1950s design. Nevertheless, the cars are very attractive and apparently are popular with the public. They also have the advantage of being available for use in developing new services on other lines which may still have unrestricted freight and passenger service. When the main line to Fort Worth is opened, they are to be supplemented by locomotive-hauled train sets.

Light DMU

The light DMU option is the equipment type represented by the Siemens *RegioSprinter*, which ran in a demonstration on NWP tracks in the late 1990s. However, other European examples also exist. In essence, this kind of equipment suggests a diesel "light rail" kind of operation, with frequent short trains running all day. The fundamental presupposition is the complete time separation of the suburban rail system from freight and main line passenger trains (including excursion trains). Compliance with FRA rules would require these conventional trains to be banned from the railroad during daytime hours south of the northernmost point of the suburban rail operation.

Largely because of the limitations on their operability under the federal regulatory framework, no such cars have yet been purchased for operation in North America, despite significant marketing efforts by their manufacturers. It now appears, however, that the first such Light DMU operation may be established in New Jersey for NJ Transit's Trenton-to-Camden line. In order to overcome railroad reluctance to agree to time separation of freight operations, the State has decided to buy the Trenton-to-Camden line and in so doing make a time-separated Light DMU operation possible.

The larger point emphasized by the New Jersey example is that running specific equipment types on shared track cannot be and should not be a unilateral decision. Decisions of what equipment to use should be developed as a result of consultation with the other constituencies using the line as well as the relevant regulatory authorities.

Diesel Multiple Unit (DMU)

Capital Cost Implications

Locomotive-Hauled Equipment: Capital costs for new equipment vary with the design specifics of the cars and locomotives, and with the size and timing of the procurement. Some recent procurements might illustrate the kinds of unit costs which could be expected. The current Seattle car order, now under construction, calls for 18 bi-level cab cars at slightly over $1.8 million per car, and 20 coaches at slightly less than $1.7 million each. Smaller orders, if placed independently, could be expected to be higher. Variations in design and market fluctuations can affect cost significantly. With regard to locomotives, ACE spent $6 million for four used but rebuilt locomotives in 1997. In the same year, Amtrak placed a large order for new passenger locomotives, acquiring 21 at an average price of about $2.2 million. A 1998 estimate for a small order (five) of new locomotives for suburban Minneapolis suggested $2.3 - 2.6 million each. Current orders suggest that "rule of thumb" prices are $2.0 million per commuter car and $2.5 million per locomotive.

FRA Compliant DMUs: The average cost for the rebuilt Budd Car was $1.9 to 2.0 million several years ago. The cost for a similar kind of rebuild for Sonoma – Marin would almost certainly be greater. Inflation would account for some cost growth. However, it is also a fact that the available fleet increasingly consists of cars needing more work relative to the Dallas Budd Cars. As a result, greater structural and mechanical improvements likely would be necessary to place the cars in acceptable condition. The manufacturer estimated cost for a total new FRA Compliant design (ADtranz *DMU 90-3*, an articulated three-car unit) was $8.5 million.

Light DMUs: Given the absence of actual consummated sales in the U.S., it is probably not unrealistic to assume that a Light DMU of foreign manufacture, modified for North American use, could have a unit capital cost comparable to a high-tech electrified Light Rail Vehicle commonly used in urban transit environments. New Jersey Transit's estimated capital cost for its non FRA Compliant DMUs (ADtranz *GTW*, an articulated two-car train set) was $6.8 million.

Operating Cost Implications

Operating costs vary so widely between systems, and reflect so many variables (equipment type, length of run, nature of operating agreement, charges by "host railroad", local conditions of all kinds, etc.), that it is impossible to provide generalized average cost figures that will do anything other than mislead. Nevertheless, some general comments can still be made.

Locomotive-Hauled Trains: On average, locomotive-hauled commuter trains in the U.S. cost about $45 per train-mile to operate. This includes both direct (such as fuel and labor) and indirect (such as marketing and insurance) costs, and assumes a four-car train of 500-600 passenger capacity. Costs vary for different operations, and the degree of variance from that figure may be quite large. For Sonoma – Marin, the costs would be far less. These figures appear in the Chapter 5, and daily train-mile figures appear in Chapter 4.

FRA Compliant DMUs: This equipment type can be expected to operate at somewhat lower cost than a locomotive-propelled train set. The usual rule-of-thumb is that DMUs will be cheaper for short trains of one or two cars, since they require no locomotive (they are "their own locomotive"). On the other hand, locomotive-hauled trains clearly offer the opportunity to provide significant capacity expansion in the future at lower overall cost.

Light DMU: Comparatively speaking, if the intent is to operate very frequent service throughout the day, the Light DMU option, with a single-person crew, could conceivably offer the lowest overall operating cost, if time separation of freight and main line passenger excursion service is not a problem.

Ridership and Revenue Potential

For the purpose of this analysis, equipment type was considered a neutral factor in terms of ridership potential.

Environmental Factors

The two main considerations are diesel exhaust emissions and noise. Both of these considerations were part of an environmental assessment, discussed in Chapter 7.

Compliance and Safety

Apart from the standard considerations common to all service options, another criterion in assessing the viability of an equipment option for rail service needed to be explored. This was a determination of whether or not the equipment option was to conform with crashworthiness rules established by the FRA, or whether it is essentially a "rapid transit" vehicle technology, intended for use on rail installations which are not part of the nation's "general railroad system." The former are termed here FRA Compliant. The latter are termed non FRA Compliant. In point of fact, manufacturing specifications for FRA Compliant vehicles are far more robust that non compliant vehicles due to the equipment guidelines specifying the degree of crashworthiness required.

A rapid transit service on tracks that are connected with the general railroad system automatically invokes the safety-monitoring authority of the FRA. However, waivers from FRA equipment guidelines may be sought, if the operation of the system is based on the strict time-separation of the rapid transit service and the freight (or passenger) railroad service. For example, if railroad freight service is restricted to nighttime hours, say midnight to 5 a.m., and rapid transit service takes place only between 6 a.m. and 11 p.m., then one might reasonably anticipate that the FRA will grant waivers from many of its guidelines. If time separation cannot be achieved, then compliance with equipment (and operating) rules of the FRA is mandatory[4].

Implementation Time

Procurements of locomotive-hauled trains may take as much as 18 months to two years. Procurements of DMUs and rebuilt Budd Cars could take longer, up to two years. It should be noted that while Light DMUs are currently under construction for New Jersey Transit, no FRA Compliant DMU has ever been built.

Phasing Potential

Significant potential may exist for the phasing of varying car types. For example, the Sonoma -

[4] FRA policy regarding shared use of rail rights-of-way by light rail and conventional trains appears in Appendix 3.

Marin rail service could begin utilizing locomotive-hauled trains. This may well be for such practical reasons as lower capital cost and the availability of equipment. If DMU purchase costs decline over time[5], the service could buy this equipment later. A ready market for the conventional equipment would allow for quick disposal of the locomotive-hauled equipment at that time.

Commission's Position

Opting for maximum flexibility, the Commission determined that it would only consider rolling stock options that were compliant with FRA regulations pertaining to crashworthiness. The decision was based on concerns that both freight trains and excursion trains might operate on NWP tracks along with Sonoma – Marin commute trains. In such a case, the FRA would require FRA Compliant rolling stock.

UTILITY OPTIONS

"Utility" refers to the capability of the railroad to meet certain speed and safety goals. A higher level of utility indicates the railroad is capable of handling trains at higher speeds commensurate with federal and state safety standards.

The condition of the track is the primary factor in determining train speeds. Poorly built and/or poorly maintained track will only be capable of handling trains at very slow speeds. Track in this condition also creates an uncomfortable ride for passengers. Track condition is usually measured according to definitions contained in the Federal Railroad Administration's (FRA's) Track Safety Standards. Class 1 track is considered safe for operation of passenger trains at a maximum of 15 mph. Passenger trains are allowed to operate at a maximum 30 mph on Class 2 track, 60 mph on Class 3 and 80 mph on class 4. There are even higher track class standards for high speed passenger train operation. Of course, there are other factors that can control train speeds in local areas, such as grades, the sharpness of the curves, or the presence of numerous grade crossings.

The FRA specifies strict tolerances for track gage, rail and tie condition and numerous other factors in determining track class, and employs inspectors who regularly verify track conditions. Railroads whose track falls below even the Class 1 standards are allowed to operate provisionally while they work to correct the deficiencies. Failure to make corrections can lead to a FRA order to cease operations, as happened with the Northwestern Pacific in November 1998. It should be noted that Rail-Ways, Inc., on behalf of the North Coast Railroad Authority (NCRA), has reportedly made repairs to bring the track up to Class 2 standards between Ignacio and Cloverdale. It is anticipated that once the FRA lifts the November 1998 emergency order, it will certify the tracks at Class 2 standards in this area (approximately 60 miles).

[5] This would be a likely eventuality, should other communities place orders for FRA compliant DMUs in the intervening period. The car concept is popular, yet no community as yet has placed an order for compliant DMU. As a result, estimated production costs remain conservatively high.

Even after completion of this work, much if not most of the railroad will still be at only Class 1 (15-mph) condition. An appropriate standard for rail commuter service would be Class 3 or Class 4.

An additional factor that can govern speed is the presence or absence of a signal system. Signals control spacing between trains and help prevent collisions. They can also indicate which route a train will be taking, such as at a junction or a passing siding. Some signals simply detect the presence of trains within the "block" of track that they govern. More sophisticated signal systems such as "centralized traffic control" (CTC) can also be controlled by dispatchers who send remote commands to route trains into passing sidings or other diverging tracks.

Passenger trains are limited to a maximum of 59 mph if there is no signal system on the track over which they are operating. For passenger train speeds over 79 mph, there must be a "supplemental" signal system, usually one which will automatically stop a train if the engineer does not take appropriate action to slow the train according to the signal's indication.

There is no signal system on the NWP, meaning passenger trains would be limited to a maximum speed of 59 mph even if the track class permits a higher speed. Accordingly, bringing track up to Class 4 standards will not allow passenger trains to operate at anything over allowable Class 3 speeds unless there is also a signal system.

The FRA has been progressively tightening safety standards, and there is some indication that they may rule that any commuter rail passenger service must be protected by a signal system even if speeds do not exceed 59 mph. There may be some discretion if only a small number of widely spaced trains are operated. There may also be some technological advances, which can provide the safety assurances of a signal system at less than the traditional cost of a full installation. As SMART moves forward, it should work closely with the FRA and the California PUC on these issues.

The Commission considered three utility options. These were:

- Class 3 track with no signal system (maximum speed 59 mph)
- Class 3 track with signals (60 mph)
- Class 4 track with signals (79 mph)

Capital Cost Implications

Track upgrade from Class 3 to Class 4 would increase track costs by less than 10 percent. The major differential when deciding on utility options is the signaling system. Such a system for Sonoma – Marin totals almost $9 million.

Operating Cost Implications

An engineering evaluation cited that annual cost for maintenance of the track would be the same for both Class 3 and 4 utility options.

Ridership Potential

To the extent that higher speeds mean shorter trip times, the additional cost of a Class 4 track and a signal system will make the rail service more competitive and attract higher ridership. It should be kept in mind, however, that the goal is shorter total elapsed trip times, not higher speeds per se. The greatest rewards in shortening trip times are likely to come not from increasing top speed from 60 to 80 mph, but from elimination of very slow speeds (such as 10 mph across the Petaluma River Bridge) and the provision of direct and frequent connecting services from rail stations to work or home.

Environmental Factors

The difference between Class 3 and Class 4 speeds is not likely to generate environmental issues. Information on train noise and emissions at different speeds appears in Chapter 6.

Compliance and Safety

As stated previously, although the existence of a signal system may not be technically necessary to operate at speeds up to 59 mph, absence of such a system may become a safety and compliance issue. Other issues related to Class 4 versus Class 3 speeds include safety at grade crossings and increased danger to people walking across tracks or trespassing on the right-of-way. Design of operational speeds should be consistent with safety considerations.

Implementation Time

Reconstruction of track to Class 4 rather than Class 3 standards should not require additional implementation time. Installation of a signal system may, however, since signal materials are traditionally “long lead time” items.

Phasing Potential

A decision to start with Class 3 standards and later go to Class 4 would save little in terms of construction cost (less than 10 percent). Again, the primary difference is the signalization, which Class 4 implies. It should be noted that the FRA may require a signal system in any case. For these reasons, the added investment in a Class 4 track appeared the most practical of the three utility options.

Commission’s Position

The Commission supported recommendations to build the utility option that represented the greater flexibility – an upgrade to FRA Class 4 track with a CTC signal system. Though trains would not operate routinely at the maximum allowable speed of 79 mph, the option offers the ability for late trains to do so in order to “make up time” and keep schedules. Given the single-track nature of the proposed service, and the comparatively high number of trains per day, this feature represents an important advantage for the timely operations that commuters expect.