Appendix B

Transit Gaps Analysis Technical Memorandum



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Subject	VCTC Transit Investment Study Task 2 Deliverable: Transit Gaps Analysis

#### **Introduction**

This memorandum is the second of several being prepared for the Ventura County Transit Investment Study. This study is designed to identify and prioritize projects that could benefit public transportation in Ventura County. Information collected for this effort will be utilized to allocate funds for both short- and long-term transit needs of the County's many public transit operators. The study is sponsored by the Ventura County Transportation Commission (VCTC). Jacobs is the consulting firm chosen to carry out the technical work.

This memorandum summarizes an analysis of gaps in service that was conducted on the existing fixed-route bus transit systems operating in the county. It is based on field surveys, examination of travel and demographic data, and analysis of operating schedules at selected points in the county. Four principal forms of "gaps" were defined:

- 5. Corridors between service areas where no service is operated today;
- 6. Geographic areas with densities that would warrant transit service but are unserved today;
- 7. Gaps in the hours of service on different bus lines; and,
- 8. Places where transit routes (or modes, like local bus and commuter rail) come together, but whose arrival and departure times are not coordinated; this results in sometimes lengthy waits for those wishing to make transfers or, in more extreme cases, no practical transfer opportunities at all.

#### Summary of Observations

This study was conducted as a high-level overview. As a result, it has identified numerous apparent gaps in transit service that later, operational studies should investigate in more detail. Among them are corridor gaps between existing transit services. Several of these may be problematic to fill because of terrain or low travel demand. Nonetheless, there are five corridors that we recommend to be studied further: Fillmore-Santa Clarita, Camarillo-Moorpark (two alternate routes), Simi Valley-Thousand Oaks, and Western Oxnard-

Ventura. Filling these gaps is important not to serve the land uses in between the end points (as there is little in most cases to serve), but rather to connect areas that already have transit service.

In addition, ten unserved areas appear to have the population density to justify regular fixed-route service. Many are already served by dial-a-ride operations, which may be the most cost-effective way to provide transit service there. Nonetheless, attracting "choice" riders will likely require the establishment of fixed-route service to negate the need to make reservations and shorten the time it takes to make a trip. The ten areas highlighted are reasonable starting points for at least considering new or modified fixed-route (or flex-route) bus service.

The lack of service on many lines during weekends or early mornings creates a gap of a different sort. Transit is simply unavailable at these times unless users have access to demand-responsive service. Moreover, when considering that much of the county's fixed-route transit service is operated at relatively low frequencies, the "gap" created by low service levels could be much greater than revealed by this initial analysis.

Finally, an analysis of the timing of transfers at key points in the network indicates plenty of room for improvement. At most, only 20% of bus-to-bus transfers could be considered convenient. In many cases, departing buses miss arriving buses by mere seconds. In other cases, the buses of many routes occupy bays at a transit center simultaneously, but long layovers increase the actual time it takes a transferee to continue a trip. Riders with a choice of travel modes will want to make their transfers as expeditiously as possible, and transfer times greater than 5 to 10 minutes for bus-to-bus and 10 to 12 minutes for bus-to-rail will not be attractive to them. Improving this situation will require a new approach to how transit vehicles are scheduled throughout the county. This may, in many cases, result in higher operating costs but is sure to result in higher ridership. This, at least, is the experience elsewhere, when conversion to timed-transfers was almost always followed by an increase in riders.

#### Corridor Service Gaps

Current transit bus lines in Ventura County are arrayed on the map shown in Figure 1. It is apparent that most of them are clustered into discrete service areas in the more populated parts of the county. In many instances, there are no transit lines connecting these service areas with each other. As a result, transit patrons must sometimes resort to very circuitous routings. To address this issue, the more obvious geographical gaps between the service areas were identified, classified into nine travel corridors, and analyzed for their transit potential. This analysis consisted of two steps: (1) physical examination of the corridors themselves and (2) review of potential travel demand in those corridors.

The physical examination of each corridor began with a remote analysis using aerial photos, followed by an on-site "windshield survey." Of particular interest was the suitability of the roadway itself for accommodating regular bus service (particularly in terms of steepness and pavement width and condition). Some of these roadways were said in advance to be unsuitable for buses, but a brief reconnaissance of them was conducted anyway to give a fresh perspective. In fact, although some steep roadway sections were

encountered, most could probably be negotiated by at least a small bus, and the condition of the roadways themselves was generally good. However, it must be said that regular bus service on the steeper roads would likely be slow and would also take its toll on the buses; it could be harrowing during periods of inclement weather and at night. Use of such corridors would have to be justified by very strong transit demand.

To gauge potential demand, the nature of abutting land uses was examined. Most of the potential corridors are in rather desolate areas, surrounded by farmland or land that is undeveloped. There are few activities in the immediate vicinity that would attract or generate transit ridership. However, it's possible that there is enough travel demand at either end of each corridor for people to want to pass through it in order to bridge the gap and access destinations in the adjacent transit service area.



To determine the potential transit demand of each corridor for through travel, countywide travel data were sought. Total trips from one transit service area to another (even if made by automobile) could be used to judge the general magnitude of ridership that would result if transit service were available in that corridor.

Unfortunately, such data (even that from the census) were hard to come by. As a surrogate, daily traffic counts were obtained from Ventura County and Caltrans to provide a general idea of existing trip making in each corridor. Daily traffic volumes less than 10,000 were considered a sign of relatively low demand, volumes above 30,000 as relatively high, and those in between as moderate. Of course, observed usage of a road is dependent, to an extent, on its capacity. A winding two-lane highway may limit a large number of drivers from using it. However, observations in the field indicated that these roadways had generally free-flowing conditions, often at Level of Service A. While some motorists may be discouraged from using them due to grades and alignment, it did not appear that roads themselves were metering the number of cars that possibly could use them.

The conclusions from both the travel demand and physical analyses of the corridors are summarized below (keyed to the numbers shown in Figure 1):

- Ojai-Santa Paula via State Route 150: This is a 20-mile corridor using the Ojai Santa Paula Road (some parts are called the Santa Paula Ojai Road). It traverses areas that include both flat, agricultural land, and winding, mountainous terrain. Regular operation of buses in this segment would be possible but difficult, given the grades and switchbacks involved. Daily traffic volumes of 2800 are low, indicating probable low transit demand, as well. Recommendation: This route is one of several that were examined cursorily in spite of obvious flaws and is not recommended for further consideration.
- 2. Fillmore-Santa Clarita via State Route 126: Following Telegraph Road through the Santa Clara River Valley, this 22-mile east-west corridor avoids the mountains both north and south of it, providing a level pathway east to I-5 in Santa Clarita, as well as to several employment centers there. Traffic volumes of 24,000 per day indicate moderate ridership potential, and a demand-responsive service currently connects the communities of Piru and Fillmore. *Recommendation: This corridor shows some promise as a possible bus route.*
- 3. Fillmore-Moorpark via State Route 23: This is a 12-mile route forming the shortest link between Fillmore/Santa Clara River Valley to the north and Moorpark/Simi Valley to the south. The terrain involves steep grades and sharp turns that are not desirable for regular transit service. Traffic volumes are relatively low, at about 7700 per day. A demand-responsive service formerly operating on this road attracted very few riders. *Recommendation: As with the first corridor examined, this route has obvious flaws and is not recommended for further analysis.*
- 4. Camarillo-Moorpark via Highway 118: This 12-mile east-west corridor would close the gap in transit service between Moorpark and Camarillo. It is situated on flat terrain, adjacent to farmland and railroad tracks, utilizing Somis Road and West Los Angeles Ave (Highway 118). *Recommendation: Daily traffic volumes of about 19,000 indicate potentially viable transit patronage.*
- 5. Camarillo-Moorpark via Santa Rosa Road: This 12-mile east-west corridor passes though largely flat land, with some residential development on streets branching off its easterly portion. Daily traffic volumes of about 19,000 are similar to those in Corridor 4. *Recommendation: This corridor offers an alternative to Corridor 4, above, for bus service between these communities.*

- 6. Simi Valley-Thousand Oaks via E. Olsen Road: This is a 4-mile east-west corridor centered on Olsen and Madera roads. A bus line here would provide a shorter trip for many riders than the current transfer to VISTA's East County Service using the more circuitous routing on Highways 23 and 101. Unfortunately, traffic data are not available for this corridor to gauge possible transit demand; former VISTA fixed-route service here was not very successful. *Recommendation: This corridor could be retained for consideration in future analyses to determine if conditions have changed sufficiently to make it more promising to reinstate regular transit service.*
- 7. Simi Valley-Thousand Oaks via North Westlake Boulevard and Circle Knoll Drive: While these areas at first appear to be connected, they are, in fact, separated by a short gap between the closest two streets (Sunset Hills Blvd in Thousand Oaks and Winncastle Street in Simi Valley). Moreover, the roadways that do exist are narrow residential streets not appropriate for standard transit buses. Given these problems, Corridor 6 (described above) would be a workable alternative to any demand for travel between these two communities. *Recommendation: This corridor need not be considered further for transit service.*
- 8. Oxnard-Thousand Oaks via Potrero Road: This 8-mile east-west corridor is served by a narrow roadway with some steep terrain. There are few abutting activities. Daily traffic volumes of 5200 indicate relatively low demand, and Highway 101 offers faster travel time between the two city centers of Oxnard and Thousand Oaks. *Recommendation: This corridor need not be considered further.*
- 9. Oxnard-Ventura via Victoria Avenue: Victoria is a wide north-south street on flat terrain. This 6-mile segment skirts the western fringe of Oxnard and Port Hueneme, and portions of it are served by terminal loops of Gold Coast Transit east-west lines. The segment between Highway 101 and W. 5<sup>th</sup> Street passes through agricultural uses, but areas to the south are rapidly developing with dense residential and some retail development. Should development occur along the more northerly segments, consideration should be made for using Victoria Avenue as an artery for a new north-south transit service to Ventura. Current traffic volumes are a high 44,000 per day, underscoring the potential for strong transit demand. *Recommendation: This corridor should be considered further for possible transit service*.

While the above analyses are not based on a highly-refined methodology, they do give an overview of the corridors holding the most promise for filling the gaps in transit service between communities. Until such time as better data are available, we recommend that corridors 2,4,5,6 and 9 be considered reasonable candidates for possible transit service. They can be a starting point for any region-wide operational study that might follow.

# Unserved Areas Worthy of Consideration

A second type of gap in service is found in areas where the levels of population density are sufficient to support fixed-route transit but none is offered at the present time. There could be numerous reasons for this, such as high income levels among residents of the area, or the fact that service had been tried in the past but was unsuccessful. For the purposes of this study, a summary analysis was conducted to highlight areas where more investigation should be undertaken in the future. The results are arrayed on the map in Figure 2. It indicates that most of the higher density areas of the county are currently served (that is, within a quarter mile of a fixed bus route). There are a number of exceptions, however, indicated by the numbers on the map:

- 11. Ventura, east of Ventura Avenue, along Seneca Street
- 12. Ventura, south of Telephone Road, on either side of the railroad tracks
- 13. Oxnard, west of Ventura Avenue, north of Gonzales Street
- 14. Oxnard, west of Victoria Avenue and along Silver Strand, Hollywood Beach, and along Harbor Boulevard
- 15. Camarillo, south of Highway 101 and north of Pleasant Valley Road (this area does not show up on the density maps but aerial photos reveal extensive residential development)
- 16. Camarillo, along Lewis and Flynn roads
- 17. Camarillo, along Upland Road
- 18. Thousand Oaks, along Pederson Road (currently served by just 2 morning and 2 afternoon trips of TOT Route 2B)
- 19. Unincorporated County at Oak Park
- 20. Santa Susana Knolls, near the southeast boundary of Simi Valley (this area does not show up on the density maps but was suggested by one of the operators)

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All of these areas, except for 10, are served by various senior/disabled dial-a-rides. In addition, areas 4, 5, and 7 offer paratransit service for the general population. In at least one instance, area 4, the transit operator reported that the Beaches and Harbor Shuttle dial-a-ride service is considerably more cost-effective and attracts more ridership than previous fixed-route service in this location. There are no doubt other areas included in the list that have similar histories. Nevertheless, fixed-route transit service has not yet caught up with much of the new residential and commercial development. Such service, with its regularity of schedules, usually proves more attractive to discretionary riders. The ten areas discussed here should be among the first considered for such service enhancements in the future.

It must be noted that a weakness of this analysis is that it assumes that a location within a quarter mile walk of a bus line is "served by transit", regardless of the level of service of that bus line. In fact, many lines, like those in Camarillo and Moorpark, offer service frequencies of an hour or greater, and several do not operate in evenings or on weekends. When considered in this light, there are likely many more "gaps" in service than appear at first glance on Figure 2. This issue should be investigated in more depth if and when an operations analysis is conducted on countywide transit services.

#### Gaps in Span of Service

A third type of transit gap occurs when some transit lines are in service during hours that others are not. A trip that appears possible by looking at a transit map may not be in reality if a transfer is involved; if one of the lines in question has not yet started for the day or has already ended service, then a traveler would not be able to complete their trip. To get an idea of the magnitude of this gap, the spans of service of the 38 lines in the county's fixed-route bus network were laid out in charts for weekdays, Saturdays, and Sundays. As can be seen from Figures 3a through 3c, the beginning and ending of the services form a "ragged" edge, showing that not all lines are in operation simultaneously. Moreover, there are gaps midday when certain peak-hour routes are not running. On weekends, the large spaces between the bars emphasize the gaps resulting from the lack of any service at all on certain lines. (Note that each bar in these figures represents the time from the first pick-up in the morning to the last drop-off at night and, therefore, exaggerate somewhat the actual time a traveler could transfer from one line to the next. Towards the end of the day, the bus on a line shown as being in service may have already left its point of transfer with another bus, making the transfer impossible.)

The number of lines in service at any one time is summarized in Figure 4. This figure arrays the information from Figures 3a through 3c as a cumulative total for each hour of the day. For example, at 5 AM on a weekday, only 3 lines are in service. This jumps to 26 lines by 6 AM and rises to a peak of 36 lines by 8 AM. The number of lines midday hovers around 33 to 34 until a peak of 36 lines is reached again at 5 PM, after which the number drops precipitously to 16 lines at 8 PM and 3 lines at 10 PM. On Saturdays, the maximum lines in service is only 26, and the rise and fall of service occurs over a longer period. On Sundays, only 18 lines are in service midday, with an even longer rise and fall in service.

None of these situations is unusual by themselves, as transit systems typically start and end service at different times, depending on the passenger demand on the line in question. Moreover, weekend service generally differs from that operated during weekdays. What is noticeable about Ventura County's situation is the lack of service available during the early hours when many commuters must begin their trips, and the great reduction in service on weekends. It is customary to reduce frequency during weekends, but in Ventura County, many lines are eliminated, as well. This results in no alternative for transit dependent populations unless demand-responsive service is available.

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Figure 3a. Span of Service of Ventura County Bus Lines on Weekdays

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# Notes:

Figure 3b. Span of Service of Ventura County Bus Lines on Saturdays

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Figure 3c. Span of Service of Ventura County Bus Lines on Sundays

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# Gaps in Service Coordination

The fourth and final form of service gap examined by this study is that occurring when transit lines that operate to the same point do not offer convenient schedules for passengers transferring among them. While there are numerous points in the county's transit network where two or more lines cross or meet, the focus of this examination was at defined transit centers, where transfers between routes are encouraged and are most likely to occur. Three were singled out for detailed analysis: Oxnard Transit Center, Thousand Oaks Transportation Center, and Ventura Transit Center. In addition, the county's five Metrolink stations were examined to determine the degree of coordination between local buses and commuter rail. These consisted of the stations at Montalvo, Oxnard, Camarillo, Moorpark, and Simi Valley.

The results of these analyses are arrayed graphically in Figures 5a through 5h. These diagrams illustrate with colored squares or bars when different lines, bus or rail, are scheduled to be present at the station in question on a weekday from 6 AM through 12 PM or 1 PM. The diagrams are divided vertically into 5minute intervals. Where the bars or squares overlap, it's assumed that vehicles of the lines involved are in the station simultaneously. Separate analyses were conducted for bus-to-bus and bus-to-rail transfers.

Bus-to-Bus Transfers. After the schedules were arrayed graphically, the figures were analyzed to determine which transfers could be made within a 10-minute period, as measured from the time of arrival of one bus and the time of departure of another. Ten minutes was chosen as the limit of what most passengers would Jacobs Engineering Group Inc. 12 consider a "convenient" transfer (5-minutes being even more desirable but not tested). The number of convenient transfers was then divided by the number of possible transfers at the center between any two routes during that hour to derive an index of transfer convenience. (Excluded from this index were connections between an inbound and outbound bus on the same line.)

The five-minute intervals on the figures admittedly mask situations where one bus pulls out of a transit center before another bus shown in that same interval arrives. However, most bus lines have layovers at these centers, which increase their chances of overlapping with others and facilitating passenger transfers. Along this same line, some transfers may be too tight, with one bus arriving just seconds before another departs. It was assumed in the case of bus-to-bus transfers that passengers could flag drivers that were about to depart and still make their transfer. Comparisons of transfers made during the peak (6:00 AM-8:59 AM) versus off-peak portions of the survey period revealed no significant difference in transfer convenience.

The portion of bus-to-bus transfers at the three transit centers that could be considered convenient, using the technique described above, is summarized below:

Oxnard Transit Center	107 out	t of 432 possible transfer movements (about 25%)
Thousand Oaks Transportation	Ctr.	48 out of 298 possible transfer movements (about 16%)
Ventura Transit Center	92 out (	of 481 possible transfer movements (about 19%)

Overall, approximately one fifth of the possible route-to-route transfers at these centers can be considered convenient. This figure should be considered optimistic, as it was based on the assumption that a passenger could transfer between two routes with very close arrival and departure times. Moreover, a 10-minute maximum transfer wait was assumed. In reality, transit systems employing timed transfers aim for a 3- to 6minute window for transfers, as waits much longer than these are felt to be time wasted by riders with a choice of mode. This point is critical for understanding why ridership levels are not higher today and how to attract choice riders to the county's transit system in the future.

A couple of caveats about this analysis are in order. First, there may be locations on the network other than transit centers where certain bus lines make more convenient transfers. For example, several bus operators reported that connections between VISTA and TOT buses were better at The Oaks shopping mall than at the Thousand Oaks Transit Center. There are no doubt other areas where this kind of situation prevails. Travelers would have to learn this information by careful analysis of timetables, consultation with transit information operators, or word-of-mouth from other bus riders. Otherwise, transit centers are the most likely places where new or infrequent riders would choose to make transfers. Secondly, more detailed study should be performed in the future that prioritizes transfers, with those serving major and intercity trip movements receiving greater emphasis.

Bus-to-Rail Transfers. For bus-to-rail transfers, somewhat different parameters were used. This is because these transfers generally require more time on the part of passengers. The distance between bus and train platforms involves a somewhat longer walk than the bus-to-bus transfers at the transit centers listed above. Jacobs Engineering Group Inc.

A transferring passenger's pathway across the tracks may be blocked while a train is in the station. Moreover, infrequent rail riders may have to purchase a ticket before boarding the train. For these reasons, a more precise schedule analysis was undertaken. In this case, a bus arrival (its scheduled time, not the 5-minute interval on the figure) had to occur no more than 12 minutes and no less than 4 minutes in advance of a train departure. The period examined was 6:00 AM to 11:59 AM, as there are no trains scheduled during the period from noon to 12:59 PM. Since this analysis included only the morning period, the focus was on buses arriving in time to meet southbound trains heading for Los Angeles. The results are summarized below:

Montalvo Station	Of 2 southbound rail departures during this period, none were conveniently served. There was only one bus arrival (of Route 6A on Bristol Road) during the hour when the two morning rail trips departed.
Oxnard Transit Center	Of 4 southbound rail departures during this period, 3 were conveniently served: the 6:59 train was served by 6 bus arrivals, the 7:37 train by 3 bus arrivals, and the 10:11 train by 2 bus arrivals (a total of 11 bus arrivals out of 37 bus arrivals during the hours when trains departed). [Neither of the 2 northbound rail arrivals during this period was conveniently served by a bus departure.]
Camarillo Station	Of 4 southbound rail departures during this period, 1 was conveniently served: the 6:30 train was served by 1 bus arrival (out of 14 bus arrivals during the hours when trains departed). [One of the 2 northbound rail arrivals during this period was conveniently served by 1 bus departure.]
Moorpark Station	Of 5 southbound rail departures during this period (excluding the 6:03, which would have been fed by buses in the previous time slot), 2 were conveniently served: the 6:41 and 8:26 trains each were served by a single bus arrival (a total of 2 bus arrivals out of 18 possible bus arrivals during the hours when trains departed). [None of the 3 northbound rail arrivals during this period was conveniently served by a bus departure.]
Simi Valley Station	Of 7 southbound rail departures during this period, 4 were conveniently served: the 6:53 and 7:32 trains each were served by a single bus arrival, while the 8:22 and 8:39 trains each were served by 2 bus arrivals (a total of 6 bus arrivals out of 31 possible bus arrivals during the hours when trains departed). [Each of the 3 northbound rail arrivals during this period was conveniently served by a single bus departure.]

# <u>Conclusions</u>

A number of gaps in Ventura County's transit network have been identified. These should be examined in more depth in a future study. At the present time, there are at least five corridors with the potential to *Jacobs Engineering Group Inc.* 14 *January 2009* 

close service gaps between areas already served by transit. Within the served areas, ten sub-areas show promise for fixed-route bus service, though further study may justify dial-a-ride or flex-route service instead.

At strategic points in the network where services converge, such as transit centers and commuter rail stations, most lines are not scheduled to provide convenient transfers. This is likely due to (a) the need to schedule meets elsewhere on a particular line or (b) the desire by operators to maximize the efficiency of each bus by minimizing layovers. Ironically, building in layover time to allow for better timed meets would result in a more attractive service, likely leading to greater ridership and an increase in the overall effectiveness of the system. This is, perhaps, the single most effective measure to increase ridership among the county's transit providers.

Finally, it must be noted that there are always trade-offs in transit planning between increasing the efficiency of a service and increasing its effectiveness. Some actions can increase both, but more often choices have to be made in one direction or the other. Much of today's transit service in Ventura County is the result of these kinds of decisions made incrementally over the years. It is wise to revisit such decisions periodically to determine if a change in direction is warranted. This high-level analysis of gaps has pointed out some areas in which there is potential for improvement, but it should be followed by a detailed analysis of routing and scheduling to develop more definitive recommendations.

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Figure 5d. Bus-to-Rail Transfers: Montalvo Station

= Both arrival and departure

= Departure

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6:20 = Arrival/Departure time.

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Ventura Transit Investment Study OXNARD TRANSIT CENTER WEEKDAY ARRIVAL AND DEPARTURE TIMES Bus - to - Rail Transfers



Ventura Transit Investment Study CAMARILLO METROLINK STATION WEEKDAY ARRIVAL AND DEPARTURE TIMES



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Ventura Transit Investment Study MOORPARK METROLINK STATION WEEKDAY ARRIVAL AND DEPARTURE TIMES Bus - to - Rail Transfers





