East Bay Broadband Report Card

Final Report

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1. Summary

An analysis of broadband availability data for Alameda, Contra Costa and Solano Counties shows that the East Bay has wide service variations within the region. Overall, the region is close to the statewide "C" average, with Solano County getting a "C-", Alameda County a "C" and Contra Costa County a "C+". The statewide average, on the other hand, falls below performance levels achieved in other West Coast states and, particularly, states on the northern half of the East Coast. Unlike the top performing U.S. states, California does not match the broadband speed levels and adoption rates achieved in other countries.

Figure 1.1 – Regional broadband availability and infrastructure grades.

The best consumer-grade broadband service is in central Contra Costa County, in the City of Concord (A-). It was the only one of the forty cities studied that rated an "A" level grade. Walnut Creek and Pleasant Hill received "B" grades, with a high "C" given to Berkeley and Alameda. The common characteristic amongst all five is competition. All five either have or recently had three competing companies building and operating core broadband infrastructure and providing consumer-grade service.

The bottom five cities – Rio Vista (D-), Moraga (D) , Orinda (D), Clayton (D) and Dixon (D) – share one or more of three key characteristics: population densities and income levels typical of rural areas, local resistance to construction and challenging terrain. These factors play a significant role in shaping residential broadband availability.

In between, a general pattern emerges. As a rule, the further a community is from central Contra Costa County and Berkeley, the lower the quality of its broadband infrastructure and service availability. On the whole, incorporated cities tend to receive better grades than nearby unincorporated communities, indicating that municipal governments can play a role in improving broadband access.

Broadband resources also vary by land use. Residential infrastructure and service, which is more lucrative for providers, tends to be better than the services and underlying infrastructure in commercial and industrial areas. There are steps that local agencies can take to help close this gap, such as adopting broadband-friendly policies and encouraging competitive service providers to build infrastructure specifically designed for commercial and industrial users.

In general, mobile coverage in the region is good but not as good as the data submitted by carriers to the California Public Utilities Commission indicates. When advertised 4G speeds are compared to mobile field tests conducted by the CPUC, reality matches companies' claims only in small areas, mostly along the Nimitz freeway. Speeds tend to drop off as distance increases from the Bay Bridge toll plaza, with some spikes in the Livermore and San Ramon Valleys. 4G facilities have apparently been installed throughout the region, but the CPUC's tests indicate that capacity and coverage issues result in mobile data connections at speed levels more consistent with 3G service.

More people use broadband – of all kinds – in the East Bay than in California as a whole, but gaps remain. The reported regional adoption gap is 19%, versus 25% statewide. Within the region, however, there are stark differences, with adoption patterns showing a great similarity to income distribution. The adoption gap in Alameda and Solano counties is 22%; in Contra Costa it is 13%.

2. Broadband Service and Technology

2.1. Broadband technology

There are two basic methods of delivering broadband services: wireline and wireless. Wireline infrastructure is made up of copper and fiber optic cables, while wireless infrastructure can include mobile phone and Internet service, WiFi, satellites and "fixed wireless" systems, where antennas are mounted on homes and businesses and aimed at central access points, usually on towers.

This report focuses on wireline infrastructure and, to a lesser extent, mobile services, although other technologies are discussed where appropriate. Wireless technologies provide valuable tools and can solve many problems, for example delivering high capacity Internet access to a commercial building in an area with poor wireline service. Or reaching homes in rural areas, where wireline companies have decided not to invest in upgrading their facilities.

But it is wireline infrastructure that does the heavy lifting in the broadband world. Fiber optic cables, in particular, have practically unlimited capacity, high reliability and service quality, and are long lived. Wireline infrastructure is the base upon which all service is built – even wireless systems must connect to wireline networks at some point, usually directly after the first "hop" from a subscriber. Consequently, the level of broadband connectivity in a region is primarily determined by the quality and extent of wireline facilities.

2.2. Broadband service and infrastructure types

Similar to other utilities, such as water and electricity, broadband services and infrastructure vary according to the needs of the user. A commercial laundry needs heftier water and waste water hook ups than a typical single family home, for example. An oil refinery has different power needs than an office building. Generally speaking, broadband infrastructure can be grouped into three categories: consumer, commercial and industrial grade.

"Consumer grade" Internet access – from AT&T and Comcast, for example – is typically a shared resource, with many subscribers contending for the same bandwidth. In other words, 10 homes in a neighborhood may subscribe to service promising download speeds of, say, 10 megabits per second (Mbps), but if all of those subscribers tried to use their full 10 Mbps at once, each might only be able to achieve 1 or 2 Mbps actual download performance. The provider's assumption is that spikes in download demand from many homes will average out, so the actual capacity provided can be

much less – typically 20 to 100-times less – than the total capacity sold. This assumption does not always hold true, however, which is the primary reason consumer broadband speeds are advertised as being "up to" a certain number rather than guaranteed to be a specific rate.

This type of service is also subject to speed restrictions and/or data caps as determined by the provider, although these limits are not always enforced.

At one level or another though, consumer grade Internet access is available to nearly all homes in the region. It also often meets the needs of small and medium businesses, but not always. And it is inadequate for larger companies, which need commercial and industrial grade broadband facilities.

"Commercial grade" service is defined as being similar to residential service in that the provider takes effectively all responsibility for installing, maintaining and supporting the service. Speeds are similar (6 to 100 Mbps), but service levels, reliability, consistency and pricing are higher. A commercial grade broadband user will usually share bandwidth with others, but usually not to the same extent as consumer grade subscribers, and consequently will pay a higher price. Comcast's Business Class service or AT&T's business DSL service are examples of commercial grade service.

"Industrial grade" service refers to service where the customer plays a much greater role in building and supporting it, including buying different elements from different vendors and managing installation and support. Speeds would be higher – as high as a Gigabit per second and more – and quality of service levels could be as high as found in top tier Internet exchanges. DS-3 circuits or dark fiber strands are examples of industrial grade service. Industrial grade broadband users are relatively few in number, but tend to be the major institutions and employers in a region, including local governments, schools and large and/or high technology companies, as well as Internet service providers who deliver consumer and commercial grade service.

For practical purposes, the terms "broadband" and "Internet" can be used interchangeably when discussing consumer and commercial grade services, as this report does. In either case, it refers to a connection to the Internet that is installed and maintained by a service provider. The distinction is more important when considering industrial grade service, because broadband systems aren't only used for Internet access – a company might use a broadband connection to link two locations privately without touching the public Internet. The companies that need this level of service tend to be deeply involved in the nuts and bolts of delivering it. Where a distinction is appropriate in this context, this report will make it.

3. Infrastructure

3.1. Consumer wireline service

The majority of the core wireline broadband infrastructure in the East Bay region is owned by AT&T and Comcast, which are the major consumer and commercial grade Internet service providers. These two companies install and control the cables – copper and fiber – that are hung on utility poles and buried in conduits along roads and local streets in the region. The two significant exceptions are in Solano County: Dixon, where Wave Broadband is the incumbent cable company, and the Rio Vista area, where Frontier Communications is the incumbent telephone company.

With few exceptions, residents and many businesses in incorporated cities and most unincorporated communities in the region can order some level of Internet service from either AT&T or Comcast and have it installed within a few days. Two other companies – Astound in central Contra Costa County and, to a lesser extent, Sonic in western Alameda County – also install cables along residential and commercial streets, providing a third alternative in limited areas.

Consumer broadband infrastructure is a generally reliable indicator of all types of service and core infrastructure availability. Except for central business districts in major cities, most AT&T and Comcast construction to date is based on expected revenue from consumers, who will purchase television, telephone (wired and cellular) and other services in addition to Internet access. Commercial and industrial districts are less densely packed with potential customers and there are fewer opportunities to sell lucrative television service, so AT&T and Comcast tend not to invest as heavily in upgrading wireline facilities in those areas, as described below.

Although there are many exceptions, as a general rule the only way to get wireline service into businesses and institutions is to use the cables installed along local streets by AT&T, Comcast and the smaller consumer-focused companies. As discussed below, there are many other companies that provide wireline commercial and industrial grade service, but the typical way they do it is by leasing lines from consumer-focused companies, and then adding their own equipment and other resources. Absent expensive upgrade work, the quality of service provided by these commercial and industrial-focused companies is limited by the quality of the existing consumer-focused infrastructure.

Consequently, the general quality of broadband service in any area – residential, commercial, industrial – can be gauged by evaluating this core, consumer-focused infrastructure. Doing so gives a clear picture of what consumers can expect to get in

their homes and a generally accurate indication of the resources available to businesses, industrial scale users and institutions.

3.2. Grading broadband infrastructure

Internet service providers regularly submit reports regarding advertised download and upload speeds to the California Public Utilities Commission. This data is either reported on a census block basis, or by address or simple maps, which can be re-mapped to census blocks. The information submitted as of 30 June 2012 and published by the CPUC in January 2013 was used for this report.

Concord	A-	3.8
Walnut Creek	B+	3.4
Pleasant Hill	B-	2.9
Berkeley	C+	2.4
Alameda	C	2.2
Dixon	D	1.1
Clayton	D	1.0
Orinda	D	1.0
Moraga	D	1.0
Rio Vista	D-	0.9

Figure 3.1 – Highest and lowest scoring incorporated cities.

To develop a broadband report card for the region, this data was sorted by the type of service provider – core infrastructure/consumer grade, commercial/industrial grade, mobile – and letter grades were assigned to each census block in the region. A "C" grade means a census block has the most common service choices found in California, typical of the standard packages offered by AT&T and Comcast.

"A" and "B" grades were given where superior service is offered. However, as discussed below, what is superior in this context is merely average when compared to international benchmarks, and the Californian average falls far short of what is considered acceptable in developed economies.

A "D" grade indicates that service is worse than the California average, but meets the minimum standard of 6 Mbps download and 1.5 Mbps upload speed set by the California Public Utilities Commission. A census block fails – rates an "F" – if the service available doesn't even meet the CPUC's minimum standard. This methodology is more completely explained in Appendix B.

These letter grades were then assigned a numeric value on a four-point scale (A=4, B=3, etc.). Average scores – similar to grade point averages – were calculated for cities, unincorporated communities, counties and the region as a whole for comparison purposes.

In general, core broadband infrastructure is best in Contra Costa County (C+), average in Alameda County (C) and less than average in Solano County (C-). Other conclusions reached are:

- Although the region generally meets or beats statewide averages for residential broadband availability (and, consequently, core network infrastructure) only a few, limited areas come close to equaling international standards.
- Competition amongst providers results in better broadband infrastructure and service. The four highest ranking cities – Concord, Walnut Creek, Pleasant Hill and Berkeley – are where Astound and Sonic have built competing infrastructure, and the fifth ranking city – Alameda – previously had a municipally owned broadband system. Even though that system did not succeed financially, the infrastructure resulting from the three-way competition remains.
- Even in cities that, on the whole, have above average infrastructure and service, areas with "D" grades can frequently be found and those areas tend to correspond to commercial and industrial zones, confirming the lack of attention paid to such service by the major incumbents.
- Rural areas lag behind urban areas in broadband availability and infrastructure, with the lowest ranking cities tending to have a rural character and challenging terrain, as well as occasionally having a reputation for being difficult places to obtain city approval for construction projects.

3.3. U.S. and international benchmark comparison

The level of residential Internet service actually available, on average, in California is low when compared to other U.S. states or to other countries with developed economies. Akamai, a company that delivers digital media content worldwide, periodically publishes measurements of actual download performance in all 50 U.S. states and 55 countries. Since it is a consumer-oriented enterprise that uses consistent methods to deliver content and to measure results, Akamai's reports provide the best apples-to-apples benchmarks available to compare global residential Internet service. Please see Appendix F for more information.

California only ranks 19th among U.S. states in Akamai's latest measurement of connection speed to its servers[1], averaging 8.85 Mbps. That compares to 11.2 Mbps in top ranked Massachusetts, 10.1 Mbps in Washington state (8th) and 9.00 Mbps in Oregon (15th). California faces an even greater divide between high and low performing households, ranking 20th in terms of the percentage of consumers who connect to Akamai's servers at speeds of 10 Mbps or greater. Only 23% of Californian

[1] *The State of the Internet*, volume 6, number 2, 2nd quarter 2013 report by Akamai Technologies, Inc.

connections reach that level, versus nearly twice that – 42% – in Massachusetts. Similarly, our West Coast neighbors, Washington and Oregon, do significantly better with an 11th ranked 31% and a 12th ranked 28% respectively. On a national basis, California is slightly better than the U.S. average of 8.7 Mbps and slightly worse than the high-performances average of 24%.

Rated against its international competition, California's average speed would rank seventh, behind South Korea (13.3 Mbps average speed, 45% high performance adoption), Japan (12.0 Mbps/43%), Switzerland (11.0 Mbps/37%), Hong Kong (10.8 Mbps/32%), the Netherlands (10.1 Mbps/31%), and the Czech Republic (9.8 Mbps/27%), in that order. It slips even further on the high performance league table, falling behind those six as well as Belgium (8.4 Mbps/25%) and the United States (8.7 Mbps/24%), landing in a tie with Finland (8.1 Mbps/23%) and the United Kingdom (8.4 Mbps/23%). On the other hand, Massachusetts would comfortably make it into the top three on both measures, ranking behind only South Korea and Japan.

3.4. Commercial and industrial grade broadband service

As described in Appendix B, data provided by companies that specialise in commercial and industrial grade broadband service was analysed separately. The service claims from those companies were then mapped (Appendix E). It quickly became clear that these companies report service availability data differently than the companies that build and own the core infrastructure. When AT&T or Comcast report that a particular download speed is available in a census block, it means that facilities are already installed and operating, even if advertised performance claims don't necessarily match up with ground truth. The entire census block might not be wired – as frequently happens in commercial areas – but at least some facilities are already in place.

On the other hand, commercially-focused service providers tend not to install equipment or lease lines until a customer actually places an order. Instead of claiming they offer a particular level of service, commercial and industrial grade providers are, in effect, saying "we believe we can deliver a certain speed in a general area, but we'll have to do a technical evaluation before we'll know for sure, and then we can figure out how much it will cost and how long it will take to do it". There are exceptions, particularly in major business districts, but otherwise the service claims made by these companies represent assumed and not actual capabilities.

Even so, some general observations can be made:

- Commercial and industrial providers generally advertise 25 to 50 Mbps in western Alameda County and 10 to 25 Mbps in the east.

- Central business districts in Contra Costa County have advertised speeds in the 25 to 50 Mbps range, otherwise it's mostly 10 to 25 Mbps elsewhere in the county.
- These providers advertise 25 to 50 Mbps in the Fairfield/ Cordelia area, but generally lower speeds elsewhere in Solano County.

However, these general observations are of little use for economic development or commercial real estate purposes, where block by block and parcel by parcel granularity

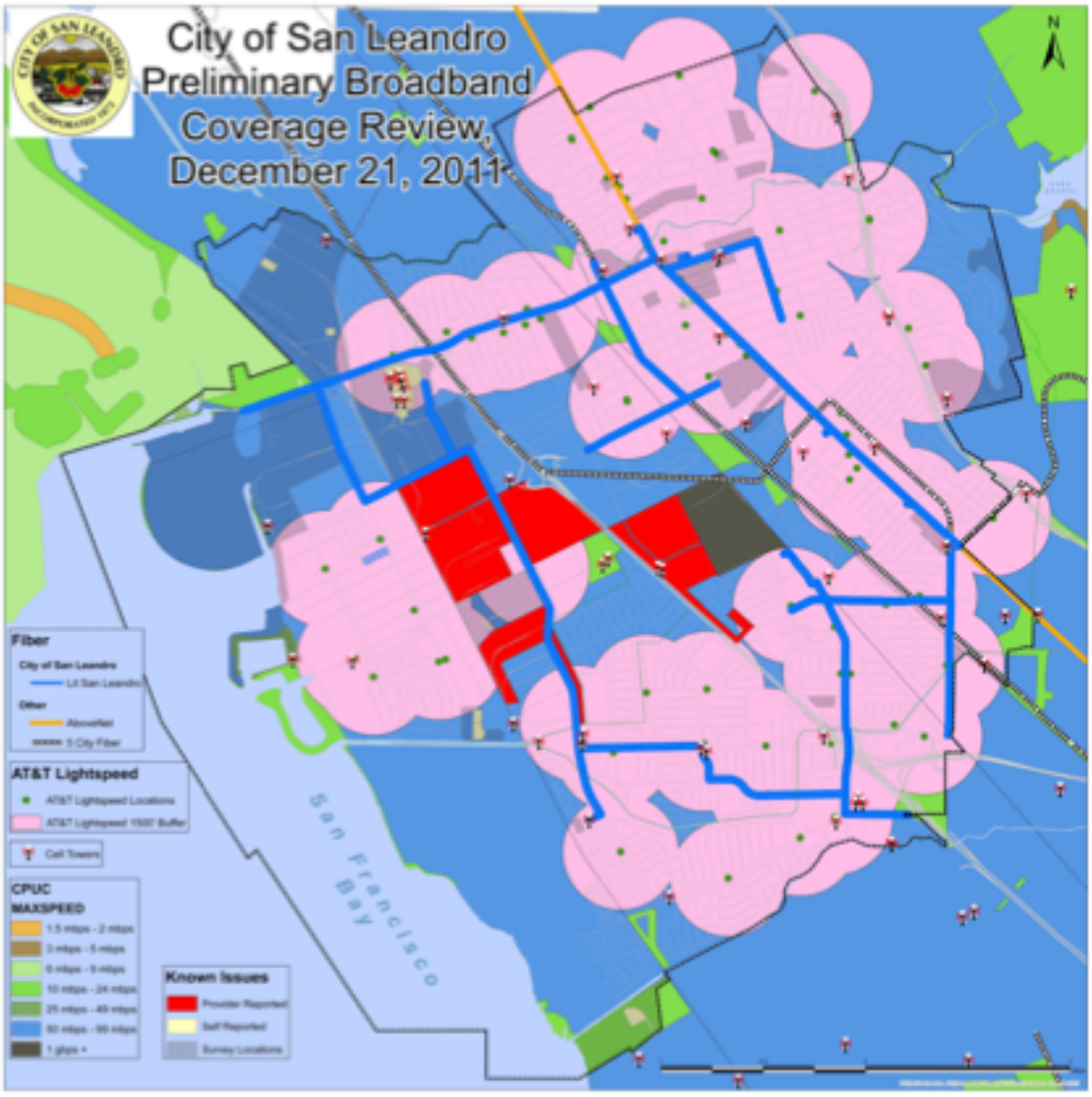

Figure 3.2 – Analysis of CPUC, City, AT&T and Comcast data highlights lack of broadband infrastructure and service in commercial and industrial areas of San Leandro.

is necessary. The grading analysis based on the core, consumer grade infrastructure is moreover useful in this regard. An earlier version of this type of analysis was performed

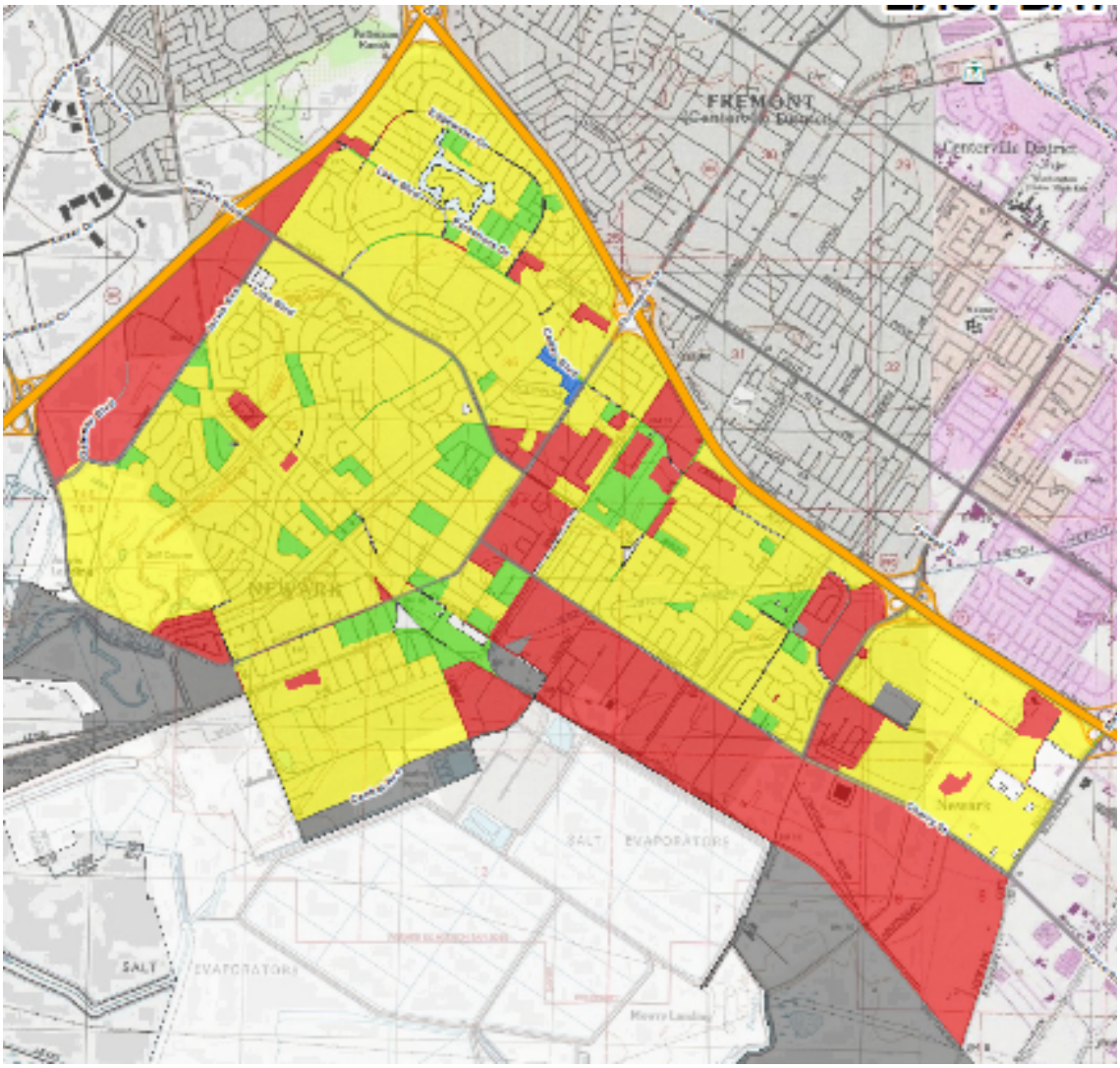

Figure 3.3 – City of Newark broadband infrastructure and service grading map. Red areas indicate below average service and infrastructure, white and grey areas indicate a failing grade.

by Tellus Venture Associates for the City of San Leandro. Five sources of information were used to try to build a picture of the broadband infrastructure and service that was available in the commercial and industrial zones of the city:

- CPUC data, as above.
- Encroachment permits given to AT&T in the course of a major upgrade project.
- Service available at specific business addresses as reported by Comcast.
- Two workshops that included major local businesses.
- An online survey of local businesses.

All five sets of data provided results consistent with each other. When the CPUC and AT&T permit data sets were mapped, both sets showed good service in a horseshoe-shaped swath that corresponded to the city's residential areas, but poor service in the commercial center and in the outlying industrial areas. The specific address data provided by Comcast and local businesses matched up with and, consequently, verified this overall picture.

Examination of the maps in Appendix D shows a similar pattern elsewhere in the region. For example, the City of Newark rates a solid "C" on the overall grading scale, but the grades for individual census blocks varies widely. Industrial areas rate a "D", as do many commercial areas. Census blocks that are primarily residential score better, some even getting "A" and "B" grades.

3.5. Filling commercial and industrial broadband gaps

As with other utilities, local governments can have a substantial impact on the development of commercial and industrial broadband infrastructure. Some already have done so, including several in the East Bay region. Initiatives include:

- Benchmarking local permit, zoning, building and other development-related policies to determine whether a local jurisdiction is creating barriers to broadband deployment or actively assisting it.
- Leveraging existing street work to develop broadband infrastructure. Examples including requiring notification of interested companies any time a trench is dug in a street or other public right of way, installing empty conduit whenever a trench is dug and providing incentives for companies to participate in open trench opportunities.
- Establish clear and consistent standards for broadband infrastructure, such as conduit or wireless towers, and make such work subject only to the standard encroachment permit processes required of other utilities.
- Enter all broadband-related data, with particular attention to conduit routes, into publicly available GIS systems.
- Require conduit be installed as a routine part of any public works project, and set standards for broadband facilities in new construction or major remodelling jobs.
- Partner with private companies to build broadband infrastructure and offer service, or do it as a purely municipal utility.

Examples of these initiatives can be found in Appendix A.

3.6. Mobile broadband availability

The four major mobile broadband carriers operating in the East Bay region – Verizon, AT&T, Sprint, T-Mobile – all provide coverage maps with service level information. Unlike wireline service, however, the CPUC then goes one step further and does standardised testing of these claims at 1,200 locations around the state.

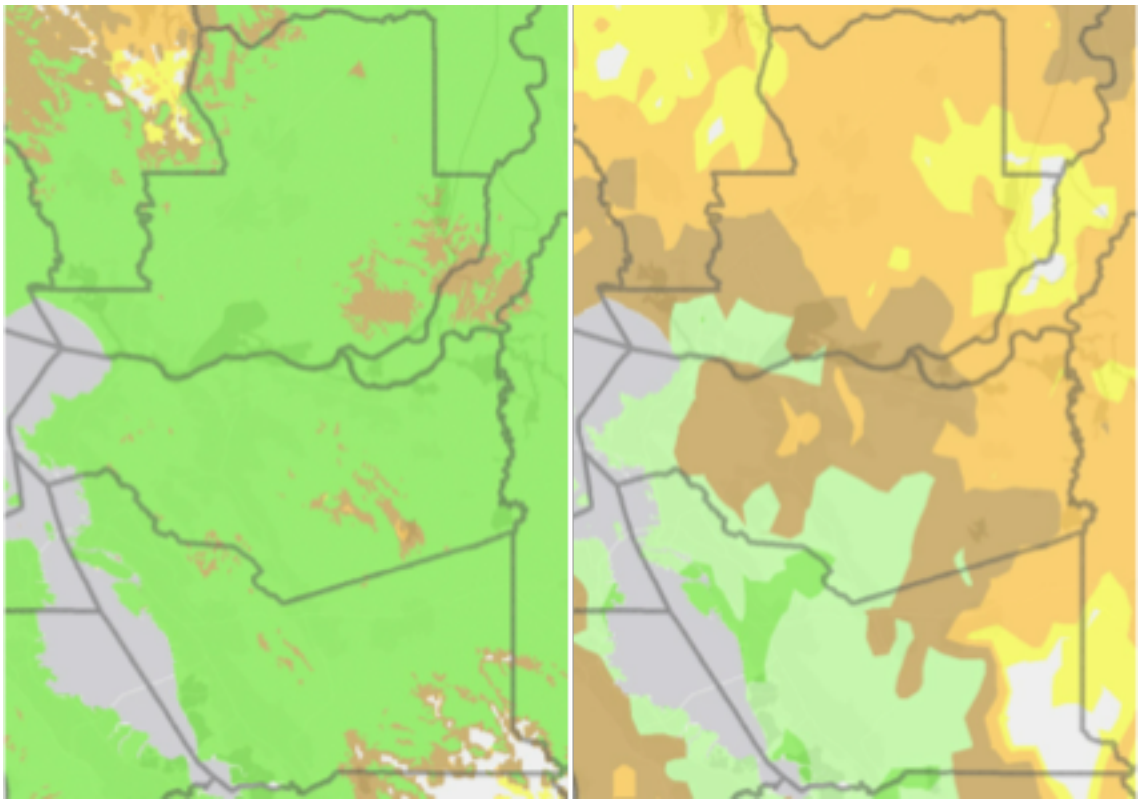

Figure 3.4 – Left: mobile carrier reported speeds, right: CPUC mobile field test results. Darker green is better; light green, brown, orange and yellow indicate progressively worse service.

Examining and then comparing these two data sets provides a basis for assessing the quality and speed of mobile broadband service in the region. When left to their own devices, mobile carriers report excellent broadband service, mostly 10 Mbps or better for consumer download speeds. Verizon and T-Mobile generally make blanket claims of of 10 Mbps or better everywhere, while AT&T is more granular, showing lower speeds in outlying areas, as might be expected. Sprint's self-reported speeds are lower, in the 3 to 6 Mbps download range.

The CPUC's standard test data, though, shows a much different picture. In the Nimitz freeway corridor, test results more or less match up with carriers' advertised claims, hitting 10 Mbps or better. Elsewhere, speeds are lower. Along the Eastshore corridor and in the San Ramon and Livermore valleys, actual speeds hit the 6 Mbps range, but in most of the rest of the three county region, measured performance is in the 1.5 to 3 Mbps range.

Based on provider claims, one might conclude that fourth generation (4G) mobile service – the technology with the fastest speeds and highest capacity currently available – is ubiquitous in inhabited areas of the region, at least from AT&T, T-Mobile and Verizon. Again, though, the CPUC's field tests tell a different story (Appendix E). It is possible – likely, even – that 4G equipment has been installed throughout the region, but the capacity of those facilities appears limited. When a consumer's 4G smart phone or tablet cannot connect to a 4G cell site, it will usually fall back to 3G or even 2G connections.

The latest test data show that Sprint's network performs at a level consistent with 3G technology, where service is available at all. The performance of T-Mobile's network is considerably less than what would be expected from full 4G technology, indicating either that its facilities are based on sub-4G technology or the capacity of such 4G facilities is so limited that a consumer should expect to receive 3G-level service. Neither provider registered a significant number of tests with speeds greater than 6 Mbps, with results in the 1.5 to 3 Mbps range more typical.

AT&T's and Verizon's mobile networks, on the other hand, do perform at 6 Mbps or better throughout the region, except for parts of eastern Solano County. This level of service indicates that 4G networks are likely in operation and available to one degree or another.

The intra-regional disparities are not necessarily as stark as these numbers would indicate. Network capacity as well as speed capability has to be factored into any evaluation. Because population density and usage patterns vary, an area, such as along a major freeway, that has high-speed service available will also tend to have many people competing to use it, which brings down performance, particularly at peak hours. In eastern Solano County, for example, mobile broadband infrastructure is not as robust but there are fewer people accessing it. The real-world mobile broadband experience in those two kinds of locations is likely to be more similar than not.

Unlike consumer or most commercial wireline providers, the major mobile carriers are still investing heavily in network upgrades, and over time coverage, capability and capacity should continue to improve. A key element in that work is building fiber optic

lines to support cell sites, which should improve overall broadband infrastructure and availability in the region.

Another barrier to full 4G availability is opposition to installation of new cellular towers and expansion and/or upgrading of existing ones. Although mobile carriers are investing in upgrading their technology, those investments are prioritised largely on the basis of expected financial return. Lengthy or cumbersome permit processes will increase the cost of any given upgrade, thus lowering the expected return on investment and pushing that project lower on a carrier's priority list.

4. Alameda County

Overall, Alameda County's broadband grade is a "C" at 2.0, putting it in the regional middle, ahead of Solano County (C-) and behind Contra Costa County (C+). Two cities – Berkeley (C+) and Alameda (C) – fall in the regional top five. Both have a history of wireline competition. Sonic has built and/or upgraded its own infrastructure in key areas of Berkeley, generally around the University of California, which has also invested in its own broadband infrastructure, to the benefit of the city, which ranks fourth in the region.

Figure 4.1 – Green area indicates Sonic's infrastructure.

The City of Alameda built and, for many years, operated a municipal cable television and broadband system until financial problems, brought on by stiff competition from incumbents, forced it to sell its network in 2008. Comcast bought it and used those facilities to improve its infrastructure in the City of Alameda. AT&T did not acquire any assets in that transaction, but still continues to benefit from the investment it made when it faced two peer broadband competitors, rather than just one. As a result, the City of Alameda's residential broadband service ranks fifth in the region.

With one exception, the cities closest to Berkeley and the City of Alameda – Albany (C), Oakland (C), Emeryville (C) and San Leandro (C) – are the next highest rated cities in Alameda County.

The exception is Piedmont (D+), which ranks last among cities in Alameda County: worse than the overall rating for the unincorporated areas (C-), worse than all but one of the county's unincorporated communities and the sixth worse incorporated city in the region. The primary reason for this low grade is the poor quality of AT&T's infrastructure and service in Piedmont.

Although there is no documented data to explain Piedmont's low grade, anecdotal evidence from residents and an AT&T representative indicates that the city has a history of opposing the construction of broadband facilities, particularly upgrades and expansion of cellular telephone towers. As noted above, it is mobile telecommunications facilities and not legacy wireline networks that are attracting private investment, particularly by AT&T. The same core infrastructure – primarily fiber optic cables – that

support mobile broadband upgrades also contribute generally to better wireline service for both residences and businesses.

Newark (C) and Fremont (C) rate as average when compared to typical service in California. Hayward (C-), Union City (C-), Livermore (C-), Dublin (C-) and Pleasanton (C-) are slightly below even that benchmark.

Alameda County also has six unincorporated communities that the U.S. Census Bureau recognises as "census designated places" (CDPs). Five – Ashland, Castro Valley, Cherryland, Fairview and San Lorenzo – are generally in the area between San Leandro and Hayward and split the difference between those two locations: all five come in with a "C" grade. The sixth, Sunol, is more rural and isolated, and rates a "D-". As noted above, all the unincorporated areas of Alameda County – including CDPs – taken together rate a "C-". Subtracting out the CDPs, though, results in a "D+" for the remainder of unincorporated Alameda County.

5. Contra Costa County

Contra Costa County (C+) has the best grades in the three county region, rating just above the statewide average. However, the quality of broadband infrastructure is not evenly distributed throughout the county. Three cities in the center of the county – Concord (A-), Walnut Creek (B+) and Pleasant Hill (B-) – are outliers in the region.

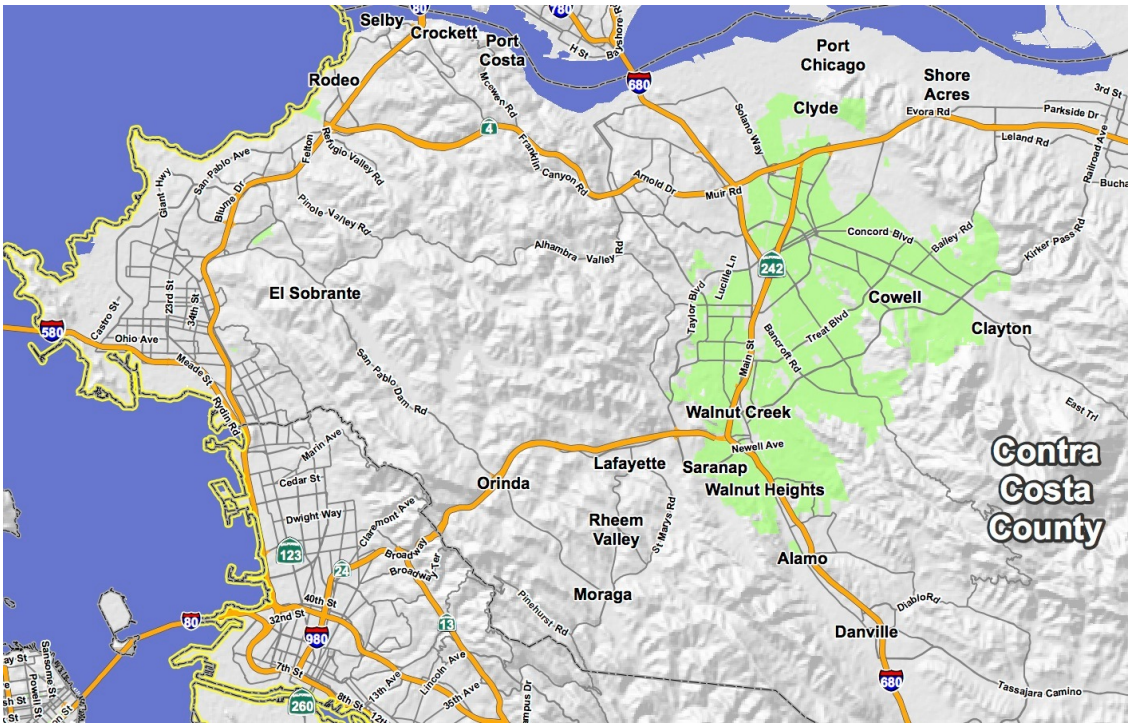

Figure 5.1 – Green area indicates where Astound has built out competing infrastructure.

Astound has built a third wireline network in the area. The competitive dynamic between Astound, AT&T and Comcast has resulted in the construction of superior broadband infrastructure directly to homes and businesses, resulting in "A" grades in or near areas where all three compete.

Outside of these broadband-rich neighborhoods, however, infrastructure grades in these three cities resemble the mix of "C" and "D" (with an occasional "B") ratings that are typical for both Contra Costa and Alameda counties. Neighboring cities – Martinez (C), Lafayette (C), Danville (C-) and Pittsburg (C-) follow this pattern as well. Grades drop slightly a step further out in Antioch (C-) and San Ramon (C-). In eastern Contra Costa County, Brentwood (C) and Oakley (C) do a little bit better, perhaps reflecting the relatively newer residential development there.

Grades for cities in western Contra Costa County follow a pattern similar to that found just to the south in Alameda County: as the distance from Berkeley increases, grades have a tendency to drop. El Cerrito (C), San Pablo (C), Richmond (C), Pinole (C) and Hercules (C-) generally follow this trend.

Three Contra Costa County cities – Clayton (D), Orinda (D) and Moraga (D) – rank among the five worst in the region. The three are generally hillier, which can create challenges for broadband infrastructure deployment. They also have a more quasi-rural character than most other central county cities, and factors such as those identified in Piedmont (see above) may also play a significant role in these low grades: similarly, AT&T's infrastructure is deficient.

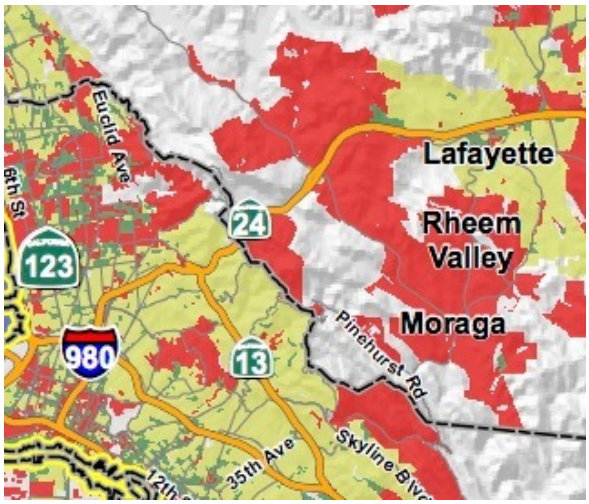

Figure 5.2 – Red area indicates where AT&T's infrastructure and service is substandard.

As Appendix C shows, the quality of broadband infrastructure and service in Contra Costa County's census designated places (CDPs) varies widely. Six – San Miguel (A), Saranap (A), North Gate (A), Castle Hill (A), Acalanes Ridge (A-) and Shell Ridge (A-) – are within or adjacent to Astound's service area and have perfect or near-perfect grades. Contra Costa Centre (B) and Clyde (C+) likewise benefit from the competitive environment created by three competing wireline service providers.

In the middle of the rankings, Mountain View (C), El Sobrante (C), Alamo (C), Rodeo (C-) and Vine Hill (C-) have grades generally equal to or slightly below nearby incorporated cities.

The remaining CDPs have significantly lower grades than their neighbors. East Richmond Heights (C-), North Richmond (C-), Pacheco (D+), Rollingwood (D), Bayview (D), Bay Point (D), Crockett (D), Montalvin Manor (D-) and Port Costa (F+) are similar in that household income levels are lower than average in Contra Costa County overall but consistent with neighboring incorporated cities. The implication is that the lack of a municipal government is an additional negative factor for economically disadvantaged areas, in regards to attracting investment by broadband service providers. For those communities located along the Eastshore corridor, these results are also generally consistent with the trend of declining infrastructure and service levels as the distance from Berkeley increases.

Kensington (C-), Reliez Valley (C-), Blackhawk (C-), Alhambra Valley (D+), Camino Tassajara (D+), Tara Hills (D), Norris Canyon (D-) and Diablo (F+) have relatively higher household income levels than nearby cities or, in most cases, than Contra Costa County as a whole. In many respects, these low rated unincorporated communities resemble the lowest rated incorporated cities in the county, as discussed above.

The remaining four CDPs evaluated – Discovery Bay (D+), Byron (D+), Knightsen (D) and Bethel Island (D-) – are located in rural eastern Contra Costa County. On the whole, rural areas tend to have poorer broadband infrastructure and service due to lower population densities and household income levels.

Altogether, the unincorporated areas of Contra Costa County score a "C-". Factoring out the CDPs, the grade falls to a "D+", identical to Alameda County.

6. Solano County

Broadband service and infrastructure in Solano County (C-) is measurably worse than in the balance of the East Bay region or even than the California average. More of the county is rural and it follows the trend of declining grades as the distance from better performing Berkeley and central Contra Costa County increases.

Service providers have a more rural character as well: Frontier Communications is the incumbent telephone company in and around Rio Vista, Wave Broadband provides cable service in Dixon, and Winters Broadband, a wireless company, serves northeastern Solano County. Wave's infrastructure and service is somewhat below the level set by Comcast elsewhere in the region, and Frontier's is considerably worse than AT&T's. Winters Broadband's service area is centered in Yolo County, and its performance drops in Solano County as the distance from that center increases.

Figure 6.1 – Left: Wave Broadband's service area in Dixon. Right: Frontier Communications' service area around Rio Vista.

Consequently, Rio Vista (D-) and Dixon (D) rank worst and fifth worst respectively amongst incorporated cities in the region.

The cities with the best grades – Vallejo (C) and Benicia (C) – are the ones nearest the region's (and the Bay Area's) urban and core suburban communities. Following the Interstate 80 corridor to the east and away from the Bay Area, grades drop in the cluster of Suisun City (C-), Vacaville (C-) and Fairfield (C-) and slide even further in Dixon.

Census designated places (CDPs) in Solano County also follow a familiar pattern: the further east, the lower the grade, which is lower than nearby incorporated cities. Green Valley (D) is north of Fairfield; Hartley (D-) and Allendale (F+) are north of Vacaville.

Elmira (F), south of Vacaville, has the worst grade of any city or CDP in the East Bay region.

The remainder of Solano County – census blocks not in a CDP or an incorporated city – gets a “D”. Add in the CDPs and the overall grade for all unincorporated areas in Solano County falls to a “D-”.

7. Broadband Adoption

The CPUC also publishes limited data regarding the rate at which people in different communities sign up for broadband service. Overall, Contra Costa County has the smallest broadband adoption gap, with 13% of homes not subscribing to some kind of broadband service, either wireline or mobile. In both Alameda and Solano Counties, 22% of homes lack Internet access. The average three county gap is 19%, at least according to the numbers the CPUC is making available.

When drilling down further, however, a different picture emerges. The CPUC data shows that affluent suburbs east of the Oakland-Berkeley hills have much lower adoption gaps, often 10% or less, than inner city neighborhoods, where between 71% and 100% of homes lack Internet access. The differential between high and low broadband adoption gaps appears to generally correspond to the equivalent gap in household income levels.

Larger maps can be found in Appendix E.

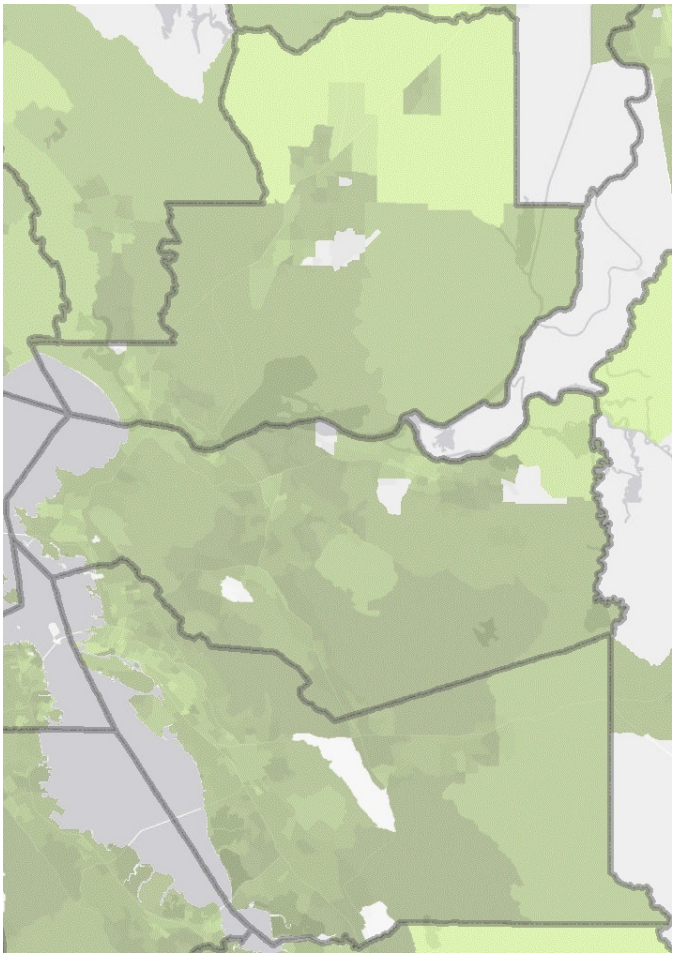

Figure 7.1 – Lighter green areas indicate areas where the broadband adoption gap is the greatest.

	HHs subscribing	HHs with availability	Adoption gap
Alameda	430,724	551,959	22%
Contra Costa	332,991	381,061	13%
Solano	110,402	141,910	22%
EBBC	874,117	1,074,930	19%

Table 7.1 – Broadband adoption rates