# THE BROAD DIMENSION

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**tbd** consultants

Construction Management Specialists
111 Pine Street, Suite 1315
San Francisco, CA 94111
(415) 981-9430 (San Francisco office)

9705 Cymbal Drive, Vienna, VA 22182
(703) 268-0852 (Washington, DC, office)

3434 4th Avenue, San Diego, CA 92103
(619) 550-1187 (San Diego office)

8538 173rd Avenue NE, Redmond, WA 98052
(206) 571-0128 (Seattle office)

www.TBDconsultants.com

**In this Edition:**

## Data Centers

Back in the really early days of computing, whole rooms or buildings were filled with electrical equipment to carry out the calculations, and that was accompanied by massive cooling systems to extract the heat generated. Then, by the time of the 1970s and 80s, microprocessors had made

it possible for computers to sit on your desktop, and the days of these rooms full of electronic equipment seemed numbered. The military, research institutions, and even some large companies might have a need for the massive calculating power of a supercomputer or the combined power of banks of smaller computers, but the smaller PC could handle most needs.

But then the Internet grew, and banks of servers were needed to dish up the Web pages in increasing volume, and those pages started to turn into Web applications, requiring more processing power behind the scenes. Streaming video started to fill the bandwidth, and business of all kinds started to go online, from selling books and anything else you could think of, to online meetings and banking. Now the Internet has become the primary communications medium and also the place where people are storing and backing up all their photos, music and data in general. All that online activity has made the need for those rooms and buildings packed with electronic equipment more essential than ever, and data centers are being built in increasing numbers as our lives are going online.
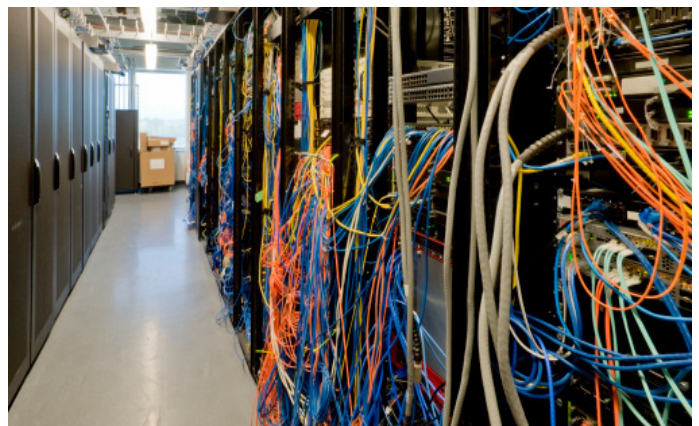


Data centers are categorized into four tiers, ranging from Tier 1, which can be a single server room, through to Tier 4,

which would normally be one or more dedicated buildings. A Tier 1 data center can be expected to provide around 99.671% availability (in other words, to be offline not more than 0.329% of the time), and a Tier 4 providing 99.995% availability.

The simple way for a company or university to add a data center is to have one delivered ready-made. They can arrive looking like a large cargo container, but one that is packed to capacity with computing power, and all that is needed is to provide a foundation for it and connect it up to a power source and the data network. That is not the most aesthetic solution or the most secure, and will not suffice for all situations. But the idea of standardization of infrastructure normally carries through to other data centers as well.
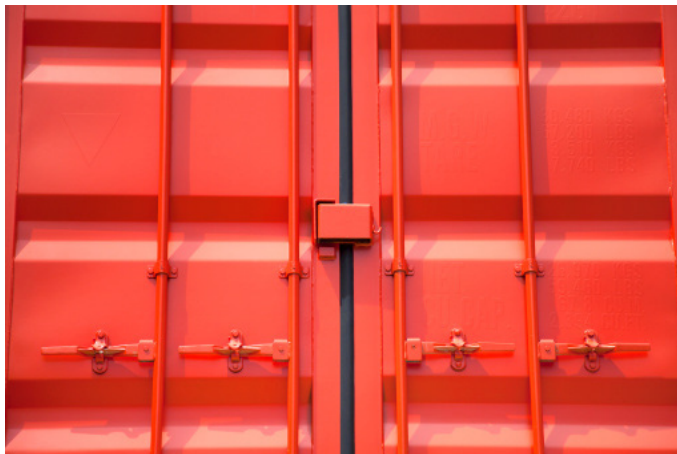


Security is normally a big consideration at data centers. Apart from the fact that it contains a lot of valuable equipment, it will also be storing a lot of valuable information, including company secrets, bank account and other personal information. Plus, it damages the reputation of the company operating the data center if service goes down for any reason, or if confidential information gets stolen. Physical security, in the form of fences, security guards, fire control and access control on the building is one style of security. Similar types of security, but in electronic form, are of equal or probably even more importance to guard against hackers (or to be more pedantically correct, 'crackers').

The security of the building itself can be at risk from natural disasters, so the location of data centers can be very important in minimizing these kinds of risks, as well as the building design. To ensure that service can continue uninterrupted, siting the data center in a location with a reliable power supply is also of primary concern. Alternative power sources, and emergency generators, would normally be expected to be part of the design as well. Redundant data connections are also normally provided to try to ensure continuous connectivity, along with redundant HVAC capacity to ensure a correct environment can be maintained despite breakdowns.



Having anyone around the building can be a security concern, but some data centers are automated to the point that they become 'dark data centers'. These operate with no staff in the building, except for maintenance or in emergency situations. Management of the server and other equipment is handled remotely.

As far as the building for the data center is concerned, it can really be almost anything. There are data centers that are part of an office building, there are those that are dedicated structures rather like giant warehouses stacked with electronic equipment instead of goods for shipping, others are housed in converted buildings.

Ideally they should be geographically reasonably close to the end users they are serving, to minimize any delay between requests being sent from a user's computer and the requested information being returned. People are not very patient when it comes to waiting for a Web page to be returned, and in the case of a business application that is housed in the proverbial cloud, such delays are not expected or generally tolerated. Consequently the big service providers have built data centers around the world, and are continuing to add to them.

A building that relies almost completely on a clean energy source like electricity might sound like an ideal green building, but some of these data centers can use as much

energy as a not-too-small town, and the generation of that much power normally adds substantial pollutants into the environment. Plus, the banks of servers that fill the data centers generate large quantities of heat that needs to be removed. Building 'green' data centers has become a high priority, and there are LEED Gold data centers around. Since these buildings generate more heat than they need, siting the building in an environment that facilitates natural cooling is an advantage (e.g. Sweden and Alaska have been selected as a locations for a number of large data centers). Temperature is not the only issue for data centers. Humidity must also be controlled because static electricity can result if humidity is too low, and that can be a serious problem for electronic equipment.

Another location issue is finding a site that can supply reliable and inexpensive power from renewable sources. Energy reductions are also being achieved by using virtualization techniques to make more effective use of the physical servers. It is also important to have a site large enough for future expansion, and, because of the frequent need to expedite construction on very tight schedules, being located in a region where planning restrictions are more relaxed and less subject to delay is advantageous.

With the continuing move to mobile devices for computing, and the related requirement for accessing your data from any location, the need for new and upgraded data centers will continue to grow.

# Keeping on Top of Data

Many people feel like they are drowning in data, but if you are one of them, we are sorry to say the news is not good. It is said that digital data is doubling every two years, and at that rate in ten years time we will have 32 times as much, and in 20 years we will have over a thousand times as much. Trying to keep on top of this quantity of data and make good use of it, rather than being buried by it, is the task of the day.

Happily, developments in software for managing and manipulating data are growing rapidly as well. Business analytical tools are now available from many sources, including Google. Not only can we use their search engine to find information among the data scattered around the Web, they also provide a couple of online tools, including

one called BigQuery, that allow you to query structured and unstructured data sources, either your own or someone else's if you have been granted access to it.

If you want to house data sources online, your online book store may not be the first place that comes to mind. Nevertheless, Amazon Web Services has become a popular platform for companies to use for online data storage.

It is one thing to accumulate vast quantities of data, but you also need to manage it. Happily, data management tools are also improving, providing faster processing and being more adaptable. These tools can help even non-IT staff to make sense of the accumulating structured and unstructured data filling up the servers.
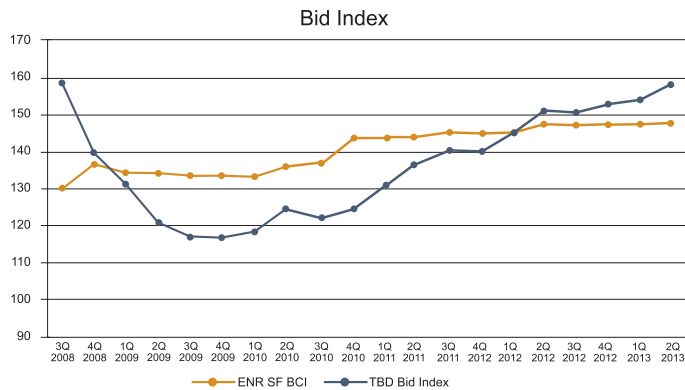


BIM applications are a form of data management software, because everything you do within the software is either adding information to the database that is at the heart of the system, or is manipulating that data in some way. One way the data might be manipulated is by providing a view into the data in the form of a drawing or a schedule. People are even looking into ways to get robots to work with that data and actually construct the building. Who knows how construction sites will change over the coming years, as technology finds more ways to carry the growing data sources into the workplace?

# Market Data

We have been discussing data centers and managing data, but what is the data saying about the economy, and what does it portend for the construction industry?

Here in the US, the stock markets are hitting record highs, and are up about 15% since the start of year. Despite that

**Bid Index**



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of the eurozone has contracted for the past six quarters, and nine of its members are currently in recession. It is now three years since Greece got its first bailout, but the enforced austerity has sent unemployment to 27%, and over 60% of young workers have no job. But the country's economy is forecast to start growing again in 2014. France is back in recession for the second time in four years, and French consumer confidence in May was at its lowest level since July 2008. Germany avoided dropping into recession, and has shown increases in industrial output, but at time of writing (early June) was suffering from bad flood conditions.

China has been the most prominent growth center in the world recently, but currently it has dropped to only 8% growth. Of course, that is still way above what the US and Europe has managed since the Great Recession, but while that growth has dropped, China's use of credit has been growing, and the quality of its investments has been questioned. However, China's industrial production was up in April, and there have been increases in China's exports.

Japan had been stagnating and suffering from deflation, but following the 'Abenomics' economic reforms, stocks have soared. The Bank of Japan has been pumping money into the economy and the Yen is down 15% against the dollar this year, and Japan's economy is expected to grow by 1.6% this year. But there have been some big drops in the market recently.

So, worldwide nothing appears to be desperately wrong with the economic situation, unless you are (say) one of the unemployed in Greece. And while generally things are improving, they are improving way too slowly for most. For instance, here in the US employment has been improving, but the number of jobs created still hasn't caught up with the number of people joining the potential workforce. And there are still too many open questions about how the financial problems will be addressed by the politicians, and the markets hate having doubt. Although the stock market doesn't like it, the fact that the Fed is starting to talk about being able to take the nation off life-support should be seen as a good sign.

At least construction has started to show growth again, but now we have the problem that so many people have left the industry that construction workers are becoming difficult to find. Material production has also been reduced, and while it ramps up again we can expect to see many fluctuations up and down in prices – but generally up, of course.

rise, the average Price/Earnings ratio is still below what had been considered the norm before the recession hit, so the bull market might not be peaking yet. And company earnings are doing well, with about 65% of them beating the estimates in the first quarter. The unemployment situation continues to improve, but slower than we would like. The economy lost almost 9 million jobs in the financial crisis, and has recovered over 6 million, but it is estimated that around 8 million are underemployed (working part time when they would prefer full time). The housing situation is also improving, while the foreclosure crisis is winding down. House prices rose 10.2% during the first quarter, and building permits rose, exceeding the one million level for the first time in about 5 years. With the improvements in unemployment and housing, consumer confidence has been improving, hitting a 5-year high in May, and inflation remains weak. The Federal Reserve has kept its short-term interest rate near zero since Dec 2008, which has been a driver in the housing recovery, making mortgage rates affordable for many. The Fed has set unemployment levels at 6.5% or inflation at 2.5% as trigger points for adjusting interest rates, and that is not expected before 2015. Quantative easing (QE2), where the Fed buys $85 billion a month of Treasuries and mortgage-backed securities has been a driver behind the rise in stock market prices. Some Fed officials have been calling for an end to the monetary stimulus this year, and that news has caused some big drops in the stock market.

In Europe the situation isn't as good. The OECD (which represents 34 advanced economies) said the eurozone will shrink by 0.6% this year, and speculated that prolonged economic weakness in Europe could damage the global economy. Eurozone unemployment currently averages 12%, but is forecast to stabilize in 2014. The blame for this level of joblessness is normally laid on austerity measures, weak confidence and tight credit conditions. The economy

*Newsletter designed by Katie Levine of Vallance, Inc.*