SEABC NEWSLETTER

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- SEABC's Newsletter is edited and managed by Robert Smith (smithco@axion.net)
- Submissions to the newsletter are encouraged and all members of the SEABC are asked to actively participate in contributing to our newsletter.
- SEABC editing staff reserve the right to include or exclude submitted material and in some cases edit submitted material to suit overall space requirements. If submittals are not to be edited, please advise editor at submission time.

Message from the President

By Dave Davey; SEABC President

QUALITY IN STRUCTURAL ENGINEERING

The prime purpose of SEABC is to promote the interests of Structural Engineers in our Province. To achieve this, our bylaws provide four objectives – one of which is "To Promote the Highest Standards of Structural Engineering".

This is a topic that interests many of our members and this interest indicates that we take our responsibilities to the public seriously. We want to be sure that we meet proper standards of design and construction, that we do not condone shirking of responsibility and we do not support the cutting of corners.

The practice of Structural Engineering has changed dramatically over the years. As a retired engineer, I well remember the days when slide rules were ubiquitous, code books and standards were ridiculously thin, survey required the use of seven figure log tables and moment distribution was the height of sophistication. I recall having a brief brush with the design of a minor part of the Sidney Opera House. Those shells were designed by analogy and experience over a period of years, using hand calculators and model testing. Today a finite element program would analyze the structure in minutes, but nevertheless, the designer still has to understand how the structure will behave.

We are not all going to be designers of a Sidney Opera House, but we all need to be aware of many common concerns, such as: the limitations of wood frame construction; how to design and reinforce a seismically resistant column; what welding does to aluminum; how to avoid brittle connections; how to design ductile steel bracing; and the effect of ground motion on retaining walls – all examples of things that can occur in seemingly simple structures.

At some time, we will all be asked to design or construct something that we have not done before. Rules and regulations are far more complex than they used to be. Architects expect more of us. The public expects more of us. For these reasons, we need to keep up to date and we need to be aware of our capabilities.

Since May 2007, the City of Vancouver has required designs of Part 3 buildings to be submitted by a Designated Structural Engineer (Struct.Eng.) and the City has found a noticeable improvement in the quality of submissions since that time. Although this program is not administered by SEABC, we do support it. No one likes to have to write more exams, but the Struct.Eng. program does ensure that those so designated have a sound understanding of structural engineering principles and codes and therefore results in an improvement in quality of work.

We must expect that, within the next few years, APEGBC will require all engineers to undertake continuing education programs. Designated Structural Engineers already have to report Professional Development hours. For those that are not currently pursuing professional development, this could mean a little extra work and expense, but it is essential to maintain the quality of Structural Engineering at the level that we aspire to.

SEABC offers courses and seminars put on by our Education Committee or through our Certificate in Structural Engineering Program or sometimes in conjunction with others. Our Technical Committees are investigating and reviewing a number of current Code changes, design techniques or design and construction problems. We plan to either publish the results of this work or to put on seminars to explain them.

The Directors and Committee Members of SEABC believe that this push to improve the competency of Structural Engineers and the quality of Structural Engineering is necessary to maintain and improve the image of Structural Engineers. Our Directors and Committee Members are committed to a program to improve the quality of Structural Engineering and the number of volunteer hours put in by them is evidence of this commitment.

Communications Update

By David Harvey; Chair, SEABC Communications Committee

By now, most SEABC members will be reading the third edition of the SEABC Newsletter. The first two editions were well received by our members who sent in many favourable comments. Your Communications Committee hopes that you enjoy reading your Newsletter and feel well informed about current activities and issues affecting structural engineers.

The communications team works very hard to bring important information to you; however, we need your help to keep the momentum going. Send us your ideas if there are features you would like to see in your Newsletter, and please take the time to forward your structural engineering stories to our editorial team. Together we can make our Newsletter even better.

The Communications Committee is growing. Since the last edition, Kevin Riederer, who is promoting matters of interest to the younger members, has joined us. Kevin is starting up an SEABC Young Members' Group (YMG). Look for Kevin's message in this issue and join the YMG activities.

Our other main communications tool is our website which has garnered rave reviews. It is visually exciting and packed with useful information on the Certificate Program and upcoming events. You can also find SEABC governance and membership details, along with contact information and links to documents relevant to professional practice. Look for the news in the Webmaster's Report in this issue, and check out the website at: www.seabc.ca.

Other initiatives we have going include a move into advertising. By the next issue we anticipate that we will carry ads in our Newsletter and on our website. Hopefully in future you will be turning to SEABC for career opportunities and supplier information.

And kindly remember to rejoin SEABC next year. We hope you like supporting your structural engineering voice in British Columbia and enjoy belonging to SEABC. Now we are "on our feet" we are planning bigger activities, extra convenience, and more information and of course better communications. Look for further details in our next Newsletter.

IStructE News

By David Harvey; Director, SEABC

As many of you know, I had the enormous privilege of serving as the President of the Institution of Structural Engineers for the previous session. This was an opportunity both unexpected and not to be missed, and with IStructE headquartered in London, was logistically challenging.

Many of you have asked about my year away, and I can tell you how enriching it was to meet fellow structural engineers from all corners of the globe and discuss the problems that we all share. Structural engineers everywhere are delightful people, very approachable, always interesting and striving to make a difference in the lives of fellow citizens. As a Canadian, my goal was to bring the perspective of the overseas member to IStructE, so that it could strengthen its international interests. While the experiences serving the Institution were memorable, it is a great comfort to be home and back at work.

This year is IStructE's Centenary session. In the previous Newsletter I reported on Centenary President Sarah Buck's visit to Vancouver during which she and SEABC President Dave Davey signed an Agreement, under the terms of which SEABC will operate as the local Division of the Institution. One key advantage to SEABC members (that are not already members of IStructE) is that they can now access Institution publications through the Members Only section of the website. To do this, members must obtain their account by contacting the SEABC Webmaster.

This year, IStructE groups across the world are holding special events to celebrate the Centenary. In Vancouver we hosted the very successful 2008 Structures Congress, which the Institution co-sponsored. The flagship events included the Centenary Conferences in Hong Kong http://www.istructe.org/centenary/conference.asp and London, both attracting over 400 delegates from across the world. The London conference culminated in the Centenary Dinner at the Guildhall where a cake cutting ceremony was conducted by the Institution President and no less than 17 former Presidents.

July 21 was the date on which the Concrete Institute was incorporated as a technical society in 1908. On that day, 17 founders met at the Smoking Room of the Ritz Hotel, Piccadilly, at 2:45 p.m. for a meeting that lasted 15 minutes. The Ritz, which opened in 1906, was then the finest location in London. The main issues at the time were related to the emerging use of reinforced concrete as a structural engineering material, hence the original name of IStructE. Fourteen years later the early material focus had broadened, and so the Institution name we use today was adopted.

Fittingly, a ceremony was held on July 21, 2008 in the same room (now renamed!) at the Ritz Hotel, attended by abound 100 members of Council, former presidents, staff and guests. IStructE Chief Executive, Keith Eaton, suitably dressed in Edwardian attire, read the minutes of the inaugural meeting. Sarah Buck congratulated the Institution for its past achievements, and described the celebratory events taking place across the world. She then presented the hotel's General Manager, Stephen Boxall, with a plaque celebrating the unique occasion. Stephen, who undertook to mount the plaque prominently so that it could be readily viewed by visiting structural engineers, commented that it was a rare event when guests returned after 100 years! Sarah wrapped up the ceremony by launching the "What's Your Favourite Structure?" campaign, inspired by the cityscape, commissioned by IStructE from artist Steven Wiltshire. You can join the experience by casting your vote at http://www.istructe.org/stephenscityscape/index.aspx

It was an honour for member of Council, Patrick Lam, and me to represent structural engineers from British Columbia at the ceremony. We, along with the others present, had a great sense of occasion and came away feeling that we were now a part of history.

Sustainable Design…Relevant to a Structural Engineer?

By Mark Porter, LEED AP

For most of us the response will be "Yes, of course", but what does sustainable design actually mean? Does it affect what we do as specialist engineers? Does it alter the way in which we interact with the rest of the design team?

Sustainable development

Sustainable development is often likened to "treading lightly" on the planet; or more accurately, using resources, while preserving the environment, in a way that meets present needs and those of future generations.[i] Sustainable development should provide balanced social, economic and environmental benefit to us all. Until relatively recently, the result of technological advance has been economic, followed by social development, with little thought given to environmental consequences. However, this lack of understanding has created an issue that we now have to rectify. There is broad consensus by climatologists that carbon emissions are affecting our climate. It is also widely accepted that we are consuming naturally occurring resources at an ever-increasing rate. Nonetheless, the worldwide demand for housing, employment and a better quality of life continues to grow. Somehow the engineering community has to reduce the demands on the environment while improving the quality of life.

This issue is no longer an academic debate. Across the world, governments are establishing laws, codes of practice and international agreements to employ a sustainable approach to development. The Government of Canada has a long-established Sustainable Development Strategy and the Federal

Sustainable Development Act received the Royal Assent on June 26, 2008 which requires the Government of Canada to create and implement a Sustainable Development Strategy for all of its development activities.[ii] As a result, sustainable design is here to stay.

Structural responsibility[iii]

Assessing and reducing the environmental footprint of a development means that as structural engineers, we need to expand our thinking when it comes to design decisions. Examples of this are:

- The choice of a structural system and material is based on fitness for purpose. The factors within fitness for purpose are usually a matrix of supplied cost, availability, site constraints and local knowledge. In a sustainable design, this matrix needs expanding to include the maintenance cost, the energy to produce, construct, maintain and deconstruct, the recycled content within material, the source of material and the end-of-life disposal. Basically, decisions need to be guided by life cycle cost considerations.
- The integration and combination of structural engineering with other disciplines is key in minimizing waste and energy. The question should be asked: "Can the structural force-resisting system have another use for the building as a whole?"
- To minimize the energy used to keep a development today in use for future generations, we as designers need to give thought to how adaptable our solution is to change; including change of use, change of layout and ultimately change of form (deconstruction).

Design Approach

Structural engineers will therefore no longer be asked to design a structural force resisting system in isolation. In a sustainable design, visual form and layout, energy efficiency and material use are all important. The impacts of decisions affect all members of the design team, including the client. To achieve successful sustainable development, it is vital that all members of a design team are brought together at the concept stage. Integrated working is necessary to achieve the optimum design for all disciplines.

As the project evolves through design and construction, the need for integration of the design and construction team is just as important. Each change to an individual element may have an effect on another part of the structure, not immediately considered by any one individual. Structures become almost 'living' by their inter-dependency on all disciplines. For example: changing the amount of recycled content in a concrete mix may mean that the source material for architectural flooring has to change to attain target recycled content for the whole building.

The thought process and attitude towards design has to become more holistic.[iv]

Next Steps

To be able to design sustainably requires some effort from us as professionals. It is in our best interest to gain the knowledge since there will be increasing pressure from governing bodies to incorporate the principles in our projects. Ethically, there is an argument to suggest that our professional code requires that effort. The demand for 'green' building is growing and there is already a growing gap in the number of people who can properly service those projects.

There are a number of useful resources already in existence to help those who are interested in finding out more.

- For general information on 'building green', Light House is a great local resource here in B.C. (www.sustainablebuildingcentre.com)
- The CaGBC (www.cagbc.org) is the administrator of LEED certification and has local representation through its Cascadia chapter (www.cascadiagbc.org)

To make it more specifically relevant to engineers, APEGBC has already published Sustainability guidelines[v] and is organizing a number of seminars and courses with more targeted topics being planned for the near future through the Sustainability committee. A specific introductory course aimed at structural engineers is currently being presented across the province by Diana Klein, P.Eng.

Finally, here within the SEABC newsletter, a regular sustainable corner will highlight different aspects of sustainable design as it applies to structural engineers with pointers for further information and learning.

Contributors:

- Mark Porter, P.Eng., LEED A.P. porterm@ae.ca
- Michael Blackman, P.Eng., LEED A.P. mblackman@rjc.ca

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ii. An Act to require the development and implementation of a Federal Sustainable Development Strategy and the development of goals and targets with respect to sustainable development in Canada

iii. Structural Engineering in the ecological age of civilization, Campbell/Head, The Structural Engineer, Centenary Issue, 21 July 2008

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On the Web

By Stephen Pienaar; SEABC Webmaster

NEW ON THE WEB

We are regularly updating the SEABC website with information of current seminars, local industry events, and webcasts by our southern neighbours. Please bookmark www.seabc.ca, and check back regularly for updates.

Online payments

With the September term of CSE courses around the corner, we are taking the first strides towards accepting online payments. You can now submit your course application online and pay by credit card (you are still welcome to mail your application form and cheque if you prefer). As well, if all goes to plan, we will be ready to process online membership renewals in 2009.

IStructE website access

SEABC members qualify for access to the members area of the IStructE website. This is a golden opportunity to gain access to The Structural Engineer Online and a wealth of other information. For more information and obtain an online account, write to webmaster@seabc.ca.

Share your photos

The SEABC website is growing and we would love to use your structural engineering photographs on the website. Please send your submission to webmaster@seabc.ca. We will give credit for all pictures used. By submitting your pictures, you are granting the SEABC permission to use them on its website and other communications.

Kicking Horse River (Park) Bridge Erection

By Martin Bollo, P.Eng., S.E., SEABC Education Committee

MAY SEMINAR RE-CAP

The SEABC May Seminar featured a presentation on the erection of the Kicking Horse River (Park) Bridge by Robert Gale, P.Eng. of KWH Constructors Corp. The room was full for this presentation on an innovative launching method that resulted in the successful construction of the four steel plate girder bridge on top of concrete piers that reached 90 meters in height.

The project was located at the highest point along Highway 1 in B.C., approximately one hour from the Alberta border. The new bridge served as a replacement for the original bridge that had been completed in 1956. But the high accident rate, risk of rock falls, and a projected traffic increase led to the need to replace the old bridge. The new Park Bridge included 5.8 km of new roads and made up the second of three phases of improvements to the nearby highway.

The total capital cost for the bridge and associated road improvements was $130 Million. The bridge was 404 m long and crossed the river, a rail line, and the old highway alignment. It consisted of six spans, and the girders were 3 m deep with a total steel superstructure weight of approximately 2700 tonnes. The bridge was supported by concrete piers that reached as high as 90 m from grade, and traveled along a 6% grade with a horizontal radius of 550 m. Three million cubic meters of material were excavated as part of the project.

The steel plate girders were launched in pairs up the 6% slope. The decision to launch the girders were driven by three factors:

1. The height of the bridge;
2. The site constraints (crossing the open old highway, the river and CP Rail line, as well as the uneven terrain and steep mountain slopes); and
3. The beneficial safety aspects of being able to assemble the girder pairs on a launching bed that was at ground level.

The launching setup consisted of hydraulic equipment and controls housed in two containers, an assembly bed that included the jacking ram and reaction frame, and a nose girder connected to the leading edge of the girders. A tail extension was also added to the end of the girders for very the last part of the launching process. Hilman rollers were located on each of the piers as well as additional side rollers to guide the horizontal alignment of the constant-radius bridge. The girders were incrementally launched by using a flange clamp to grip the girder and push it forward 1.5 m, at which point a wedge brake held the girders in place while the ram was retracted. The process was then repeated and by the end of the project, the girders were being launched at a rate of 18 m per hour. It required a total of 270 pushes at 1.5 m each to get one girder-pair to the east abutment.

Girder splices were located on the outside portion of the girder flanges so that the inside portion formed a smooth surface for the Hilman rollers. Once the girders were in place the girders were jacked up, the rollers were removed, the bridge bearings were put in place and the assembly was then lowered and welded onto the bearings. Great care was taken to time the lowering down and welding of the girders so that thermal movement was minimized.

A web-cam was installed at the site to assist in remote monitoring of the work. Mr. Gale concluded his talk with an impressive time-lapse clip of the erection sequence made from spliced daily web-cam photos.

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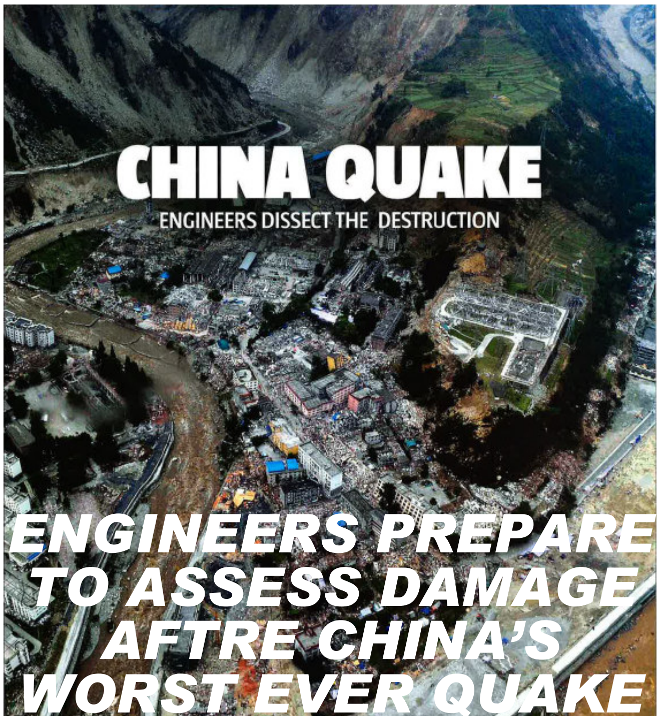


ENGINEERS PREPARE TO ASSESS DAMAGE AFTRE CHINA'S WORST EVER QUAKE

By Jessica Rowson

Key roads cut off by landslides and collapsed bridges, isolating ravaged towns and hampering the relief effort in Sichuan.

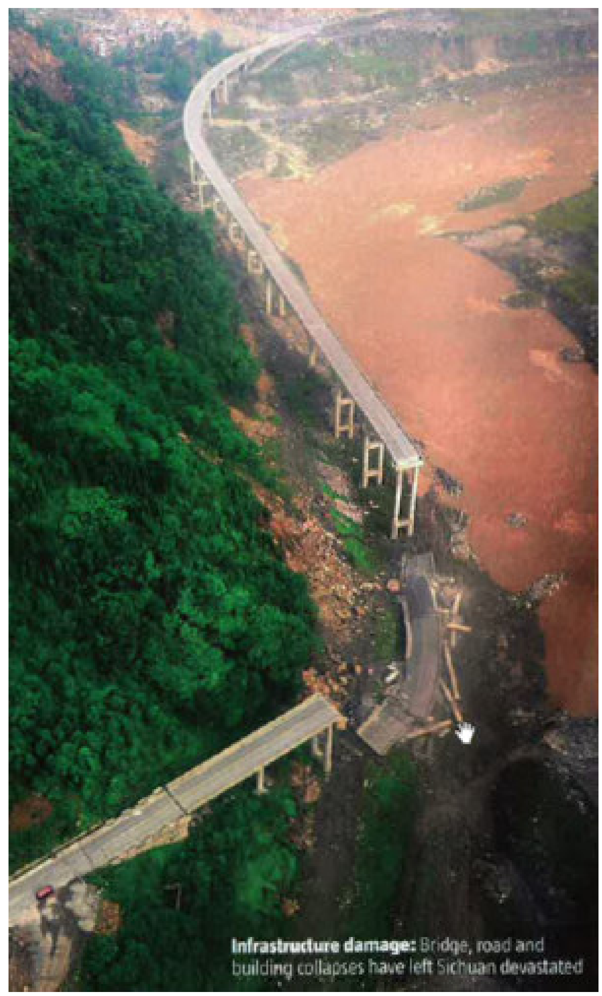
Serious damage to vital road infrastructure was this week hampering efforts to provide emergency food and shelter to those caught up in the magnitude 8 earthquake that shook China's Sichuan Province earlier this month.

The earthquake occurred in Wenchuan County in south west China's Sichuan Province on 12 May.

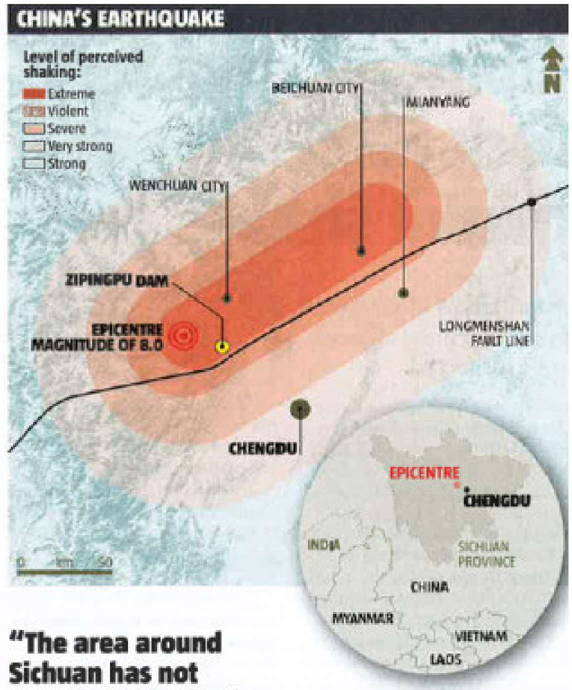
As NCEI went to press, the latest figures indicated that over 40,000 people had died, 250,000 were injured and over 30,000 people were missing.

The quake triggered numerous landslides in the mountainous province. It also damaged 33,333 ha of farmland, including more than 10,000 ha of wheat and canola and more than 20,000 ha of vegetable fields.

Mountain roads connecting Chengdu the regional capital with the quake-hit zone were cut off by landslides, and bridges alongside and across the river Min were badly damaged.



Infrastructure damage: Bridge, road and building collapses have left Sichuan devastated



"The area around Sichuan has not experienced seismic activity for a long period of time. The buildings in the area would not have been allocated high risk"
Chitr Lilavivat

Other infrastructure hit included the concrete-faced rock filled Zipingpu Dam and countless public buildings.

"The road infrastructure has been damaged in two ways," said Hong Kong based Atkins director Patrick Ng.

"Some of the bridge panels between columns have dropped down onto the river bed. With those road sections cutting into the mountain sides, there have been major landslides. Large boulders have come down from the steep hillside, some are the size of half a house."

The damage has isolated many of the worst affected villages hampering efforts to get supplies in and people out. Efforts to bring in heavy lifting equipment to rescue trapped people and clear damaged buildings have also been hit.

Some aid has been parachuted in by helicopter and people have been transported on the Min River.

More than 5M buildings have been confirmed destroyed and more that 21M were damaged in the earthquake.

Local news reports claim, over 80% of the building in Beichuan City have collapsed.

The government is reported to be planning to preserve the town as a memorial and relocating its inhabitants.

Arup head of earthquake engineering Ziggy Lubkowski said that while modern Chinese design codes were comparatively strong by international standards, much of the building stock was built before the late 1970s, when these codes were developed.

"The modern Chinese codes are equivalent of the best of the West and are actually in front of Europe and America," said Lubkowski.

"On certain types of buildings, there is a two level design. The design has to show that there is no damage for smaller earthquakes and for bigger earthquakes there's no collapse. In the United States and Europe we just design for loss of life.

"However, there are a lot of relatively old buildings in their building stock and it looks like the buildings that suffered were the ones built before codes of practice or before better monitoring," he added.

Ng added that in Beijing and Tianjing, high risk structures are designed to withstand magnitude 8 earthquakes.

"This earthquake, at 8.0 is already at the ultimate outer scenario," he said.

He also pointed out the not all buildings are designed to the same level as there are variations between regions according to geological and seismic data.

"The area around Sichuan has not experienced seismic activity for a long period of time," said the ICE's local representative Chitr Lilaviavat.

"The buildings in the area wouldn't have been allocated high risk."

The Institution of Structural Engineers-backed Earthquake Engineering Field Investigation Team (EEFIT) has confirmed that it wants to send a team of engineers to Sichuan to investigate building and infrastructure damage.

The investigation would help to improve understanding of structural behaviour under seismic loads and evaluate the adequacy of current design practices and regulations. Structures left standing are being assessed by Chinese government engineers.

"Ideally there will be a disaster management plan at local and district level where they [the Chinese authorities] will be checking critical facilities, communications, dams and checking them off the list or repairing," said Lubkowski.

"In the US, there's a traffic light system, where one structural engineer will walk down one side of the road and one will walk down the other and will put a red, amber or green sticker on the buildings. A red one will mean that there is a serious problem and it needs to be pulled down, an amber one means that it needs a proper review and a green sticker means that it can be used straight away. Every country will have its nuances."

Ng remained less optimistic about the area which has been devastated by the earthquake.

"Virtually all buildings in the area are collapsed or unfit for occupancy.

"There are not many buildings left to be assessed as the majority are already collapsed."

Aftershocks still plague the region. Nearly 9,000 people were evacuated from Qingchuan following the appearance of 0.5 m wide cracks in a nearby mountain. The mountain has sunk by up to 1 m in places. It is feared that new aftershocks or heavy rainfall could trigger serious landslides.

"An earthquake on this scale happens more often than you think" said Lubkowski.

"All around the world there is maybe one magnitude 8 earthquake or greater per year, there are 15 magnitude 7 to 7.9 on average and 140 measuring 6 to 6.9. These might occur in the middle of nowhere.

It's when it hits a populated area when there's a problem. It's not the earthquake that kills people; it's the infrastructure that we build that kills people. The key is to design it adequately and construct it correctly."

New York Penthouse Crushed After Second Tower Crane Collapse This Year

By Adrian Greeman in New York

Crane connection to tower probed as cab topples from tower, killing two.

Investigations into a fatal tower crane collapse in New York, on 30 May, are focusing on connections between the crane jib and its tower.

Eye witnesses to the collapse said that the crane's jib came away from the tower at the point where the cab was connected to the crane. Investigators were considering the possibility that welds to the slewing ring assembly were cracked or had become so.

The crane fell into a 23-storey block crushing the top apartment block. The driver of the crane and a construction worker below were killed. Another was seriously injured.

The collapse is the second in the city this year. In March six workers died after a tower crane's 61m high mast broke free of the building it was attached to, crashing into an apartment block on the other side of East 51st Street. (See page 16). The crane's height was being increased at the time.

It is unclear at this stage whether the latest accident occurred during a similar self erecting operation.

Circumstances surrounding the collapse are being investigated by the City's District Attorney office.

The District Attorney's office confirmed that recent repairs made to the crane would be examined" among many other things" but would say nothing more definite at this stage.

Fire Department and city Building Department officials are also investigating the incident.

The crane was used for construction of a 35 storey apartment block on the junction of 2nd Avenue and 91st Street in the exclusive Upper East Side of Manhattan. Work had reached around the 10th floor.

The crane was supplied to the project by the New York Crane & Equipment Corporation. The company refused to comment on the incident.

Replacement I-35W Bridge Span Construction Begins

Erection of the main span of Minnesota's new bridge began last month with the first pair of precast concrete main span segments put in place. The structure will replace the original bridge that collapsed in August 2007. Work is also continuing on the ground on the fabrication of the last few of the 120 precast concrete segments for the main span. On the north side of the project, the concrete pour for the northbound and southbound approach spans is ongoing. A Flatiron-Manson joint venture is the design and the build contractor and Figg Bridge Engineers is the designer. The $240M bridge is due to open by the end of the year, in less than 18 months after the original collapsed.

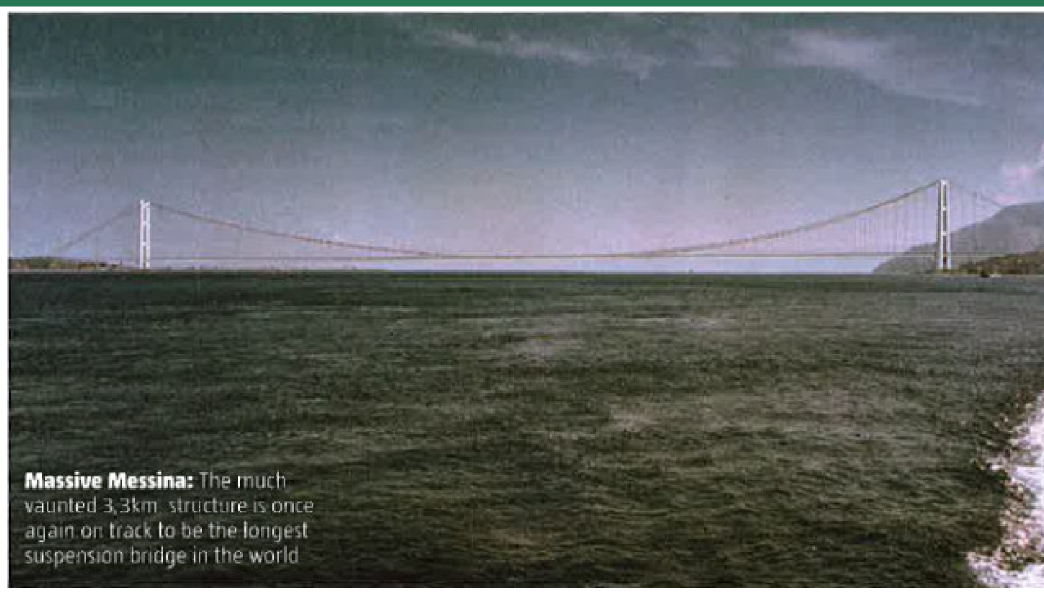
China mega-motorway bridge opens to traffic

Hangzhou Bay Bridge, the longest trans-oceanic bridge in the world, opened to the public last month. It is 36 km long with six lanes in each direction. However massive traffic jams have been reported as the drivers have slowed down to admire the views. The Hangzhou Bay Bridge links Shanghai to the industrial city of Ningbo across Hangzhou Bay, cutting the driving distance between them by 120 km.
The bridge was the first major mainland infrastructure project in China to invite private investment.

Messina is Back on Blocks

By Damian Arnold

Berlusconi's return to presidency puts Italian mega bridge back into country's infrastructure plans.



Massive Messina: The much vaunted 3,3km structure is once again on track to be the longest suspension bridge in the world

Construction of the Messina crossing between Italy and Sicily could be underway by the end of the year, the consortium originally appointed to build the mothballed bridge claimed last month.

Silvio Berlusconi's recent triumph in the Italian elections means that the much-vaunted 3.3 km-long structure is again on track to be the longest suspension bridge in the world.

A construction consortium led by Italian contractor Impregilo was set to start building the bridge before Romano Prodi ousted Berlusconi in the May 2006 presidential elections and scrapped the project on cost grounds.

"The new government wants to restart the bridge and I will be very happy if we are starting again with construction within this year," said Stretto di Messina consortium technical director Guiseppe Fiammenghi.

Speaking exclusively to NCEI, he added that he did not see any problems with reactivating the design, build, finance and operate contract that the consortium signed in 2005.

But he said the contract, which allowed eight ears to design and construct the bridge and 30 years to operate, would have to be renegotiated as a result of the two year delay. Fiammenghi said this should be a very straightforward process.

"It depends on the willingness of the new Minister of Transport but this is something that can be done very easily," he said.

"We have already designed a bridge that has been approved by many people.

"The bridge is a very challenging and difficult project but there is now strong political willingness."

Fiammenghi added that Stretto di Messina, which is led by main contractor Impregilo, was already looking to increase staff levels after being wound down in the last two years.

The next step to move the scheme forward would depend on the appointment of a new Transport and Infrastructure minister.

The bridge is said to have a budget of $7,6bn and Fiammenghi added that he did not expect this to rise too much despite soaring materials costs.

"The cost of the raw materials is a low percentage compared to the final cost of the bridge," he said.

Fiammenghi added that Berlusconi will need to press on quickly with the project to ensure the continued support of Rafael Lombardo and his Movement for the Autonomy of Sicily (MPA) that strongly supports the project. The party was vital in helping Berlusconi secure a parliamentary majority, said Fiammenghi.

Other firms that have been involved in the project are UK consultant Flint & Neill, which was advising the client, US firm Parsons International which had been appointed project manager and Danish consultant Cowie.

Sequential stressing: The strand jacks had to be stressed in a specific order to avoid deforming the arch

Jack Arch

By Jessica Rowson

The ailing Clyde Arc needed securing and repairing in double quick time after the failure of a key component. ***Jessica Rowson*** *reports on the 24/7 work to get the bridge up and open in six months.*

The Clyde Arc, a labour of love and four years hard work for the Nuttall and Halcrow design team opened in 2006 to awards and applause. It fast became a symbol of Glasgow, with its stunning shape integrated within local company insignia. The structure itself formed the backdrop for the BBC Glasgow evening news.

But when the project was back in the news in January, it was for all the wrong reasons.

At 11:30 pm on Monday 14 January, a connection failed causing a 35m long Macalloy bar to fall onto the carriageway below. The bar was one of 14 tension bars which suspended the deck from the bridge's bowstring arch. It was connected to the steel arch with a custom connection.

Fortunately the bridge was free from traffic at the time of failure (NCEI February).

It was closed immediately. A second crack in another connection was found 10 days later, prompting a decision to replace all the existing connections.

And so it is back to site for the construction team. Contractor Nuttall and steel supplier Watson Steel have worked tirelessly to secure the bridge and install the temporary works necessary to allow the bars to be taken down one by one and their connections replaced. After continually working for the last three months, the temporary works are now finally in place. The team has just had its first weekend off in months.

When the hanger came down in January, the team had to act fast to secure the bridge. The first job was to replace the failed hanger; the bridge is designed to function with one hanger missing but, with the performance of the other hangers called into question, it was imperative that the failed hanger be replaced as soon as possible.

But a new bar had to be made in Sweden and needed between 16 and 20 weeks to procure.

Therefore a temporary measure had to be employed in the interim. Twinned M90 Macalloy bars were used as they were readily available. They were connected to the arch and the steel deck by custom Watson Steel connections.

"Watson installed the replacement hanger in the dark," recalls Nuttall contracts manager Dougie Grant. “They were lifting 30m long bar with a lifting beam [used to stop the bending of the bar during installation], trying to twist it to get it where they wanted it to sit and levering it from a basket on a crane.

The replacement hanger was installed by the end of January and discussions on how to support the deck while all the hanger connections were replaced was something that happened in parallel.

"We could have propped the deck from underneath," explains Grant.

"But the piles that were used in the original temporary works had been burnt off under water and it would have been difficult trying to locate them."

That option was swiftly discounted. Another option was to support the deck's transverse beams -which connect to the hangers - at each end using piles. But this too was ruled out.

"We would have needed a 300t crawler crane," says Grant. "At that time of year it's very windy and there would have been considerable risk. Also it takes four to six weeks to procure piles and due to the tapering nature of the outrigger beams we would have needed all kinds of packing."

Having ruled out supporting the deck from underneath, the team decided to, as Grant puts it, "use the arch to support the bridge deck as it was originally intended to do."

They started looking at the simplest solutions: straddling the arch with steel support units or saddles and then sending strand jacks straight down to pick up the ends of the transverse beams. But this would have involved taking the cables straight down and drilling straight through the deck, a solution, not favoured by the client, Glasgow City Council.

The temporary works designer suggested taking the strand jacks down to temporary outriggers in a similar way to the original bars. After looking at several variations the optimum solution was decided on.

This involved installing five saddles along the top of the arch. Temporary outriggers were welded to the ends of transverse beams which pick up the ends of the strand jacks. The outriggers protruded enough to eliminate the need for the strands to pass through the deck.

Halcrow had to check the impact of the temporary works on the permanent works, including what equipment would be used during the repair works. A forklift and a cherry picker were decided on.

The design of the saddles involved complex loading and geometric modelling.

"The geometry was key," says Grant. "Each saddle was different and had to exactly pick up the angle from the top of the arch. Also each of the outriggers was a [custom design].”

When the saddles arrived on site, Watson had to use ultrasound to detect 50mm diaphragm plates embedded in the arch. The saddles were then positioned on these higher strength locations.

Once the outriggers and saddles were in place, the strand jacks could be installed.

"We had to lift the saddles up and bolt them on," says Grant.

"Then we dragged the cables across and fixed them. The cables were very heavy, with one of the strand jacking components weighing two and a half tonnes."

The strand jack stressing operation took place in three stages; 15%, 45% and then finally 100% of the load was put into the strand jacks. At 100% load the strand jacks are carrying the load of the deck.

Also the strands had to be stressed in a specific order to ensure that the arch was loaded evenly and did not deform.

All the strands were fully stressed by Friday 11 April, allowing work to begin on replacing the tension bar connections the following Monday.

The connection components being replaced are milled steel instead of cast steel; a decision taken by the connector suppliers.

The new milled steel connectors are made from 250mm thick plate.

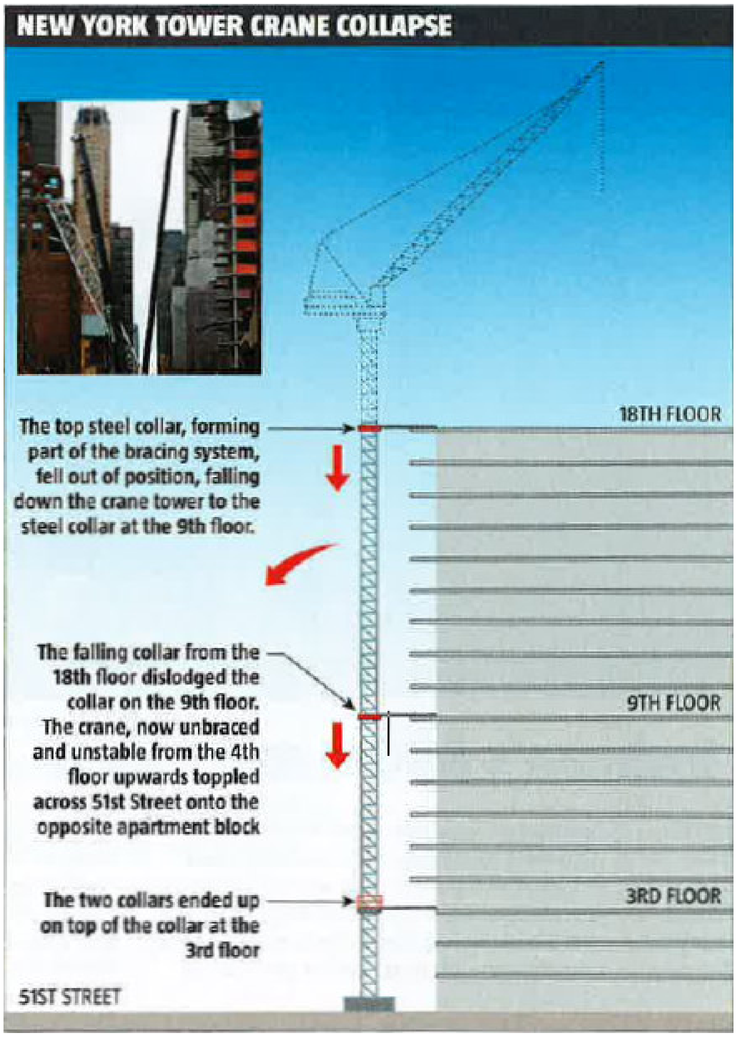
Nuttall and Watson Steel need one and a half days to take down the existing hanger, take the old connections off, screw the new connections on and replace the hanger. This means that 21 days will be needed to change all the hangers. Once they are all replaced and stressed, the load is transferred back to the hangers and the temporary works can be removed. During May and June, peripheral works such as repairing the parapet and road surface damaged in the initial fall and repainting will be completed in time for the grand reopening of the bridge this June, restoring the Clyde Arc to its former glory.

Work Starts on Incheon's 800m Main Span

Construction of the 800m main span for South Korea's Incheon bridge was due to start in April following the completion of the east and west side spans in March and completion of the 230.5m high cable stay towers in February. Contractor Samsung Corporate joint venture will also start installing main and side span cables shortly. Side span sections were installed using a 3,500t floating crane and were initially supported by two temporary construction piers as well as permanent concrete sidespan piers. Client is Incheon Bridge Company, project manager is Amec and the steel work subcontractors are Hanjin Heavy Industries of South Korea and Zhenhua Port Machinery Company of China. Completion is due in October 2009.

New York Crane Smashes Through Apartment Block

By Kevin Walsh



Lack of redundancy in the support bracing system has been identified as the likely cause of a deadly tower crane collapse in New York City in March.

It has emerged that retired contractor and local resident Bruce Silberblatt had lodged a formal complaint with the New York City Department of Buildings (DOB) a week and a half before the crane collapsed, arguing that contractors had failed to use enough bracing to support the crane.

"There should have been more bracing"
Bruce Silberblatt, local engineer

Six construction workers and one member of the public died, 24 were injured and seven neighbouring Manhattan buildings were damaged when the tower crane's 61m tall mast broke free of steel braces and crashed into an apartment block opposite the site on East 51st Street.

"There should have been more bracing. There was no redundancy that was the problem," said Silberblatt. "Redundancy has to be brought back into common practice in the whole of the US, not just New York."

Silberlatt's complaint is one of 38 lodged with the DOB since 2005 over the construction of the 43-storey apartment block that the crane was to work on.

The DOB released a statement saying that a heavy-duty steel collar, which should have been firmly attached to brace struts on the crane on the 18th floor had fallen from the building before the collapse. This damaged other crane supports as it fell.

"Workers were adding tower sections to extend the crane upwards," says the statement.

"While crews were jumping the crane to the 18th floor, a heavy duty steel collar, which wrapped around the mast of the crane and used to tie the crane to the side of the building, fell as workers attempted to install it.

"When the steel collar fell, it damaged a lower steel collar, installed at the 9th floor."

This collar served as a major anchor securing the tower crane to the building under construction. Without it, the 61 m tall mast fell.

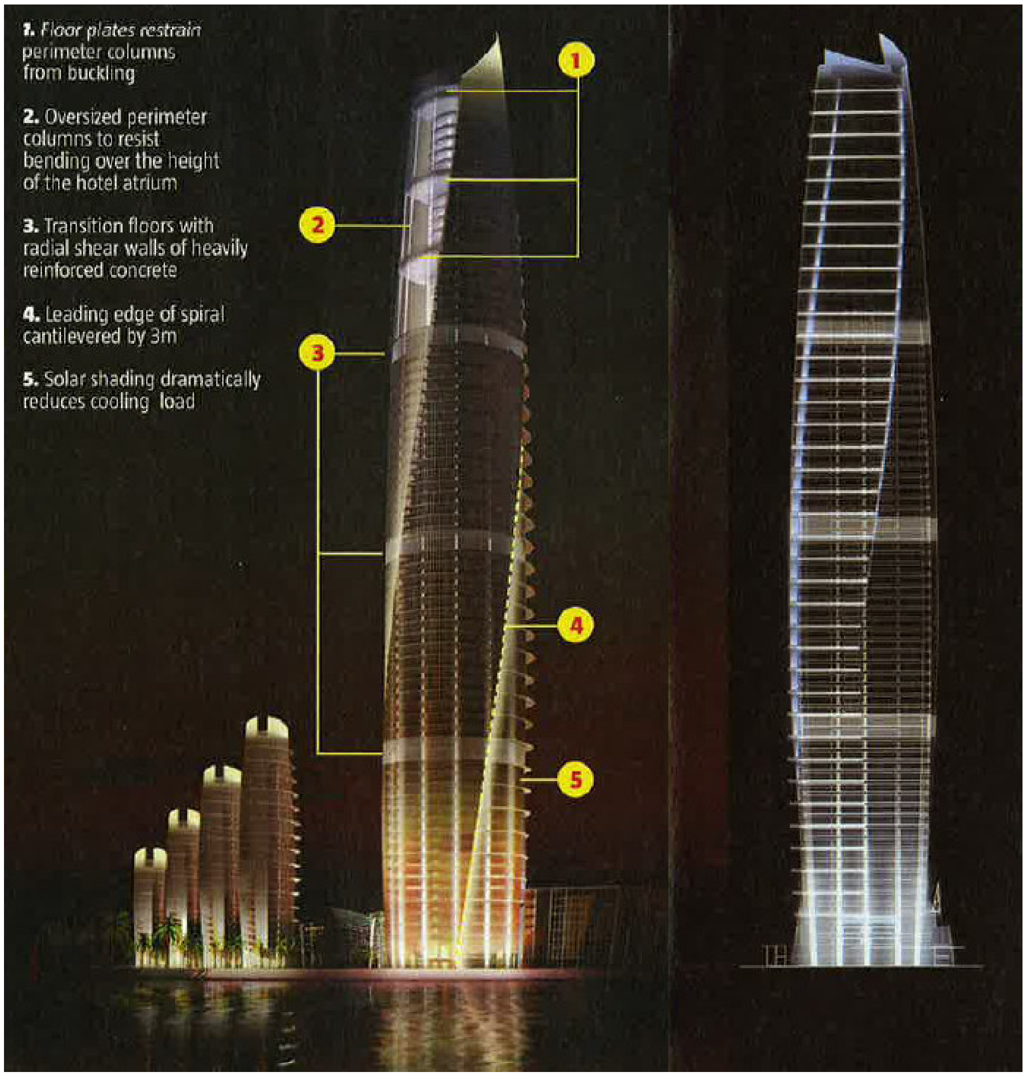
Manhattan Borough president Scott Stringer said: "It's clear that the current Buildings Department construction safety oversight protocol is not working, and we can't keep going on like this."

Forensic engineers from the DOB are currently trying to determine whether mechanical failure played any part in the incident.

Reliance Construction Group, the project managers for the site refused to comment on the collapse, as did a spokesman for crane supplier the New York Crane & Equipment Corporation.

Karachi Cracker

Building a super tall tower in Karachi calls for international know-how and an understanding of local subcontractors' capabilities.



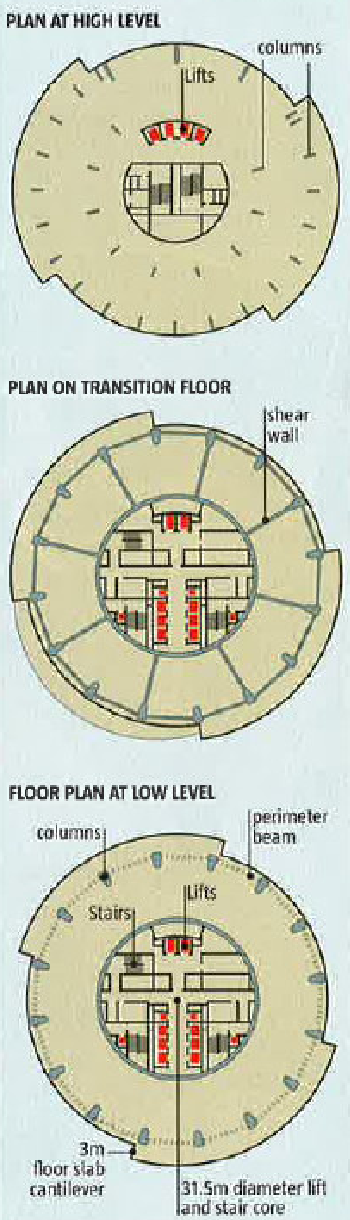
In Karachi, Pakistan's second city, a tall building is characterized as anything over 10 storeys. The loftiest have reached 20. So it is no overstatement to say that the 78 storey Karachi Port Tower, construction of which is scheduled to start this year, will transform the city's skyline.

Compared to the Burj Dubai, which will be the world's tallest building at 146 or more storeys, 78 storeys doesn't sound so remarkable. But Karachi Port Tower will be the tallest building on the Indian subcontinent.

Building on this scale in Pakistan is a one-off and poses some interesting challenges. Nobody in the country has ever carried out a site investigation for a building of this size before. Exceptionally deep and large foundations are required but local batching plants are not equipped to produce concrete in the volumes and strength required. The specialist falsework, formwork, cranage and concrete pumping equipment needed for ultra-high buildings does not yet exist in Pakistan.

"Construction will require international know-how, but with local knowledge. Three joint ventures of foreign main contractors with local firms have been shortlisted," reveals Mott MacDonald director Steve Gregson, who is leading

KARACHI TOWER



structural, facade, mechanical and electrical, and fire engineering. "But whichever of the three is selected, they will be heavily reliant on local subcontractors."

Throughout the design process a close eye has been kept on buildability and making the structure suitable for local conditions and skills.

THE BIGGER PICTURE

Karachi is 200km from the nearest seismic fault line and is generally regarded as at low to medium risk from earthquakes – UBC seismic zone 2B. But, because nothing even a fifth as tall as Karachi Port Tower has been attempted in Pakistan before, Mott MacDonald decided to reassess the seismic risk.

"Our specialist geotechnical engineers have just completed the analysis and concluded that for the purpose of this project Karachi should be treated as seismic zone 3," says Mott MacDonald director Steve Gregson. "Complying with structural requirements for zone 2 is easier. Taking it up to zone 3 introduces some major structural issues."

And "sloshing" tuned mass dampers will be installed on the tower's roof. These will consist of water tanks connected by large-diameter pipes with tuned baffles.

QUAKE ENGINEERING

- Karachi Port Tower forms the focal point in a scheme involving construction of a conference centre and five residential towers.
- Underlying the complex will be a double-storey, 2,000-space subterranean car park.
- The only vehicles seen above ground on site will be the Port Trust's fleet of electrically powered service trucks.
- Power cuts are commonplace in Karachi. To prevent the tower being plunged into darkness, it is being equipped with twin 132kV power supplies – in Karachi the high voltage supplies are less affected by cuts than low voltage lines. In case of blackout, the complex also has its own generating plant.
- Karachi Port Tower will have its own water and waste water treatment plants.

Focal point: Karachi Port tower is part of a larger scheme

Client Karachi Port Trust is the port authority and operator and is also a major property and infrastructure owner. It is undertaking the project on a speculative basis. In addition to office space it also wants housing, a hotel and a conference centre, and it specified "something iconic". Mott MacDonald and architect Aedas won the design competition last year, and are taking the design to "detailed concept" stage.

Offices will occupy ground level up to floor 58, a hotel will take up floors 59 to 76 and the top two floors will be apartments and leisure facilities. The contractor will be appointed to deliver the $396M-plus scheme under a FIDIC design and build contract.

Steel construction is rare in Pakistan, so Karachi Port Tower will be built from concrete. It will consist of a cylindrical core ringed by columns at the building's perimeter. Structurally, square cores are stiffer, Gregson notes. The cylinder was specified for architectural reasons and to achieve spatial efficiency within the tower's circular footprint. But lack of stiffness has been more than made up for by increasing the core's diameter to 31.5m and tying in the ring of perimeter columns.

The core size and other aspects of the structural design were dictated by the post-9/11 rethink of fire evacuation from tall buildings, driven by Mott MacDonald's fire specialists.

"You used to be told 'if there's a fire, evacuate using the stairs'," says Justin Garman, one of Mott MacDonald's fire engineers. "But the World Trade Centre disaster showed that stair capacity wasn't enough, and that some people were physically incapable of descending tens of storeys by stair.

"So now, for very tall buildings, lifts are being looked on as integral to the fire evacuation strategy." Lift capacity has been designed for an office population density of one person per $11m^2$, so there will be a lot of them.

Karachi Port Tower will be equipped with a combination of express and local lifts. High speed lifts, moving people over large numbers of floors, will be double deckers. Passengers will then catch local lifts from transition zones to their destined floor.

Over the height of the tower there will be three transition zones. Structurally these are very different to the tower's typical open plan floors. Floor slabs throughout the tower will be 260mm thick post-tensioned concrete, stiffened by a 400mm deep edge beam. Columns will be tied into the circular ring by an 850mm-deep downstand.

But the two-storey transition zones will be of far heavier construction, with thicker floor slabs and heavily reinforced concrete outrigger shear walls running from the core to the building's perimeter columns. Each zone will house a technical floor dedicated to building services, and a fire-proofed refuge. It is to these refuges that people will be led if fire breaks out. They will then be speeded to ground level in express lifts.

The transition zone shear walls play an important role in linking the core and columns. Gregson says that at the lowest of the technical floors the stiffening effect of the outrigger walls is minimal. "When we modelled the structure we found we don't need outrigger walls there, so we've omitted them and gained a fairly significant cost saving."

Design has had to deal with the age-old problem of differential axial shortening between core and columns under dead load. This occurs when a structural member is squashed by the weight of the structure above. The taller the column, the greater the degree of potential shortening.

Sized purely for structural efficiency, columns would have shortened by more than 75mm, Gregson notes. "You can allow for a degree of axial shortening by introducing a slight camber into the floor slab. That camber comes down as you build the structure up, and the floor ends up level." But a greater than 75mm correction was at the edge of technical feasibility.

Columns have therefore been sized to reduce stress and shortening. In plan they are elongated triangles with rounded corners, measuring 2m wide by 3m deep. Column sizes diminish as they rise up the building - first in width, then in depth.

Mega columns are required over the height of the tower's hotel atrium, slicing through the topmost 25 storeys. "Five columns are left free-standing by the atrium," Gregson says. Perimeter beams every five floors provide lateral restraint - columns follow the cigar-like profile of the tower's facade, so are subject to considerable outward force. Otherwise, the columns are structurally independent.

Gregson says that lower down the tower, axial shortening could have been reduced by specifying very high-strength concrete. "But we want to keep the concrete mix within the realms of what is feasible in Pakistan."

Achieving C100 would require the use of exotic additives and very precise mix control. C65 concrete will be easier to batch and more forgiving in construction.

Concessions to the local construction market have also been made in the arrangement of columns and in the tower's foundations. Karachi Port Tower's facade is dominated by a spiral that twists through 180° over its height. "We initially looked at following the spiral with the columns, so they would have been raking," recalls Gregson. However, "to make them work it would have required very heavy reinforcement and precise steel fixing. Because there's no precedent for a building of this height in Pakistan, we felt it sensible not to add avoidable complexity."

Though columns are oriented to the curvature of the facade, an alternative way of expressing the spiral was found, says Gregson.

"The spiral is achieved by cantilevering the floorplate by just over 3m on opposing sides of the tower. As you go up the tower, the cantilever moves around a few degrees.

A Stone's Throw

By Jessica Rowson

*The colossal 1018m long central span of Hong Kong's Stonecutters Bridge is entering the "most difficult and exciting part of construction". So says Arup project director Naeem Hussain, who talks to **Jessica Rowson** about the challenges of designing and building this spectacular engineering feat.*

Hong Kong's stonecutters Bridge is currently experiencing its most exciting period of construction since the project began on site in 2007. Its huge 290m tall single pole towers are complete and the deck sections joining them are about to be winched into place. Once the gap is closed, Stonecutters Bridge will be the second largest spanning cable stayed bridge in the world.

The 1.6km long crossing will be the centrepiece of a new dual three-lane expressway across the Rambler Channel, which will improve access to Hong Kong International Airport, urban areas of West Kowloon and the busy Kwai Chung container port.

Construction of the bridge has always been constrained by the fact that the Rambler channel must remain open to navigation throughout.

The first deck lift took place in December and required some impressive temporary works. Large brackets were fastened onto both sides of the east tower with temporary stay cables. These brackets supported the strand jacks, or hydraulic jacks, which lifted 4000t of deck steelwork up into position.

Subsequent deck sections will be lifted into place directly from a barge using two lifting frames with winches which are secured to the end of the existing steel deck. This method of construction speeds up the lifting operation, which leads to less disruption in the busy shipping channel.

Manoeuvring these deck segments, which each weigh 550t and measure 18m long by 53m wide is no easy matter.

"It's a very controlled operation," says Arup project director Naeem Hussain. "We have to make sure we have the right window for lifting, especially when we enter the typhoon season. The lifting sequence has to run like clockwork, so that there are no surprises."

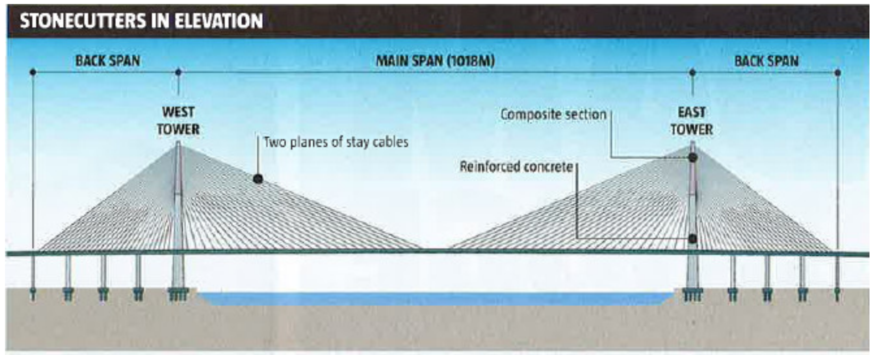
The main span segments are floated out on a barge, located using GPS (Global Positioning System) to ensure that when the lifting starts, the segment is in the right position. It then takes about 45 minutes to winch the segment into position and it is then secured and welded in place. The welding process takes between eight and ten days, after which the next lifting sequence can begin. All the while ships continue to pass through the channel.

"We are launching the main span which is the most difficult and most exciting part," says Hussain. "A 200m by 200m exclusion zone operates around the barge and we use GPS to make sure it is in the right position. It's a controlled manoeuvre and we don't want the winched section to catch on the last section. There's a lot of shipping going on and we have to not interfere."

As the main span segments are winched 70m up into place, they increase the deck out incrementally, cantilevering until they meet in the middle. Three segments have been launched on the east side while launching on the west side is just about to begin. The two halves should meet by November this year.

The main stay cables are erected using a tower crane attached to the side of the bridge tower. One end of the cable is lifted up and fed into the tower anchorage. Then smaller mobile cranes at deck level drag the other end along the deck, where each cable is winched and jacked into a deck anchor point.

Arup worked closely with contractor Maeda-Hitachi-Yokogawa-Hsin Chong joint venture on the construction method, taking high winds into account. Wind speeds can reach up to 117kmph in the typhoon season between May and November.



"We have to make sure we have the right window for lifting, especially when we enter the typhoon season. The lifting sequence has to run like clockwork"
Naeem Hussain, Arup

Deck lifting: Sections are lifted into place from a barge using lifting frames secured to the existing deck.

Numerous wind studies were carried out during the design phase and a 1:1500 terrain model test in a wind tunnel was also analysed. Wind measurements came from a 50m tall mast, as well as a review of existing data from the nearby Tsing Ma bridge and the Hong Kong Observatory. All this helped define the turbulent properties of the wind; how it would vary with time, distance and direction.

Extensive testing was also needed for the upper sections of the bridge's two towers. As access for maintenance would be difficult on this part of the structure, Arup proposed fabricating the outer part of the structure from stainless steel. This is corrosion resistant but has not previously been used structurally.

"The bridge feature the first use of stainless steel as an engineering material," says Hussain. "We used it as there will be benefits in terms of long term costs in that you don't have to repaint it."

A 1.75m tall prototype was constructed in order to determine the suitable type and grade of stainless steel for the 100m tall tower tips.

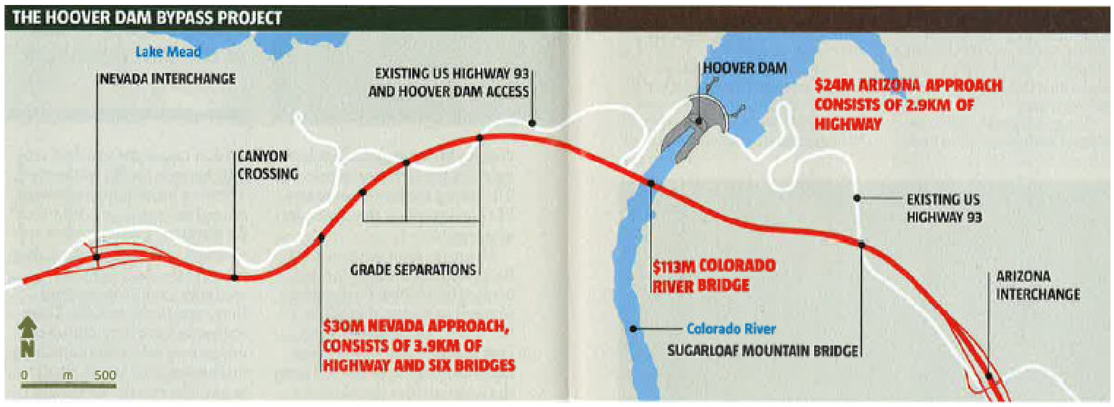
The investigation included looking at roll forming plates into a conical shape, fabrication of typical details and the finish that could be achieved on such large scale fabrication.

"We looked at the conical shape, how to get the matt finish and experimented with different (fabrication) technique," says Hussain. "We wanted to know that what we were proposing could actually be done."

Assuming all goes well, the structure will be opened to traffic in June 2009.

Dam Bridge

By CJ Schexnayder



Contractors are building a concrete arch road bridge over the Colorado River to relieve congestion on the two-lane highway on top of the historic 73 year old Hoover Dam. ***CJ Schexnayder*** *reports.*

When the Hoover Dam was complete in 1935 it was rightly hailed as an engineering marvel.

The massive gravity-arch dam - then known as Boulder Dam -became the world's largest electric power producing facility and the world's largest concrete structure.

Less noticed at the time was the fact the two-lane roadway atop the dam finally completed a direct road link between Las Vegas, Nevada and Phoenix, Arizona - U.S. Highway 93.

Within a decade, the Grand Coulee Dam in Washington State eclipsed the Hoover Dam in its record-breaking categories but the importance of the highway continued to grow as more people began moving to the American Southwest.

Today, more than seven decades later, the highway is in dire need of upgrade and another historic structure is in the making to achieve that. Just 460m downstream from the dam a massive steel and concrete single arch-span bridge is being built.

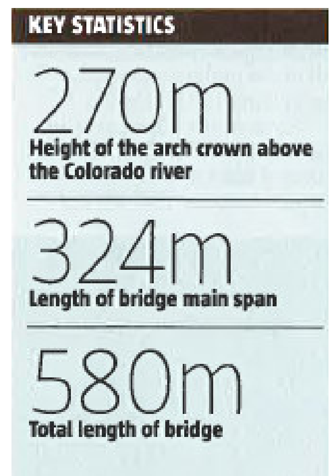
When completed in 2010, the structure 270m above the Colorado River will support a four-lane highway and become the longest concrete span in North America.

The project is being built under the direction of The Federal Highway Administration (FHA). The primary contractors for the work on the bridge are California based firms Obayashi and PSM Construction whose joint venture won the job with a $114M bid in 2007.

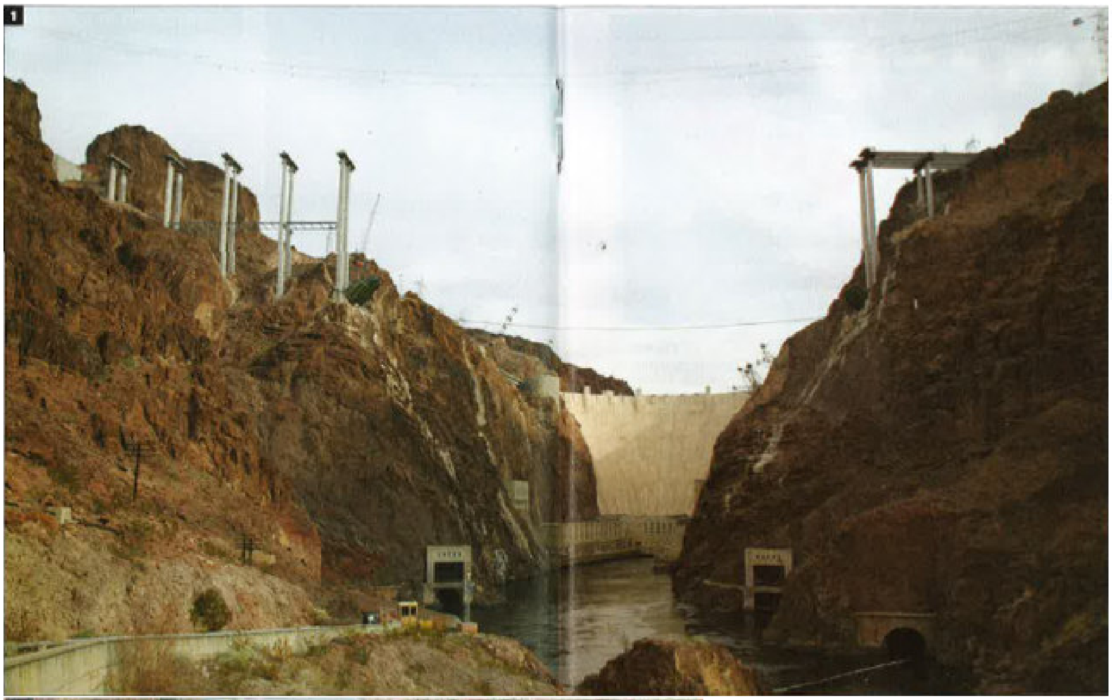
The bypass project was originally slated to be completed this year at a cost of $237.5M but delays including an accident involving the crane system needed to build the massive arches altered the deadline and have claimed the full $6M contingency budget on the bridge section.

The formal name of the 580m span is The Mike O'Callaghan-Pat Tilman Memorial Bridge.

O'Callaghan was a former governor of Nevada and Pat Tillman was a player for Phoenix's NFL football team who was killed in Afghanistan.



The type of bridge was selected by a design team lead by HDR Engineering of Omaha, Nebraska. Of eight possible alternatives, the team, which also included Jacobs Engineering unit Sverdrup Civil and T.Y. Lin International, chose the arch bridge.



1. DECK SUPPORT TOWERS
The towers which will support the road deck are complete

2. ARCH ELEMENTS
Close up of the arch elements which are being cantileverd off the tower as can be seen in the main picture

3. CANYON CROSSING
The bridge will span the canyon, it's arch echoing the curve of the Hoover Dam

"The arch has a number of advantages," explains FHA project manager David Zanetell.

"It's truly the classic solution for a canyon face type crossing, it has significantly lower long term operation and maintenance costs and it has a very low vulnerability to threats – environmental and malicious."

Keeping the look of the bridge harmonious with the historic dam was a key priority, he adds.

The shape of the arch echoes the curvature of the dam and the shared building material, concrete, help achieve that. That said, the bridge also had to be contemporary as well.

"And the arch does, in many ways, provide a link from the past to the present," Zanetell says.

Almost al of the elements of the bridge except for the arch itself are precast off-site. The individual arch segments will be poured in place. Each of the arches will be constructed of 53 cast-in-place concrete segments – 12 base segments, 40 cable supported segments an a final connecting segment.

The initial six segments on each side of each arch are being post-tensioned and extend 46m out from the canyon wall. Internal guy wires pull the sections back to the cliff face which enables them to be self supporting. Work on these segments is expected to be complete by summer, Zanetell says.

The remaining sections will be supported by external guy wires held aloft by two temporary stay towers on each side of the bridge. As the section is laid, it will be strapped to the precast concrete tower and held in place so the next section can be set – essentially creating a cable-stayed bridge. A final segment – or a closure pour – will connect the two sides of the arches.

According to Zanetell, the precast towers will be put in place by June so the work on the arches can begin.

The high line crane system will be used to deliver and erect the precast spandrel segments. The columns which have been precast will be brought in from overhead using the crane system, set an then stacked on top of each other.

The span itself will require 15,200m^3 of unusually high strength C70/85 concrete. To allow better control over the construction, a high energy or 'pan' concrete mixer was installed on site.

"It is a real advantage in terms of quality in terms of the actually produced material," Zanetell said. "We also get at the reliability of the delivery itself and the ability to then make revisions live time and not have any material en-route."

To do extensive work above the canyon, the contractors opted to use a pulley-type, high-line crane system. The system consists of two sets of 100m tall towers secured by staybacks and concrete foundations.

The set of 760m long cableways would then have the ability to carry loads of up to 45t.

The contractors purchased a 42 year old system from American Bridge Company for the bypass bridge job. The system had been built to erect West Virginia's New River Gorge Bridge through 1977 and was taken out of service a decade later. Refurbishing the cranes and producing a second set for the bypass job cost $10M.

High line cable cranes have a number of very specific drawbacks including limitation is how they deliver material, slower speeds and availability of the hook. But when you factor in the demands of the location, they are a solid choice, Zanetell says.

"The advantage is they are providing you continuous access from above your whole jobsite," he says.

On 15 September 2006, the crane system collapsed. Although no-one was injured traffic on the highway was detoured through Laughlin for three days.

According to the agency, one of the reconditioned cranes failed first and caused the entire system of support cables to fail bringing the rest of the towers down.

Winds through the canyon at the time of the accident were at approximately 90km per hour - not unusually strong for the location.

The cause of the incident remains under investigation. Preliminary assessments of the accident indicate one tower on the Nevada side collapsed causing a failure in the support cable system and leading to the collapse of the other towers.

The contractors are expected to absorb the cost of the tower collapse and the costs associated with the delay to the project will be absorbed by the contingency fund, Zanetell says.

The main work on the arch itself was completely halted but to keep working on other aspects of the bridge near the canyon walls two large derrick cranes were brought in to the job - a Manitowac 2250 and an S70 Derrick. As a result, all of the column work on the canyon walls has been completed,

A new crane system has been designed, fabricated and constructed for the job and is now completing final testing before being put into operation.

Within the next few weeks, Zanetell says he expects to complete testing of the new system and begin the difficult work on the arches out over the canyon. As frustrating as the delays to the project have been, the one advantage is they have allowed all of the preliminary work to be completed and finished.

"So now this job is ready to rock and roll," he says. "Everything is done and we are ready to go."

THE HISTORY OF THE HIGHWAY

At the time the Hoover Dam was built, Las Vegas was only a quarter-century old and had just 7,500 residents. Phoenix, by contrast, was celebrating 50 years since being incorporated as a city and boasted more than 48,000 residents.

A lot has changed since then. Today, Phoenix and Las Vegas are two of the fastest growing cities in the United States. As of 2006, there were about 4M people living in the Phoenix metropolitan area and about 1.7M reside in the Las Vegas metro region. And as the urban centres have expanded, so has the traffic between them. Currently, the road handles more than 16,000 vehicles daily.

Worse, every day the two-lane road is beset by hundreds of visitors whose numbers swell to the thousands during peak periods. Speed over the dam itself is capped at 15mph but often is slower than that as visitors wait for parking spaces.

"The accident rate within the limits of the bypass itself is three times the accident rate on the rest of the highway," Zanetell explains.

The search for a solution to the highway problem dates back to the 1960s when the U.S. Bureau of Reclamation began working with officials from Arizona and Nevada to examine the problem. Their solution was for a crossing 1.6km south of the dam but the project languished.

In 1997, officials from Nevada and Arizona appealed to the US Department of Transportation for funding to restart the project. The FHWA took over as lead agency for the project. But the price tag allied with the unavailability of funds hampered progress.

The initial cost estimates for the project jumped substantially after a geotechnical survey, conducted by AMEC and Environmental Inc., found the canyon walls required substantial excavation.

There was a lengthy delay getting approval by congress. But in 2004, Arizona and Nevada each pledged $48.7M in bonds to allow the bypass work to move forward.

Ask Dr. Sylvie

To access Dr Sylvie's information, and to read the current or earlier issues of Advantage Steel, click on the following link:
http://www.cisc-icca.ca/content/publications/ publications.aspx

Mark Your Calendars

SEABC Education Committee

September 17, 2008

SEABC Wine and Cheese Reception

Venue: UBC
Presentation: Steel deck diaphragm testing at UBC

October 22, 2008

Canada Line Extradosed Transit Bridge

Presenter: Andrew Griezic, P.Eng, Buckland & Taylor
Venue: BC Hydro Building, 333 Dunsmuir St., Vancouver
Time: 6:30 pm (refreshments from 6:00 pm)

November 14-15, 2008

Time History Analysis Seminar

(in collaboration with CSCE)
Venue: Woodward 2, IRC Building, UBC
Topic: Beijing "Bird Nest" Olympic Stadium

Certificate in Structural Engineering (CSE) Course Offerings

The September 2008 Term will run on Tuesdays and Thursdays from September 16 to December 11. Courses will be offered via Internet Delivery (live webcast) as well as Classroom Attendance. Classroom sessions will be held at the Vancouver Public Library.

Course list:

- C4 Earthquake Engineering and Seismicity
- C9 Computer Structural Analysis
- E1 Masonry Design of Buildings
- E12 Seismic Design of Steel Structures

SEABC members qualify for a $25 member discount per course.

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http://www.seabc.ca/course_registration.html

Advertising

From November 2008, we plan to carry Employment Opportunity advertisements in our newsletter and also on our website for the duration of that edition. If you would like to advertise, our pre-paid rates per edition are $270, $360 or $450 for a quarter, half, or full page advertisement, respectively. 50-word Available for Employment ads will be free. Advertisements will be available for purchase through the SEABC website.