



Supplied

NOT FEELING THE VIBES

Having to drill 8000 holes to help strengthen a multi-storey carpark posed significant health risks, notably hand-arm vibration, and would have taken forever.

PETER BATEMAN reports on the solution which won the Health category.

It was during the tender process that it became clear just how challenging one aspect of the job was going to be.

Tauranga City Council's Spring Street carpark in downtown Tauranga – all eleven storeys of it – needed to be seismically strengthened by improving the concrete shear walls and installing additional structural steel.

Naylor Love calculated that around 8000 holes would need to be drilled

into or through the existing concrete structure, mostly 20mm diameter by 600mm long, equating to around 4.8km of drilling. Furthermore, the structural engineer specified that only percussion drilling could be used to avoid any risk of cutting into the existing structural steel.

"Percussion drilling is really hard on the human body," says Dean McGahey. "We wanted to come up with a solution which minimised those effects."

The company sought advice and did some further sums, finding that the site conditions – awkward head-height work, from a mobile scaffold, on sloping ground, in an operational car park – produced an estimated rate of work of between 2m and 10m per drilling worker per day. With four workers on the job drilling an estimated 10 holes per worker each day, the arithmetic was grim: it would take 200 days of physically stressed and repetitive work.

“THE MORE WE LOOKED AT THIS, THE MORE IT DAWNED ON US HOW MUCH OF THIS WAS A RISK TO WORKERS.”

SERIOUS VIBRATION RISK

But it was worse than that. McGahey, Naylor Love’s operations manager for Waikato/Bay of Plenty, says the company was particularly aware of the risk of HAVS (hand-arm vibration syndrome). Using the UK Health and Safety Executive’s ready reckoner for HAVS risk produced some sobering results: a duration of between nine minutes and two hours per 8-hour shift, given other influencing factors such as temperature and the health of the individuals doing the work. This represented a maximum of only three holes per worker per day. Based on this, they would need ten to 15 workers drilling each day, but only for a maximum limit of two hours each, then working on other tasks with zero vibration for the rest of their shift.

“The more we looked at this, the more it dawned on us how much of this was a risk to workers.”

There were other health risks too: drilling would produce concrete dust full of silica, heightened due to the workers being up close against the walls. There was significant strain and sprain risk due to the prolonged need for awkward postures carrying heavy gear, and of course the noise was an issue. On the safety side, there was the risk of falling from the scaffolding.

CUSTOM DRILLING RIG

There had to be a better way, and not only for this job. There was a lot of seismic strengthening work coming up around the country. Could they devise a solution which would eliminate or minimise these health risks and which could be applied elsewhere too?

McGahey says the company approached steelwork fabricator Fabworx, explained the problem and asked them to come up with some ideas for an engineering solution.

“They came up with a really innovative design. It did everything we wanted to eliminate or minimise risks, in one piece of kit.”

In consultation with Beca, the three parties finalised a custom drilling rig, consisting of a three-tonne rubber tracked excavator suitable for weight and point load distribution on a suspended floor system. An industrial vacuum and compressor fitted onto a custom-designed rear tray, while an adjustable drilling frame contained two hammer drills connected to the vacuum. The compressed air supplied force to the drills housed within the frame. Meanwhile, a generator attached to a custom-fitted tow ball powered the vacuum, compressor and drills.

Result? A single operator could now drill two holes per operation from the safety and comfort of the excavator. No work from height, no carrying a vibrating drill in awkward postures, no exposure to dust, and better managed exposure to noise.

The rig was trialled and tweaked before the prototype was deemed ready for use on site, and it was refined and adapted from time to time during the job, as dictated by the site situation.

McGahey says the kit’s compact size was another advantage. “We could slowly cordon off small areas and the operator could just go along and drill. We started in the basement and just moved up the building.”

The rig was so effective it could be used by one operator, who could safely drill around 30 holes per day while others followed behind and did the bolting and fixing the steel to the building.

“The guys were rapt,” says McGahey. “It’s not nice holding a vibrating piece of kit for any length of time. It’s noisy, it’s dusty, it’s actually just

horrible work. The guys could do more productive work rather than sitting on the end of a hammer drill for hours at a time.”

The rig operator wasn’t forgotten. He was encouraged to take his breaks and get up and walk around so he wasn’t just sitting down for eight hours a day. And there were a few tight areas where the excavator couldn’t quite reach, meaning a small amount of manual drilling was still required.

WE NEED TO DISCUSS HAVS

McGahey describes another advantage of the rig: the drilling mechanism can be removed and fitted to other mobile plant, such as a forklift, if a higher reach is required.

He gives kudos to Fabworx, who he says deserve most of the credit.

“They were the brains behind it. We just put out the burley and breadcrumbs and these guys worked out a solution.”

More generally, he says risks such as HAVS need to be more widely discussed in New Zealand’s construction sector, along with silica exposure too.

“The posture you have to adopt to hold these drills for extended periods is really hard on your body. You’re in an awkward crouching position, so we wanted to eliminate it.

“We’ll keep working on this rig and make it better.”

He says the small, compact size of the rig is essential for working in seismically compromised buildings, where you can’t just drive in a truck laden with massive pieces of structural steel. It’s just too heavy.

“There are a lot of challenges with seismic work. People need to go into it with their eyes open. It’s not as simple as it looks on paper. You’ve got to spend the time up front to consider all the risks.” ■