TECHNOLOGICAL PRACTICE CASE STUDY | JUNE 2006

HARD MATERIALS TECHNOLOGY | DESIGN | YEARS 11-13

BYPASSING CENTRAL WELLINGTON

In mid-2007, Wellington's Inner City Bypass project was completed. Half transport solution, half urban renewal, the project completes a process that started as an original grand concept in the 1960s and a project half finished in the 1970s. This case study looks at the historical context of the project and examines critical aspects of both its physical engineering and urban planning and resource management considerations.

FOCUS POINTS INCLUDE:

Nature of Technology

- Historical positioning and socio-cultural influences

Planning for Practice

- Stakeholder and environmental considerations; ongoing critical evaluation and efficient and appropriate documentation

ADDITIONAL SUPPORT MATERIAL

- Questions and answers in relation to the construction project: www.nzta.govt.nz/projects/wicb/faqs
- Bypass related news items prior to completion: wellington.gen.nz/bypass
- Articles following project completion: www.opus.co.nz/projects/project_profiles/profiles_u_z/wellington_inner_city_bypass_new_zealand www.fultonhogan.com/idc/groups/web_au/documents/webcontent/nz_020306.pdf

BYPASSING CENTRAL WELLINGTON

In 1963 international engineering consultants De Leuw Cather and local firm Rankin Hill completed a report on inner city extensions to Wellington's planned motorway, defining a £20m "Foothills Motorway" through the city. It was a plan for its time, involving big, bold engineering works, a six-lane motorway curving through Te Aro, a massive interchange at the foot of the Dominion Museum's hill, and flyovers to a second Mt Victoria tunnel. Forty-two years later the inner city bypass was at last being constructed.

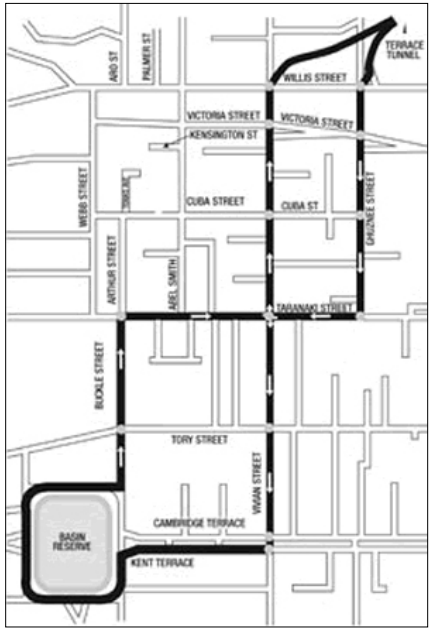
New Zealand's economy was one of the strongest in the western world when the original report was written. But by 1978, when the motorway had been completed as far as The Terrace tunnel, it was a different story. The demand for our wool had waned, and the 1973 oil shock had turned the world's attention to energy. The government planned new energy industries, and expected subsidised farmers to breed record numbers of sheep, but neither produced good returns, and the funding for major roading projects evaporated. The Wellington motorway extension stalled, half-built.

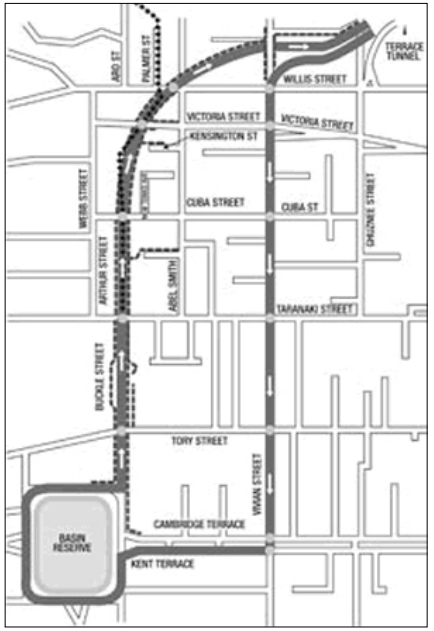
Then in 1989 Works Consultancy Services dusted off the original De Leuw Cather plans with a view to reinterpreting them. Its $110m tunnel-link plan was modelled on the De Leuw Cather vision but the days of "progress" were over; and in 1991 the Resource Management Act replaced the Town and Country Planning Act, heralding the age of "sustainability".

BATTLEGROUND

The battles surrounding the planning and consent process between 1994 and 2005 could fill many volumes. Suffice it to say there was considerable opposition to what was now called the Wellington Inner City Bypass, and the scheme was whittled down lane by lane, element by element. Opposition came from local residents and some shopkeepers, many of whom were current or former students of nearby Victoria University. It was loud, persuasive, cheeky, and later connected with the Green Party, whose influence on transport policy under MMP was considerable. Ultimately the opposition did not prevail, but along with more realistic assessments of the costs, it helped transform the project from a massive motorway into a far humbler realignment of inner city streets. As a roading project the Inner City Bypass is relatively unremarkable.

"If it was being built in a rural setting nobody would take much notice of it at all," says Transit project manager Jonnette Adams MIPENZ. The length of the new road being built is just 700m, and the total length of the project is 1.2km. It includes cycle-lanes, pedestrian walkways, a heritage precinct to which heritage buildings are being shifted for restoration, and 150 new trees to join the 50 historic trees being maintained. Heading north, Buckle St is extended through Arthur St and into a new route curving to follow what was Oak Park Ave to The Terrace tunnel. Heading south, Vivian St will reverse its direction in parts, to run one-way all the way from the tunnel to Kent Terrace. The only engineering feature of note is a large trench cut into the foot of the hillside leading toward The Terrace tunnel.





Left: Existing route
Right: New route

COMPLICATIONS

This is the first major inner city roading project since the 1970s to be built in the middle of a residential and commercial area with significant heritage interest. Such concerns got short shrift when the Wellington motorway was built in the 1970s; this time the difference is remarkable.

First, to avoid disturbing residents, there are restrictions on noise, silt run-off, and the times of day the contractors can operate. Added to this is the traffic – 35,000 vehicle movements per day – which must continue to flow. Wellington City Council is also taking advantage of the project to piggy-back a mini-project of its own, laying a large stormwater drain along much of the route. Then there is the ever-present security threat posed by protest action. The icing on the cake is that the project site is also home to one of the biggest archaeological digs and one of the largest historic building conservation projects ever carried out by the Historic Places Trust.

Cooperating with the bypass has been a divisive choice for the Trust, as many in the heritage community sided with the project's opponents. Ultimately the Trust's lack of compulsory powers, Transit's accommodating plans for restoring many of the historic houses in a heritage park alongside the route, and an unprecedented opportunity to carry out an archaeological dig in the middle of the city meant there was more to be gained from cooperation than resistance. And the work is turning up valuable finds for the archeologists and historians.

Evidence of slum tenement housing has been uncovered on Arthur Street, Trust spokesperson Emma Brooks says; archaeologists have found bottles, crockery, chamber pots, shoes, meat bones, and brushes of various types. They have also found six wells, one of which still holds water. The material will be analysed to increase our knowledge of the day-to-day life of people in a nineteenth-century working-class district.

The Historic Places Trust has identified 23 buildings along the route as having heritage value. Seven of them will remain where they are. A further 17 will be refurbished and relocated to a nearby heritage precinct. Many of these buildings are in poor condition and will have to be repaired. A further 11 buildings that are not considered to have heritage value are being relocated, and 12 more are being demolished.

Ms Adams says the archaeologists have posed no real problem for the construction of the project. The major digs have concluded and the project is now running slightly ahead of schedule.

Protest action has proved to be more of a nuisance than the promised die-in-the-ditch obstruction, with break-ins, petty arson and occasional confrontations resulting in arrests. Some protesters unfamiliar with heavy machinery have annoyed workers by putting themselves in danger. But some protests have inspired a degree of admiration. "I think the best yet was when two young ladies stripped butt-naked and walked past the site. As you might expect all work stopped!" says Ms Adams.

Other issues that confront the project include working around parades, sports events and street carnivals. Ms Adams says Transit maintains close contact with Wellington City Council, with a view to risk-mitigation and forward planning. The project, including the stormwater mini-project, is worth around $53m, and is being managed by Transit New Zealand. Design has been largely carried out by Opus and the main contractor is Fulton Hogan. Sub-contractors include Fulton Hogan Civil for the structure; EN Ramsbottom for the drainage and stormwater project; and Britton House Movers for the historic building relocations. The contract is fairly standard for a Transit project.

An indication of the scale of the project is the 11 management plans developed by Fulton Hogan in the three months after the tender was let. They cover matters from quality assurance to site security, sediment to archaeology. Together the plans form a stack about 45cm high. And these are not plans that can be written and ignored; they have to be understood by everyone involved in managing the project. "Making sure everyone knows what is important, when, is essential to keeping the project within its consent obligations," says Fulton Hogan project manager Richard Fulton.

ENGINEERING

By far the largest engineering feature of the new road will be the $11m trench – 150m long, 11-13m wide and 7m deep – which skirts the hill by The Terrace tunnel. The trench follows the orientation of local fault lines, and has been designed with a 670-year return period (0.95g peak ground acceleration*) earthquake in mind. And to add to the fun, it sits atop a local aquifer, so preventing the trench from collapsing requires special measures.

For a start, the walls and floor of the trench will be made of reinforced concrete up to 1,200mm thick. Steel struts, 760mm in diameter, at 5m intervals will hold the top of the walls open, forming a grid above motorists as they head north out of the city. Because of the high water table, extensive use will be made of soil nails, in 200m of the largest soil-nailed wall in New Zealand. On their own, the soil nails will cost around $1.3m. Made of reinforcing steel, the nails are from 4 to 14 metres in length. The holes for the nails are drilled into the wall at a slight downward angle from the horizontal. The holes are then filled with grout and then re-drilled to take the nails, then grouted again. A total of 7km of soil nails will be used.

Groundwater pressures and potential subsidence are the biggest engineering risks of the project. An extensive network of sensors has been deployed to ensure that nearby buildings are not affected by the construction; the amount of rainfall will have a significant effect on the progress or otherwise of the project. So far, according to Ms Adams, there have been fewer problems than were planned for.

A $7m underground stormwater pipe, 2.1m in diameter, will follow the bypass route between Aro St and Taranaki St. Cutting through Palmer St and into Aro St, it will eventually replace a 130-year-old brick stormwater drain, but in the short term will have no connection to the sea. Wellington City Council needs the completed Inner City Bypass to reduce traffic sufficiently down Taranaki St before it can consider constructing a pipe down Taranaki St to the sea.

Altogether the Inner City Bypass project is less about transport than about urban renewal. The animated video simulations developed by Truescape for Transit show a leafy boulevard far removed from the concrete monstrosity first envisaged by De Leuw Cather. Given that Wellington's urban growth south and east of the Basin Reserve has largely stalled, it is difficult not to conclude that the design that has emerged after all these years is the right one, balancing the needs of Wellington's pedestrians and motorists in a sensitive and intelligent way. When it is completed in mid-2007, most Wellingtonians will wonder what all the fuss was about.

The bypass has taken far longer to build than it probably should have. The initial vision seems to have been rather over-designed, and the opposition the project engendered was probably self-inflicted. If there are any lessons engineers can draw from the saga of the Inner City Bypass, they are that projections into the distant future are almost always unreliable, and that designing a project a community wants, the way it wants it, is ultimately the only way in the current era to get them built at all.

**Peak ground acceleration is a measure of earthquake intensity. Unlike the Richter Scale, it is not a measure of the total size of the earthquake, but rather how hard the earth shakes in a given location. Peak ground acceleration can be measured in G (the acceleration due to gravity) or m/s².*

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