

## Forsyth Barr Stairs

### Interview with Paul Tonkin at 2:15pm, 31 May 2011

**Beca office, Comfort Hotel, Bealey Avenue, Christchurch**

**Richard Sharpe (Beca); Paul Tonkin (Woods Harris)**

*Sharpe: Paul you were the foreman on the Forsyth Barr...*

Tonkin: Correct

*Sharpe: ...building site during building construction and you've come in to just tell us something about the construction of the installation of the stairs. Anything that you can remember would be grateful to hear. You've just been talking to me before we started the recording a little bit about the process of constructing the joint. Would you like to just talk about the origin of the precast stairs and particularly the sequence that went on and what was built before the stairs were put in*

Tonkin: The building itself was, we felt, was a fairly good design in terms of from a constructability point of view with the insitu columns and insitu perimeter beam with the precast diagonal beams for want of a better term across the centre of the site. It allowed us to progress the project in effectively two halves where we built the triangle that was formed by two sides of what was the square building and then the diagonal precast beam that ran across the centre. So the process was to pour the columns and then erect the insitu formwork for the perimeter beams. The internal shutter for that formwork was the seating for the Interspan, would have been the Stalton they were called back in those days, flying beams with timber infills. So all that work was completed and that triangle, if you like, that first half of the floor was cast and then we would progress to the other side of the footprint and progress the insitu columns and then again the perimeter formwork and then the floor construction; and at that point when that second side of the floor would go up, that was the time when we would offer the precast stair and it would go from the lower floor that had been completed where it sat on that seating..

*Sharpe: Steel channel?*

Tonkin: Steel channel that was cast onto the lower precast beam and the top of the precast stair had reinforcing coming out of it. That was cast into the through the top half of the precast beam that was left there and out onto the floor slab at that point. So the stairs weren't placed until the level above was ready to form and reinforce.

*Sharpe: So in this - at the pouring at the lower end of the landing the beam on which it was seated, that pouring was that was completed*

Tonkin: Before the stairs

*Sharpe: Before the stair going to the level above was offered up to it*

Tonkin: The top part of that beam was cast. That precast beam was also the seating for the Interspan units as they came across

*Sharpe: Sure, you're just drawing the diagram in front of you*

Tonkin: Illustrating that. So the Interspan flooring sat on one side of the precast beam and we put our formwork that created the top half of the beam on the stair side if you like through. Reinforcing was placed and then that floor was cast and that allowed - that gave us the total step for that lower part of the stair to be placed into.

*Sharpe: Can you recall who actually provided the precast units?*

Tonkin: I think Firth Stresscrete did, I don't really want to be quoted on that

*Sharpe: Sure*

Tonkin: But I think that's where they came from

*Sharpe: Do you, I know it's a long time ago, but do you suspect that because of the number they were doing, they would be dimensionally pretty good?*

Tonkin: Definitely, they would have been steel form, so I image that every single stair was within probably 5 or so mills of the previous one. I don't recall there being an issue with the dimensional accuracy of the stairs in terms of getting them in place. I don't remember there being an issue. It would be fair to say, and as I said earlier on, the stairs were seen as a very straight forward part of the structure and I bought a couple of photos along that I've managed to drag out of the archives at home. None of them indicate the stairs I think that's a reflection of the fact that I felt at the time the stairs were just part of the build process. One thing that was quite special with these ones was the weight of them given the comparative width because they're only 1 metre 50 wide from memory and they have about a 300 throat on them which makes that stair about 7 tonne and I can remember when we lifted the first couple into place because they were over the taller floors that the crane couldn't pick them up off the truck on the street. We had to back it in onto site coz it was over the limits which from the crane. So they were a very chunky stair to be honest. I wondered whether if there was any bounce that occurred in the building, vertically up and down, whether that might have created a little whip in the stair given the inertia that could be created with such a very narrow stair and a very thick one because that could have contributed to some failure of some kind I wasn't sure but I know a lot of other buildings around town it seemed all these hairline cracks running through precast and even insitu stairs had building that our offices had been demolished currently and that's an insitu stair and a lot of cracks through the stairs, through the treads, also through the throats.

*Sharpe: What do you think the processes at the time would have been for cleaning out that gap before the polystyrene or neoprene bead was put in?*

Tonkin: I don't, the only stuff that, I think the only material that could have been in there that may have compromised that would have been general construction rubble, rubbish because the fact that that was cast prior to the stair being placed would indicate to me that the formwork would have been struck, the stair would have been placed and that gap may well have stayed open with that sealant not been put in until the finishing stage of the project and so there could have been a degree of construction rubble and grit and dirt and a bit of tile liner and I'm not aware I certainly don't have any recollection of there being a cleaning process apart from the fact that that would have been good trade practice to go ahead and clean that out.

*Sharpe: Just going back to the precast settlements the main ones on the tower were all delivered as the full scissor*

Tonkin: Correct

*Sharpe: None of those high ones were brought in as two pieces?*

Tonkin: Not to my memory. No, they were all from one side to the other, one level to the next. And in terms of accuracy we actually prided ourselves on that project in terms of its dimensional accuracy and the exterior cladding system was a system that was prefabricated in Australia and it had, they guys that had installed it came from Australia and they had some very strict tolerances that we had to comply with in terms of building plumbness and floor heights, both in floor to floor segments overall and it was within 10mm of the overall building height the structure when completed and the worse point I think it was about 11 or 12mm out of plumb and so I can say quite confidently that the actual construction tolerances that we maintained throughout that build, because it's not a big building its 22m<sup>2</sup> from memory and the podium was additional of course, but the main tower was 22m<sup>2</sup> and we went to great lengths to make sure it was accurate because we knew that they didn't have very much in the way of tolerance for this exterior cladding system which was an aluminium and glass composite

*Sharpe: There had been some attempts since the February earthquake to do some LIDAR scanning of the outside because they're trying to see whether the buildings tilted or warped with a little bit of plasticity in it and we haven't heard anything conclusive about that*

Tonkin: Right

*Sharpe: but it's reassuring to hear what you say that at the time you think dimensionally it was pretty good*

Tonkin: When I met the USAR team in Victoria Square on I think it was the Monday after the earthquake to assist with some information because documents weren't available at that stage as to the structure of the building and they were keen to know its components and how it was assembled, and they had a laser theodolite and I was looking at a couple of other buildings around Victoria Square with a degree of scepticism and I was, a chap from LA leaned over my shoulder and he said you're right its leaning out in reference to another building and I pointed at Robert Jones - Forsyth Barr as it's now known and I said what about this and he said no, it's not bad. That's all he said, he said it's not bad so he said that's one of the things that we check before we go headlong into a building is to make sure it's still relatively vertical and you can see by looking at it it's still reasonably plumb; even with a builder's eye

*Sharpe: You described to me a few days ago that I think did you go into the building with USAR?*

Tonkin: Yes, I did

*Sharpe: And did you actually travel through in height, or just look at it from the bottom?*

Tonkin: We went up to Level 6 which was as high as we could get at that stage because obviously the stairs were gone and we were doing initial inspections of the main structure and making some preliminary investigations on the connections around the stairs, doing the toilet blocks and the lift shaft area just to see if we could come up with any preliminary thoughts as to why this collapse had happened and that was quite limited by the fact we couldn't get a crane to get to the upper floors and the fact via a torch we could see that there was a stair at Level 16 I think that had broken in half and half of the top half of it was still hanging in a precarious fashion and nobody wanted to get into the shaft proper which is understandable. That's what led me to believe that that was the first one that failed and wondered whether that one had actually physically broken in half with the bottom part of that not physically connected to the building and only sitting on that slide; if that stair had broken half of the stair would have come down and

*Sharpe: Like an arrow*

Tonkin: punched into the midway bottom third of the next one wouldn't have been able to sustain that sort of impact and that therefore created that stack you know that domino effect down the building. Pure supposition of course but the fact that half of the last ones still connected was still up there made me a little suspicious that that may have been the potential cause of the collapse. Once we'd done those preliminary inspections we went through and there was some gib linings removed in and around the lift shaft area and one thing we noted at Level, I think it was Level 4, that the lift shafts, there's two, there's four lifts in total in the building and two in two pairs and they're the openings are created by some large steel beams. I think they were 610s or 490s that went between these two precast beams on that by going across there. And on this, placed centrally over those two steel beams was a precast slab that was I think it was about 11 tonne from memory that basically was sat on those beams and then it was welded into place and I think it was welded in four places, on each corner, it might have been it; and I noticed that there appeared to be some duress of those welds at the stairway end which implied that that precast slab and its connections had been twisted in some way but

*Sharpe: Do you think that would be worthy of*

Tonkin: It would certainly be worth having a look at

*Sharpe: looking at? Yes*

Tonkin: I think it was Level 4; I wasn't aware of it on the any of the lower floors, the carpark floors which you can see quite clearly it didn't appear to have happened but it would come back to the point that the middles of those taller buildings tend to be where all the damage is done and where there's that plastic movement. The other thing that we noted was at a point where we removed the exterior cladding from around the prefabricated toilet blocks, and I suggested to Carl that... this was the USAR chap...

*Sharpe: Yes, I know Carl*

Tonkin: That the precast toilet blocks came with the prefabricated toilet blocks came with precast concrete slab and on that slab had been cast down in... Geest in Oamaru constructed them... and they were on two 390 UBs that came as part of that whole package. The unit was offered onto the steel needles that projected out the rear of the building

*Sharpe: That's these? The same ones?*

Tonkin: That's the same ones that are cast into the side of the precast beams that the stairs sat on and the prefabricated toilet block was bolted on the outer extremities of those needles via an angle bracket which I think had four or six bolts in it and on the inner UB via weldplates and we had the opportunity to inspect Level 3, the other side of Level 4 toilet which is the first toilet block so that's the top of the carpark level and the one above it and from my observations it didn't appear that there had been any form of stress or duress, there was no bolts that had been sheared, there was no witness marks that plugs had moved in the bolted joint or in the welded which I found hard to get my head around because of the witness on the precast slab at the lift which was impeccably only 2 and ½ metres away there had obviously been some duress at that point so I think Carl was of the impression that the back of the building may have spread a little that would have allowed one of these stairs to drop but and that may be the case up higher if an investigation can be done on those it would certainly be worth looking at but certainly down at that lower level there was no evidence that the building had moved apart as two segments. Because that would have been effectively two triangles like that with those needles sticking out the back. Carl

thought that there could have been a little bit of that going on seeing we've got that's an insitu... very much poorly drawn....so that's all insitu floorslab then at that point we've got one of those big beams for the lift shaft, another big beam there that goes across, the precast lift slab sat there. That created.....

*Sharpe: The lift wells which is....Paul is showing to me on the sketch*

Tonkin: and then this toilet block came in with its own beams so that was on the toilet block and that one was on the toilet block, that was, from memory, that was the welded joint there and there and that was a bolted joint there and there. There's no evidence of movement there at that lower level

*Sharpe: If we were to go to the 15<sup>th</sup> level and try to look at that would there be quite a bit of removal of linings for us to be able to see that?*

Tonkin: To view that if you can gain access and that's the challenge there's two ways of seeing it. One is you could go up the outside and remove some of the aluminium cladding which would be quite difficult because of the way that cladding interlocks. You could go up the open stairwell now and remove the linings there and there's a crawl space that's from memory 0.5 metre maybe 400mm between the top of the one toilet block and the underside of the next so there may be an access point there but it's going to be difficult cause you've got 15 floors of nothing there haven't you.

*Sharpe: That's what I was thinking*

Tonkin: Yeah. So really the only way to view those now would be from the outside unless with that cleared you go to the expense of building a scaffold up and put a lightweight stair up there just for, I mean that will have to happen at some stage anyway to access the building for whatever other purposes people will get in there for.

*Sharpe: When you were peering up the lift well with USAR with Carl, did you happen to notice whether there was any damage to the seats that you could see up there; was that something that you notice or*

Tonkin: I didn't, and I think if there had been even in the back of my mind I'm thinking if I saw damage to those angles my thoughts would have been they would have been damaged as stuff was coming down. You know, been damaged as impact with the stairs flying past rather than. I was actually looking at the ends where the stairs had been cast in, looking at reinforcing that looked like had just been guillotined. It was just amazing the amount of force that had obviously come to bear on, and they were big rods in some of those like 16s or 20s.

*Sharpe: Yes, we've looked at them in the carpark*

Tonkin: Oh yeah. So to be honest I was I think as an engineer and as a builder we understand what kinds of forces have to be applied to create the damage that we've seen on this city and a lot of the general public just don't appreciate it very much. It was it actually, to say it took my breath away was probably a slight overstatement but it was that kind of feeling like it was absolutely astounded that that failure could have happened like that and it just mince-meated the concrete and steel and yet the rest of the structure I looked, we didn't look at the superstructure above Level 4 because it was all behind claddings but I had a good walk around with Carl on two and three on the carpark levels and apart from that column out here just by the ramp were the top spalled away a little bit which was I very concerned about. There was a little bit of spalling at a few beam-column joints on the ramps which had failed in September as well

*Sharpe: Yes*

Tonkin: That's my understanding, but the remainder of the beam column joints and even the welded connections where the podium beams connect to the tower and the pockets where the welds had occurred were only basically a high-strength mortar perimeter pack in the end. There was no signs of cracking or failure at any of those points so to me the main structure of the building appeared to have survived pretty well compared to what I've seen in other multi-storey buildings.

*Sharpe: You happen to be there right at the ground opening when they were, you were part of the team when the foundation pad was being constructed?*

Tonkin: Yes. I worked for a company called Paynter & Hamilton which is a local construction company. I worked for them for 12 years and the other site manager and myself that were there were employees of Paynter & Hamilton. Paynter Development had struck the deal with Robert Jones to build this building and the deal was all done in a year, 18 months preceding the stock market crash of 87 and we had excavated, we had sheet piled, we had de-watered, we'd done our site concrete, we had that's a 22 m<sup>2</sup> raft I think it's about 2.2 m deep maybe 2.4 I can't remember; heavily reinforced at 1500 cubic metres of concrete, cast in one core, one block. We were ready to pour and we were told by our office senior construction manager to stop and we were on hold for effectively two weeks and during that period Paynters were put into receivership. Fletcher Construction took over the..this particular project and the completion of the Clarendon Towers, no that's not true. Paynters carried on and as part of the deal for their closure they were allowed to complete Clarendon under the Paynter banner. So Paynter & Hamilton Construction finished Clarendon and then those guys basically were without a job. The all the Paynter staff that were on this which was Gordon and myself as the foremen and a handful of carpenters were taken over to the Fletcher umbrella and then we ended up working for Fletchers for the next few years.

*Sharpe: So there were no particular problems in the foundations?*

Tonkin: No, nothing. Nothing in the ground. I mean it was a pretty straight forward sheet pile process. From memory the ground was just sandy sort of clays; it stood quite well when you dug it. It wasn't like it was; once we got down to the water table it was running a bit, but the base before we put site concrete down was certainly solid. There was nothing that made me think you know this could be a problem and the rest of the structure, the podium and that's all shallow foundation, so there's nothing as deep as the main block.

*Sharpe: Well, thank you very much Paul. I'm mindful of the time and I think you've covered everything I had in mind, so we stop the clock at 20 to 3. Thank you*