
Habitat For Humanity

Project Management/Critical Chain

A 4 Bedroom House in 3 Hours, 44 Minutes & 59 Seconds

Warren Jack is the owner of the dream to break the Habitat for Humanity World Speed Record for building a house, and Chairman for the Planning Team. He said "The technique of **Goldratt's Critical Chain** technique was one of the two Key Success factors that enabled the Speedbuild team to set a new Habitat World Record. The second was the wall construction method developed in New Zealand by Laser Systems Ltd under the trademark "Laserbilt". This system utilises panels made from 36mm particleboard 2.4 metres high and up to 7.2 metres long.

John Parr, Director of Manufacturing Education Ltd and a Licensee of the Avraham Y Goldratt Institute was the Scheduler for the project. "The job would have been impossible without the ProChain Software. From early November when the plan was first put into MS Project until 2 days before the build, the tasks, order of tasks and labour available was constantly being refined. A rough guess is that the Critical Chain was recalculated 150 - 200 times, and then analysed to optimise the new sequence of operations. The speed with which ProChain was able to recalculate the schedule permitted many scenarios to be input and quickly reviewed for feasibility. This iterative process was used to progressively develop the final plan.

Habitat for Humanity is an international charitable organisation that builds simple, affordable houses and sells them on a no-interest, no-profit basis to needy families.

The previous record, set in June 1998 in Nashville, Tennessee was 4 hrs 39 minutes and 8 seconds. The NZ target was 4 hours. Actual time was 3 hours 44 minutes and 59 seconds. The rules provide for construction to commence from an established floor platform and the house is deemed complete when it meets the local building code and the family can move in.

Two adjacent sites were available with foundations completed. On the first site the floor, with drainage, power etc up to it was in place, with the wall panels sitting on top. On the second site the ceiling was sitting on the foundations. After the klaxon sounded the wall panels were lifted into place while the roof trusses were lifted and run along into position. The roof section was completed with fascia, soffit, purlins, etc but no roofing iron. Once the walls were in place and square, an 80 tonne crane lifted the roof on to the walls. Roofing iron was then put on. Meanwhile, the wall sheathing was attached to the outside walls and windows fitted, with the painters almost painting the face of the hammers as sheath nailing was completed. Inside the vinyl was laid first in the utility areas, while painters started in the bedrooms. After the vinyl the bath, toilet etc were fitted, walls painted, ceilings painted, carpets laid, doors fitted and curtains hung. The rule was to be "One trade(sman) in one room at one time" but enthusiasm took over and people were doing whatever they could, whenever they could, particularly near the end. Some more discipline about that and also getting people to move out of the house as soon as they had done their task would have reduced the

time by 15 minutes. On the outside while the roofing iron was put on, decks and steps were constructed, a front path laid, letter box and clothes line installed, wooden fence constructed around the perimeter, 3 trees planted and lawns levelled and grassed.

Murphy did strike. The bathroom was planned to be fitted out in 30 minutes. After 25 minutes, time to completion came back as - 30 minutes! Apparent disaster. And it was a Critical Chain task as well. However, when buffers were inserted, the Critical Chain itself had a 30-minute gap in it as well as the 45-minute project buffer (i.e. 1 hr 15 mins). So not a worry. In fact the bathroom took 1.5 hours, 1 hr longer than estimated. So the project buffer ended up with 15 minutes remaining.

Murphy struck a second time. The wiring loom for the ceiling was assembled on four boards off site and nailed together on the day and the interconnections made. Before the gable end sheathing was put in place this 13 metre long loom was fed in through the trusses. The end sheathing was fixed (so the loom could not be removed) before the electrician discovered the loom had been fed in wrong end first! He thought he had blown the attempt with his mistake, but there was a big feeding buffer so it was not a problem as he disconnected his joints, levered the boards apart and individually turned them end for end inside the ceiling space.

The times that were used were the times that the tradespeople had given. There was no suggestion of trying to cut them in half (as the theory suggests) because people were already being reasonably optimistic. Most tasks took about the time given or a little bit shorter. Mind you, those times were scrutinised by a lot of people over the preceding weeks. The objective in the planning phase was to get the Critical Path time (before buffer insertion) down below 3 hours. In fact, 2 3/4 hours was achieved and with the addition of 30% buffers took the project time to 4 hours.

The resources planned were about 130 people, some as individuals and some as teams (e.g. 20 painters). About 100 people were required on the first two tasks, and it was amazing how the planned time reduced as we ensured the same people/teams were not on both of these early tasks. Original times were something like 5 - 6 hours without buffers and purely through the use of ProChain and analysis of the network (Critical Chain analysis, splitting of long tasks, changing or increasing resources) the time before buffers was reduced to 2.75 hours. This may have been possible to achieve just using MS Project, but ProChain made the job a lot faster.

If we had not used Critical Chain technique, the planned time as a traditional project manager would have published it would have been 2.75 hours. Critical Chain put our buffers in the correct place and enabled the planned time of 4 hours to be met.

Because labour was not an issue, the network showed all the tasks to be started as early as possible, but still with no resource contention. Hence our feeding buffers were effectively very big. Which explains why none of our feeding buffers ever got used up. So we got bored with printing buffer management reports and just followed the tasks minute by minute on a big laminated wall chart 3' high and 4' 6" long.

Handing over from one task to another had to be done by the people concerned. We asked ProChain to write a special "Task Sheet" which detailed which resources were allocated to the task, any task notes where we had decided special things to be done,

materials and tools required, etc. Also the predecessor and successor tasks, complete with team leaders names so they could communicate before the event and know who they were handing a job on to or who they would be getting it from.

After the final countdown a dedication ceremony was held and the keys presented to the new owner. What a day!!
