

Greetings all. Today's Bulletin is about lifting concrete elements.

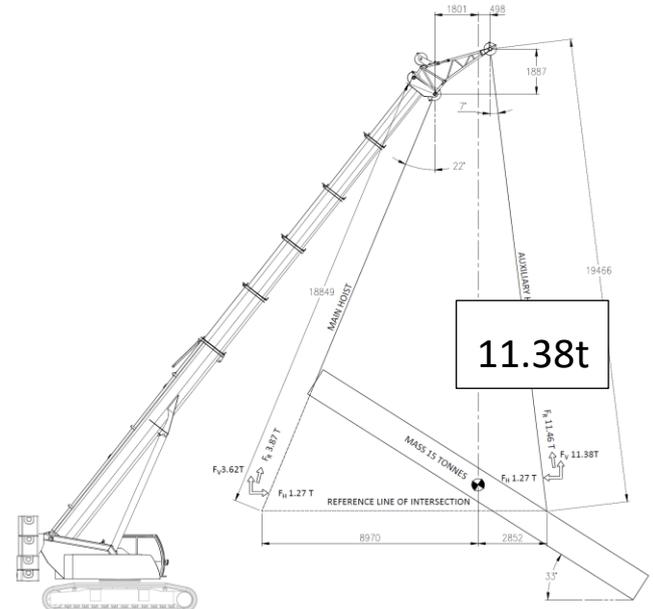
In our previous Safety Bulletin #291 we talked about single crane dual hook operations; this type of lift is often conducted on site for tilt-up construction works or for precast concrete element installations. We talked about the steps of the lift planning process in Bulletin #291, and today we are going to focus on the load share calculation and rigging designs.

Load share between the hoists

For lifts, quite often the initial lift is considered a relatively even distribution of the forces to both winches but often due to the hoist line moments occurring at 90 degrees to the centre of gravity, the worst-case load distribution can occur mid rotation / post initial pick position.

Forces from load rotation need to be carefully considered at all stages of the lifting operations with particular consideration to the loads that are relatively slender in nature, with great differences between main and auxiliary lift points. The load shape and attachment points can change the distribution of load between the two hoist ropes after initial pick position.

The example below shows that at the start of the lift, the initial load is primarily on the auxiliary hook (10.84t). As the load is tailed on the auxiliary hook, the load increased on the tailing hook after the initial pick (11.38 t).

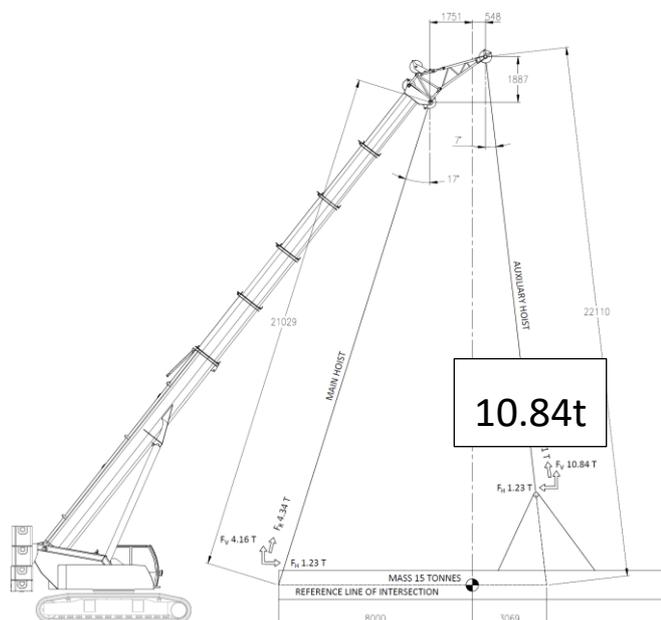


Rigging Design

The industry standard “Precast and tilt-up concrete for buildings” has been published by WorkSafe Victoria to help with establish a safe working environment when using precast and tilt-up concrete in construction. It provides guidelines on erecting and incorporating precast concrete elements by crane into their final position in the building structure. The AS3850 series standards also have requirements for cranes and rigging used for concrete elements.

Rigging design is part of the erection design, the erection designer should possess a thorough understanding of rigging arrangements, load equalisation and lifting operations. The erection designer should provide element details on the mass, dimensions, and centre of gravity. And the location, orientation, type, make, capacity, and technical specifications of lifting inserts in the erection documentation and shop drawings.

It is important to note, as shown in the example above, that the load share between the hoists depends on the load geometry and the position of the lifting points. This load share changes as the panel rotates, and is accomplished with rigging equipment, like a snatch block(s), that allows for the dynamic adjustment of the sling lengths to account for the changes in geometry between the hook and load attachment points. Ensuring the lifting clutches remain oriented for engagement and the sling angles stay less than 60 deg is critical for safe panel rotation.





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Maintaining tension on rigging gear until the load transfer has completed is critical to avoid shock loading. Shock loading should be avoided for all lifting operations as shock loading on the crane components and crane supports may cause failure of a component (e.g., hook, rope) and/or the catastrophic collapse of a crane.

The recommended way to control risks for concrete element construction starts in the planning stage with an erection designer with lifting operation knowledge or have the erection designer communicate/work with the lift designer during the erection design phase to plan the lift at an early stage. The training for crane crew members on understanding the certification, inspection and testing of rigging equipment and clutches has improved with recent changes to the HRWL units.

The crane crew members should raise their awareness of the specific legislative and Australian Standard requirements for lifting clutches and handling of concrete elements. In particular, the importance of the engineering certification and relevant requirements. Check the condition of the rigging equipment, lifting inserts and clutches before the lift. Follow the concrete element manufacturers' instructions for installation requirements.

Before lifting any load, the Rigger shall ensure the following:

- Check all relevant erection documents, shop drawings, manufacturer requirements and certificates for the load to be lifted.
- The slings and lifting equipment are fit for purpose and are correctly applied to the load and the crane hook.
- Compatibility between lifting clutches and inserts
- Use tag lines where it is necessary to control the movement of suspended loads.
- The load is secure, and the load is free and ready for hoisting.
- When hoisted the load will not foul on any object or cause a hazard to any personnel or plant.
- The load/boom travel route is clear and the landing area is clear and ready to receive the load safely.

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