



## DEEP SHAFT CONSTRUCTION EXPERTS

*Rob Carr has specialist capability to safely undertake deep shaft construction in all ground conditions.*

With in-house design and construct capability, Rob Carr provides total solutions for clients requiring any type of shaft construction. We can prepare detailed design drawings for conventional shafts and underpinned or in-situ caissons, obtain RPEQ certification of the design, provide all equipment and ultimately self-perform the construction. In particular, we have successfully constructed multiple shafts of varying depths and diameters utilising caisson sinking or underpinning techniques.

### SINKING TECHNIQUE

Rob Carr has a solid track record in design and construction for both precast and in-situ concrete caissons in extremely difficult ground conditions using our sinking technique. This technique is most effective when used in wet, non self-supporting soils such as silt, sand and clay and enables us to achieve significant depths. We have successfully constructed caissons up to 12m in diameter and 20m in depth, with the capability to achieve more extensive depths where required. The technique involves constructing a specially designed cutting toe at surface level. Once done, excavation commences within the walls of the cutting toe. Upon completion, the next section of the caisson is constructed at surface level immediately on

top of the cutting toe with excavation continuing from surface level inside the walls of the cutting toe and new caisson section, allowing the new structure to progressively sink. The cutting toe assists the caisson section to cut through the soil as it sinks into the ground. The process is repeated until the desired depth is achieved. At this point, the caisson shaft is sealed by pouring a concrete plug at the base, locking the caisson toe and walls with the plug. This technique minimises dewatering as the caisson is excavated wet whilst work continues at surface level and is commonly used for the construction of access shafts, permanent structures for storage or wet wells for pump stations.

### UNDERPINNING TECHNIQUE

Rob Carr has constructed multiple caissons using underpinned precast segments up to 9m in diameter and 26m in depth. Underpinning is most effective for shafts in self-supporting soils such as stiff clays and rock and is a safe proven method for extreme depths. We utilise this technique on our urban sites where construction is confined to a small footprint. It involves constructing a circular concrete anchor at surface level, which is used to support the segment rings below. Once completed, excavation continues inside the anchor at 1m intervals. Individual segments are interlocked until a full ring is completed with grout to lock in the completed segment ring with the surrounding ground. New segments are then underpinned directly to the previously completed segment ring until another full ring is formed. The process continues until the targeted depth is achieved and a plug is poured to seal the caisson.



## Pimpama Coomera Waterfuture Master Plan Initiative – Package D

COOMERA 

**CLIENT** Abigroup Contractors

**WORKS COMPLETED** The Pimpama Coomera Waterfuture Master Plan Initiative (PCWMPPI) aimed to secure a sustainable water future for residents of the 7,000 hectare Pimpama Coomera region by using multiple sources of water in all new homes approved after August 2005. As a specialist sub-contractor to Abigroup, Rob Carr constructed 790m of DN1200 and 820m of DN1400 gravity sewer at grades as low as 1:900. A key part of Rob Carr's challenge was to construct a 26m deep shaft, which had two DN1200 tunnels leading into it. Using precast underpinned concrete segments, we were able to successfully construct the deep caisson and concrete structures in difficult ground conditions including rock up to 200MPa UCS.



## Alphington Sewer Project

ALPHINGTON 

**CLIENT** Lendlease

**WORKS COMPLETED** Rob Carr was engaged to construct approximately 1km of pipeline by microtunnelling. To facilitate the TBM launch and reception as well as construct complex concrete maintenance structures up to 5m diameter and undertake detailed connections to existing assets, we constructed access shafts up to 16m deep and 9m in diameter. Varying methodologies were used to construct the access shafts with consideration given to ground type, strength and location within the environmentally sensitive park zone. Traditional methods were used for the shallower shafts while underpinned caissons were the preferred choice for the deep shafts in confined locations with environmental constraints. The use of the underpinning methodology also accommodated the site's variable ground conditions—ultimately ensuring the safe, structurally sound completion of this section in line with the client's program.

## Green Square Stormwater Drain

SYDNEY 

**CLIENT** Drying Green Alliance, a joint venture formed between Seymour Whyte Constructions, UGL Engineering, Parsons Brinckerhoff, RPS Manidis Roberts and client partners Sydney Water and the City of Sydney.

**WORKS COMPLETED** To address the challenge of working in high water table ground and facilitate the 4km trenchless pipeline installation, Rob Carr self-performed the construction of five caissons varying in diameter between 10–12m, and in depths between 7–10m, eight other conventionally shored shafts up to 6m deep and the construction of permanent complex civil structures within each of the caissons.

A major achievement was the development of the caisson knife gate structure by our Green Square team and plant department in Queensland. The knife gate arrangement minimised wet sand and soil entering the caisson during the TBM set-up and launch. Use of the knife gate reduced safety hazards and risks including soil/sand collapse, additional excavation, installation of piles and stabilised sand outside the caisson and some re-work.

This innovation was a key element in enabling multiple successful launches of the TBM into the wet sandy conditions, and has now become part of standard practice on subsequent Rob Carr projects addressing similar challenges.

*With our extensive  
in-house design and  
construction capability, we  
provide total solutions for  
clients requiring any type  
of shaft construction.*

For more information please visit  
[rob carr.com.au](http://rob carr.com.au) or call **1300 883 602**

