

## Novel Tunnel Segment Manipulator

The expertise of Bennett Associates, the South Yorkshire based mechanical and structural design consulting engineers, has again been used by Balfour Beatty Civil Engineering Ltd, this time on the Heathrow Express contract currently under construction for the BAA.

The brief was a fixed price contract to design and supply a novel segment manipulator which could be attached to, and operated from, a Case 888 excavator.

Bob Wood, a Senior Design Engineer at Bennett Associates, worked closely with the Heathrow Express team and various local manufacturers to design and produce the apparatus in a very short time scale.

The method of operation is simple and commences when the excavator driver unhitches the conventional digger bucket, using cab controls, and then hitches the segment manipulator to the excavator by the same method.

The hydraulic power for the segment manipulator is taken directly from the excavator. Using the conventional controls of the excavator the driver attaches the segment to the manipulator and positions it to within 100mm of its final location.

Final accurate placing of the segment is then carried out by the Ring Builders using the hydraulic control located on the manipulator.

Commissioning of the manipulator and instructions of the operators was carried out at site by Bob Wood just before Christmas 1995. Since then the manipulator has been assisting the site team to progress segment erection in the CTA Concourse Tunnel section of the project.

Following the operational success of the manipulator, Balfour Beatty Civil Engineering Ltd placed an order for the design and supply of a second unit incorporating interchangeable end adaptors to suit 3 different sizes of segment for use on other sections of the contract.

This is another example of the experience of Bennett Associates in providing practical, cost effective solutions to engineering problems.

