TenCate Mirafi® PET
Mine services corridor, Cape Preston WA

The Sino Iron Project is a world class, large scale magnetite iron ore project located at Cape Preston, 100 km south west of Karratha, in Western Australia's Pilbara region. This iron ore project is the largest planned magnetite project in Australia with an estimated 2 billion tonnes of identified magnetite ore. Mine development and infrastructure costs are estimated at USD 3.5 billion.

The project has an extremely tight time schedule, with construction beginning in mid-2008 and is due for completion at the end of 2010. In addition to the large open pit mine, major infrastructure items consist of a 450 MW power station, a 25 km long slurry pipeline, a 50 gigalitre desalination plant to supply fresh water, and a new deep water port with stockpile facilities. The port handles the import of heavy equipment for the mine site as well as the export of magnetite pellets.

A crucial component of the overall project was the construction of a 30 km long services corridor connecting the port to the mine site. This services corridor had to be completed in advance of other infrastructure items to enable the transportation of all heavy equipment for the mine site, power station, desalination plant and all other related facilities.

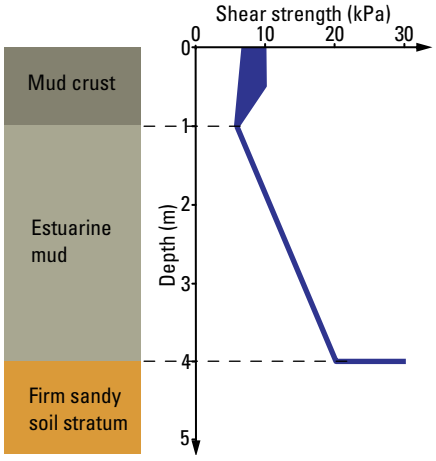
Part of this services corridor consisted of a 2 km long causeway constructed through a river estuary. The foundation conditions within the river estuary consisted of soft estuarine mud of approximately 4 m in depth overlying firm sandy soil. The estuarine mud consisted of a slightly overconsolidated crust of 1 m in thickness with an undrained shear strength ranging from 7 kPa to 10 kPa. Below this the undrained shear strength increased with depth from around 6 kPa to around 20 kPa at 4 m depth.

The causeway embankment ranged in height from 1 m to 7 m, with a crest width of 32 m, and consisted of mine waste rock fill. The side slopes of the causeway were maintained at 1V:2H. At the centre of the causeway a 200 m long reinforced concrete bridge was constructed to enable river flows during both normal and flood periods.

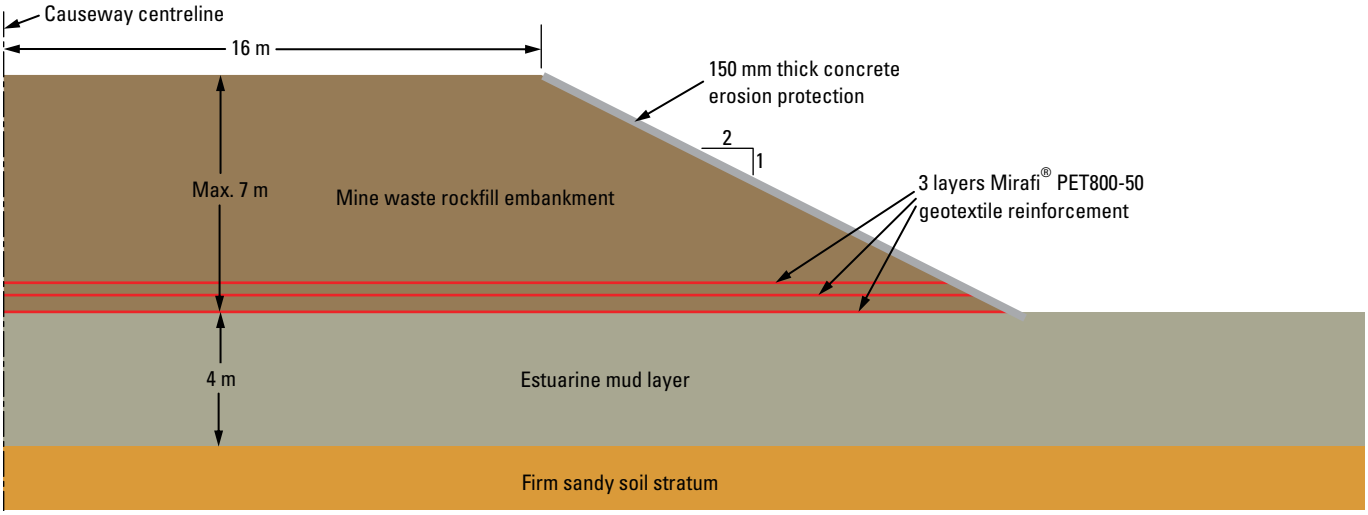
In addition to the tight construction schedule, the causeway embankment had to be designed to allow for heavy vehicle loadings from 240 tonne haul trucks as well as the safe transport of 1400 tonne giant grinding mills for the mining operations.

To construct the causeway a number of design and construction options were evaluated. These ranged from stage construction to soft soil replacement. The only solution that was economically and environmentally viable was to use basal reinforcement across the base of the causeway embankment to enhance stability and achieve the required factor of safety. A detailed analysis was performed using the limit equilibrium method to determine what strength properties the basal reinforcement should have to meet the stability requirements.

Once the basal reinforcement design loads were established, other factors such as the effect of the placement and compaction of the coarse mine waste rock fill on the basal reinforcement were also evaluated, as well as the design life over which the basal reinforcement was



Foundation undrained shear strength profile



Typical cross section through the basal reinforced causeway

required. Taking all these factors into account, 3 layers of Mirafi® PET800-50 geotextile reinforcement was chosen as the basal reinforcement for its ability to meet all of the requirements. Mirafi® PET800-50 geotextile reinforcement is a woven polyester geotextile with a tensile strength of 800 kN/m at 10% strain in the longitudinal direction and a tensile strength of 50 kN/m in the cross direction. The polyester yarns used are of high tensile modulus and have an excellent resistance to creep.

The Mirafi® PET800-50 geotextile reinforcement was placed directly on the surface of the soft estuarine mud with the rolls of geotextile laid out 90 degrees to the direction of the causeway embankment. No geotextile joins were allowed in this direction across the width of the embankment. The first mine waste rock fill lift was placed on top of the geotextile reinforcement, spread out and compacted to construct an initial fill platform of 0.5 m thickness. On top of this fill platform the second geotextile reinforcement layer was placed and then a 0.3 m thick fill layer placed on top. Finally, the third geotextile layer was placed and then the embankment was constructed to its completed grade alignment.

Where the causeway embankments abutted the central bridge structure another three layers of Mirafi® PET800-50 geotextile reinforcement, placed coincidentally with the cross-wise layers, was used at the base of the 7 m high abutments to ensure adequate stability in the vicinity of the main river channel. These 3 layers were placed 40 m into the causeway to ensure the bridge abutments had adequate stability.

The use of basal reinforcement has enabled the causeway embankment to be constructed quickly, directly on the estuarine mud foundation, without soil replacement. Consequently, the impact on the environment has been reduced to a minimum. Further, the services corridor has been completed on schedule. No subsequent embankment deformations have been observed.

Layout of Mirafi® PET800-50 woven geotextile reinforcement on site

Client: CITIC Pacific Mining Management Pty Ltd, Perth, WA, Australia.

Consultant: Connell Wagner Pty Ltd, Perth, WA, Australia.

Contractor: MCC Mining (Western Australia) Pty Ltd, Perth, Australia.

Photographs courtesy of CITIC Pacific Mining Pty Ltd.

Construction of basal reinforced causeway abutment

Completed reinforced causeway and bridge structutre

Transport of giant grinding mill along services corridor