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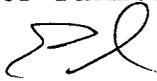
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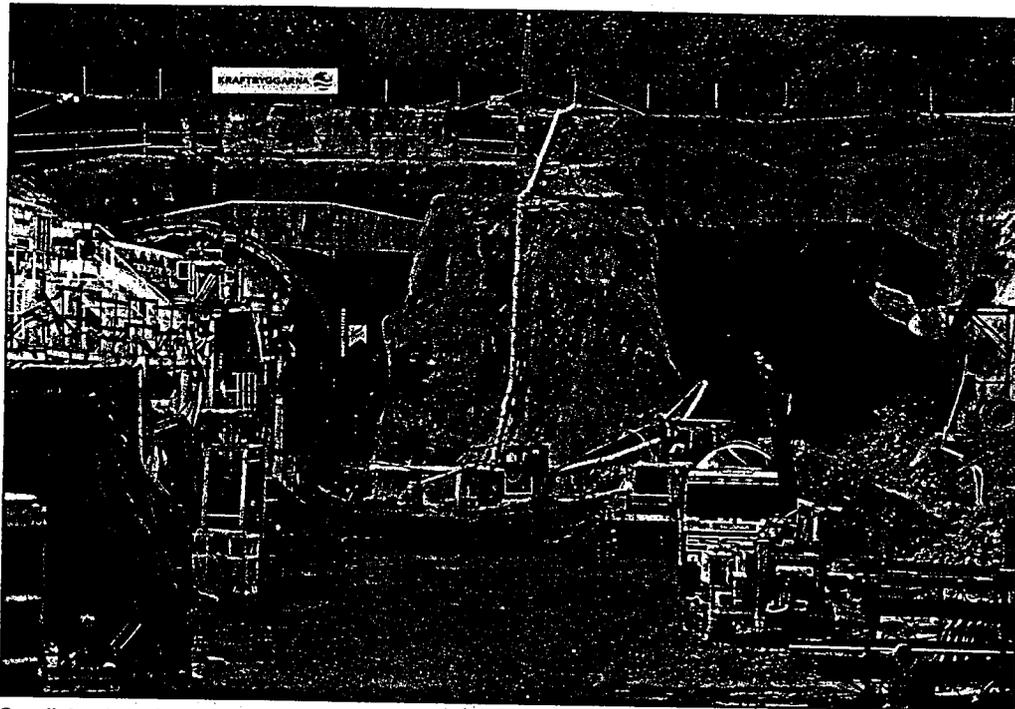
MEMO TO: MTA & RCC BOARD OF DIRECTORS & ALTERNATES

FROM: EDWARD McSPEDON 

SUBJECT: SWEDISH RAIL TUNNEL PROJECT

The attached article describes some of the problems encountered in tunneling for a railroad upgrade project in Malmo, Sweden. I'm asking staff to review for "lessons learned".

EM:mpw (7a:\srto)
Attachments



Swedish railroad contractor bored through a ridge with clay that proved so wet that TBMs were withdrawn.

Sweden. With a population of 8.5 million, Sweden is spending more per capita than any European country on upgrading railroads. Its system centers on a triangle connecting Stockholm, the capital, with Gothenburg and Malmö.

Rather than building high-speed track, Banverket, the State Railroad Administration, uses tilting trains to ease discomfort on tight bends. It ran test trains at 210 kph on sections of the 455-km route between Stockholm and Gothenburg. Banverket is upgrading the track and removing 210 of 300 at-grade crossings.

Improvements include a new 30-km section due to open this year, and the 2-km-long, twin-deck Igelsat bridge. It is one of 29 bridges on the line, which includes 11 tunnels up to 1.8 km long. Banverket aims to complete upgrad-

ing the 600-km-long Stockholm-Malmö line in 1996.

The company is also upgrading tracks between Gothenburg and Malmö in sections. The most important and troublesome section has twin 8.6-km-long tunnels through the Hallandsås Ridge north of Malmö.

The tunnel penetrates a ridge of

gneiss with water and clay-filled fissures. Banverket expected contractors would bid drill-and-blast for the generally hard-rock work. But Kraftsbyggarna Entreprenard AB, Luleå, won with an \$89-million bid using a tunnel boring machine.

But KE had to withdraw its 9.1-m-dia TBM after driving just 13 m. Clay ground was so poor that "when we stopped [the TBM] it started to sink," says Project Manager Sög Östfjord. KE is mining with an excavator looking for good rock, hoping to restart the TBM in January.