"Perceived Risk versus Cost in Karst Remediation – A Case History"

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7th Annual Technical Forum
Geohazards in Transportation in the Appalachian Region
August 1 and 2, 2007
Asheville, North Carolina

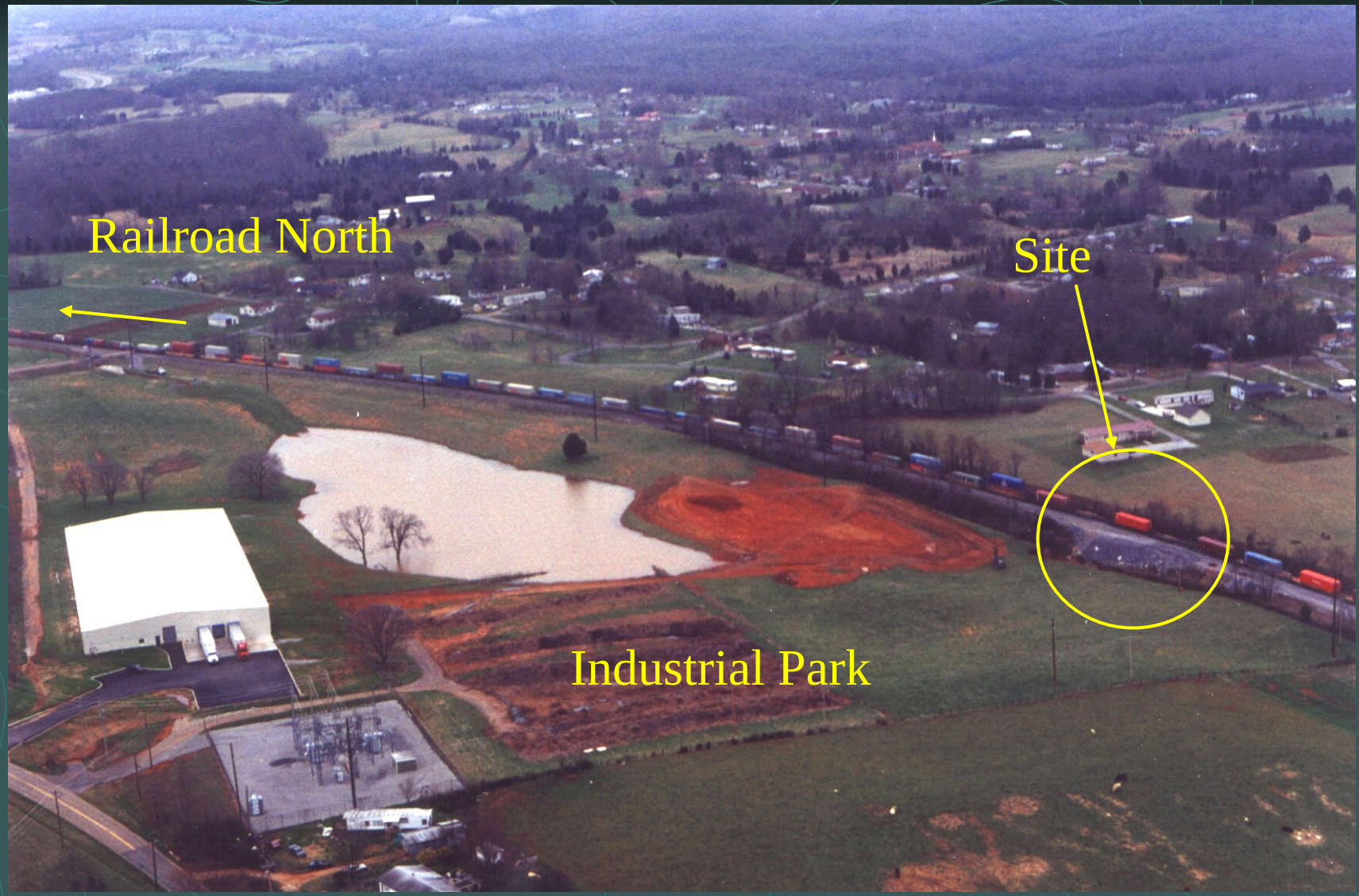
Project: Norfolk Southern mainline railroad, Milepost 96.1A; near Morristown, Tennessee.

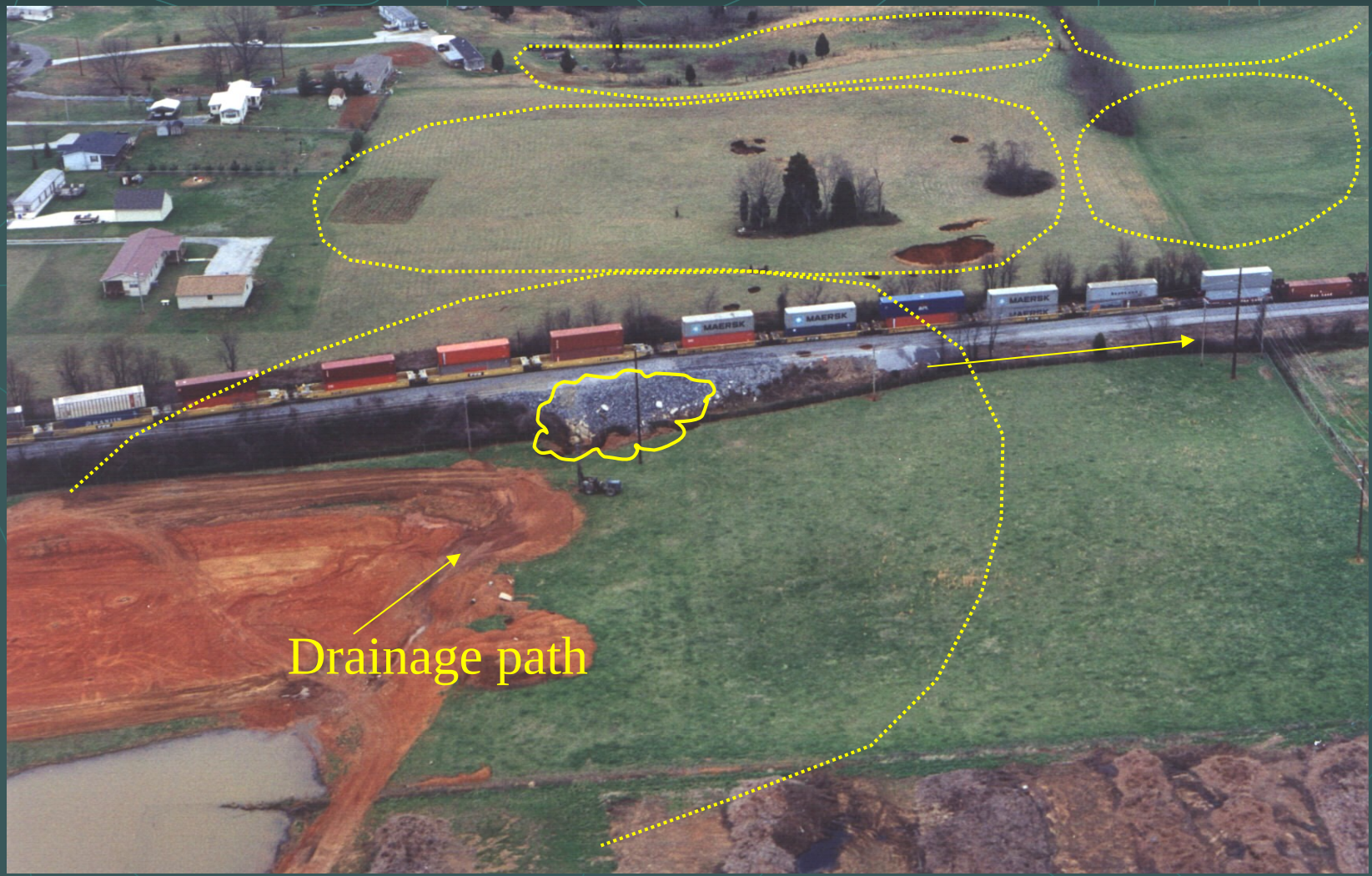
Site Conditions: Curve built upon fill across closed depression;
fill thickness up to about eight feet maximum;
open fields adjacent to site;
karst topography; some regional bedrock faulting;
Knox and Mascot Limestone Formations.

Problems: Ground loss and subsidence near track;
periodic slow orders for traffic (up to 30 trains per day);
ongoing maintenance to add/regulate ballast, re-establish profile/SE;
occasional repairs (boulder fill) to choke dropouts/rebuild shoulder.

AMEC Scope: To explore general subsurface conditions;
develop remediation scenarios.


Talbot Quadrangle
About 3 miles to
downtown Morristown
Highway 11E
Site
About 30 miles to
downtown Knoxville
HAMBLEN CO
JEFFERSON CO
Talbott
Talbott Sch
BM J 129
1191
BM LHT 148
1196

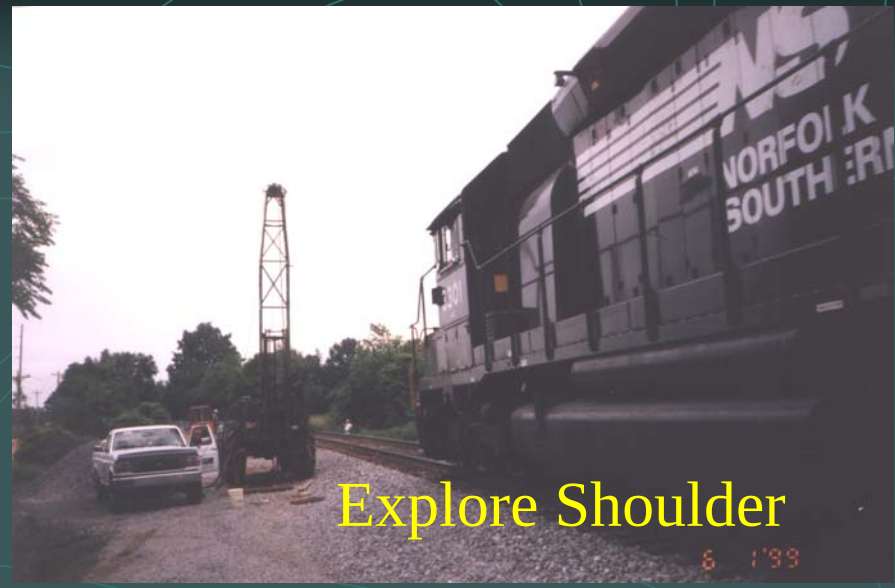

Railroad North
Site
Industrial Park


Drainage path

Dropouts/Rock Fill near Track

AMEC Geotechnical Study

- 20 borings (plus one)
- Review of GPR data obtained by NSC
- Review of subsurface data from earlier studies performed by others




Houston, we have a problem……
4 6'89


Corridor of highly weathered rock
+/- 250’

➢No brainer: Address surface drainage

➢Remediation schemes to address subsidence:

- Compaction/cap grouting: $250K to $400K
- Track shift: $750K to $950K plus additional right-of-way issue
  : Temporary (during repair work to treat voids)
  : Permanent

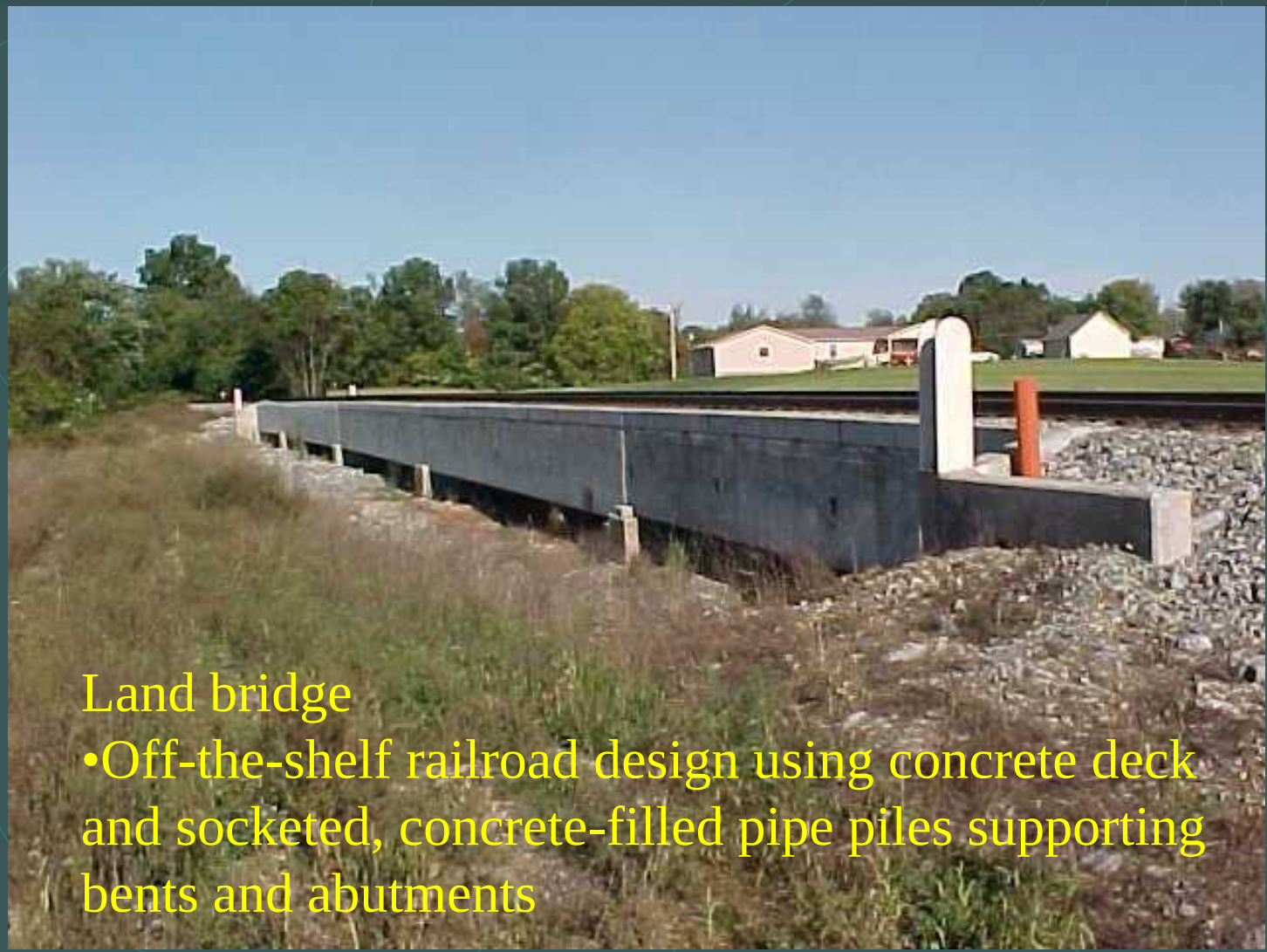
-Land or at-grade bridge: $1.5M +/-

➢Perceived Risks:

- "What if world fell from beneath us?" (catastrophic collapse or dropout)
- Derailment/safety
- Environmental contamination from HAZMAT spill affecting air and/or water
- No convenient run-around if track out of service: freight $, schedules
- Unknowns/uncertainties with grouting/history of site
- PR issue associated with accident and perception of not having adequately addressed concerns if used lower cost/higher risk fix

➢Client's Selection:

- Client chose expensive but permanent, walk-away fix – land bridge


Land bridge
•Off-the-shelf railroad design using concrete deck and socketed, concrete-filled pipe piles supporting bents and abutments


Note improved surface drainage and removal/ sealing of dropouts.


2001


4/25/2003


4/25/2003

➢Summary

• Risk-conscious client elected to minimize risk of future problems at specific high-risk site by utilizing expensive, low risk solution

• Risk of future problems within adjacent areas nonetheless