

Railway Protection: The Regulations and Surveyors' Role

Land Transport  Authority

Development & Building Control Division – Railway Protection & Survey & Land Division

Outline of Presentation

- Regulations
- Definitions
- Submission Process
- Surveyor's Role, Common Mistakes
- S&L Division Involvement & Case Studies



Development & Building Control Division – Railway Protection & Survey & Land Division

Regulations

Rapid Transit System (Development & Building Works in Railway Corridor and Railway Protection Zone)

Regulations

- Applicable within railway corridor & protection zone
- Regulates development and building works
- Code of Practice for Railway Protection

Rapid Transit System (Railway Protection, Restricted Activities) Regulations

- Applicable within railway protection zone & safety zone
- Regulates restricted activities (9 restricted activities in Schedule)
- eg. installation of boreholes, wells, sheet-piles, pile foundations

Definitions

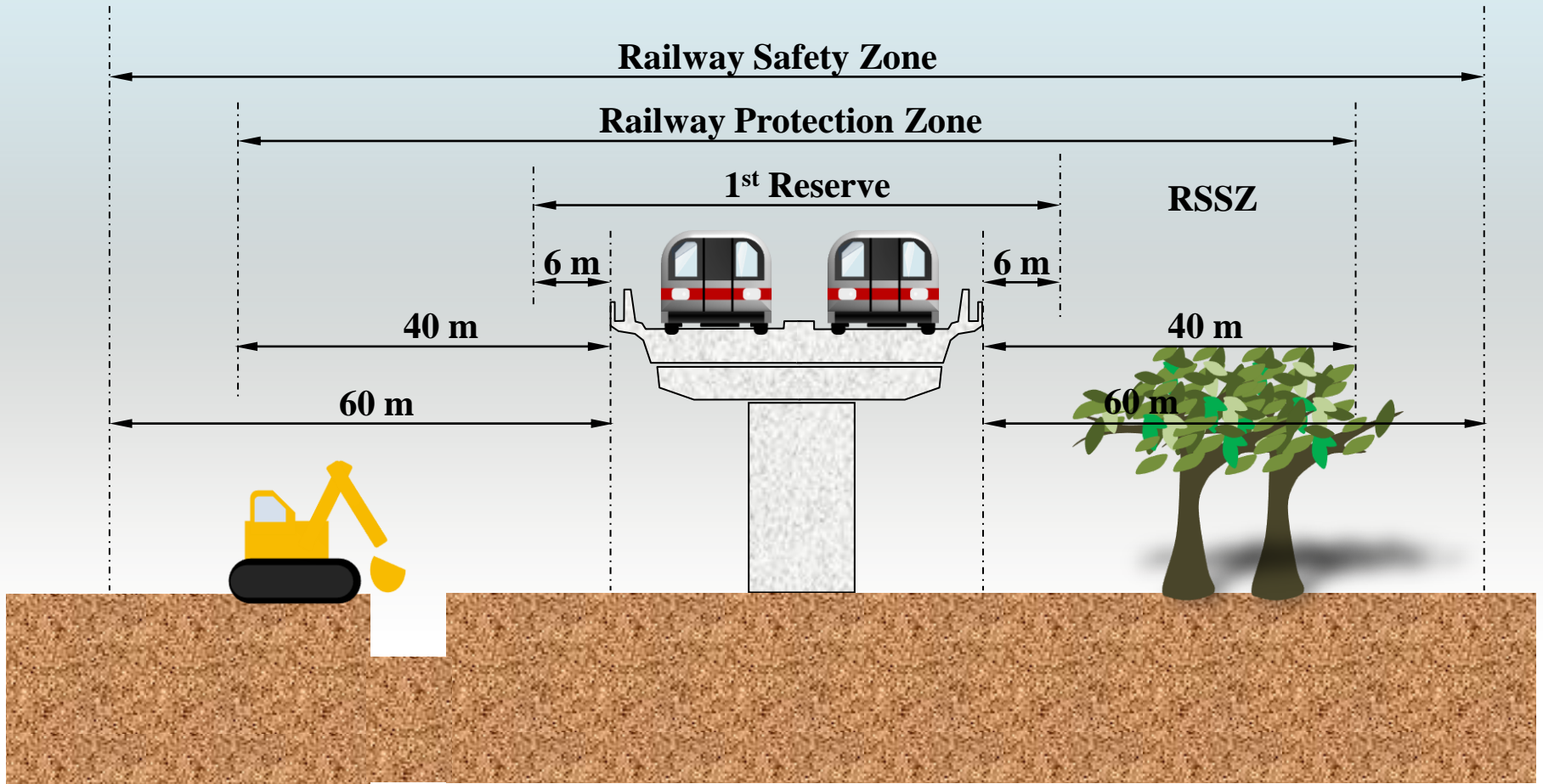
RTS Lines planned or under construction

- Railway Area (Gazetted under RTSA Section 3)
- Railway Corridor, RC (40m either side of Railway Area)
- Railway Safety Zone, RSZ (60m either side of Railway Area)

RTS structures completed and in operation

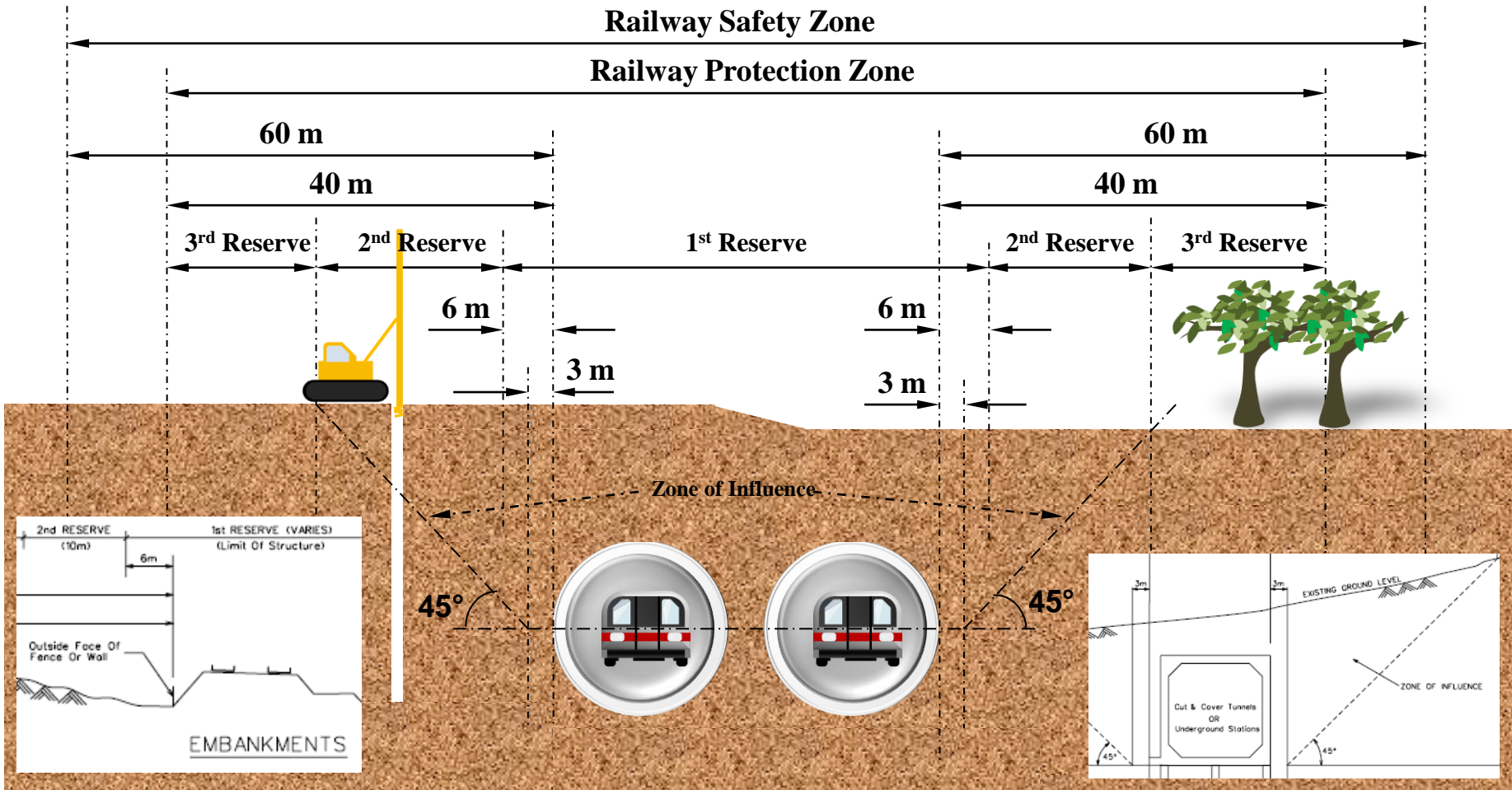
- Railway protection zone, RPZ (40m)
 - 1st Reserve (6m from the outermost edge of RTS structures)
 - 2nd Reserve (depth dependent, only for underground RTS structures)
 - 3rd Reserve
- Railway Safety Zone, RSZ (60m)

Definition – RPZ & RSZ



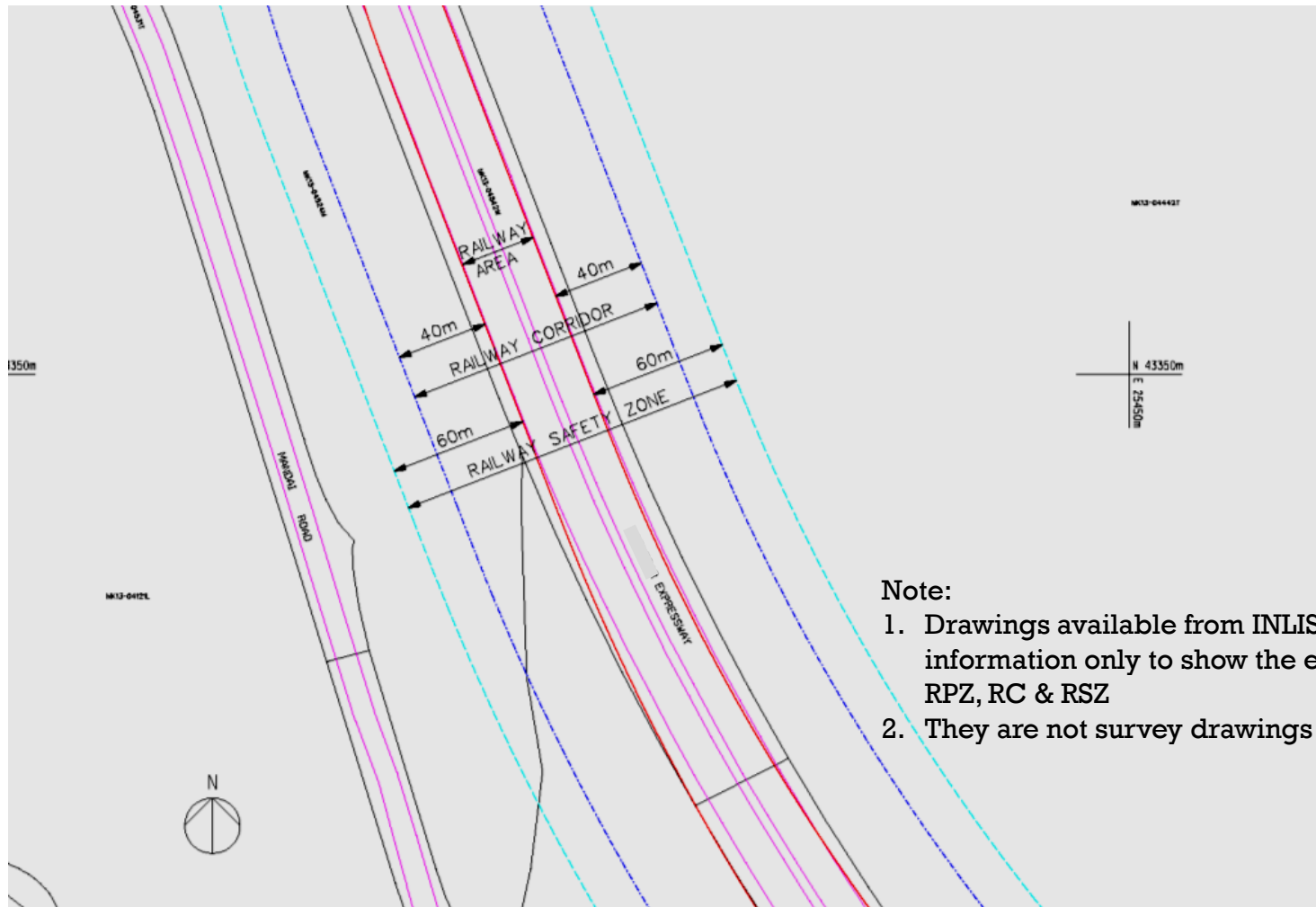
Above Ground Railway Structure

Definition – RPZ & RSZ



Underground Railway Structure

Definition - RC



Note:

1. Drawings available from INLIS are for information only to show the extent of RPZ, RC & RSZ
2. They are not survey drawings

Railway Corridor

Submission Process

LTA Clearance required for:

- Development & Building Proposals
- Restricted Activities

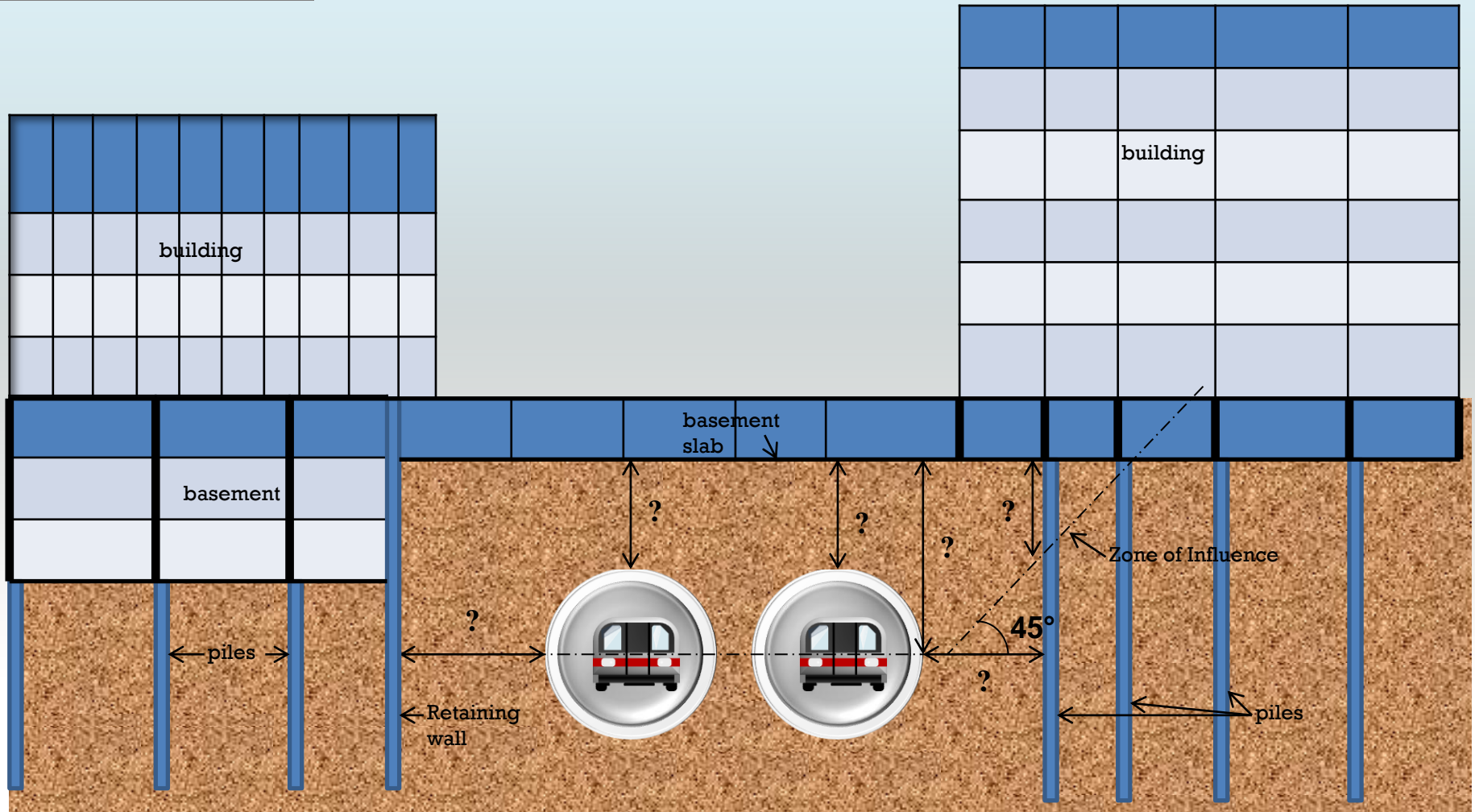
Qualified Persons (Architects/Engineers)

- Development/Building Proposal
 - Layout of building/basement/separation distances to MRT
- Engineering Works
 - Effects of excavation, foundations, etc. on the MRT structures
 - Location of foundations piles, earth retaining structures, etc
 - Instruments to monitor ground & MRT structures/tracks

Restricted Activities

- Boring/drilling works (e.g. soil investigation, ground instruments)
- Digging or excavation of trenches or pits
- Construction of tunnels, etc

Some Critical Dimensions for design



Underground Railway Structure

Where does Surveyor come in?

Topo Survey

- Location of Tunnels & Underground Stations
- Setting out of Pile, Soil Investigation Boreholes, etc
- Temporary Earth Retaining Walls for Basement Construction, etc

Prepare Certified Survey Plan

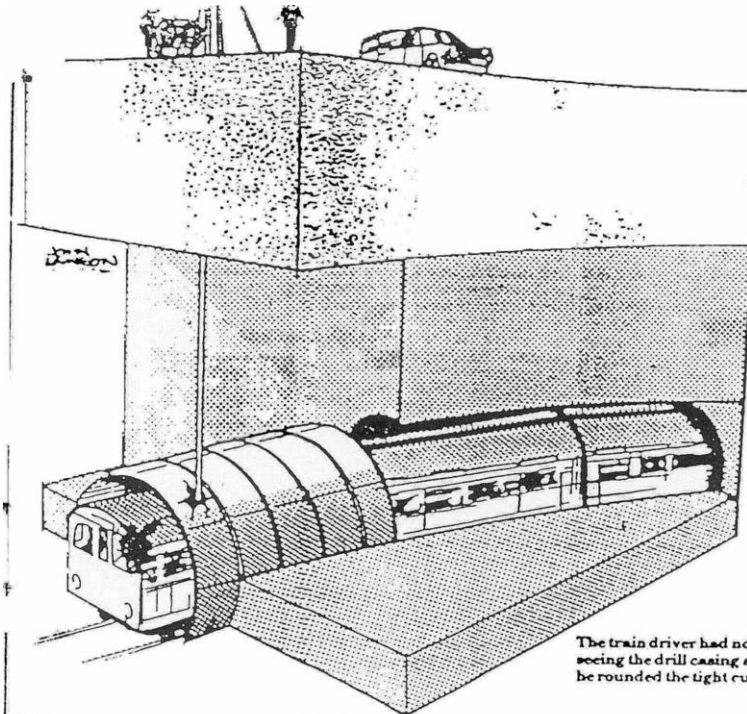
- Development & Building Proposal
- Engineering Works & Restricted Activities

Monitoring Instruments Installation in Tunnels/Trainway

- Location & Setting out in tunnels & stations
- Train Structural Gauge clearance

Setting Out & Installation at Site!

Example of an incident



The train driver had no chance of seeing the drill casing ahead as he rounded the tight curve.

Bad marker blamed for tube drill blunder

Consultant WS Atkins & Partners faces full responsibility for the accident last week in which a London Underground train ran into a drill casing which had pierced the Central line tunnel.

Inaccurate setting out led to the soil sampling rig being positioned over the tunnel. LU has criticised Atkins' decision to go ahead with boreholes prior to detailed discussions with the tube train authority on drilling in the tunnel area.

Atkins refused to comment, claiming it was unable to get client Department of Transport's authority.

The accident happened when an southbound train heading for Wanstead passed under the A11/A12 Green Man roundabout

The driver was slightly hurt by flying glass as the 200mm diameter bit landed in the cab, and a length of the casing was abraded off and thrown back up at the crown of the tunnel, causing further damage to the cast iron lining some 10m beyond the original penetration.

A second, empty train sent down to the tunnel to investigate what had caused the accident was slightly damaged when it ran into an investigating probe, itself sent down by Phoenix to discover what had happened.

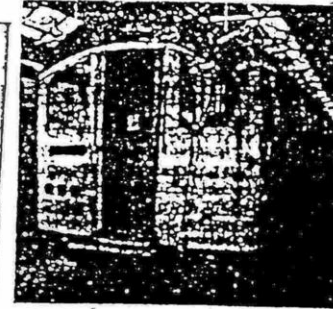
Atkins was carrying out sampling

for the Hackney to M11 link road which is to be built through the roundabout (NCE 17 October 1985). The consultant had let the drilling work to Terresearch, which in turn had subcontracted Coventry based Phoenix Drilling to augment the number of rigs available. Phoenix had just one soft ground boring rig on site to Terresearch's three. It was the Phoenix rig which hit the tube train as it passed beneath sampling point A12.

But LU's principal civil engineer David Hornby told NCE that the A12 marker peg was 10m to 12m out.

'We had talked in general terms with Atkins on what we expected in the area because there will be a lot of structural road work which will have a very significant impact on the tunnel' said Hornby. But LU claimed that a meeting to discuss drilling details was set for the near future but had still not been finished.

Phoenix sank the casing through



ABOVE: The damaged cab of the Central line train awaiting repair at London Underground's Hainsault depot this week.

6m of sand and gravel and 7m of London clay before hitting an obstruction which was thought to be a stone.

But one further application of the sinker weight drove the bit through what turned out to be the tunnel's cast iron lining and allowed the drill to drop 4m to the tunnel invert.

The accident is all the more surprising because the vibration from passing trains is clearly noticeable on the surface above the tunnel though that vibration would have been masked once the rig's motor was running.

The findings of Atkins' internal investigation into the accident were handed to LU earlier this week and drilling has been suspended until talks between the two have established exactly where further sampling will be carried out. In the meantime LU has plugged the bottom of the hole which has now been backfilled with concrete.

'Damage to the tunnel is fairly extensive but there is no major structural concern' said Hornby. 'One panel and two flanges have been broken where the drill came through and three flanges have been damaged about 10m along the tunnel. We will repair the lining plates and straps. Repair work is expected to start next week.'

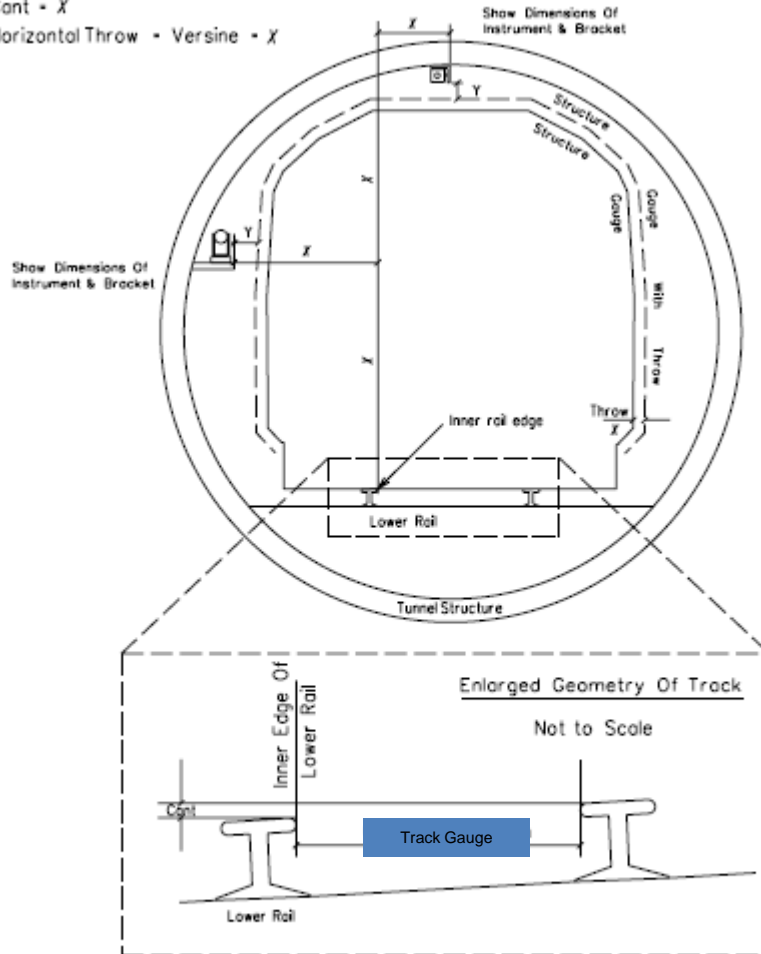
The £125M Hackney to M11 link road will pass 5m above the Central line tubes and under the existing roundabout in a 162m long cover tunnel. The project won ministerial approval last October.

Instruments in Tunnels

TRACK GEOMETRY

Cont - X

Horizontal Throw - Versine - X



Train Structure Gauge

Minimum clearance outline for train with throw.

Note:

1. Structure gauge shown applicable to North/South Line bored tunnels with 3rd rail only.
2. Structure gauge different on different lines due to size of tunnel, alignment, train body & length (MRT/LRT), traction power supply system (3rd rail or catenary), etc.

Note :

1. Dimensions in mm
2. " X " indicates site measurement.
3. " Y " indicates computed value.

Example: Monitoring Instruments Installation in Tunnel

Common Mistakes

Development/Building Proposal

- Did not show the railway reserve lines, RPZ or RC and RSZ
- Did not include sectional view
- Did not show offset distance from railway structures

Engineering Works & Restricted Activities

- No co-ordinates of railway structures , reserves lines, etc
- Did not show the co-ordinates of boreholes, piles locations, etc
- Did not show the distance from the drilling location to the MRT reserve lines.

Common Mistakes

Monitoring instrument installation in trainway

- Tunnel or trainway cross-sectional plans
 - No PE(Civil)'s endorsement for fixing details
 - Did not show clearly the horizontal & vertical offsets of outmost object protrusion towards the rails
 - Did not show the structure gauge profile, throw, cant
 - Did not show horizontal & vertical clearances from structure gauge
 - No chainage to indicate location & direction



Thank You

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