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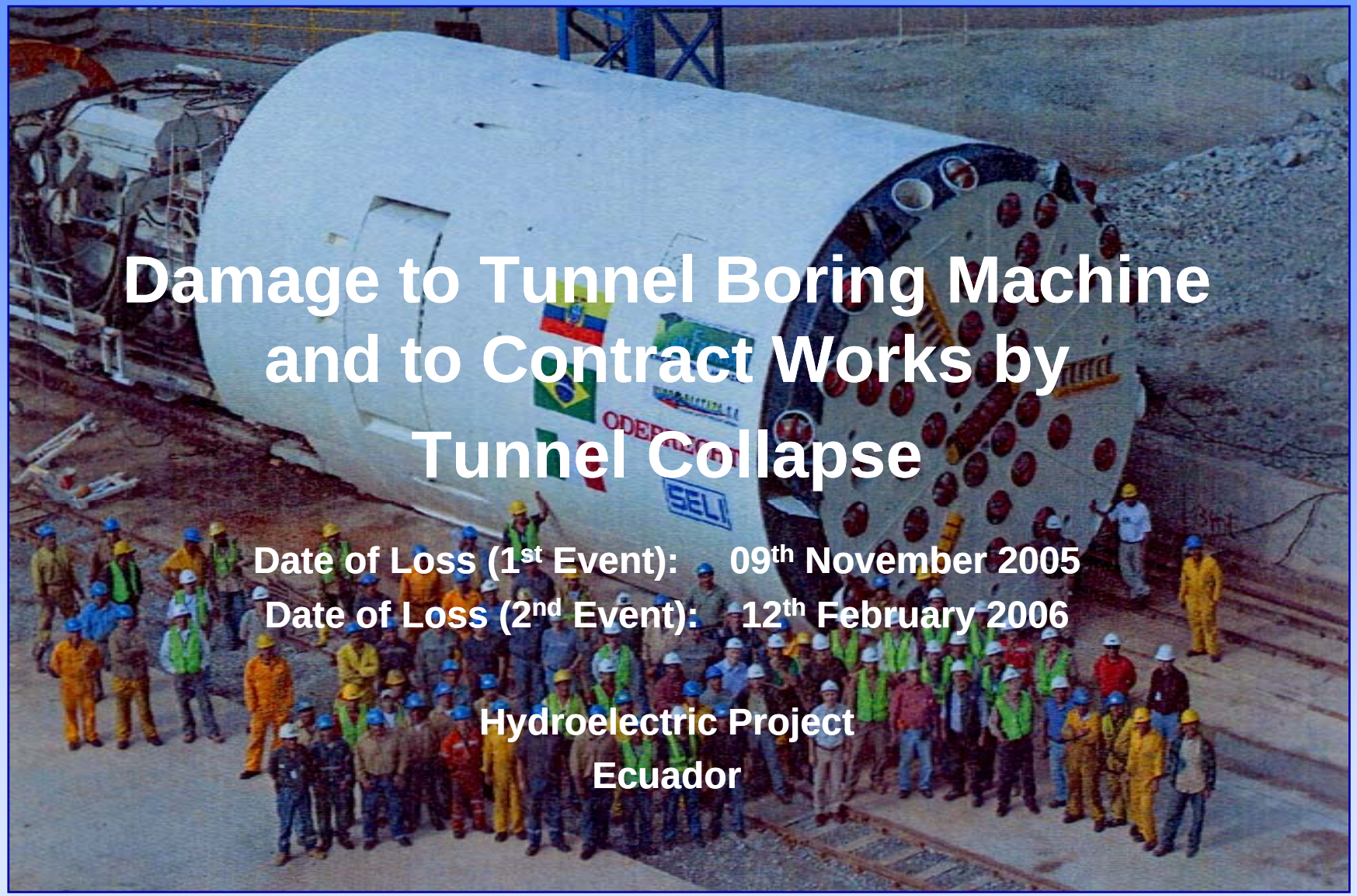

Damage to Tunnel Boring Machine and to Contract Works by Tunnel Collapse

Date of Loss (1st Event): 09th November 2005

Date of Loss (2nd Event): 12th February 2006

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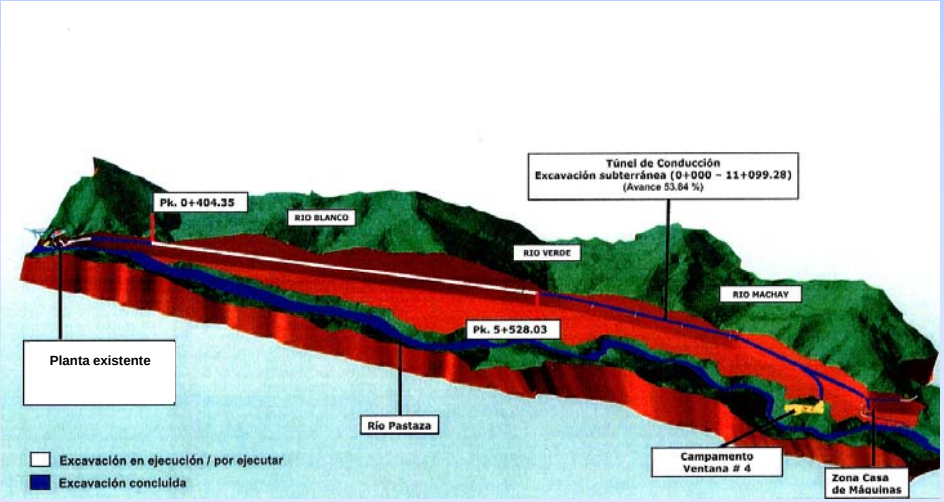
Background

Disposición de las obras



Hydroelectric Project Ecuador

Hydroelectric Power Plant in Ecuador located near active volcano

230 MW Power plant with majority of works located underground in volcanic rock

Discharged water from existing upstream power plant diverted

11km Main headrace tunnel connecting existing plant with project

Diagram illustrating TBM advance up to chainage 5+528. TBM got stuck at chainage 5+945 in area thought free of geological faults

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Background

Tunnelling work performed by Double Shield Universal Tunnel Boring Machine (TBM)

Picture depicting the TBM and back-up train during assembly

Insert showing TBM cutter face with hard rock cutting discs

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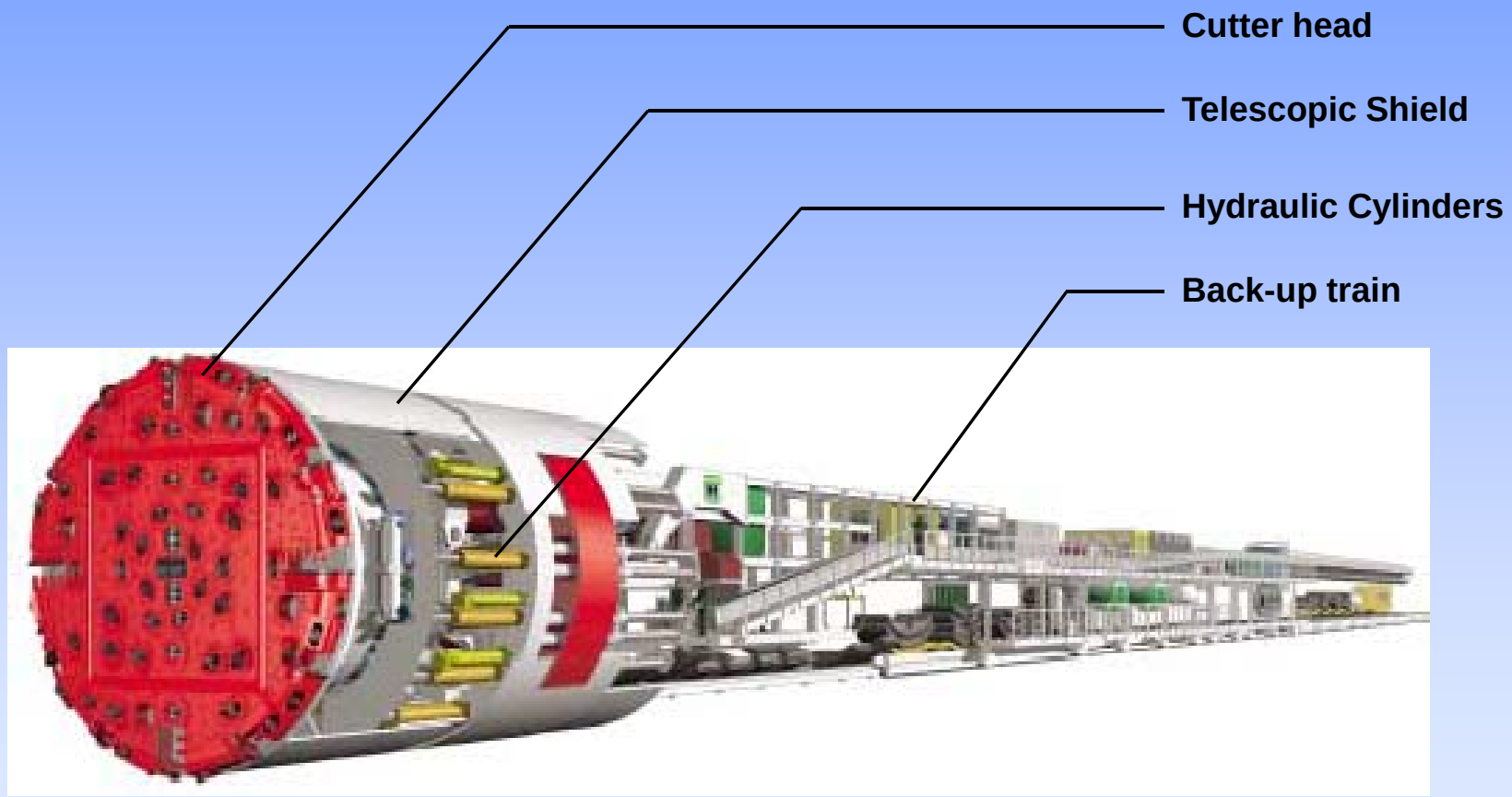
Background


Cutter head
Telescopic Shield
Hydraulic Cylinders
Back-up train

Background

- Drilling commenced on 21th March 2005 and completion projected on 28th February 2008
- Prior to loss TBM completed 4,900 m of planned total 9,400 m with 7 months in advance of scheduled project
- Date of Losses: 1st Event – 09th November 2005
  2nd Event – 12th February 2006
- ADVANTA notified on 14th November 2005
- Claimed amount: ca USD 20 Million

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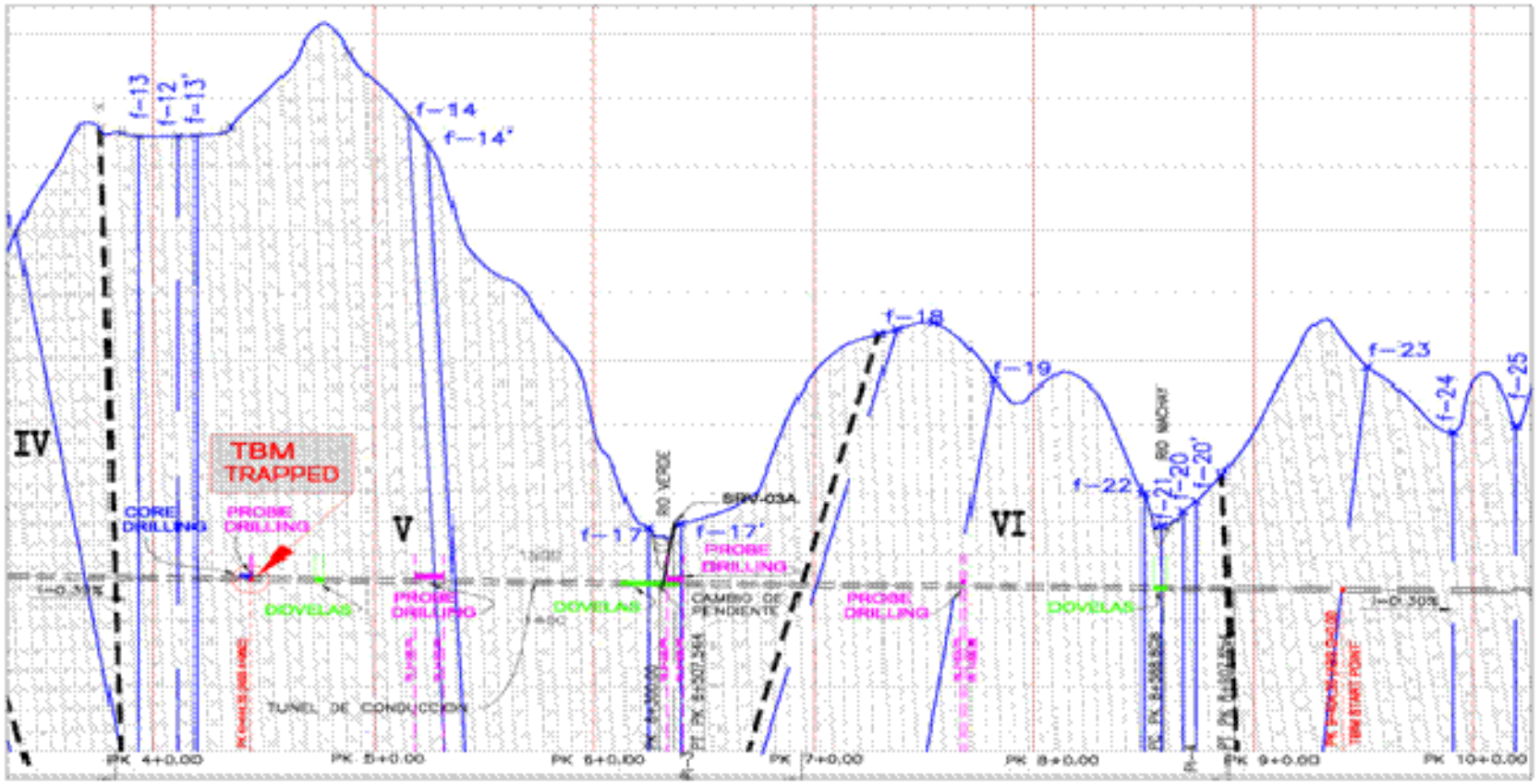
Circumstances – 1st Event

- On 9th November 2005 TBM entered into a massif fault zone (not anticipated) initiating collapse of a 12 m section of completed tunnel onto TBM, thereby trapping and damaging it

- Remedial measures necessary:
  - Installation of drainage and pumping equipment to handle water ingress
  - Rock massive support and consolidation by installation of steel girders, rock bolts and grouting
  - Excavation of pilot tunnel along TBM crown to cutter head and enlargement down sides to access for repair

- Freeing and restart of TBM on 9th February 2006 (after 3 months)

Circumstances



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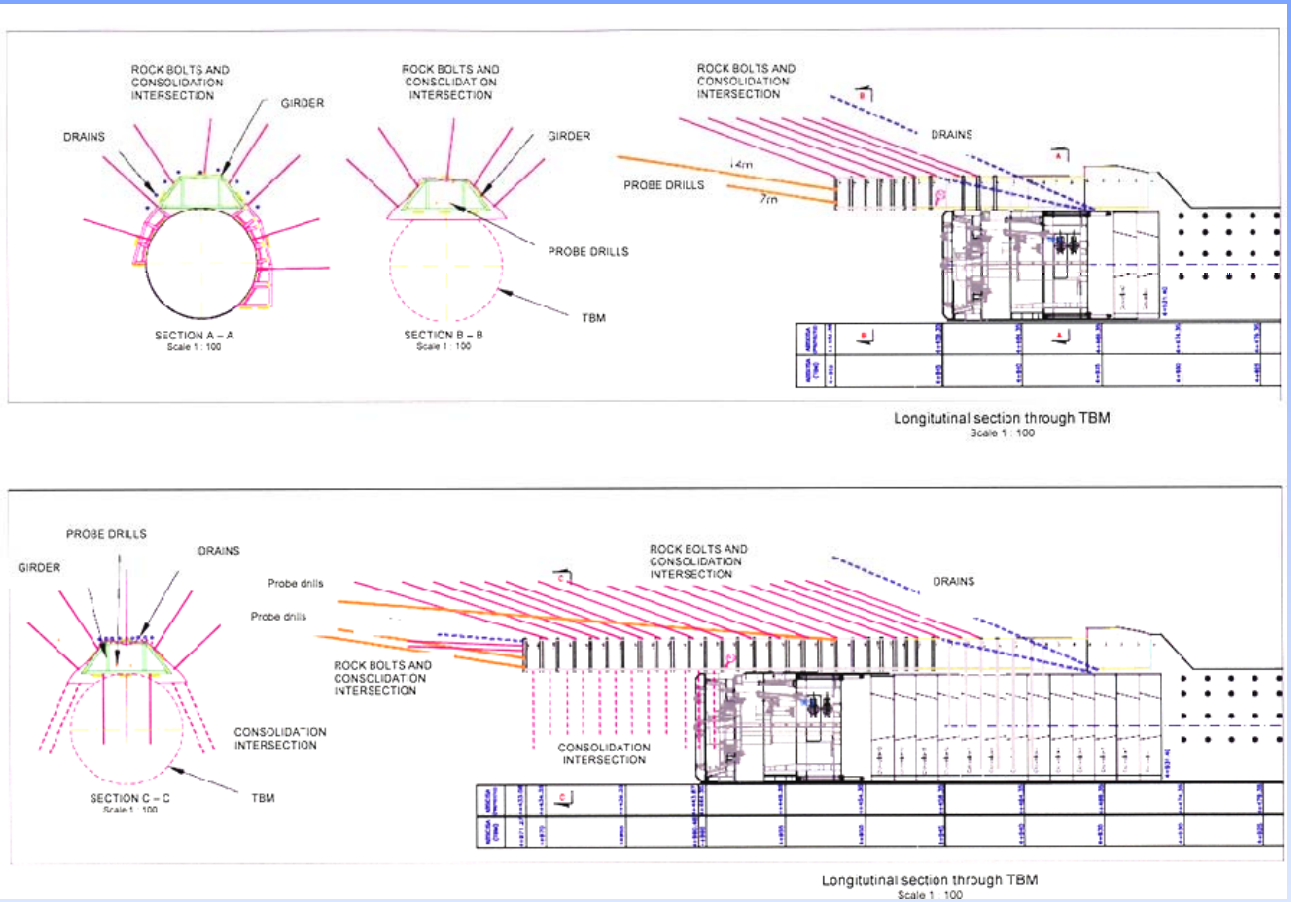
Remedial Measures



Excavation of pilot tunnel

Installation of drains &pumping equipment

Installation of anchors & rock bolts

Consolidation of rock massif by grouting

Installation of I-beams & girders

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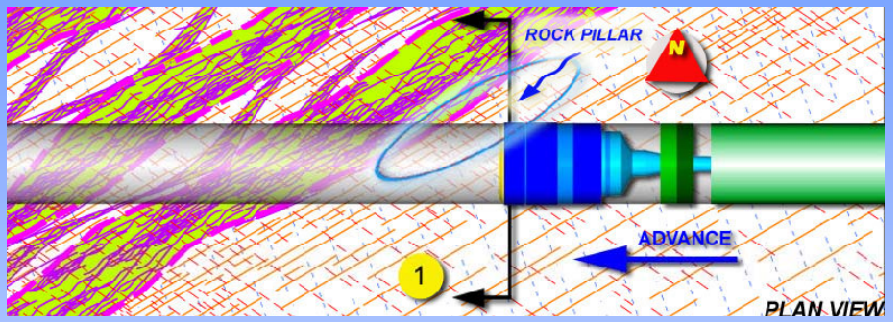
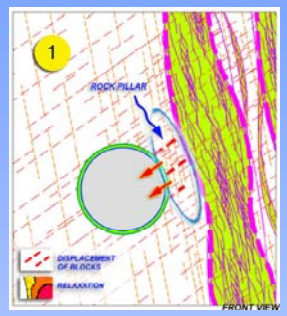
Circumstances - 2nd Event

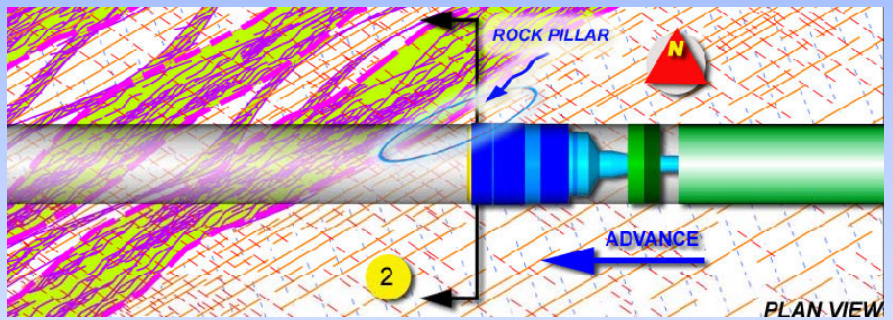
- On 12th February 2006 (after 15 m TBM advance) 2nd collapse of surrounding rock massif occurred (6 m completed tunnel section), again trapping TBM and deforming the shield
- Remedial measures similar to 1st event
- TBM restart on 17th April 2006, breakthrough achieved on 21st September 2006
- Project completed end of April 2007 about 10 months ahead of original Insured program

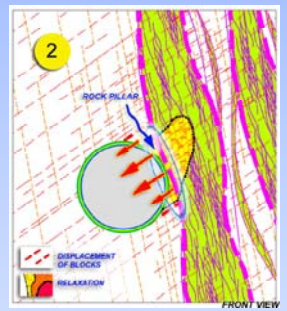
Cause



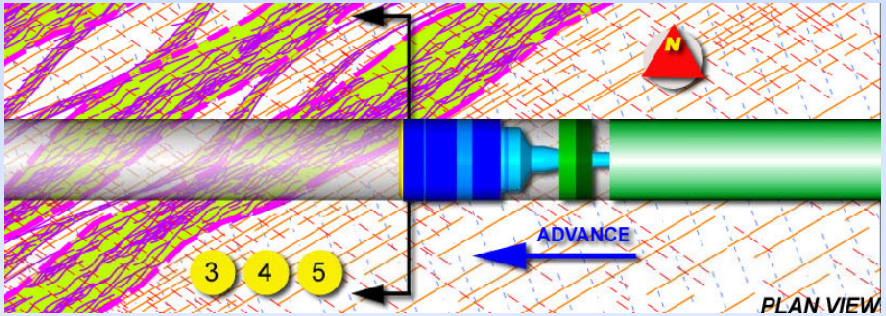


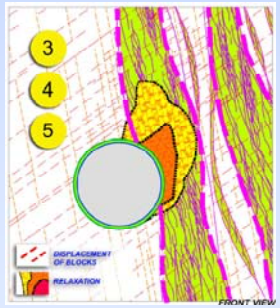
TBM approaching fault zone, diminishing "rock pillar"





Intersection with fault zone initiating collapse





Relaxation of massif

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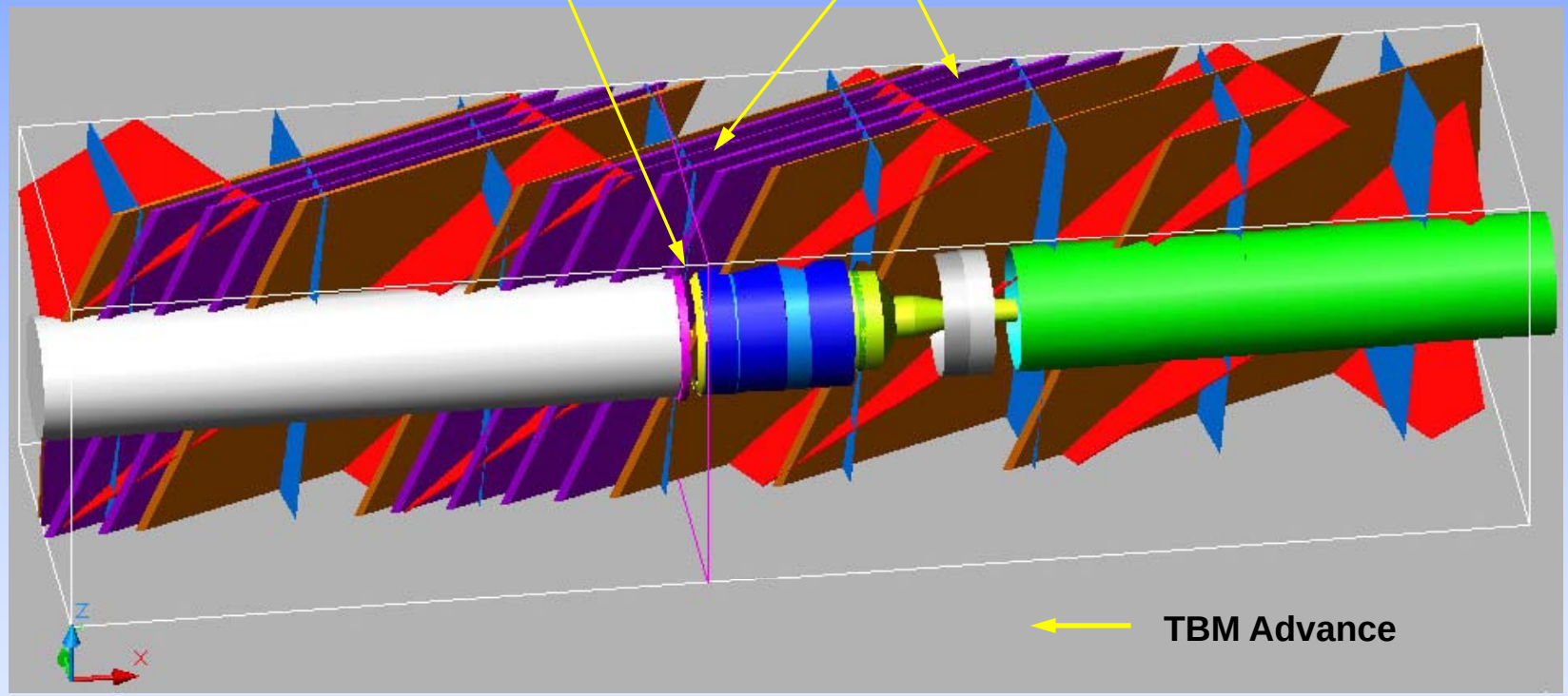
Cause



Cause

Cutter-head of TBM after removal of rock fragments, LHS stable

Fragmented rock from fault zone on RHS

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Cause

- **Failure investigation revealed:**
  - **- TBM operated well prior to loss**
  - **- TBM crew sufficiently experienced**
  - **- Design and implementation adequate**
  - **- Classification of rock/soil types and parameters sufficiently accurate**

- **Cause of loss 1st event:**
  - **- Excessive rock mass deformation**
  - **- Sudden change in ground conditions**

- **Cause of loss 2nd event:**
  - **- Same fault zone**
  - **- Probe drilling error/different drill rigs used**

Policy Liability

- **CAR Policy**

  - Section 1: Material Damage
  - Section 2: Third Party Liability
  - Section 3: Principles Delay in Start Up
  - Note: TBM included under Section 1 and not separate CPE Section

- **Two separate tunnel collapses occurred resulting in physical damage to the contract works and TBM**

- **Deductibles applicable per event**

Policy Liability

Relevant endorsements and special conditions:

- **"*Removal of debris*": with limit applicable for all covered losses**
  - **Limit was not maxed out**
- **"*M Re 006 – Cover of Extra Charges for Overtime, Night Work, Work on Public Holidays, Express freight*": Insured operate 3 shifts, 24 hours, 7 days per week**
  - **No significant impact**
- **"*M Re 007 – Cover of Extra Charges for Airfreight*": Limit applicable for all covered losses**
  - **Significant airfreight costs for expediting special foam to control water ingress**

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Policy Liability

***M Re 101 – Special Conditions Concerning the Construction of Tunnels, Galleries, Temporary or Permanent Sub-surface Structures or Installations*, excluding:**

- ***alterations in the construction method or due to unforeseen ground conditions or obstructions***
- ***measures which become necessary to improve or stabilize ground conditions or to seal against water ingress <u>unless</u> to reinstate indemnifiable loss or damage***
- ***removing material which has been excavated, or due to over break in excess of the design profile and/or for refilling cavities resulting there from, unless if resulting from other losses or damages recoverable under Section I of this policy***
- ***dewatering <u>unless</u> necessary to reinstate indemnifiable loss or damage***
- ***loss or damage due to breakdown of the dewatering system if such loss or damage could have been avoided by use of standby facilities***
- ***the abandonment or recovery of tunnel-boring machines***
- ***the loss of bentonite, suspensions, or any media or substance used for excavation support or as a ground-conditioning agent***

In the event of indemnifiable loss or damage the maximum amount payable under this Policy shall be limited to the expenses incurred to reinstate the insured property to a standard or condition technically equivalent to that which existed immediately before the occurrence of loss or damage but not in excess of percentage as stated below of the original average per meter construction cost of the immediate damaged area.

Maximum percentage payable: 120%

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Policy Liability

Comparison to M Re 400 – Cover for Underground Machinery and Equipment (not included in present cover) indemnifying the Insured for:

> ***"…loss of or damage to item(s) No(s) [listed] contained in the Specification of Insured Items of the Policy due to flood, inundation, landslide or rockslide, subsidence, collapse of adits, galleries, tunnels, etc. up to a limit of […] per accident.***
>
> ***However, loss or damage due to abandonment of these items shall be excluded from the cover"***

Discussion:

- **Clear that all activities associated with saving TBM for further use are covered.**
- **In current case there was uncertainty regarding the meaning of "recovery"**
- **Legal council held that to "recover" item must first be "lost"**

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Policy Liability

Relevance of M Re 101 to the claim:

- **Costs due to unforeseen ground conditions excluded**
  - **consolidation measures forming part of contract works excluded**
- **Measures to seal against water ingress covered as necessary to repair**
  - **cover installation of drains, resin/foam injection**
- **Dewatering covered since necessary to reinstate indemnifiable loss**
  - **cover installation of pumping equipment**
- **Abandonment or recovery of TBM:**
  - **not applicable as TBM was not "lost" hence was not recovered (legal opinion)**
  - **definition of recovery not given**
  - **difficult to apply "works wording" to CPE**
- **Repair of insured works limited to 120%**
  - **applied the per meter construction costs of collapsed tunnel based on rock type being excavated prior to loss**

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Policy Liability

M Re 115 – Cover for designer's risk:

"The Insurers shall not…be liable for

d) The cost of replacement, repair or rectification of loss of or damage to items due to defective material and/or workmanship and/or faulty design, but this exclusion shall be limited to the items immediately affected and shall not be deemed to exclude loss of or damage to correctly executed items resulting from an accident due to such defective material and/or workmanship and/or faulty design."

Discussion:

- **Fundamental consideration when tunnel fails due to unforeseen ground conditions.**
- **What type of cover do Insurers want to provide?**

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Policy Liability

- **"*X4 – Loss Minimisation*": subject to limit any one loss and on aggregate**
  - **Element of loss minimisation difficult to determine**
- **"*X5 – Professional Fees*": subject to limit**
  - **Limit reached in this instance**
  - **Legal fees alone can reach limit rapidly**
- **Adequacy of Sums Insured:**
  - **Contract Works adequately insured**
  - **Tunnel Boring Machine underinsured**

Adjustment Concept

Costs allocated along following guide lines:

- **Review time sheets differentiate activities:**
  - **Debris removal**
  - **Installation of drains**
  - **Installations of rock bolts/trusses/shotcrete**
  - **Excavation of pilot tunnel**
  - **Repair TBM etc.**
- **Apportion monthly cost of labour, material, subcontractors & equipment to above activities**
- **Allocate % contribution of individual activity to following categories:**
  - **Loss minimisation**
  - **Repair of TBM**
  - **Freeing of TBM**
  - **Repair of Contract Works**
- **Repair activities mainly sequential: cost allocated per event and post event**

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Adjustment Principles

Applied adjusting principals:

- **TBM damage covered for both events**
- **TBM freeing not covered under Section I, does not constitute “physical loss”**
- **Repair of contract works limited to 120% of per meter tunnel cost being excavated prior to loss**
- **Overhead costs: 18% negotiated**
- **Removal of debris and consultants fees apportioned over two events, one policy limit applied**
- **Repair of TBM and contract works considered as separate events, deductibles applied for each event (damage to TBM and works)**
- **Repairing and freeing costs of TBM allocated to 50/50 split (negotiated)**
- **Underinsurance of 20% applied to TBM repair**

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Legal Aspects

- **Law governing insurance contract: Law of Ecuador**
  - Check local requirements (wording must be registered in Ecuador to be acknowledged otherwise civil law applicable)
  - Worth checking if same legal fundamentals applicable (eg obligations of Insured to minimise loss)
  - Protection of patrimony
- **Local Policy issued in Spanish had precedence:**
  - Differences in wording
  - Insured's lawyers raised issue of unfair contract
  - Insurers obligation to ensure clarity
- **Section I provides cover for "sudden physical loss or damage" question arising:**
  - Does trapped TBM constitute as physical loss?
  - Are costs to free TBM indemnifiable?

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Final Negotiation

- **Two loss events, Insured entitled to two consultant fees limits**
- **Multiple deductibles not applicable:**
  - **Tunnel collapse proximate cause; damage to TBM resultant.**
  - **Since TBM insured under Section 1 only one deductible per section/event**
- **Proposal to declare Sum Insured for TBM at end of project with additional premium payable accepted by Underwriters:**
  - **No underinsurance applied**
- **50/50 Split between TBM repair and freeing not accepted by Insured - majority of costs incurred for pilot tunnel to allow TBM repair:**
  - **Settlement negotiated: 70% repair - 30% freeing TBM**

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