

**Sea wall/reclamation failures Part 2**  
**Junk Bay (Tseung Kwan O) Controlled Tip Failure**

By  
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▪ A very large failure occurred at Junk Bay (Tseung Kwan O) controlled tip on 18 March 1984.

▪ The volume of failure was estimated to be 500 000 m<sup>3</sup>.

▪ The GEO (GCO at the time) Advisory Division conducted an investigation into the details and the cause of the failure as requested by project offices, CEO and PMJB.

▪ This presentation will focus on the technical aspects of the investigation and the lessons learnt that may be taken account of in preventing future similar failures.

▪ The controlled tip is an area on sea shore used for disposal of waste.

▪ The tip was developed in stages, adding cells of lagoon which were enclosed by bunds, and the lagoons were then filled up.

▪ Further bunds were added and the controlled tip face was then advanced away from the shore line, final boundary would be formed by a permanent seawall.

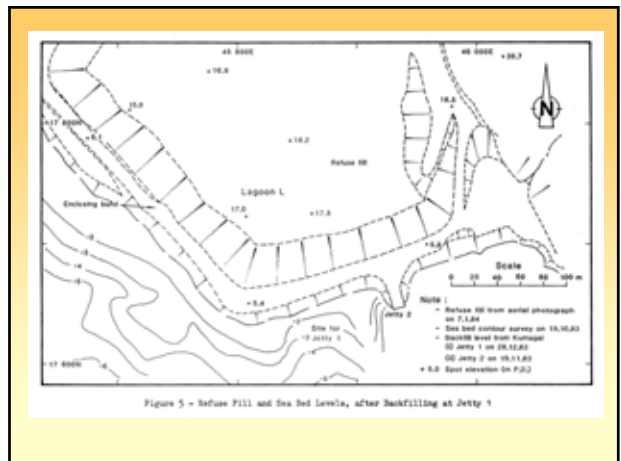
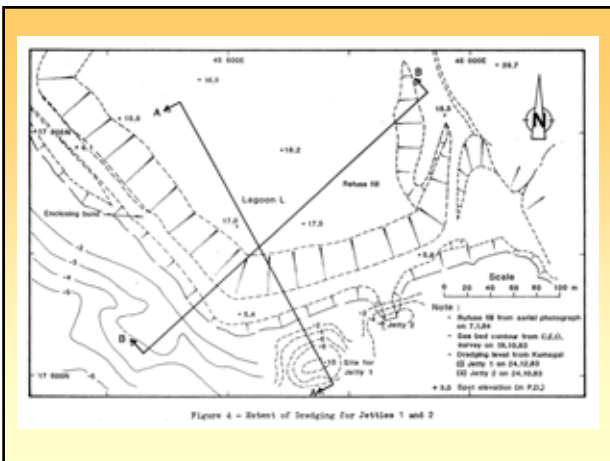
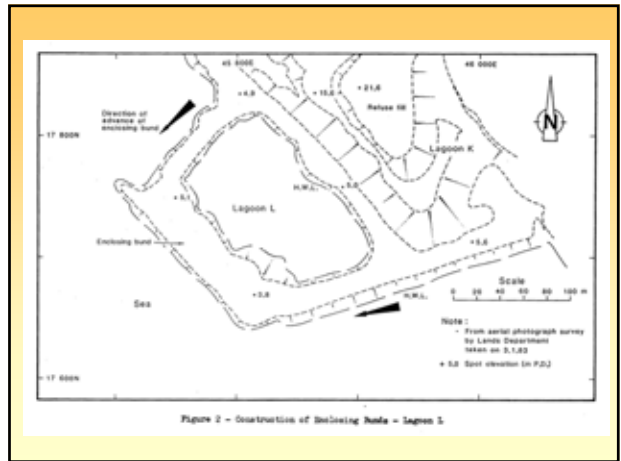
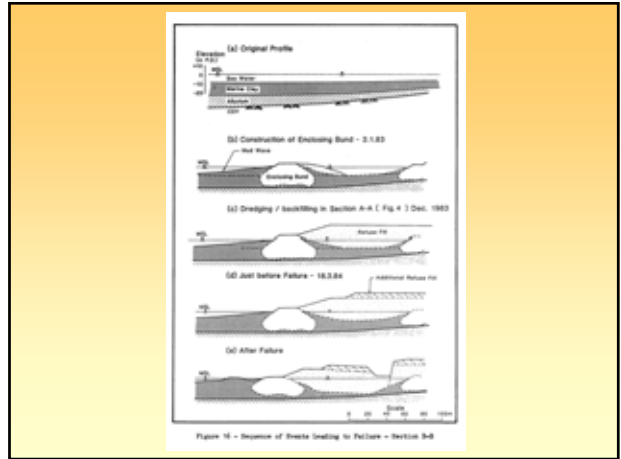
▪ The bunds were created by dumping construction waste (soft fill & building rubbles) to displace the mud, to found the bund on firm layer below, but no mud dredging was carried out.

The presentation was taken largely from :

**GEO Advisory Report No. ADR 17/84 –  
Investigation of A Failure at Junk Bay  
Controlled Tip**

**Available at the Civil Engineering  
Library at CEDD**





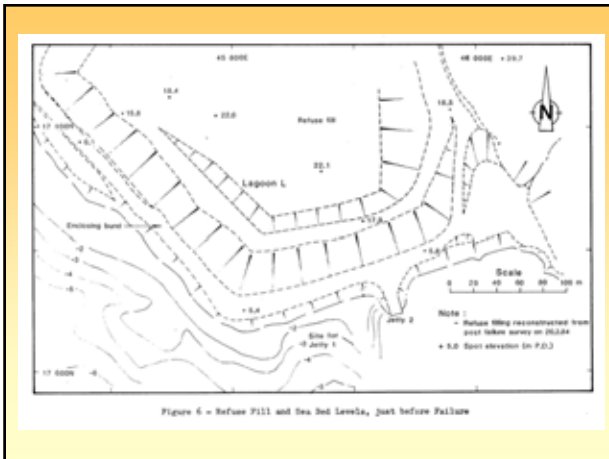


Figure 6 - Refuse Pile and Sea Bed Levels, just before Failure

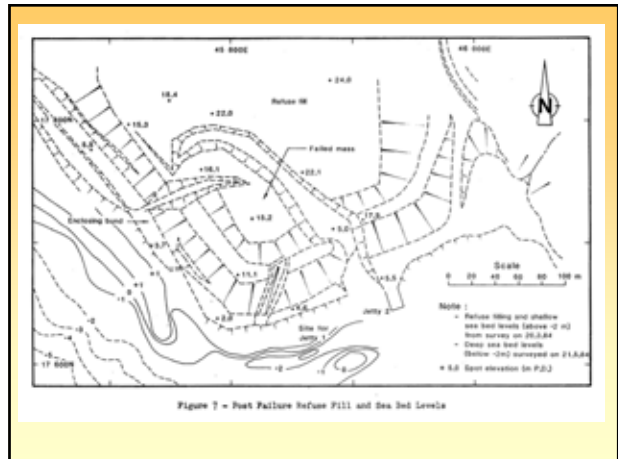


Figure 7 - Post Failure Refuse Pile and Sea Bed Levels

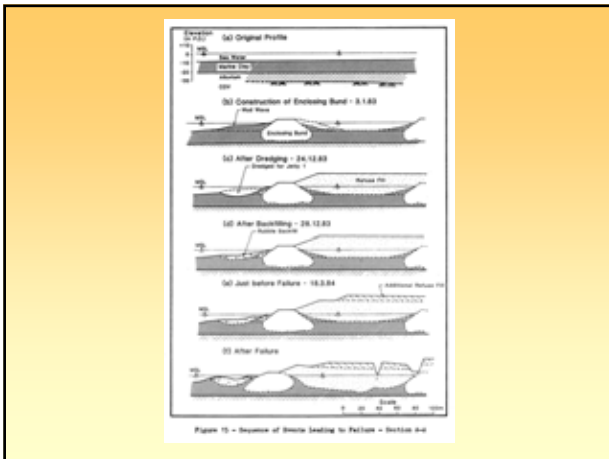


Figure 15 - Sequence of Events leading to Failure - Section A-A

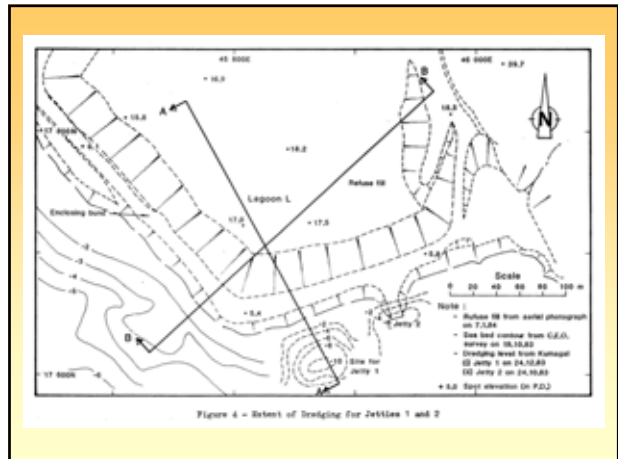


Figure 4 - Extent of Dredging for Jetties 1 and 2

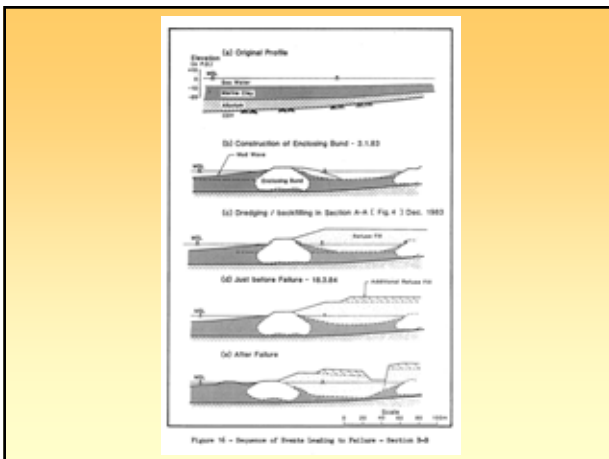


Figure 16 - Sequence of Events leading to Failure - Section B-B

## DATA ON THE SOIL PROPERTIES

- Existing data including previous series of ground investigation (7) with more than 30 drilled holes in the immediate areas of the controlled tip.

- Additional ground investigation was carried out as a part of this investigation, including boreholes, field vane testing, dynamic penetration tests and GEO probe.



Figure 9 = Profile Section in the vicinity of the Junk Bay Commercial Slip

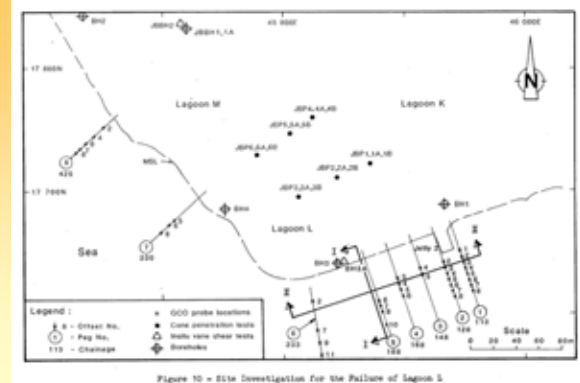


Figure 10 = Site Investigation for the Failure of Lagoon L

- 2 boreholes were drilled near centre of a lagoon with samples of marine mud taken and some field vane tests in the mud.
- 18 locations were investigated by Dynamic Penetration Testing using a 65 kg hammer to find variability and thickness of the waste fill, and met refusal at about 10 to 12 m on average.
- 4 boreholes were drilled through the bunds to determine nature of the contact with underlying sediments, samples of soft layer were taken when found.

- A series of laboratory tests was conducted on the marine mud samples including PSD, Atterberg's limits, specific gravity, triaxial tests, oedometer tests and hand torvane.
- 37 locations along 8 sections were investigated by GEO probe through marine mud to find post-failure profile of the bund and extent of back-filling at dredged areas.

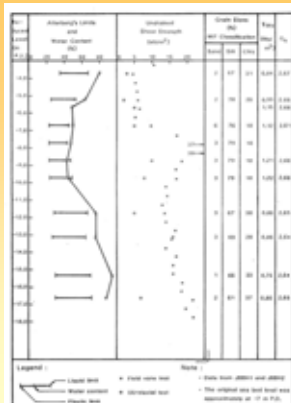


Figure 13 = Borehole Properties

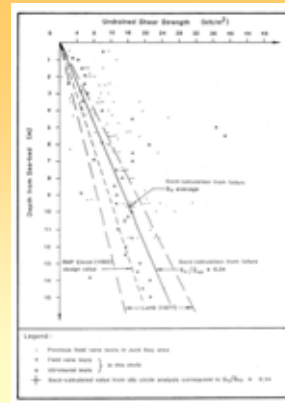
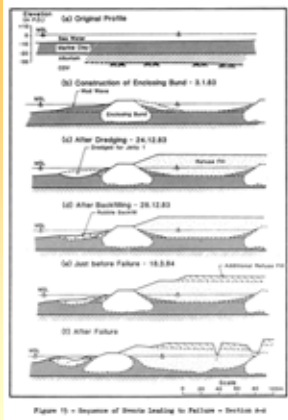


Figure 14 = Dispersion between Undrained, Field and Laboratory Obtained Strength Values





**Review sequence of events**

- 3.1.83 enclosing bund built.
- 24.12.83 dredging for Jetty 1 done, refuse filling to about +16mPD.
- 28.12.83 backfill of dredged area completed, refuse fill at about +16mPD.
- 18.3.84 large failure occurred when refuse fill reached a level of +22mPD ... 81 days after backfilling of dredged area.

**SUMMARY OF FINDINGS**

- The bunds did not make full contact with underlying alluvium, hence there is potential for failure through entrapped mud under the bund.
- Localised failures had occurred before on this controlled tip.
- Seabed dredging for Jetty 1 lowered the factor of safety to marginal value locally and caused some small local movements but no failure.
- Main factor is the continuing refuse filling, imposed increasing load on the bunds until the large failure occurred.

**THE END**