16th SINGAPORE SYMPOSIUM ON PAVEMENT TECHNOLOGY (SPT 2011)
27 May 2011
Engineering Auditorium,
National University of Singapore, Singapore

Pavement Rehabilitation by In-Situ Recycling
- A Case Study on Seaport Container Yard & Road

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Contents

1. Introduction

* Due to weak and soft foundation, most of the seaports in this region experience substantial settlement issue over time
* Northport (Port Klang) is one of the oldest seaport in Malaysia encountered serious differential settlement in most port facilities including container yards and internal roads
* Maintenance and upgrading of G-Block Container Yard was conducted in 2010 to rectify differential settlement issue and upgrade the container stacking capacity


Existing Condition
P&O Nedlloyd
MOL
KMTC LINE
2010/10/07 15:31

2. Evaluation Criteria

Major Considerations:

2-1 Structural Design & Reliability

2-2 Construction Speed and Timing

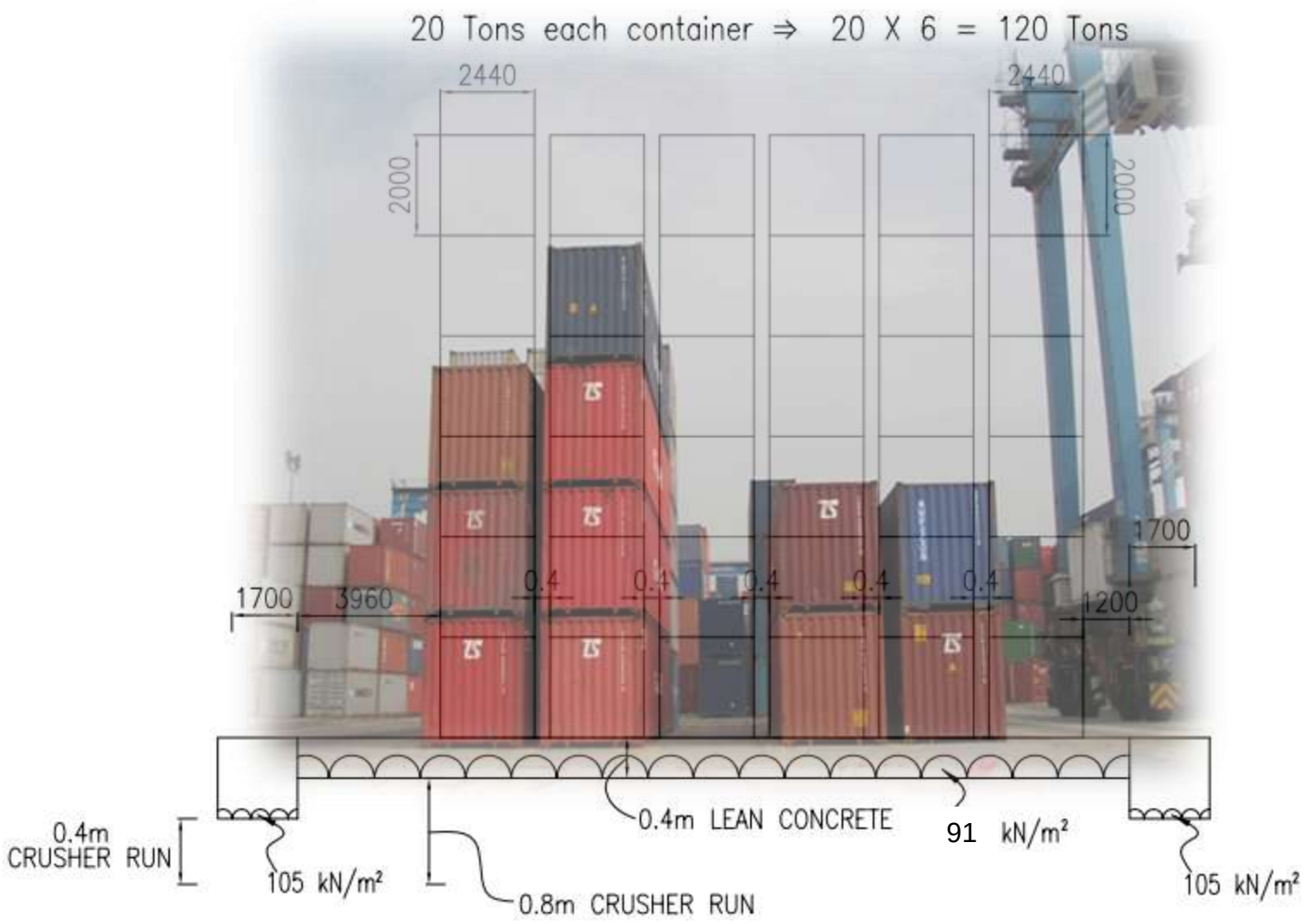
2-3 Cost Effectiveness

2-4 Environmental Impact

2. Evaluation Criteria

2-1 Structural Design & Reliability

- High Loading
- Sub-grade conditions – marine clay with high tidal level
- Long term performances and reliability



Typical Container Stacking Section


High localized point loading
– 30 ton per point

2. Evaluation Criteria

2-2 Construction Speed

- Higher construction unit rate
- Shorter project duration
- Safer construction activities

2. Evaluation Criteria

2-3 Cost Effectiveness

- ❖ **Overall Costs**
  - ❑ **Short Term Construction & related costs**
  - ❑ **Long Term Maintenance & related costs**

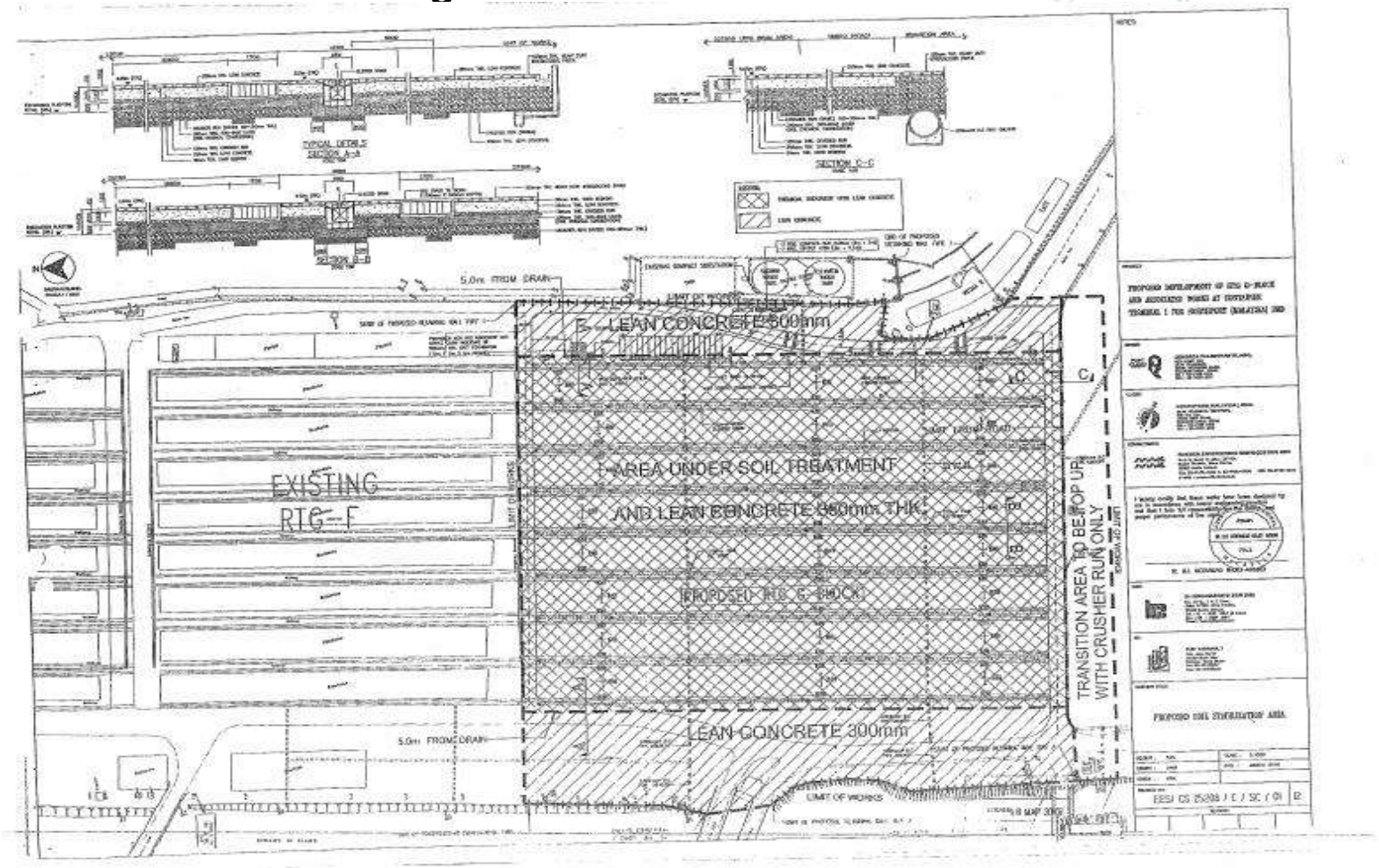
2. Evaluation Criteria

2-4 Environmental Impact

- Environment friendly
- Less excavation and backfilling
- Less ground movements caused by vehicles, machines and manpower
- Less port security control and coordination works

2. Evaluation Criteria

❖ Final Pavement Design

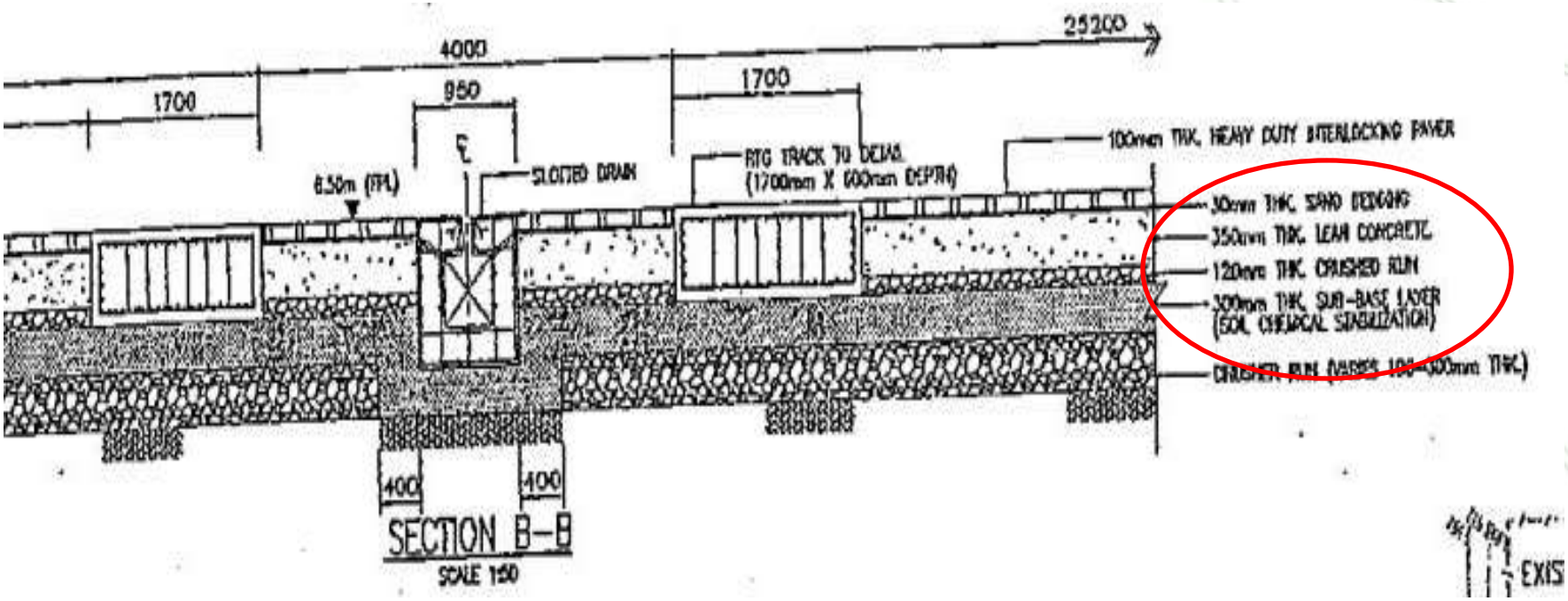


Typical Cross Section of Container Yard Rehabilitation

2. Evaluation Criteria

❖ Final Pavement Design

Combination of Rigid Pavement and In-situ Recycling



Typical Cross Section of Container Yard Rehabilitation

3. In-Situ Recycling Process & Technical Performances

❖ **Definition:**

"Mixing proper chemicals with in-situ soils to improve/strengthen the soil properties through chemical reactions for engineering purposes."

❖ **Design requirements:**

- ❑ UCS ≥ 2.0 MPa (7-d)
- ❑ CBR ≥ 120% (7-d)
- ❑ Compaction Degree ≥ 95%

3. In-Situ Recycling Process & Technical Performances

❖ **3 Major Steps**

Step 1: Spreading

Step 2: In-Situ Mixing

Step 3: Compaction

3. In-Situ Recycling Process & Technical Performances

❖ Quality Control

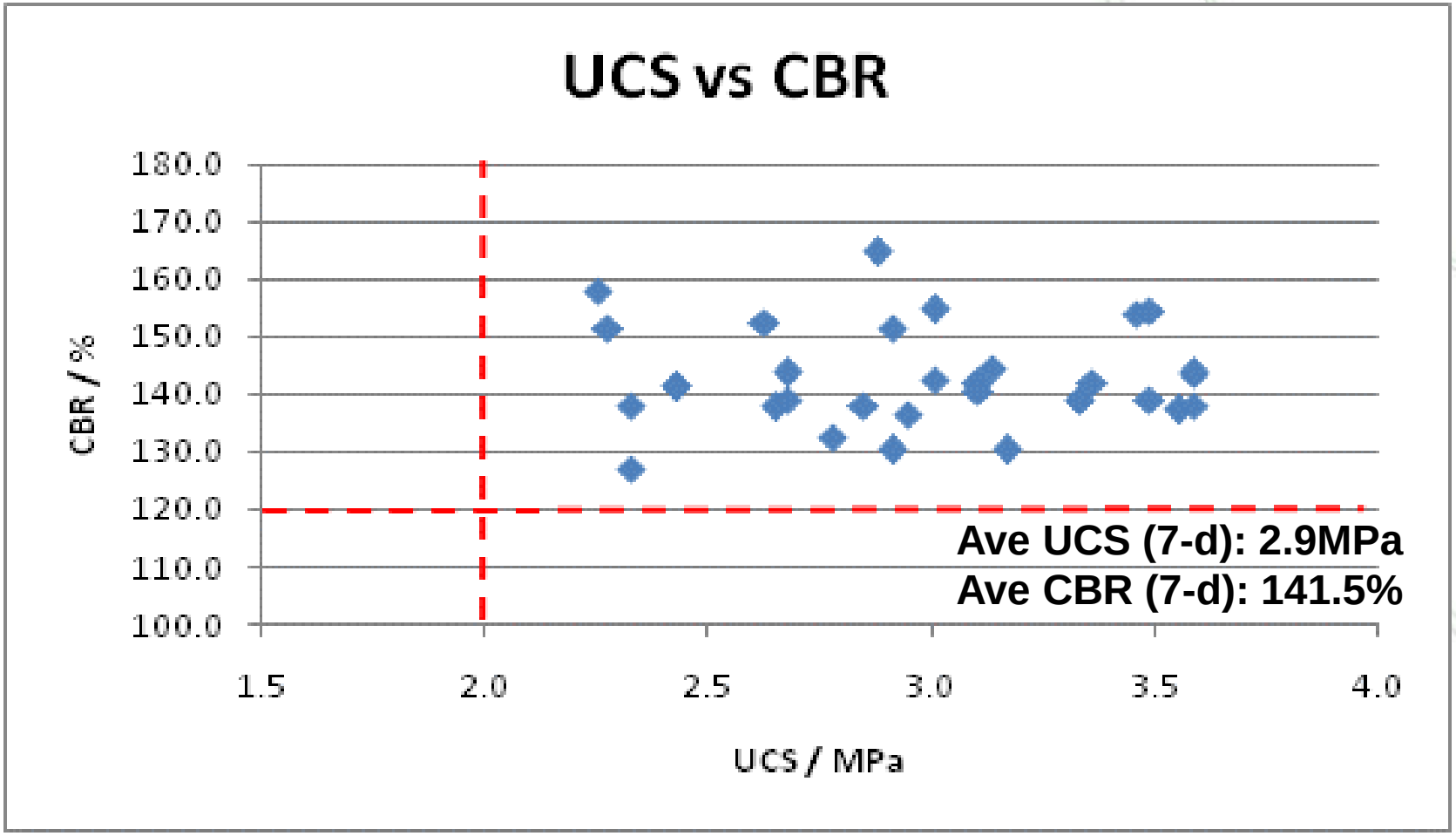
Field Density Test

Re-mould UCS Test

Re-mould CBR Test

3. In-Situ Recycling Process & Technical Performances

❖ Quality Control – Chemilink SS-108/SS-111 Stabilization



Project: Proposed Development of RTG G-Block and Associated Work at Container Terminal 1 For Northport (Malaysia) Berhad.

Project Duration: June 2010-March 2011 **Testing carried out by: Geolab(M) Sdn Bhd (Accredited Lab)**

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First Phase in Operation


9 months after Completion and in Use
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4. Benefits of In-Situ Recycling in the Environment Aspect

Benefits

- Better Technical Performances
- Cost Saving and Overall Cost Effectiveness
- Simpler and Faster Construction
- Less Materials Transportation
- Limited Disturbances to Port Operations
- Environment Friendly

4. Benefits of In-Situ Recycling in the Environment Aspect

Comparison Item	Conventional Replacement Method	In-Situ Recycling Method
Imported Material?	Yes Graded Aggregate	Yes Stabilizing Agent
Quantity of Imported Materials	58,650 ton	1380 ton
Construction Waste Created?	Yes	No
Quantity of Construction Waste	25,500 m^3	ZERO
Transportation Required	7,200 trips	69 trips

5. Conclusions

1) Rehabilitation of Northport G-Block container yard and roads were completed in mid 2011

2) Comprehensive project planning and methodology evaluation are critical for the smooth and on-time project completion

3) The In-situ Stabilization Method was adopted with significant advantages and benefits

4) Technical performance to-date is satisfactory

Acknowledgements

- Northport (Malaysia) Bhd
- Emenea Engineering Services Sdn Bhd
- Trans Resources Corporation Bhd
- MTS Construction Sdn Bhd

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Thank You for Your Attention!