Design and Maintenance of Container Terminal Pavements

Terms of reference

1. Historical background – Definition of the problem

Container terminals require special types of pavement to resist the heavy and continuous loads of container handling equipment including straddle carriers, reach stackers, top picks, rubber fire gantries and automatic guided vehicles (AGV). Typically, container terminals use either asphalt or concrete block pavement systems. The design of these “structures” has been largely based on highway pavement technology. Load repetitions associated with port pavement, however, can be much slower, much heavier and more confined to single wheel paths than roadway conditions. Under such conditions, port pavements can be subject to rutting and other distresses that require repair, maintenance. In some cases, traditional asphalt/block pavements are not optimal for container terminals. Designers do not always know how to design pavements properly. Terminal operators do not always recognize the need for maintenance and do not plan for same. This can give rise to problems. The proposed WG would address:

- Asphalt and Portland Cement Concrete pavement design procedures
- Concrete block pavement design procedures
- Roller Compacted Concrete pavement design procedures
- Methods for quantifying equipment repetitions
- Differences in between port, highway and airport pavement design
- Foundation design including the need for specialized treatment of reclaimed material in order to limit pavement settlement
- Container terminal pavements for inland ports and multimodal terminals (railway)
- Detailed survey of port owners/operators to quantify pavement experience throughout the world. Among other factors, the survey will address pavement dimensions, properties, design loads, typical timing/magnitude of pavement distress, initial costs, maintenance costs and pavement lives
- The WG will be comprised of engineers, terminal designers, terminal operators and construction experts

2. Objective of the Working Group

The objective of the WG is to provide information regarding design procedures, maintenance costs/procedures, construction oversight, and impact of terminal operations on pavement. Information regarding port pavement design, maintenance, construction and general performance is scarce. It is hoped that the proposed WG will provide information that significantly improves the understanding of port pavements with a commensurate improvement in performance.

3. Earlier reports to be reviewed

While these reports offer a plethora of information, the proposed WG will extend the state of knowledge with new developments informed by recent experience of terminal operators, designers, academics, construction management professionals, and contractors.

4. Matters to be investigated

Geotechnical and structural design criteria for pavements, life cycle analysis for pavement systems, manufacture of blocks for block paving, innovative alternative solutions for Container terminal Port Pavements.

5. Method of approach

Review existing standards and recommendations regarding structural and geotechnical design, bibliography, analysis of main geotechnical, structural and soil-structure interaction problems involved, available technologies and analysis of Case Studies with special focus on design and construction criteria and final results achieved in several case studies.

5. Suggested final product

Recommendations in the form of a guide relevant for designing, maintaining, constructing and testing container terminal pavements.

6. Desirable disciplines of the members of the Working Group

The WG members are expected to be comprised of practising/experienced engineers from: (1) terminal operators, (2) port authorities, (3) consultants, and (4) contractors. We expect to be able to attract a serving member from most PIANC participating countries. We know from literature and experience that numerous countries are likely to participate including: Australia, Dubai, Germany, Japan, Netherlands, Spain, UK, US and others.

7. Relevance for countries in transition

Many of the new container ports being planned and constructed throughout the world are slated for Countries in Transition. Accordingly, these countries will be the beneficiaries of new technology and preferred design/construction methods. This WG will help such countries to avoid any problems or misunderstandings from the past. Manufacture of blocks for block paving will also be a topic of interest for countries in transition.