SELF-PROPELLED MODULE TRANSPORTER (SPMT)

AN OPERATIONAL GUIDANCE

Capt. Joseph Alphonse
Marine Risk Consultant

Almarco Maritime Pty Ltd
PO Box 12078, A'Beckett Street, Melbourne Vic 8006
Phone: +61 3 9846 8657, Mobile: +61 421 841 251,
E-mail: joseph.alphonse@almarco.com.au
www.almarco.com.au

Executive Summary

This article explores the role and operational assessments that should be considered and reviewed with respect to the usage of SPMT (Self-propelled Modular Transporters) for the movement of large structures and equipment's. These structures and equipment's cost tens of millions of dollars and can have a huge impact on the cost and timely completion of particular projects, if they are damaged. This is due to the long lead times that are required to build these structures from ground up and/or due to the time required to procure particular specialised equipment's.

SPMT`s plays an important role in modular based construction, both at the fabrication yard and at the construction site. This type of construction activity is usually the preferred option in countries that has a high labour cost. In Australia for example, almost all of the current LNG construction projects are built using this modular based concept.

The current trends for these operations to be left to the sole purview of its trained and expert operators alone should be challenged in view of the recent increase in a large number of claims for damages that were caused due to various non-conformance or incorrect assumptions or assessments made for its operation.

A detailed method statements should be prepared on the various considerations as detailed in this risk bulletin in assessing the sufficiency of the SPMT`s arrangements prior to the actual transport. The arrangements made should be supported with the corresponding calculations. This information should further be provided for review by an independent third party to ensure that the information provided is accurate and that sufficient redundancy are in place to manage any eventualities.

During the course of the actual works, further checks should be made by the attending Marine Warranty surveyor to ensure that the SPMT arrangements for the planned transport are as per the approved arrangements. Any major deviations to the planned arrangements should be further inspected and verified prior to proceeding further.

It is only by proceeding in a structured transparent manner, in looking at the processes and procedures involved for a particular transport that a major loss can be avoided.

Introduction

Due to cost efficiencies, many construction activities are modular based and are constructed at yards, being at some distance away from actual construction sites. These fabrication yards being mainly located in Asia provides an abundance source of labour with various technical and engineering skills at a far lower cost. This offers cost reductions in the overall construction cost of the manufacturing plant.

The fabrication yards in Asia are very flexible in terms of how it is set-up and managed thus being responsive to the requirements of its customer base. SPMT`s are used in this yard to move various equipment's to be lifted and installed into modules. It is also used for the movements of various large sections of a processing plant (referred to as modules) onto large specialised transport vessels or barges for shipping to construction sites. In some cases, smaller sections of the modules are transported on specialised Heavy Lift vessels (HLV).

In some cases, apart from essential services, the control of the whole yard is handed over completely to the customer to manage. The customer will then put in place its own full complement of management, technical and operational teams to manage and control all the activities in the yard. This in turn further facilitates among others a more effective control and protection of intellectual property rights on its technical knowhow with respect to critical components, equipment or structure of the plant.

At the construction site, SPMT`s are used to off-load these large structures from the transport vessels and for final positioning works at the construction site. It`s capabilities and limitations do in most instances have a direct impact on the planning, management and design of construction work sites.

Scheuerle, Nicolas and Kamag are some of the companies that manufacture SPMT. Most SPMT manufacturers do in addition provide training and consulting services on the maintenance and operation of this equipment's.

Pre-planning and Technical evaluations

Historically, SPMT related activities have been solely managed within the very organisations that own and operate these equipment's. There were minimal external interfaces to its processes and procedure and they were left to their own devices to get on with completing its work.

However, in recent years there have been a number of incidents where damages have occurred during the transportation of some very heavy modules by SPMT`s. The cause of these damages has been numerous and in some cases was difficult to identify due to the knowledge gaps by external parties and lack of information on the processes and procedures with respect to the activities concerned.

In order to protect the modules against any risk of damages, a proper method statement should be developed by and for the SPMT operators. This method statement should contain the planned methodology with the corresponding procedural and technical evaluations for the planned transport of a particular module.

In some cases where the modules are large and critical to the project, a peer review should be carried out on the method statement so as to further verify and confirm that the information provided is true and accurate.

SPMT operations – Method statements

Method statement for the transport of a large module from its lay-down area to a barge should as a minimum contain the following detailed information:

(Explanation notes are provided in italic.)

1. Management of operations
   This section should provide information on the different roles and responsibilities of each individual team member.

2. Transport operational procedures.
   This section should detail the manner in which each operation should proceed, and the sequence involved.

3. Change management procedures
   In the event of non-conformance due to the initial intentions of the documented plan, a procedure should be established as to how these deviations should be managed. It is usually categorised as being a minor or major change and each would require a distinct course of action in addressing the deviations from the agreed process.

4. Weather limiting criteria
   Procedures should be established on the weather limits that would be acceptable for the operation. Information should also be included on what are the sources of reference on the required information needed to make the assessment. This will ensure that all involved parties are considering the information from the same source in arriving at the same conclusion.

5. Abort and module retrieval procedures
   This procedure should be established to address any eventuality which may lead for the whole activity to be aborted. This can possibly occur, mid-way of transport onto the barge particular where there is a large tidal variation.

6. Study / information on transport route
   A site assessment of the transport route should be carried out so as to identify any obstructions, ground or space issues.

7. SPMT configuration
   The composition of the trailer arrangements and information on grouping.

8. Information on SPMT steering coordinates
   Where applicable, information on the calculated coordinates settings.

9. Tidal information and operational windows
   Tidal information including range for the site where the planned operations will occur. This should be obtained from a reliable source.

10. Information on barge ballasting system / Potable pump systems
    A description of the ballast tank arrangements and line diagram should be provided. Any restrictions on the operations of the pumps or pumping sequence should be clearly identified for the benefit of the Ballast system operators and considered during the planning stage of the ballast operations.

11. Ballast plans for Load-out/Load-in operations
    A ballast plan should be prepared for the transport vessel on the ballast changes require to maintain its level with the wharf. This should consider redundancy arrangements in the event of pump or tank valve failures.

12. Trim / Stability information based on the loading / Discharge sequence
    Results of the stability calculations should be provided for the different stage of loading/discharge onto the transport vessel.

13. SPMT trailer Checklists / Operational checklists / Pre-transport checklists
    The inspection regime for the preparations of the SPMT should be made included in the method statement.

14. Module weight and Centre of Gravity calculations
    Module weight and the location of the centre of gravity is usually derived by calculation and at times inspected on a random basis by actual measurement. This is done by using load cells or SPMT`s (weight only) and is usually provided in a separate document.

15. Lashing calculations
    Information on the location and type of lashings should be provided. This should be backed up with the relevant calculations on the load restraints.

16. Trailer loading and stability calculations
    Calculations should be provided on the support and reaction on the trailer, bending moment, shear and deflection. These results are checked against the allowable limits.

17. Transport calculation
    An inspection should be made on load taken by the SPMT configuration. Axle load for the shipment which may not be uniformly spread should be calculated and compared with its rated capacity.

18. Tractive effort calculations
    Calculations should be shown on the tractive effort required and compared to the amount available. Allowances should be made for the site gradient, rolling resistance and wind effects for worst case scenario.

19. Bridge plates/Link-span arrangements
    Dimensions and design of the bridge plate arrangements should be provided. Strength calculations on the load bearing capability of all its sections and any other restrictions should be provided for inspection and review.

20. Health, safety and Environmental risk assessments
    In the case of particular large constructions project, a Hazard identification workshop should be carried out involving a lot the parties involved. This exercise will assist in addressing any concerns that are unique to the project be it at the fabrication yard or at the construction site.

The above provides a good reference base on pre-operational requirements prior to the actual transport.

Training and technical capabilities

The SPMT operations team should have the required numbers, expertise and experience to operate and manage the transport requirements in a safe manner. Information on the trailer configuration and setup, steering coordinates, lashing requirements, link span arrangements, etc. as stipulated in the method statements must be clearly understood by the supervisors of the operations team.

A system must also be established to counter check each other of the setting and arrangements that have been put in place. For example, information on the steering coordinates for the proposed SPMT configuration must be correctly entered into the control box as per plan. There should be a procedural system in place to counter check these entries to ensure that it has been correctly entered.

An incorrect entry of the steering coordinates can lead to the modules having sustained damages.

The team on site should also be sufficiently equipped to attend to any technical issues during operations. Tyre punctures, over-heating, computing failures, electrical faults on the power packs are some the issues that can be experienced during module transportation.

Information on the technical qualifications and training of the personnel's involved should be made available for inspection by the Marine warranty surveyor.

Peer review

Operational procedures as provided in the Method statements should be presented for peer review by and external independent Engineering Company for verification purposes.

It would usually be inspected for compliance against widely used industry standards and guidelines.

This document should in addition be reviewed and commented on by the attending marine warranty surveyor in due course.

Any concerns raised by the verification party should be addressed and resolved. This information should also be presented to the attending marine warranty surveyor for his review and comments, where applicable.

Marine warranty survey

With reference to the SPMT equipment and set-up, the Marine warranty surveyor (MWS) must ensure that all relevant procedures and checklist have been complied with.

Comments made by the peer review party should all be resolved satisfactorily and closed.

All team members of the SPMT operators should be trained and competent for the task at hand. An inspection should be made of their training records and experience in managing similar activities.

MWS should ensure that the SPMT`s has been set-up in accordance with the approved configuration by conducting the following checks:-

- that the SPMT. Correct number of axles and lines are being used,
- that the distances between each of the lines are as per plan,
- that the power packs are in the correct position that the steering coordinates have been checked and confirmed to be as per plan, where applicable,
- that management structure of the transport is in place,

- that the lashing arrangements are as per the lashing plan,
- that the bridge plates arrangements are as per plan,
- that operational checklist and redundancies for punctured tyres, hydraulic failures, power pack failures, etc. are in place, and
- that the planned route is clear of any obstructions or other simultaneous operations.

In the event that the transport is over a long distance where there are a number of large turns, a further check should be carried out to ensure that the SPMT has not shifted from underneath the load, midway during the transit.

This is carried out by measuring the distances between each line of SPMT and by inspecting the markers placed initially on the load. A near zero difference from initial setting would mean that all is well.

The marine warranty surveyor should also ensure that sufficient spotters are in place at the appropriate locations to monitor the transport activities due to the large number of blind sectors that the SPMT operator will be exposed to. A good communication system should be in place to manage this process.

Conclusions

The usage of SPMT for large projects will only increase in the coming years. By having a detailed method statement, a thorough informed assessment can be made of the risks that will be involved for a particular transport.

These procedural and operational guidelines can serve as an avenue to inform other involved parties such as the Master of the vessel, vessel operators, Site managers, etc., of the activities that are at hand. It will ensure that the transport activities are carried out in an efficient and effective manner for all involved parties.

End.