

Safety factors within ports and harbors

How stakeholders can take steps to identify potential risks and mitigate against them

Mark Yong, Associate Director, & **Dr. Richard D Colwill**, Managing Director, BMT Asia Pacific, Hong Kong

While health and safety is driven mainly by legal and moral obligations, there is certainly a commercial element too. The major corporations involved in ports, harbors and shipping are very aware of the commercial fallout that will inevitably follow an accident or incident. In the ever more litigious society that we live in, planning and risk mitigation has taken on a whole new importance.

Contemporary port and harbor operations demonstrate a classic case of risk and reward. In order to reap the commercial benefits, ports are catering for a higher volume of shipping with far more vessel movements than a decade ago. The associated risk is that with increased traffic, often in a restricted environment, there is a far higher chance of a ship-to-ship or a ship-to-infrastructure collision. With economic factors driving the need for port operators to maximize revenues, it is necessary that ports optimize all available water space to the best of their ability. This often leads to delays to inbound vessels if berths are not immediately available. Ships waiting to berth need access to a suitable anchorage away from major transit routes and with protection from rough weather; however, this facility is not always provided, increasing the risk of accident or incident.

Safe vessel traffic

The issue of safe vessel movement often extends beyond the port's jurisdiction but must still be addressed. In areas such as the south-eastern approaches to Hong Kong, which provides the principal access to the Western Shenzhen port clusters and Hong Kong's container terminals, there has been a rapid increase in marine traffic. This has meant a rise in the occurrence of congestion as large numbers of ships try to enter and leave the multiple ports in the vicinity. Recent

investment in passage planning 'expert systems' by Hong Kong illustrates one element of the response required to such challenges.

In parallel with the issues associated with vessel movements, external environment factors such as wind, waves and currents need to be taken into consideration. The Sunda Straits, between the Indonesian islands of Sumatra and Java, have a reputation for strong currents and heavy weather. Ships visiting the cluster of petrochemical facilities near Merak need to be ready to deal with these conditions, especially when in close proximity to port infrastructure or other vessels. Experience pilotage and harbor control is key to maintaining safety.

Challenges posed by new super-sized container ships

The new generation of 12,000-18,000 TEU container ships also adds extra complexity to the issues of vessel movement in existing ports. Vessels of this size are set to become the 'work horses' of key international trade routes. While channels can be dredged to accommodate the draft of this new class of vessel, there may be limiting operating windows with regards to wind speed and maneuvering in close proximity to other vessels or port infrastructure.

It has been suggested that more onerous operating procedures should be applied to these vessels because of the impact an accident or incident might have. It's conceivable that a damaged 18,000 TEU container ship could effectively close a port for a number of months if it was disabled in the main channel. Globally, there is only a small amount of marine plant capable of recovering the cargo from such a large vessel, and the same goes for recovering the vessel itself.



As it begins to handle more liquid DG, the Port of Tanjung Pelepas, Malaysia, will need to change operational protocols to ensure the correct separation between container ships and DG carriers.

Dangerous cargo

The risks in the port environment are further multiplied when dangerous cargos are introduced where a potential risk of fire, explosion and pollution must be considered and planned for.

While none of these issues are insurmountable, they do require careful consideration, planning and execution to ensure safe operation in and around the port. In order to ensure that there is a safe system of operation that will benefit all stakeholders, port authorities need to review all current operations under their jurisdiction and, where necessary, recognize plans for future expansion. With this information to hand it is possible to identify the major risks and mitigate accordingly. In general the following guidelines may be followed:

- Both the level of individual risk and societal concerns resulting from the activity must be taken into account when deciding whether a risk is unacceptable, tolerable or broadly acceptable
- The decision-making process should be inherently precautionary
- For every hazard there must be a suitable and sufficient risk assessment
- Suitable controls must be in place to address all significant hazards
- The controls, at a minimum, must achieve the standards of relevant good practice precautions, irrespective of specific risk estimates
- Where there is no relevant best practice (or the best practice is not good enough) the decision as to what control measures are suitable will be informed by risk assessment
- There are some risks that are not tolerable whatever the benefits.

Mitigating risks to vessel traffic posed by new developments

In ports where future developments create significant changes to the fairway structure or traffic mix, it is critical that stakeholders have the means to predict the nature, distribution and magnitude of future risks. One such approach is BMT's Marine Application of 'Massive'. Developed in partnership with Massive Software, BMT has used the software to study marine traffic in busy harbor areas, including sites in Hong Kong, China and Europe.

By running simulations using variation of the following factors it is possible to identify scenarios with raised risk profiles and mitigate accordingly:

- Geometry (draft, width & air draft) of navigable channels
- Traffic Mix (size, speed, type of vessels & maneuverability)
- Metocean Environment (current, wind & wave)
- Control Regime (Traffic Separation, speed limits, VTS advisory)
- Operational Capability (Mariners familiarity and tolerance to vessel proximity).

One of the scenarios that 'Massive' can be used to assess is the transit of vessels carrying dangerous cargos such as LNG. The particular challenges of ensuring safe LNG carrier access creates a series of new issues within a complex environment that need to be examined by pilots, Vessel Traffic System (VTS) operators, adjacent port stakeholders and harbor authorities who are all crucial to the safe and efficient operation of port systems. Consequently, the ability to clearly and accurately identify and predict the behavior of traffic flows, as well as impacts and delays within the port is a key element in identifying and mitigating risk.

The human element

Realizing that 'ships don't travel around harbors, people travel around harbors in ships' it is key that human decision-making in response to the environment and perceived threats is well represented. Increasing mechanical reliability ensures that human factors are now the most significant elements of risk within these systems, yet these are frequently the most poorly replicated. Training a ship's crew is a vital part of delivering a safe system of work, especially when the issues of vessel size, limited maneuvering space and awkward environmental conditions are combined to increase the risk of accident or incident. Ship maneuvering simulators, such as BMT's 'Rembrandt', can be an invaluable, cost effective way of providing classroom based training that faithfully replicates specific ships and harbors.

Using VTS and Aids to Navigation to reduce risk

Within the port environment, vessel movement needs to be monitored and controlled with up-to-date vessel traffic systems (VTS) and other navigation systems. While traditionally port authorities have provided the drive to ensure that suitable VTS is in place, they are not necessarily best placed to fulfill this function due to lack of funds or other more political factors. It is now often the role of local or central government to provide the investment, especially when a successful port can have such a positive effect regionally or even nationally. However, there is still a need for checks and balances to ensure that adequate investment is secured to deploy suitable navigation and control systems in line with the volume of traffic.

Safe port planning

By proactively managing risk in the planning stages, a port developer can add value to the facility in the longer term. While it might appear easier designing a port complex from scratch, a rigorous planning process must be completed to ensure that the facility will be fit for purpose and safe to operate. However, it is not always possible to consider all eventualities at the planning stage and some pragmatic action by the port authority is often required.

The Port of Tanjung Pelepas in West Malaysia opened in 1999 and has had nearly 12 years successful operation as a container terminal. However, in coming years, liquid DG storage facilities will open adjacent to the container terminal creating a whole new set of risks for the authorities to address. Operational protocols will need to change to ensure the correct separation between container ships and DG carriers. Additional tugs will need to be made available to assist berthing; contingency anchoring points will have to be established and a whole range of additional contingency measures developed to address the different risk factors involved.

Conclusion

Port authorities and developers need to be very careful to identify and mitigate as many current and future risks as practicable. It is a complex task that requires expert knowledge and experience in order to be confident that all known bases are covered. The commercial, legal and moral drivers are onerous when considered in isolation; however when dealt with by subject matter experts can be both illuminating and rewarding.

ABOUT THE COMPANY

BMT is an established multi-disciplinary consultancy operating on a global basis and serving clients in the Energy & Environment; Transport & Infrastructure and Defense sectors. The company operates through a series of subsidiary companies each focused on particular markets, technologies or geographical areas.

ENQUIRIES

BMT Asia Pacific Limited
5/F, ING Tower, 308 Des Voeux Road Central, Hong Kong
Tel: (+852) 2815 2221 Fax: (+852) 2815 3377
Email: post@bmtasia.com.hk Web: www.bmtasia.com.hk