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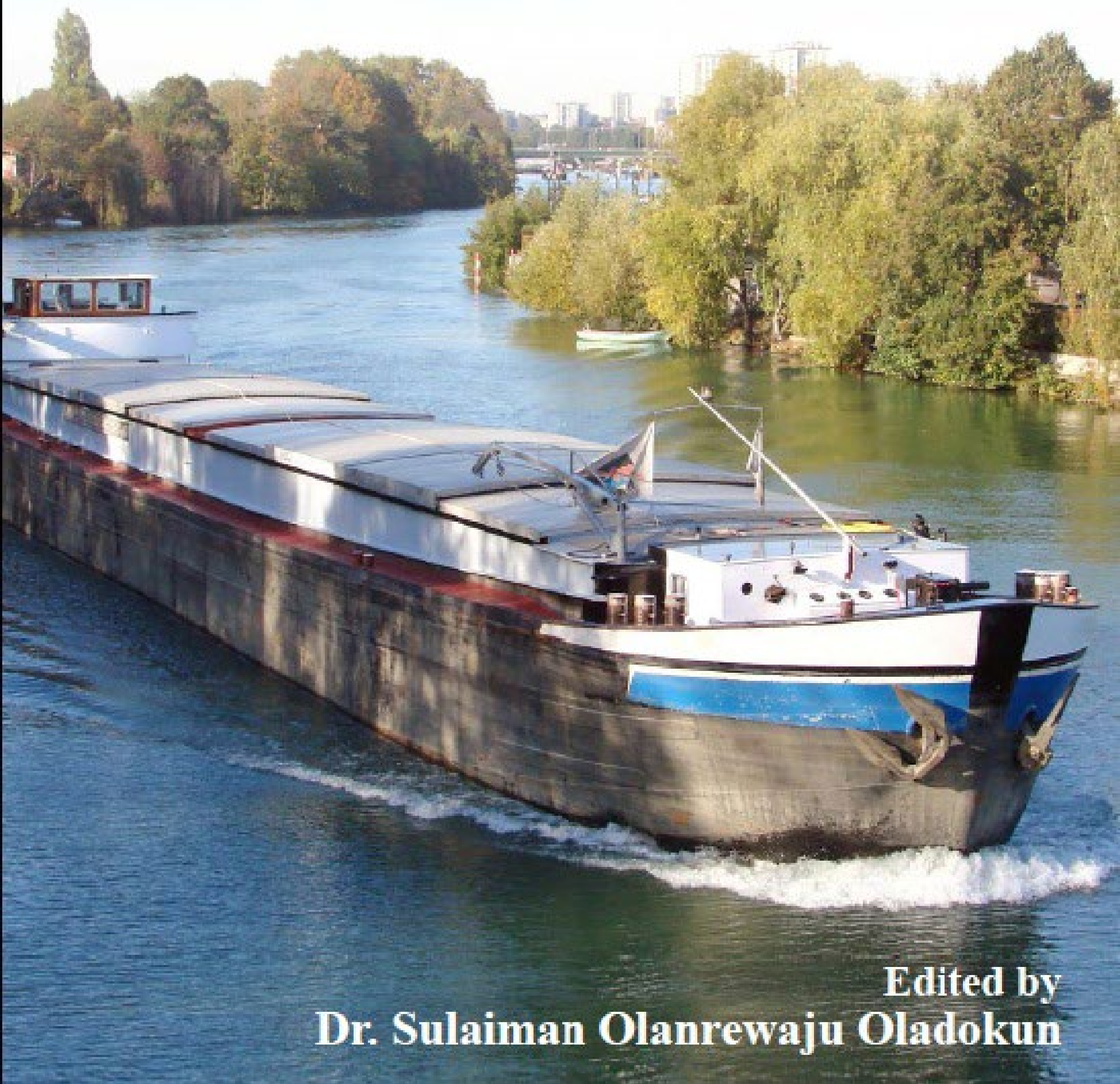
Inland Water Transportation Systems Series



Edited by

Dr. Sulaiman Olanrewaju Oladokun

Inland Water Transportation Systems Series

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Preface

The vastness of the ocean and its various processes that support life and earth remain a big challenge for humanity. Despite so much achievement in human civilization, logistic, to information technology to multimedia and sensor technology, the knowledge of water and ocean has left man with much more work to do on innovation front and new discovery. Modern day challenges are cluster of alternative energy, protection of the environment, ocean space exploration, sensing technology and material science. The book presents recent studies that have been carried out in maritime research and innovation front. Potential users of the books are library, societies, universities, research centers, professional bodies, government and NGO.

-Dr. Sulaiman Olanrewaju Oladokun

About Author

Dr.O.O.Sulaiman is Associate Professor of Ocean Engineering, and coordinator for Maritime Technology International program, University Malaysia Terengganu. His specialization is in Safety and Environmental risk and reliability for maritime and ocean systems, maritime and ocean energy and environment, sustainable maritime system design. He is chartered engineer with diverse academic and professional background. He has taught and mentor courses and research projects on contemporary issues in maritime and ocean engineering field. He has authored and co-authored a total of about more than 120 publications which include proceeding papers, journal papers, technical report and chapters in book, monograph, seminar papers and other types of academic publications. He has authored more than 60 peer review journals and 6 books. He has patented research work on marine green technology. He is chattered engineer registered under UK Engineering Council. He is the member of royal Institute of Naval Architecture (RINA) and Institute of Marine Engineering, Science and Technology (IMarEST), PIANC, IEEE, ASME.

Acknowledgement

A book that cover wide range of salient information on contemporary sustainable marine maritime technology and systems in coastal and ocean environment owe much appreciation to various individuals, equipment manufacturers and organizations. I am grateful for those who helped in different ways during the preparation of the book.

Introduction

The book will represent a master piece that provides information and guidance on future direction of marine technology and sustainability requirement. The book focuses on various contemporary issues that make its contents richer, more informative and beneficial to the wide number of readers in industry and academic sphere. This book provides the most recent information about proactive approach to sustainable development technology for readers about requirements of sustainable marine system. The book will be useful as followed:

- Reference material for academician, students, researcher, universities library, research institution as well as classroom subject.
- Networking, literature citation
- Useful information for maritime industry and organization Industry and regulatory institution.

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Inland Water Transportation

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Sustainable Periodic Navigation Channel Assessment Initiative for Restricted Waterway

Abstract

The nature of human activities has remain that one thing will always complement the other. Today the world is moving so fast and but the maritime industry from issue of cybernation of ship to environmental has been quite at low frequency with development. This nitigrity is due to so called conserve nature of the industry and of course because concerned people are blithely unaware of frequency deviation of the new generation ULCC vessel and in relation with existing channel and port situation, likewise, the international organization, focus too much of their proceedings on vessels in the deep sea, and less on port status or waterway issue. This paper will address environmental, human and reliability factors affecting our channel in relation to ships operations, channel design, ship design and ship maneuverability in restricted channel, the need for periodic cost benefit risk assessment of restricted channel against new generation of larger class of ships that are coming to the market. The need to generate maritime environment awareness in maritime curriculum through evaluative simulation and assessment of fictitious situation that reflect real life for our channels, deduce actionable alterative options, mitigation measure and recommendation for improving the safety of navigation and protection of the marine environment by enhancing cost effective channel maintenance and controllability of ship in shallow water and restricted water.

Keywords: Assessment; Channel; Cost; Environment; Maritime; Navigation; Risk; Safety; Ship;

Introduction

Life of man has always been about pressure response action that has lead him to transitions between different technological ages, during this transition he has hardly recognize his inherited and supportive lithosphere, hydrosphere and atmosphere that equally take their natural course as ordained and generate reciprocating response that lead today both of this reactions has cause imbalance that has resulted to environmental degradation leading to issue of environmental revolt we are seeing today For years, normal practice of human activities waits for disasters to come before we take care of the environment we live or operate and of course that support our life. It remain our responsibility as human to be serious as time is calling to change the way do things especially using proactive approach rather than conventional reactive approach necessary for studying, recording, analyzing ,integrating and matching new system with the environment to ensure preparedness and reliability through simulation and adjustment that will minimize calamities and heavy disasters cause by point form degradation that has resulted to unprecedented floods and landslides especially in coastal areas. Multivariable nature of channel maintenance work require studies of various method which we have been exploring, this paper will discuss a holistic methodology approach that will account for proactive assurance and sustainability of channel maintenance work are formulate for one of the nation’s channel.

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Consequences of System Imbalance

Today and every day, flood waters is coming and taking over our cities, cut off transport, routes, communication power supplies, have inundated destroyed our homes, crops and livelihoods, affect millions in rural and urban areas. Areas that are especially hard-hit have seen widespread devastation death from heaviest rainfall on record that has forced and forced millions of people from their homes and neighboring state have seen with unprecedented severe damaged, damage ranging from agriculture and industrial units is also widespread The Table 1 below shows what disaster has been causing us.

Region	Hydrometeo	Geobgical	Biological	Trchnological
Africa	1.661	0.354	7.436	3.654
America	7.613	0.410	0.103	1.318
Asia	2.696	2.412	0.332	1.275
Europe	5.904	0.310	0.054	1.097
Oceania	1.694	7.337	0.937	2.056

Table 1: Average Number of People Killed per Million Inhabitants -1994-2003

The UN investigation has confirmed that almost one million houses are damaged annually by human, economic, social and other similar causes. In recent years, the increasing instances of disasters have heavily affected the socio-economic development across the globe. Below is what disaster has taken out of our pocket. Source of data: EM-DAT: The OFDA/CRED International Disaster Database. http://www.em-dat.net, UCL - Brussels, Belgium. Figure 1

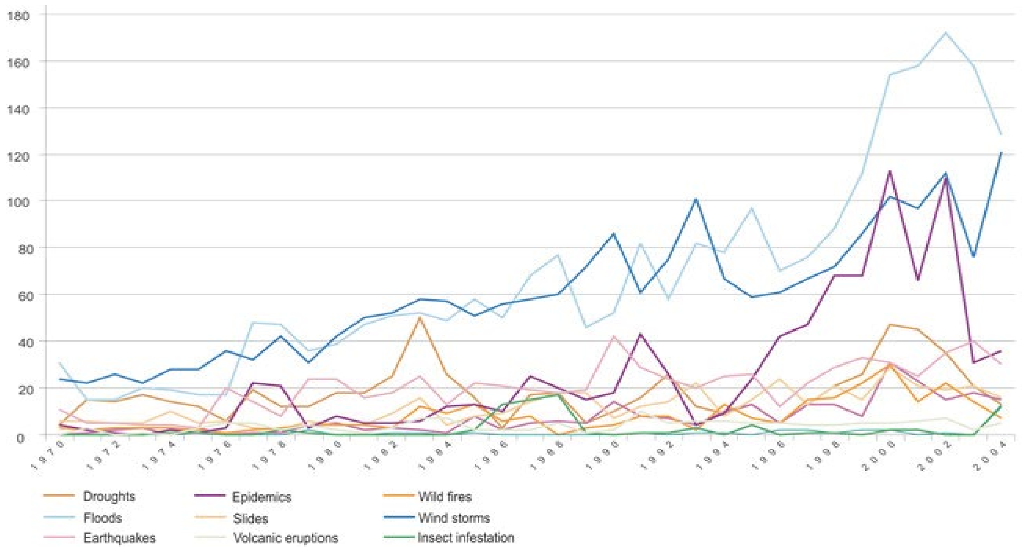


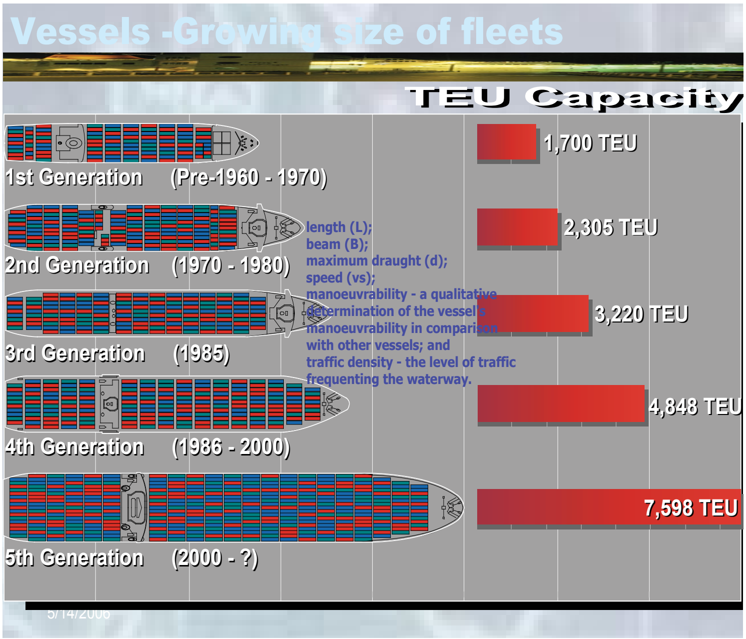
Figure 1: Number of Natural Disasters by Type of Triggering Hazards 1970-2004.

These are all consequence of failure and imbalance leading environmental degradation as a result of imbalance of human activities and negligence to our environment

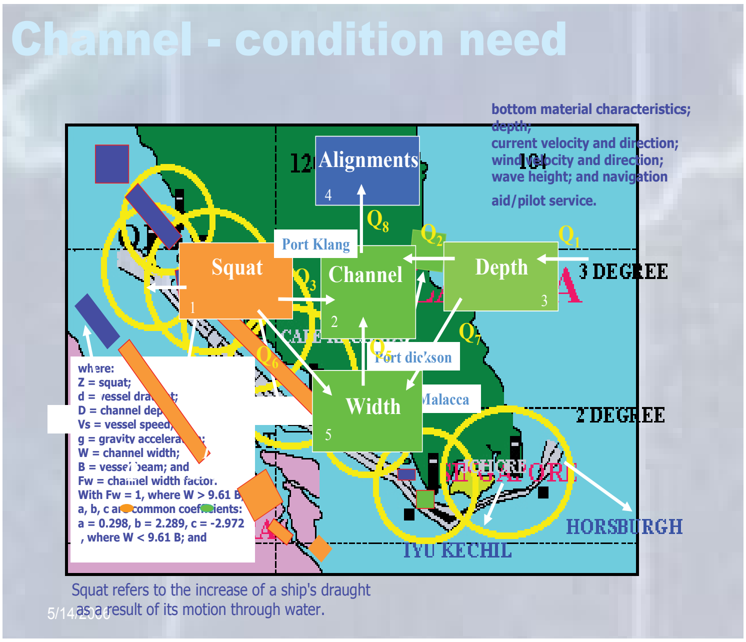
Shipping Trend: Ships and shipping remains a very important instrument to mobility, if ships could no longer transit our waterways, we will experience shortages of power, heat and food in days or weeks at the outside. Recent years have seen economic of scale due to improved trade, the significance of these trends is that more, larger ships will continue to use our waterways for the foreseeable future. But there are limits on size of ship that a channel can accommodate and means of determining when special measures must be imposed on handling ships in order to ensure the continued safe, efficient and environmentally friendly use of our channel.

This make it incumbent authorities concerned upon regarding our waterways to evaluate and address the risks associated with ships that are plying them and find way and information sharing avenue systems for channel designers, naval architects, ship masters and pilots and waterway managers that will help develop policy recommendations that will address the way channels are laid out and enlarged and how ships of various types using them should be designed and handled. And of course ways to monitor existing and new ships operating at channel approach in order to guide ship designers understand and review ships, pilot age, channel current design and operational practices on how to make needed improvements.

In shipping, ships coming to the market need to be matched with the port condition, ships are necessary to facilitate trading through marine transportation and Recent time has proved that there is continuous growth or need for larger and sophisticated ship through increasing shipping activities and this has leads to design and production of sophisticated state of art safety oriented marine vehicle in term of size, speed and structure albeit, this safety based designed development is out of phase with conditions of navigation channels. To create a balance for safe navigation in restricted water this big ship will ply, we must maintain the channel at a frequency the ship production are growing.



a.



b.

Figure 2: Vessel Grow Size and Condition of Channel-Source Transmarine.

Figure 2 shows the growing trends of container vessels and need of channel to match this growth. Recent projection is looking at 18,000 TEU. Which I believe the technological capability is there for such target.

As the ship sizes are increasing it is imperative to do periodic examinations of the requirement of the channel in regards to depth, width, squat and alignment. Channel design and maintenance work fall among the works that require multivariable exercise that need model studies for good outcome. Shoaling remaining unavoidable part of most harbor and navigation channels and one method to preventing shoaling and associated siltation hurdles is using of maintenance dredging at economical frequency.

Present Treat: Analysis drawn from marine departments in Figure 3 and 4 show disasters record of the Strait of Malacca - collision and grounding take the highest share of the risk.

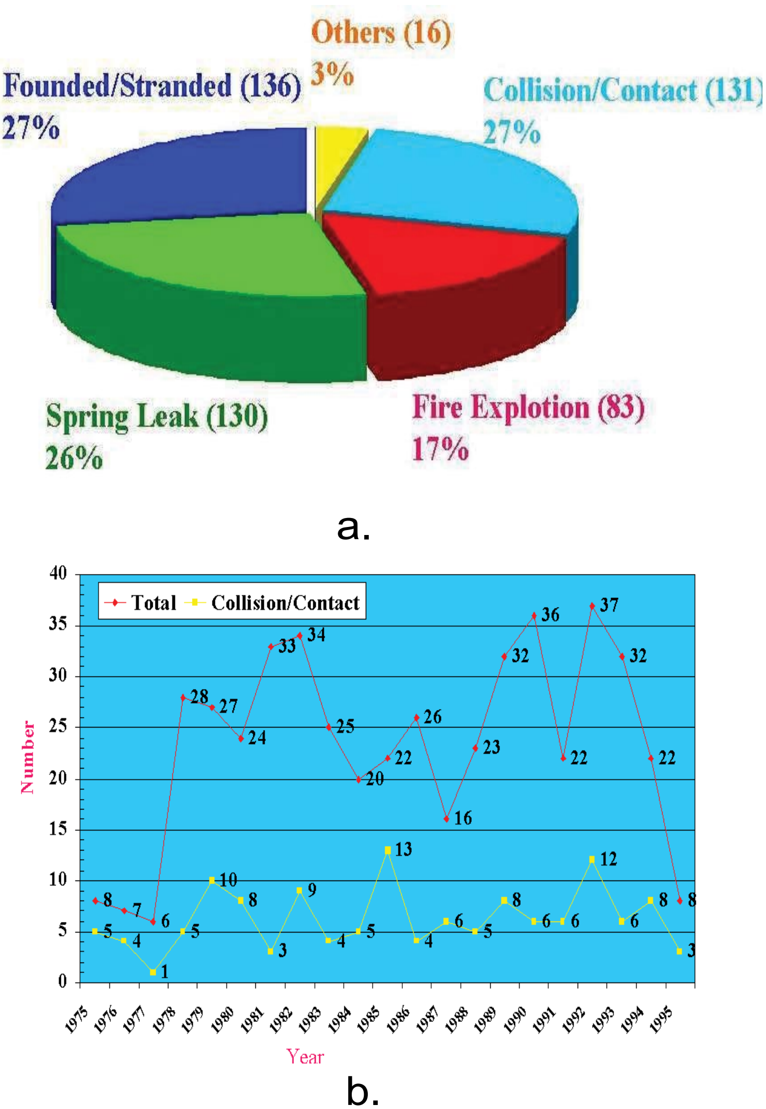


Figure 3: Risk in the Strait of Malacca source Malaysian Marine Department.

Also a risk assessment studies carried out by Norske Veritas for various navigation water ways put present the strait risk situation as follows

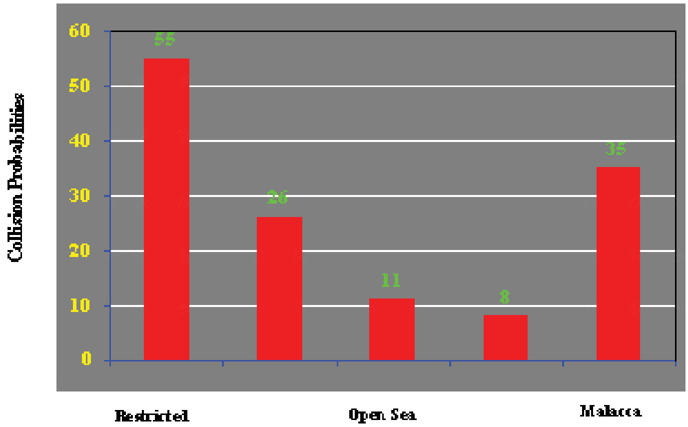


Figure 4: World Coast Risk Area- Source DNV.

On sustainability, analysis made by the UNEP regarding region under coastal treat concluded that following as shown in Figure 5, this due to the so due to Asia having a lot of river runs off to the sea than any other continent.

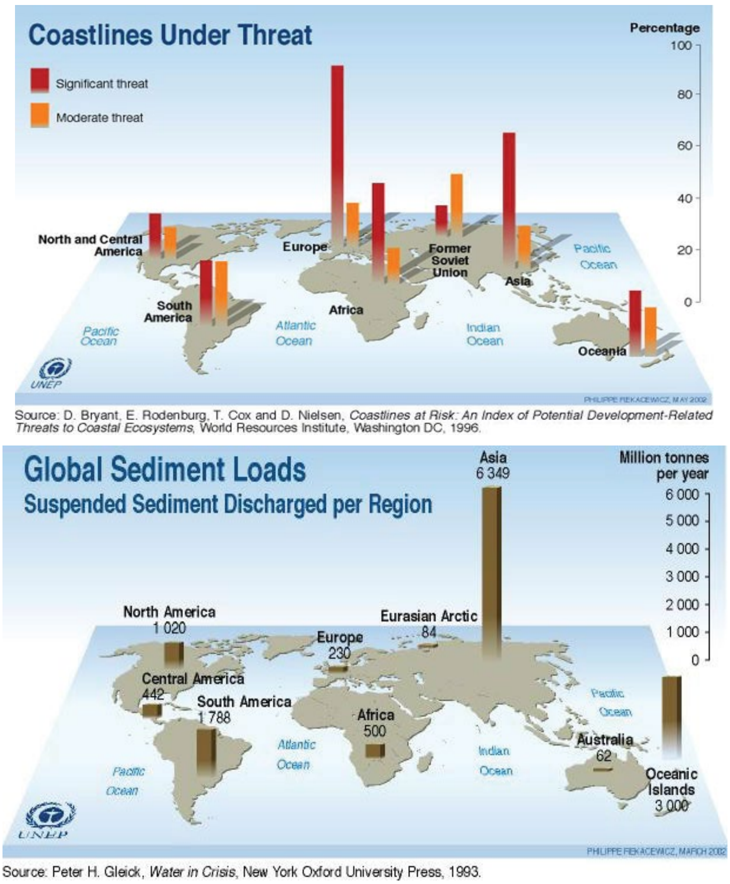


Figure 5: Coastal treats (UNEP ,2007).

Chanel Maintenance Work: Maintenance dredging is the activity of periodically removing material which has been deposited in an area where capital dredging has been undertaken. The frequency of maintenance dredging varies from port to port, however the objective remain to allow ship to enter a leave port at stated draft t without delay and this is what give ensure of efficiency of maintenance dredging. Thus step must be taken to minimize siltation and shoaling. Every human activities on earth is about need and response to need and of course mitigation issue relating to channel and ships is not left behind in this, the Ship is about port access to port by optimum size ships can be made available through navigable channel where maintenance dredging is needed. Ship production and condition of channel are out of phase. Economic of large scale and demand has begot big ship to emerge within a short period of time after Second World War however less attention has been given to the channel that will continue to accommodate these ships. Large ships typically maneuver with difficulty in confined areas and channel width is a critical component of deep-draft channels .The requirements for access and protection in harbors and ports often lead to dredged channels and engineered structures, such as jetties and breakwaters Figure 6.

Channel Width Characteristics:

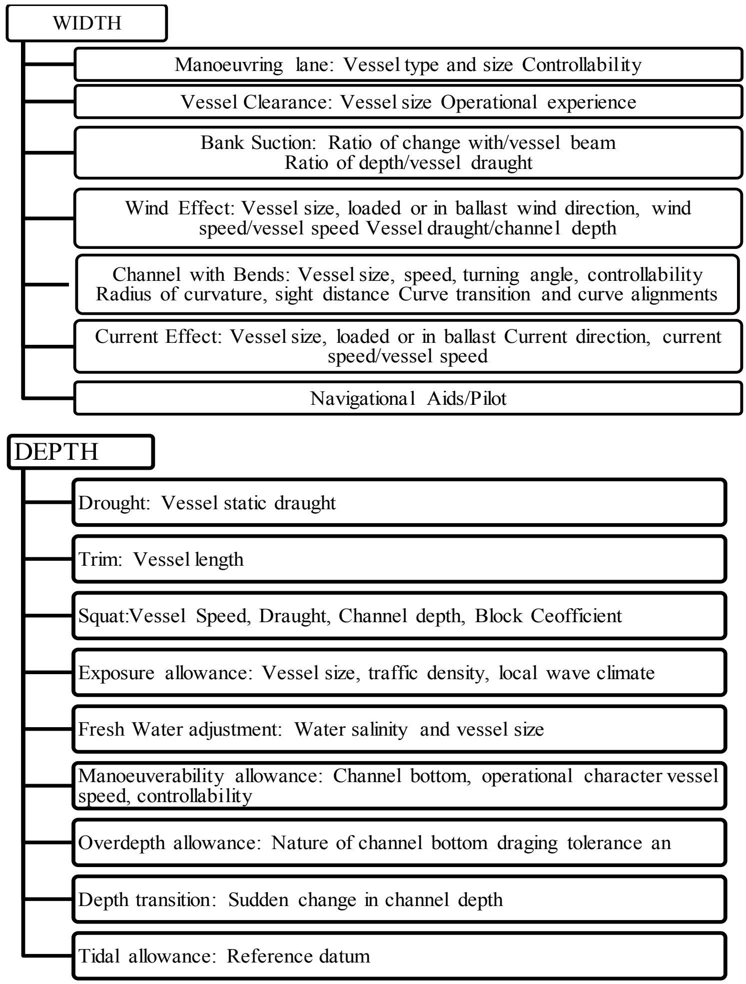


Figure 6: Channel Depth and Width Parameters.

The main characteristics of a channel may be grouped into the following general categories:

i. Channel Layout (i.e., plan view path characteristics such as straight and curved sections).

ii. Channel Cross-Section (hydrodynamic characteristics such as depth, width, and side-slopes) many factors feed into the determination of the dimensions and specifications of channel characteristics, including.

iii. Vessel traffic characteristics (e.g., traffic mix and density, length, beam, draft, air draft etc. of vessels), environmental factors (e.g., tide, wind, waves, currents) and location and characteristics of features such as bridges and economics, along with many others.

Channel Depth Characteristics: Channel deepening is considered more important by channel designers, economists and mariners alike. PIANC have detailed guidance for determining channel depth based on a number of factors as illustrated in Figure 7. Although channel width is treated somewhat similarly by PIANC because of conventional definition associated that depth is for productivity, width is for safety. The significance of this mindset and this trend in channel design is that channel width may potentially be reduced to a point where certain vessels may not even be able to transit a channel based solely on width similar to the present-day limitation of channel depth. Other more immediate impacts include one-way vs. two-way limitations, as well as reduced vessel speed (and therefore reduced efficiency and perhaps maneuverability) in channels due to increased blockage factors. Source PIANC, 1997 the following allowance according to water quality of the port (Table 2).

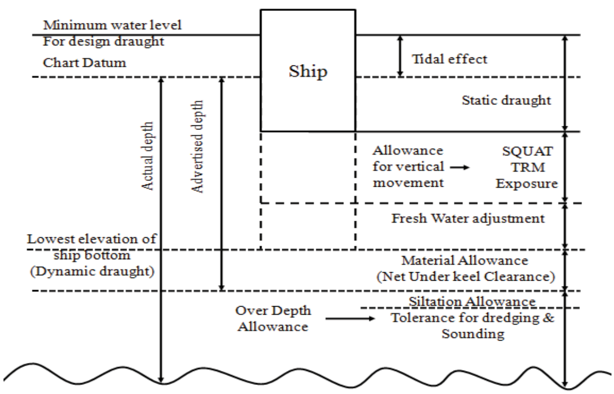
And the following empirical formulae is widely used to determine channel depth and width

$$\Delta W = \frac{0.9144\phi v_s^2 L^2 F}{R_t C_c S} \quad (1)$$

Actual Waterway Depth=Target Vessel Static Draught+Trim+Squat+Exposure Allowance+Fresh Water Adjustment+Bottom Material Allowance+Over depth Allowance+Depth Transition (2)

Port location	Allowance
water	Depth (m)
Blackish water	0.13
Fresh water	0.3

Table 2: Depth Allowance (PIANC, 1997)



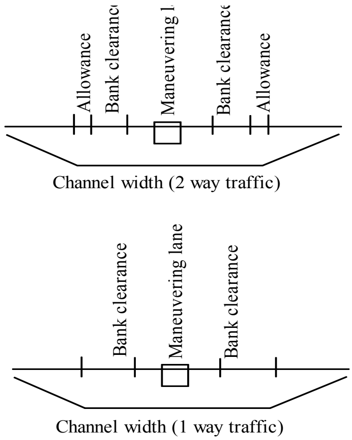


Figure 7: Detailed Guidance for Determining Channel Depth.

Design Characteristics: Ship - Important characteristics being considered in ship design regarding their controllability in constricted waters are:

i. Container ships have large windage that can complicate ship controllability in narrow channels as well as during slow speed maneuvering.

ii. Direct-drive diesel ships with high installed power to achieve design service speeds can, in some cases, have a minimum bare steerage speed of about 8 knots quite a high speed in confined waters.

iii. Tankers and dry bulkers are also increasing in size. While the largest tankers, 300,000 dwt VLCCs and 400,000-500,000 dwt ULCCs.

Design features, including twin screws and rudders, that are intended to reduce the risk of marine causalities on some new tankers have the additional benefit of improving slow speed maneuverability. However, some new single screw tankers and bulkers being built at minimum cost with low power/tonnage ratios and small rudders do not incorporate these features and pose significant maneuvering challenges in shallow and confined waters. Few of the newest designs are being built at minimum cost. These ships have very low power relative to their dwt as well as rather small rudders.

Channel-Permanent International Association of Navigation Congresses (PIANC) approach to channel design Guide provides the basic assumptions drawn from information sharing in 1978 Symposium that many significant articles addressing issues ranging from technical and maintenance to policy and regulatory and aspects of navigability of constraint waterways. Channels are designed to accommodate both the type of vessels and the level of vessel traffic that are forecasted to use a given channel, there are no guarantees that the forecast will accurately predict actual usage. In reality vessels actually transiting the channel are frequently much larger than those for which the channel was designed. At some point, a channel becomes unsafe, unreliable and inefficient for larger and larger vessels. Thus there is no recognized measure or point at which a channel is identifiably substandard. Channel improvements should ideally keep up with traffic so that a channel never becomes substandard. Previous works in improvement work are done in reactive manner, rather than in a reactive manner.

Shallow/Restricted Water Maneuvering Standard - There is need for a design standard for shallow- and restricted-water maneuvering capability should be established. To ensuring that ships can be controlled when operating in shallow water, such a standard could also be used to improve the safety of navigation and protection of the marine environment. Thus ships spend 90-98percent of their operational lives underway at sea speed in deep water, it is during the mandatory beginning and end of every voyage when the risk of collisions and groundings are highest. Ensuring the ability to maintain complete and positive control of a ship's movement during these segments of a voyage is absolutely vital if that risk is to be reduced. The current practice of not positively addressing shallow water, slow speed controllability during the design process is not unlike assuming that an airplane will be able to take off and land if its inflight controllability is adequate.

Aids to Navigation/Navigation Information-There was some discussion about how navigation systems, both short-range aids, such as buoys and ranges, and systems providing real-time tide and current data methodology and electronic systems for monitoring under keel clearance contribute to ship controllability and remain vital components of the channel that directly contribute to the safe navigation of ships in dredged channels.

Maintenance Dredging Capacity - Sediments Output and Estimates: Maintenance dredging with objective to reduce channel delay, accept big ship to be done in environmental sustainable manner and optimal efficiency –in maintenance dredging quantifying the loss of depth pave wave for dredging requirement to be determined and this lead to optimal choice of dredger. Generic calculation on data results from analysis of:

i. Vessel and channel requirement

ii. Basic rate output of the dredger

iii. Computation of volume

iv. Cycle time and Number of work day per year

v. Working condition and Environmental discounting

Where:

Output = number of cycle per day load factor x hopper capacity x number of working day

Load factor = volume/ hopper volume

Number of working day per year = 365 days

Iterative process in analyzing the data's will involve dealing with uncertainty and managing the risk and will help to:

i. To get all concerned involve in formulation of new method

ii. To identify the significant and level of each cause, source and impact of the design changes

iii. To help deduce the possible corrective actions and preventive measures to minimise the avoidable design changes

iv. To help Verified the limitations of the existing methods

Impacts Level - Impact Level is characterized into the Following Categories: Impact to channel during operations (Permanent effect).

i. Hydraulic (Wave climate in port, Reduction of wave height Navigational condition and safety)

ii. Environmental (Coastline erosion development, Maintenance dredging, salt intrusion into the lagoon)

iii. Fisheries (Aquatic life, Water quality at disposal site)

Effect during construction-(temporary):

i. Fisheries

ii. Navigational and port operations

iii. Urban land traffic

iv. Recreation

Prevention is better than Cure: In engineering most of the time we design under the condition of uncertainty with regard to material properties, service requirements and engineering models to name just a few. Navigation, coastal and geotechnical engineers have a very pronounced problem. Past design in human activities has been based on aftermath assessment of calamity where engineers have dealt with the high level of uncertainty by conservatively assigning or specifying much larger capacities than the projected demand. This ratio of capacity to Predicted demand is the classical safety factor approach, which requires significant experience levels to be done right. Conventional project environmental assessment focuses more on economy with pretense that we can't see what surround issue in concern.

Sustainability: Principle 15 of the 1992 UN conference on the Environment & Development in Rio de Janerio.

In order to protect the environment, the precautionary approach shall be widely applied by states according to their capabilities. Where there is threat of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost effective measures to prevent environmental degradation.

In line with UN recommendation to balance environment with economics on development issue with doctrine of sustainability, maritime industry need to adjust to the ways we do things in a world sensitivity characterized by sustainability capacity building, efficiency optimization of development, practice and operations that meets the needs of the present generation without compromising the ability of future generation to meet their need.

Environmental sustainability: The term environmental issues usually implies one of two interpretations:

i. Wind, waves, tides, sediment characteristics and/or other environmental factors involved in channel design and usage, or

ii. Environmental protection in the sense of reducing the negative impact on water quality or aquatic and coastal habitat quality.

The earlier deal is more conventional and there are numerous historical well as recent and predictive datasets. System that provides real-time information about water levels, currents, and other oceanographic and meteorological data from bays and harbors now casts and predictions of these parameters with the use of numerical calculation models are available. In certain locations this information is very important to track because changes to the bathymetry due to dredging or as a resulted in changes in water currents or other oceanographic effects.

The latter is more of revolving environmental issues, especially difficulty in finding suitable dredged material disposal sites. Access to an easily available, economical disposal site determines economical feasibility of dredging. this an has been a long standing issue , but now because of serious environmental issue and consequence and proof that cost of environmental degradation is enormous required all concerned to incorporate positive environmental aspects into channel design instead of just digging deep and hauling the sediment out of the site. Some typical environmentally beneficial uses of dredged material include:

i. Watch out for reef and coastal species
ii. wetland creations or improvements
iii. Beach fills and/or shore protection.
iv. coal combustion by-products as cultch material
v. Recycled of seds. for roadways, golf car paths, and building foundations
vi. Developed on-site system to treat contaminated marine sediments

Economic Sustainability: The economic optimization of a waterway requires study of several alignments and channel dimensions (width and depth) that are acceptable for safe and efficient navigation. Costs are developed for the alignment and dimension for each alternative. Benefits are determined by transportation savings with consideration of vessel trip time and tonnage, delays for tides, weather conditions and the effects of reduced depths in waterways that have rapid shoaling tendencies. For larger traffic in limited-depth waterways, reconciliation between safety and efficiency becomes a complex challenge, both to the regulatory and operational agencies.

i. For the regulatory agencies, it is extremely important to ensure that safety is not compromised for the sake of efficiency.

ii. For the operational agencies, it is equally important that efficiency is not compromised in order to optimize safety.

The optimum design of a waterway requires studies of the estimated costs and benefits of various plans and alternatives considering safety, efficiency and environmental impact. These studies can be used to determine the most economical and functional channel alignment and design considering initial dredging, maintenance and replacement costs for different design levels

Risk assessment: Risk Benefit-Cost Analysis (RBCA) is a tool for organizing information on the relative value of alternative public investments like environmental restoration projects. When the value of all significant benefits and costs can be expressed in monetary terms, the net value (benefits minus costs) of the alternatives under consideration can be computed and used to identify the alternative that yields the greatest increase in public welfare. However, since environmental goods and services are not commonly bought or sold in the marketplace, it can be difficult to express the outputs of an environmental restoration project in monetary terms. However complicated factors associated with cost quantification exercise are

i. A lot of money must be spent up front to deepen a harbor, but the benefits are realized little by little over time. The distributional effects of publicly funded projects must be considered from the standpoints of equity and justice.

ii. Harbor deepening can result in significant externalities benefits or costs that are not directly generated by the investment under consideration but that are the indirect result of that investment.

iii. Not all the costs of harbor deepening can easily be monetized. There are very real costs, for example, associated with the re-suspension of contaminated sediments, the use of upland sites or ocean bottom for the disposal of materials, and the loss of marine life, such as loggerhead turtles, during the dredging process.

Distinguish Hazard & Risk

Hazard: Anything that can cause harm (e.g. chemicals, electricity, natural disasters). Severity may be measured by:

i. No. of people affected

ii. Monetary loss

iii. Equipment downtime

iv. Area affected

v. Nature of credible accident

Risk assessment is a process that evaluates both the SEVERITY and PROBABILITY of adverse consequence (Hazard) of the project. Systematic process to quantitatively measure perceived risks/values of waterways using input from waterway users/experts.

RISK = Hazard x Exposure (an estimate on probability that certain toxicity Will be realized)

Dealing with Uncertainty: Uncertainty will always be part of our activities because of limitation of knowledge of unseen in real world settings issue associated with uncertainty are normally.

i. Influences on recovery process

ii. Test of new advancements

iii. Influence on policy

iv. Address system changes over time

v. services & resources\

Benefits and Harms Benefits: Risk management is the evaluation of alternative risk reduction measures and the implementation of those that appear cost effective .where Zero discharge = zero risk, but the challenge is to bring the risk to acceptable level and at the same time, derive the max. Benefits. Uncertainty because of the highly variable nature of elements and properties involved with the situation.

i. Simulate extreme condition and model using combination mathematical modeling and stochastic techniques while considering all factors in holistic manner.

ii. Risk areas and assessment – taking all practical using historical data's and statistics that include all factors - Public health (people > other species)

iii. Mitigation to risk assessment and risk areas - This involves making permanent changes to minimize effect of a disaster - Immediacy: (Immediate threat>delayed threats)

iv. Prefer and no option choice - As prophesied my Newton- time travel in space, no matter what one thing must compensate for the other.

v. Panel of expert -Reach out to those who are capable to extend hand and do the right thing at the risk area- Uncertainty (More certain > less certain).

vi. Community participation - Educate and all concern about the going and lastly place firm implementation and monitoring procedure. Adaptability (Treatable > untreatable).

vii. Emergency response – provide monitoring and information facilities and make sure necessary information is appropriately transmitted and received to all concerned Reversibility (Irreversible threat > reversible threat).

Conclusion

Critical activities involved in port projects like entrance channel design, oil spillage, break touches, navigations condition, oil spillage, fisheries, aquatic life, sediment and disposal need go through intense studies and review on justification of containment measure recommended for better protection against wave, improvement of navigational safety conditions. But little is not done on making policies to for periodic overhauling or assessment nor do such do critical test or simulation of extreme flooding hat visit hearth like tsunami. Various environment institution have various methodology and limitation they follow to simulate or determine risk, integrating them or using good faculty of judgment to borrow them in other situation could be good thing to be ahead of destructive disaster. In shipping IMO has standard rules and limitation assigned for disaster and of vessels and channel. But nonetheless, there is no standard rules put in place for periodic simulation and assessment.

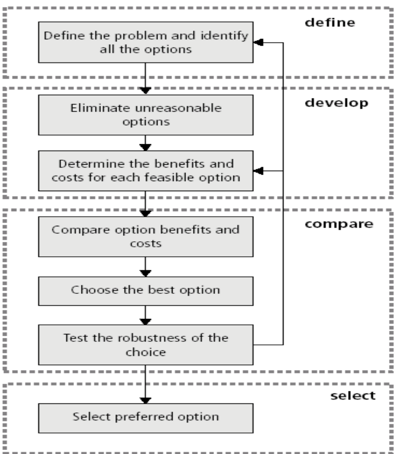
The marine department mission is to provide safe, reliable, efficient, and environmentally sustainable waterborne transportation systems (channels, harbors, & waterways) for movement of commerce, national security needs and recreation. However, there seem to become fundamental difficulties in achieving this mission. Most notably is that there are no recognized standards for safety, reliability, efficiency or environmental sustainability relative to navigation channel promulgated by PIANC. Risk and uncertainty analysis of channel design and usage is desperately needed to incorporate vessel transit data, accident data, as well as other factors into an assessment of channel safety, reliability and efficiency. However, it is a challenge to even define risk in terms of channel design due to the varying independent, dependent and coupled factors involved. The role of simulation in the design process is valuable and significant but simulation technology needs to be supplemented with other tools for assessing total risk and uncertainty. Perhaps the most important issue identified in the discussions is that channel design is often done in a purely reactive manner.

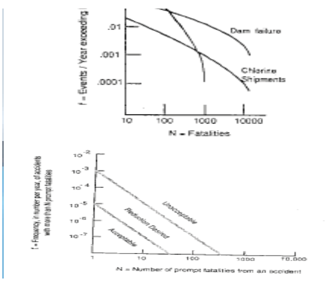
There is an acute need for a proactive process to look at improving channels to meet larger vessels, as well as to meet the significant changes in the nature of maritime shipping. Future vessel designs and design trends could be regularly tracked and incorporated into planning processes. However, in most places people are completely unaware of the existence of maritime shipping industry and cannot even begin to realize the impact it has on our daily lives and our quality of life.

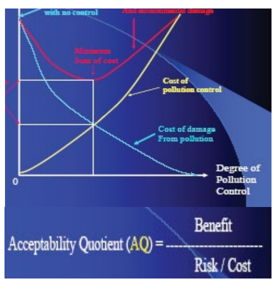
The way things started forming and how the world started closing together; even with the aggressive harmonization with the environment is obviously integrating all professional together nowadays. Shipping industries are not left out in this need to maintain balance with the environment is obviously calling for work on vessel design, Channel design and Vessel Maneuverability and professional channel designers, naval architects, pilots, and ship operators to review and share design approaches and standards that affect safety of operations and the environment. This will nonetheless led to development of policy, recommendations that can be implemented both in the way channels are laid out and enlarged and how ships of various types using them should be designed and handle with Resulting recommendations based on the discussions promises to improve overall safety of ship operations in restricted waterways.

Appendix

Frame work for RISK COST BENEFIT ASSESSMENT







Sustainable Maintenance of Navigation Channel: The case of Port Tanjung Pelepas (PTP) Port

Abstract

Maritime industry is the cradle of all modes of transportation where port is and ship is necessary to facilitate trading through marine transportation. Human development and demand for international trade has resulted to need for economic of large scale for ships. Recently, there is continuous growth or need for larger and sophisticated ship through increasing shipping activities and this has leads to design and production of sophisticated state of art safety oriented marine vehicle in term of size, speed and structure albeit, this safety based designed development is out of phase with conditions of navigation channels. To create a balance for safe navigation in inland port which are considered to be restricted water, this big ships will ply, it is necessary to maintain the channel to keep accepting the target largest vessel , and the channel should be maintain at frequency the ship building are growing. This paper presents the result of application of best practice simplified method for channel maintenance against vessel design and reception requirement. The model is used to calculate channel dept requirement to be maintain for Port Tajun Palapes (PTP) in Johor, Malaysia which arrived at 15.2. The paper also discusses reservation regarding sustainability reservation requirement for channel maintenance.

Keywords: Channel; Dredging; Maintenance; Port Tanjung Pelepas (PTP); Sustainability; Vessel;

Introduction

Recent time has proved continuous growth or need for larger and sophisticated ship through increasing shipping activities and demands, this has leads to design and building of sophisticated, state of the art, safety oriented marine vehicles in term of size, speed and structure, albeit, the design and production of vessels take little consideration in phasing them with navigation channel requirement of waterways. To create a balance for safe navigation in restricted water these big ships will ply, we must maintain the channel at a frequency the ships building are growing. Maintenance dredging is the activity that involves periodic removal of material which has been deposited in an area where capital dredging has been undertaken. The frequency of maintenance dredging varies from port to port, however, the objective remain to allow ships to enter and leave port at stated draft without delay and ensure efficiency of maintenance dredging, thus step must be taken during the process to minimize siltation and shoaling in channel.

Shipping Trend: Ships and shipping remains a very important instrument for mobility, if ships could no longer transit the waterways, the people will experience shortages of power, heat and food in days or weeks at the outside. Recent years have seen economic of scale due to improved trade, the significance of these trends is that larger ships will continue to use our waterways for the foreseeable future. But there are limits on size of ship that a channel can accommodate and means of determining when special measures must be imposed on handling ships in order to ensure the continued safe, efficient and environmentally friendly use of our channel.

To create a balance for safe navigation in restricted water this big ship will ply and the channel at a frequency the ship production are growing must be maintained. De Jong et al., provided data on the explosion in the size of container ship that has occurred since the first post Panama vessel analysis shows that ships exceeding the panama canal limit (ship length, breath draught of 256mx32.2x11m) started to appear a few years ago. Other study mad by transmarine also demonstrated that recent time is seeing vessel of size up to 18,000TEU. See Figure 8 for growing size of ships as presented by Transmarine.

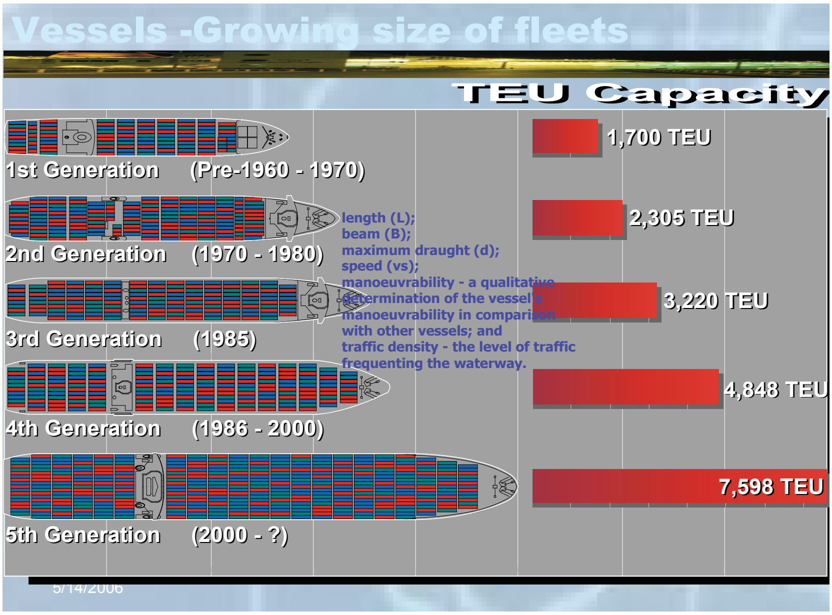


Figure 8: Vessel size increase.

RINA periodic recently report that Maesrk line has built 14, TEU ship that is ready for operations, however, safe operation of those big will be operated remain is under deliberation. This show the rapid the growing trends of container vessels and need of channel to match this growth. Recent projection is looking at 18,000 TEU Which I believe the technological capability is there for such target. As the ship sizes are increasing it is imperative to do periodic examinations of the requirement of the channel in regards to depth, width, squat and alignment. Figure 9 shows the needs of the channel.

Channel design and maintenance work fall among the works that require multivariable exercise that need model studies for good outcome. Shoaling remaining unavoidable part of most harbor and navigation channels and one method to preventing shoaling and associated siltation hurdles is using of maintenance dredging at economical frequency and sustainable manner. Also, Study made by Mac every, 1995 also stressed on the fact that the design of controllability of the ship is equally out of match with the size of the ship, all what has been the main focus on design spiral is best design of basic requirement of speed, payload and endurance focus is not placed neither on channel design nor its maintenance.

Present Threat: Growing size of fleets and lack maintenance of channel has been going in human society for a long time, (INTERTANKO report in 1996 on the same issue regarding US water). Analysis drawn from marine departments revealed that disasters records of the Strait of Malacca collision where grounding takes the highest share of the risk, Risk in the Strait of Malacca. Norske Veritas study on various navigation water ways put present the Strait of Malacca as one of the high risk areas of the world. This issue is considered very necessary and required diligent attention, especially in protected water and restricted water like the needy patronized straight of Malacca and its riparian which PTP is part of where more than 800 ships pass through there a day, accident and causality figure by Malaysian marine department.

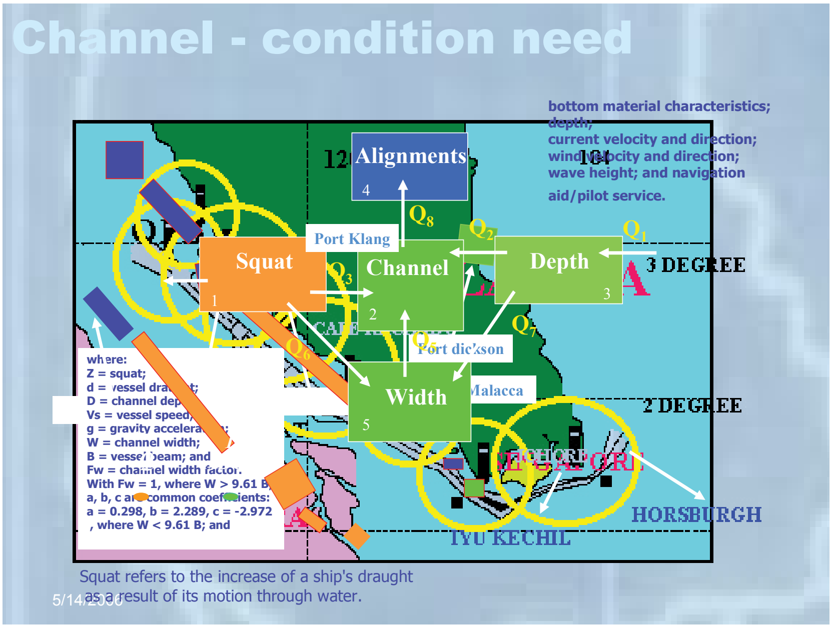


Figure 9: The straight of Malacca and channel requirement.

Analysis made by the UNEP regarding region under coastal threat concluded that Asia coast is far more affected, because Asia have the largest river runs off to the sea than any other continent. According to UNEP report maintenance of navigation channel remains one sensitive area of environmental degradation concern for environmental thematic problem especially dredging, its disposal disturbance to marine life.

Pollution source and Impacts to Port: The pollution found in the sediments that accumulate in harbors is one of the main causes of environmental impact of dredging operations. This is important feature since harbor waters and sediments are heavily polluted worldwide- containing high levels of a range of chemicals. The sources of pollution are multiple in many cases they are linked to the harbor activity. TBT (tributyltin) is a compound used as antifouling that has been recognized as a harmful pollutant and whose use has been restricted at the international level. However, the problems caused by TBT will continue for many years because TBT is kept stored in the harbor sediments. The main source of TBT to marine waters is the direct release from surfaces treated with antifouling paints containing TBT and other organotin compounds.

They have been used in order to prevent the attachment of aquatic organisms on the hull of ships or other devices that are immersed in the sea, such as the cages used for fish-farms [1]. Paints incorporating TBT are regarded as the most effective antifoulants ever devised giving rise to important economic benefits. Their use reduces the fuel consumption of the vessels (and thus reduces CO_2 emissions), ships can go faster, and repainting costs are lower. Little is still known of the effects on marine organisms of dredging operations contaminated sediments, and the need of research on this issue is often claimed.

To assess the potential impacts of a certain project is a difficult task. First, although the (a priori) main possible impacts of dredging can be identified, clearly it is not possible to review all the potential effects;, once the impacts of concern are selected, it might be costly, complex or impossible to assess the extent and the consequences of each of the effects caused by the activity assessed. Jensen and Mogensen Consequently, the dredging operation causes the resuspension of sediments, solids in water to some extent produces an effect called turbidity, which is defined as an optical property of water related to attenuation of light. Other factors influence the level of turbidity (such as size distribution and shape of particles). Although, they are regarded as short-term impacts, the presence of large quantities of particles in the water can cause serious effects in areas where the system is not used to it and particularly to sensitive species or areas (for example, coral reefs or aquaculture ponds) as well as reduction of oxygen in water, release of toxic components from suspended solid, covering of organisms, reducing food supply etc. Moreover, lack of light may reduce photosynthesis, which might be relevant for sensitive species.

This make it incumbent for authorities concerned regarding waterways to evaluate and address the risks associated with ships that are plying them and find way and information sharing avenue systems for channel designers, naval architects, ship masters and pilots, and waterway managers that will help develop policy recommendations that will address the way channels are laid out, enlarged and how ships of various types using them should be designed and handled. And of course, ways to monitor existing and new ships operating at channel approach in order to guide ship designers to understand and review ships, pilotage, channel, current design and operational practices on how to incorporate needed improvements.

The case of Port Tanjung Pelepas: The Port Tanjung Pelepas of the Sungai (river) Pulai located in Malay Peninsula's most southern tip in the State of Johor, close to the new Malaysia-Singapore Second Crossing, a new 1800metre bridge linking Singapore with Malaysia's. The port development at Tanjung Pelepas is one unique state of art capital project design work done on sensitivity and helps transform the river and mangrove area in 1998 into one of the world's most equipped container port. it remain one the significant implementation of Malaysian VISION 2020 plan, a 60 years concession 60-year concession for 800 ha port with Free Zone Status was made to Seaport Terminal (Johor), under operation of her subsidiary company, Pelabuhan Tanjung Pelepas Sdn. Bhd of by Malaysian Government and syndicate of banks agreement of RM 2 billion loan. The port has stimulated rapid development in the region stretching from state capital Johor towards the west along the Johor Straits, it has changed the region to developed area with excellent infrastructure, housing facilities and new areas for industrial development. Figure 10

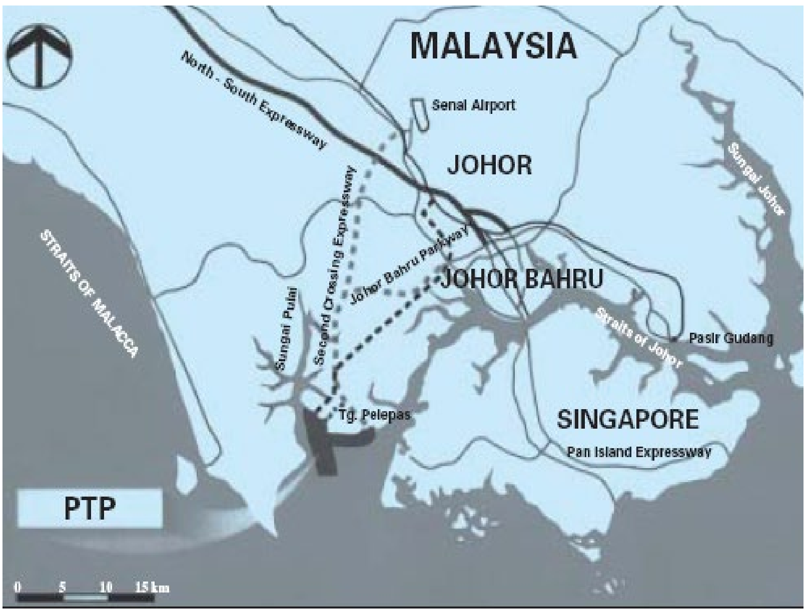


Figure 10: PTP.

What necessitated the port development initiative is again the demand and growth since the seventies, with forecast for potential critical capacity problem by the year 2000. The Johor Port Authority reached maximum expansion of the Port area with the completion of Phase 4 of Pasir Gudang studies in 1990 end up with selecting Tanjung Pelepas as the most suitable location for Johor's.

Previous Dredging Work: The initial main dredging work done on Phase 1 of PTP development towards complementing a fully operational Container Terminal by end of 1999For the Dredging and Reclamation scoped for the removal by dredging of existing soft material to provide an approach channel, turning basin and bund foundation area and construction of the Wharf Bund and filling of the terminal and infrastructure areas to provide a stable platform for the Container Area. Summary of work done is as follows:

i. Year 1997, Contact cost - US$ 158 million.

ii. 200 hectares of Site Clearance, mangrove and bush clearing, Additional Site Investigation.

iii. Dredging of the 9km long approach channel and turning basin, approx. volume 16,000,000 m^3.

iv. Dredging to foundation level below Wharf Bund, approximate volume 5,500,000 m^3.

v. Constructions of the Wharf Bund, approx. volume of sand 4,000,000 m^3.

vi. Installation of 20,000,000 meters of wick drains as ground treatment.

Reclamation and surcharge of Phase 1 Area, Terra et Aqua Number 80 September 2000 foundation area and construction of the Wharf Bund and filling of the terminal and infrastructure areas to provide a stable platform for the Container Area. Summary of work done is as follows :

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vi. Reclamation and surcharge of Phase 1 Area, Terra et Aqua Number 80 September 2000.

The construction, completion, maintenance of the Dredging and Reclamation Works involved the dredging of 16,000,000 m^3 of soft and stiff material to form a 12km Access Channel and Turning Basin, together with the dredging of 5,500,000 m^3 of soft to medium material from a trench to form the base for the new Wharf Structure. The initial activity concentrated on dredging an access of 12 metres deep, 100metres wide and approx. 5000 meters long (pre-dredging depth only approximately 4 metres by low tide) to allow the jumbo hopper dredgers to reach the Site. Dumping ground -in the Malacca Straits northwest of Karimun and along the coast of Pontian up to 120 km from The Sand was won from Karimun southeast. The most economical filling method for the bund would have been.

i. Filling up to –6 to –7 CD direct dumping from a hopper dredger.

ii. From –6 to –7 to +4 CD rain bowing.

Channel Maintenance Process: Within the scope of this project the main elements that method will be faced are analysis of:

i. Channel dimension establishment through navigation requirements and Side slope tolerant

ii. Hydrographic and dredge volume concept, Calculation of yearly dredge quantity output

iii. Dredge capacity and selection of dredge equipment

iv. Disposal of dredge material, issue of transport distance and sustainability concept

v. Concept of uncertainty, risk cost and benefit assessment Figure 11, 12

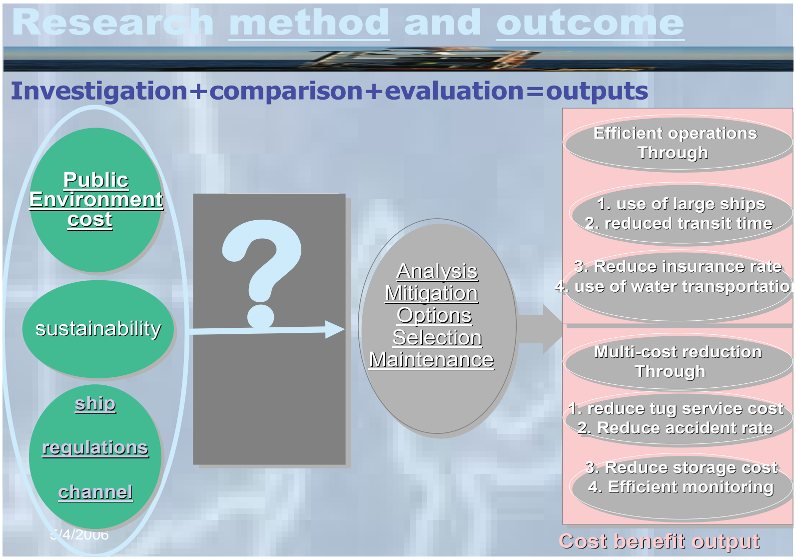


Figure 11: Navigation Channel Maintenance Process.

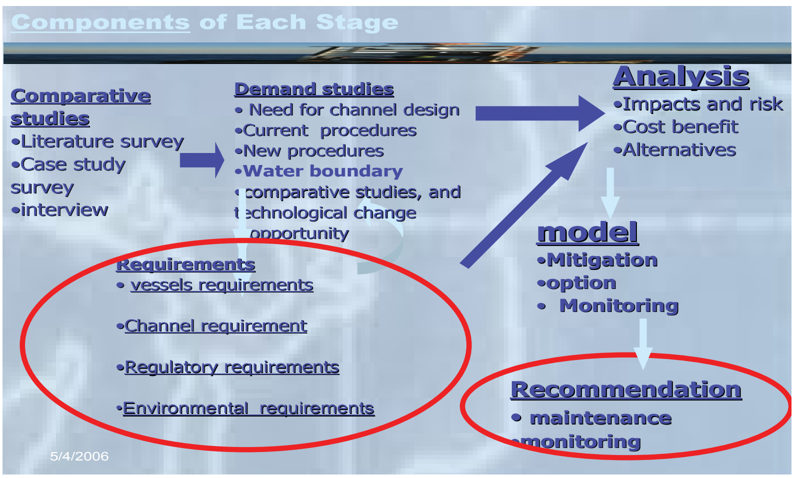


Figure 12: Components of each stage.

Navigation requirement: Having got various vessels to channel equipment ratio, what the size of the channel should be and how much to dredge down can actually be determined. Figure 13

Maintenance dredging requirement: Analysis will go through iterative round of all the thematic part of the project:

i. Need for channel maintenance

ii. Old, Current and new practice

iii. Technological change and opportunity

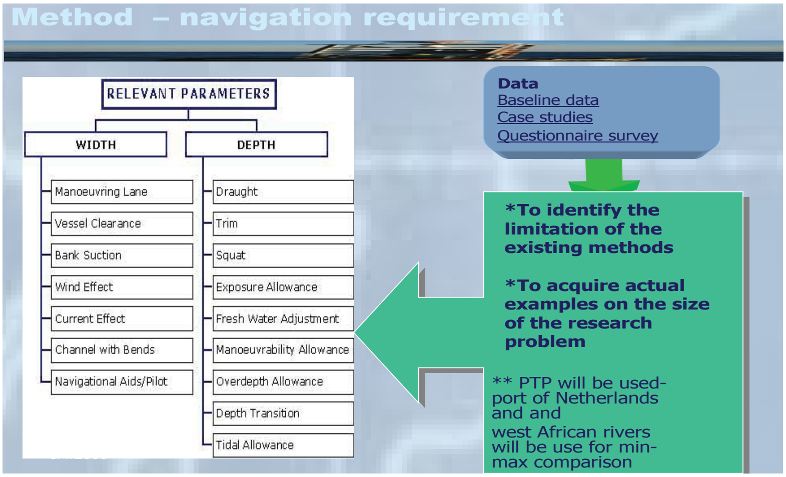


Figure 13: Navigation Parameters.

Recommendation for channel deepening work requires the following:

i. Loaded vessel draft/Squat, this involve the hydrodynamic sinking effect of lowering vessel keel relative to channel bottom with speed.

ii. Wave induced motions, Safety clearance and Dredging tolerance.

iii. Advance maintenance dredging Table 3

To determine this iterative process with regulatory requirement, necessary projection base on the following data parameter as shown in the framework for depth calculation will be performed. Figure 14,15.

Depth parameters	Subparameters
Draught	vessel static draugh
Trim	Vessel depth
Squat	Vessel speed, draught, channel depth, block coefficient
Exposure allowance	Vessel size, traffic density, local wave climate
Fresh water allowance	Water salinity and vessel size
Maneuvering allowance	Channel bottom, operational characteristics, vessel speed and controllability
Overdepth allowance	Nature channel bottom, dredging tolerant and siltation
Depth transition allowance	Sudden change in channel depth
Tidal allowance	Reference datum, highest and lowest level tidal window

Table 3: Navigation depth parameters requirement.

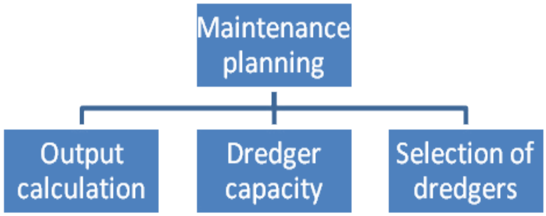


Figure 14: Maintenance dredging components.

Figure 15: Dredging and sustainability Process.

This three studies have been done prior to establishment of PTP prior to the initial capital, however to maintain and capital dredging techniques for channel use similar process. Thus, methodology varies, and simplicity itself remains the beauty of design.

Baseline Data Analysis: The input parameters are used to develop the requirements and design considerations for channel width and depth, as demonstrated in the flow chart shown above which proves detail on the width and depth parameters. Input data is captured from baseline studies that are undertaken involving an analysis and evaluation of the following data supplied by PTP.

Pressure Need for Navigation Optimizing Navigation Channel, Economic and Fairway Analysis: The optimum channel depth requires studies of estimated costs, benefits and risk of various plans and alternative designs considering safety, efficiency and environmental impacts in order to determine the most economical, functional channel alignment and design depth .Channel deepening design is often one of the major cost-determining parameters for navigation project and design of such depth is of various types that require adaptability of each design to future improvements for increased navigational capability. Figure 16,17

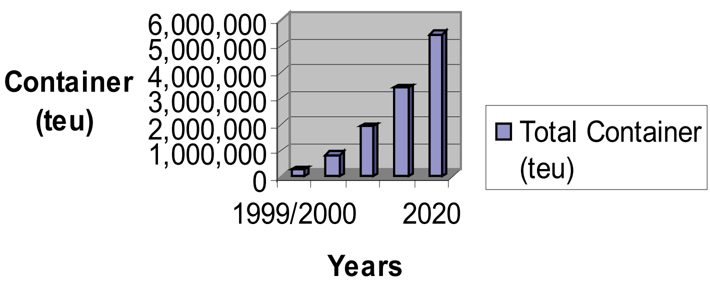


Figure 16: 2020 Cargo Projecyion-Total Container (Teu)-PTP.

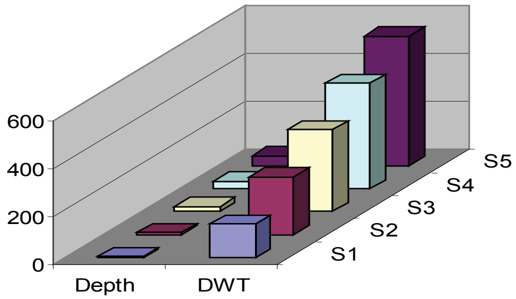


Figure 17: Fairway analysis- Source PTP.

The optimum economic channel is selected from a comparison of annual benefits and annual costs for each channel maintenance plans. Deeper channels will permit the use of larger ships, which are more economical to operate.

Cost, Benefit and Depth Increase: In respect to PTP and channel maintenance work the following economic analysis based on need and projection datas analysis represent the demands stage of this work for the fairway. Figure18

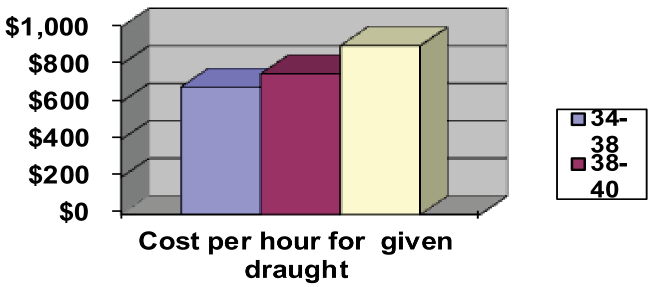


Figure 18: Hourly cost of vessel (UNDP).

tudies made by W. Winkelman estimated time saving in hour as a consequence of deepening of river Scheldt by 4feet is as follows: Figure 19

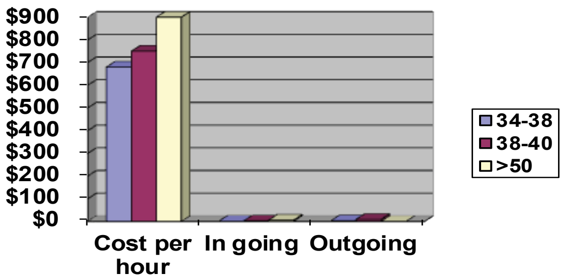


Figure 19: Estimated Time due to Deepening.

Channel dimensioning: navigation vessel and channel requirement, this involves the input variables required, to determine the minimum waterway dimensions required for safe navigation.

Vessel Requirement: The critical component in the design of the waterway is the selection of the target vessel. In evaluating the waterway manoeuvring parameters, the target vessel is normally the largest vessel that the waterway is expected to accommodate safely and efficiently. The largest vessel that has plied PTP is 340m, and the channel is expecting to receive 420m vessel. Figure 20

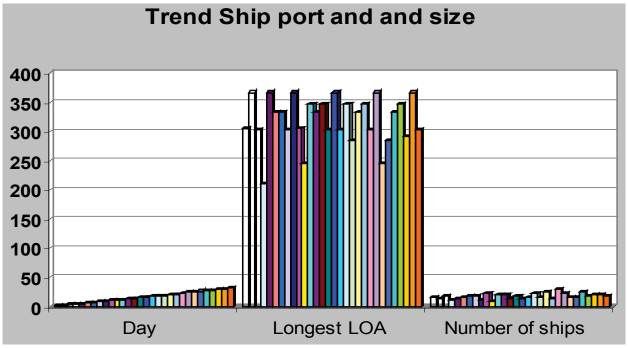


Figure 20: Trends ship calling port, shows trend for day time, longest ship and number of ships calling at PTP (PTP).

Water level and depth of the waterway

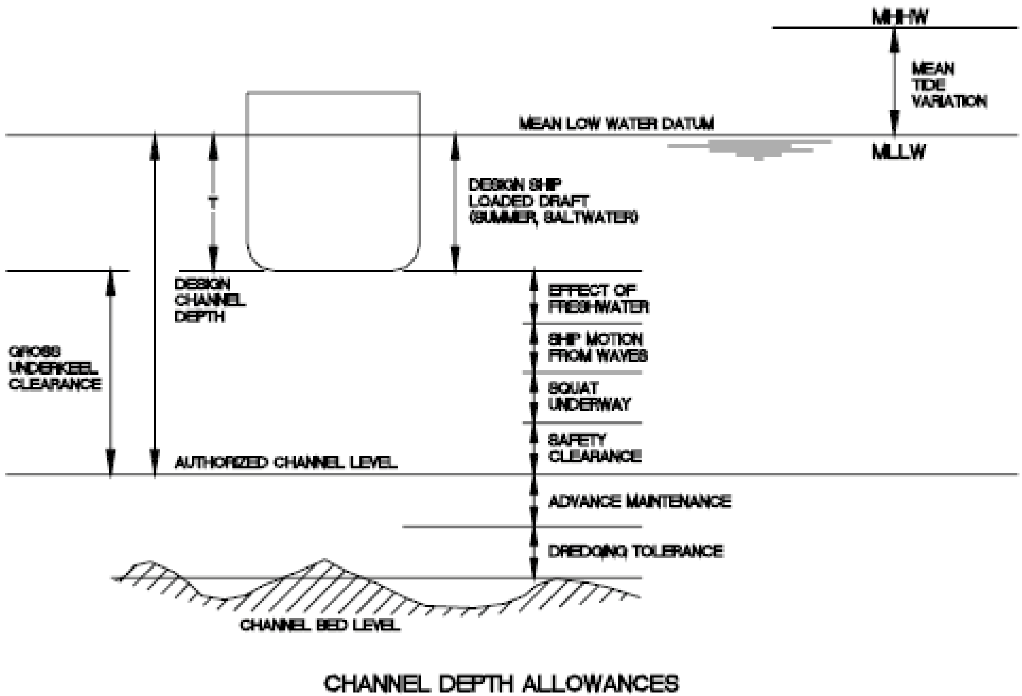


Figure 21: Channel depth allowance.

For channel to accept ships there must be corresponding depth required to maintain vessel manoeuvrability. Therefore, minimum value for water depth/draught ratio is necessary to for assurance and reliability Figure 21, Table 4, 5.

Width	250
Manoeuvring lane	1.6 to 2.0 times vessel beam
The ship clearance lanes	80% of the vessel beam
Bank clearance	80% of vessel beam is added to both sides of the channel
Depth	12.5m (Bellow MLLW) related to LAT
Under keel clearance	1m
Safety clearance	0.3
Advanced maintenance dredging Allowance	0.5m
Turning basin	600m
TEU estimate	6000 TEU
Berth	18m below LAT with containment dike for future dredging
Projection	350m wide by 20m with turning basin of 750m diameter
Side slope	1:8 to 1:6 vertical: horizontal) for silt and mud- assumption at 1:10, depending on material

Table 4: PTP channel parameters.

Pos	Parameter	Data/Size / Dimenssion	Source
14.3.1	Max Wind Speed during Vessel Berthing	22 m/s	Master plan Vol. 2
14.3.2	Max Wind at Berth	27.7 m/s	
14.3.3	Max Significant wave length	Hmax=1.2m	
14.3.4	Max river current	1.0 m/s	
	Wave period	Ts =4-5 sec	Sellhorn Wind wave cal.

Table 5: Environmental criteria (PTP).

Result

Total Depth calculation: The design (authorized) depth will include the various allowances as shown in Figures. Advance maintenance and dredging tolerance are provided in addition to the design depth.

Minimum Waterway Depth for safe navigation is calculated from the sum of the draught of the design vessel as well as a number of allowances and requirements. The Canadian model the following recommended Canadian model formula is used. Table 6

Actual Waterway Depth = Target Vessel Static Draught + Trim + Squat + Exposure Allowance + Fresh Water Adjustment + Bottom Material Allowance + Over depth Allowance + Depth Transition - Tidal Allowance, (see Figure 5: Components of Waterway Depth). Figure 22

Channel (Advertised) Waterway Depth = Waterway Depth - Over depth Allowance

Water way depth	16.5
Over depth allowance	0.5
Advertised depth	16

Table 6: PTP Water depth.

Channel depth calculation for PTP Table 7

Target vessel static draught	9
Trim	1
Tidal window	0
Squat	1.2
depth allowance for exposure	0
Fresh water adjustment	0

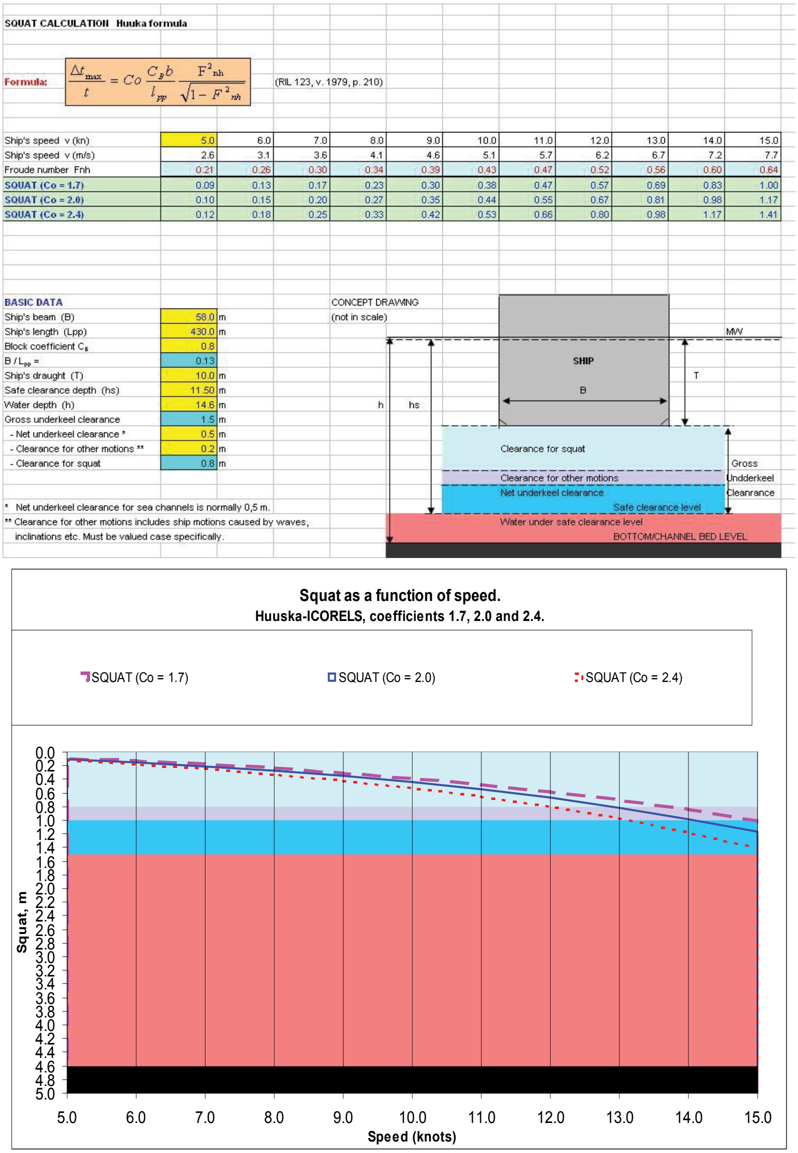
Bottom material allowance	1.5
Maneuvering margin	2
Over depth allowance	0.5
Depth transition	0
Depth	15.2

Table 7: Channel depth calculation.

Alternative equation for validation by UNDP

H=D+Z+I+R+C+#

Squat Calculation


SQUAT CALCULATION Huuka formula

Formula: $\frac{\Delta t_{max}}{t} = Co \frac{C_B b}{l_{pp}} \frac{F^2_{nh}}{\sqrt{1-F^2_{nh}}}$ (RIL 123, v. 1979, p. 210)

Ship's speed v (kn)	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0
Ship's speed v (m/s)	2.6	3.1	3.6	4.1	4.6	5.1	5.7	6.2	6.7	7.2	7.7
Froude number Fnh	0.21	0.26	0.30	0.34	0.39	0.43	0.47	0.52	0.56	0.60	0.64
SQUAT (Co = 1.7)	0.09	0.13	0.17	0.23	0.30	0.38	0.47	0.57	0.69	0.83	1.00
SQUAT (Co = 2.0)	0.10	0.15	0.20	0.27	0.35	0.44	0.55	0.67	0.81	0.98	1.17
SQUAT (Co = 2.4)	0.12	0.18	0.25	0.33	0.42	0.53	0.66	0.80	0.98	1.17	1.41

BASIC DATA

Ship's beam (B)	58.0	m
Ship's length (Lpp)	430.0	m
Block coefficient C_B	0.8	
B / L_{pp} =	0.13	
Ship's draught (T)	10.0	m
Safe clearance depth (hs)	11.50	m
Water depth (h)	14.6	m
Gross underkeel clearance	1.5	m
- Net underkeel clearance *	0.5	m
- Clearance for other motions **	0.2	m
- Clearance for squat	0.8	m

* Net underkeel clearance for sea channels is normally 0,5 m.
** Clearance for other motions includes ship motions caused by waves, inclinations etc. Must be valued case specifically.

Figure 22: Squat calculation.

Maintenance Dredging Capacity Sediments Output and Estimates: Maintenance dredging with objective to reduce channel delay, accept big ship to be done in environmental sustainable manner and optimal efficiency –in maintenance dredging quantifying the loss of depth pave wave for dredging requirement to be determined and this lead to optimal choice of dredger. Thus PTP is a new port with very big clearance to accept third generation ships, personal communication with the health, safety and environmental department there also confirmed regular survey for siltation towards planning to maintain balance which is put at 2- 3 year for now(personal communication. Issue relating to investigation or communication about what size vessel will ply the channel in the 10 years is rarely discussed by channel workers, and this is a big issue and what to in such case should be a big issue. Generic calculation on data results from analysis of:

i. Vessel and channel requirement

ii. Channel dimension

iii. Hydrographic data

iv. Basic rate output of the dredger

v. Computation of volume

vi. Cycle time and Number of work day per year

vii. Working condition and Environmental discounting

Where:

Output = number of cycle per day X load factor x hopper capacity x number of working day

Load factor = volume/ hopper volume

Number of working day per year= 365 days

For PTP:

Number of cycle	4- 5 per day,
Hopper capacity =	2500- 5000/6000
Number of days =	150,000/6000
Volume of maintenance dredging =	300,000-400,000 for 3 years
Load factor=	150,000/year
Output =	150,000/5000=30,000

Table 8: Dredge output for PTP.

Alternative equation for validation (USACE) -> V=0.5x (A1+A2) x (S2-S1)

Dredger Selection: Hydraulic dredgers, for example, are based in the use of pumps for raising the materials (suction dredgers). The dimension of dredging as an economic activity itself at the global level is considerable. The other main group is that of mechanical dredgers. Such as the backhoe Previous PTP dredging work was made using state of art combo slip hopper barge dredger, uniqueness in this dredger stand on capacity to contain dredge material while in operation, transit until disposal location, (personal communication). Table 8.

Split hopper dredger is a modern hydraulic excavator, mounted on a platform fixed to the seabed. The material is excavated by the bucket of the excavator, kept and contained. Then is raised above water and transported directly to the disposal site. The soil at PTP is basically silt and mud and the dredgers well sweated for this. Accuracy is only achieved if monitoring and control equipment are used. Thus, the containment has guarantee of no leakage during transportation.

The volume of soil is very important in dredger selection, a smaller and more economic and environmental sustainable dredger is preferred. Table 9.

Site conditions	Cutter Suction	Bucket Wheel	Standard Trailer	Grab Hopper	Bucket chain	Grab
Bed arterial						
Loose silt	1	1	1	2	2	2
Cohessive silt	1	1	1	1	1	1
Fine sand	1	1	1	2	2	2
Meiumm sand	1	1	1	2	2	2
Coarse sand Sea conditions	1	1	1	2	2	2
Enclosed water	1	1	3	1	2	2
Shelter water	1	1	1	1	1	1
Exposed water	3	3	1	3	3	N
Disposal to:						
Shore	1	1	2	N	2	1
Sea	N	N	1	1	1	1
Quantities						
100,000 cubic meters	1	1	2	1	2	1
250, 000 cubic meters	1	1	1	1	1	1
500,000, cubic meter	1	1	1	2	1	1
>500,000 cubic meter	1	1	1	3	1	3

Table 9: Below is guideline for dredger selection given by (UNDP).

1- Suitability 2- Acceptability 3- Marginal N – unsuitability

Considering PTP specification grab hopper is a good choice of dredger for maintenance dredging. Traditionally, dredging quantities for purposes of design estimates and construction payment have been obtained from cross-sectional surveys of the project area. These surveys are normally run perpendicular to the general project alignment at a predetermined constant spacing. The elevation data are plotted in section view along with the design/required depth and/or allowable over depth templates. One or more reference or payment templates may be involved on a dredging project (e.g., zero tolerance, null ranges, etc.). Given sectional plots of both preconstruction and post construction (as-built) grades (or, in some cases, intermediate partial construction grades), the amount of excavated (cut) or placed (fill) area can be determined at each cross section. Figure shows the typical templates used to compute relative cut/fill quantities.

Conclusion

Conclusively, in regards case studies and the discussion presented here, I would like to highlight some of the main lessons that I think might be extracted from them. They are reflections that hopefully could be helpful for understanding the meaning and relevance simplified monitoring procedure, understanding and the concept sustainability in practical cases of environmental management. The model tested in this work from the records will allow us a first look at the simple system for monitoring the channel and to draw the following conclusions, The depth of the channel is large; approximately 16m x 420 and taking ships in the order of approximately 350-420m LOA But there is tendency that the channel will soon get close to its limit. The rate of design ship to the channel state still exhibits non-linear behavior, bigger ship is coming there and the channel remains the same. The best that could be done is removing the shoal. 20m is projected against 2020, to meet the demand, however but. Critical study and employing a sustainable risk based methodology with good record of environmental change rationalization will be necessary .The phenomena of squat its effect are of major importance to the system ,applying simplifies model tested in this work could help close monitoring towards reliability and confidence of the channel.

Approximately 600,000 million cubic yards of sediment will be dredged annually from the navigable water and the condition environmental change of such sediment required. The contaminants of concern and their risk to the environment and to humans will vary widely depending upon site specific factors ranging from ecological habitat to sediment particle size distribution. The soft alluvium in previous work allowed consolidate under high surface loads, resulting in settlement of finished ground surfaces, however continuous analysis on geo-technical engineering studies will always be required to complement sustainable planning work. Facing capacity difficulties are issue of concern everywhere today particularly the fate of the channels. Demand for ship has approached supply and the tradeoffs will be more and more carefully scrutinized by the resources available and environmental demands. The channel is very important for land and land use and safety linked to environment required, as demands of the ship increase so does the need for system integration at local and international level.

The way forward: Waterways development need to have a strategy for the future of its marine structures program by examining the removal of non-core operations, and negotiate responsibilities for water depth forecasting with the Hydrographic Department. The case tests how to develop plans for simple waterways performance measurement information system, it is recommended that such method could be incorporate could tap existing information and communication to link reporting system of data to National Channel Inventory system. Such system could be implemented in line with the accountability framework), in order to provide improved monitoring and performance reporting capability on measures and indicators such as: channel monitoring level of service compliance; subject matter expertise level of activities; timeliness of notification to mariners and actual repairs to structures versus required. Under doctrine of sustainability, it has been widely accepted that new approach to design and maintaining system should focus on top down risk based, whose matrix will holistically cover all issues of concern including uncertainty. Uncertainty itself remains a big issue who's definitional and framing fall under complex circumstance. Future studies on this work then lies on issue of risk based assessment for channel design and decision support system, simple data inventory system, system integration, and extensive studies that cover type of uncertainty that exist.

Review of Potential of Inland Waterway Hybrid Transportation for Sustainable Transportation Capability Building Terengganu

Abstract

Civilization has brought us to a speed like never before, we live in a world where we have so much to finish and the time remain the same, where there is call for need to review the way we have been doing things and adopt more associative, sensitivity philosophy. Likewise, human ingenuity has provided this age with formidable technology including the information that can help us deal with the question of the time. There is no doubt that all what is left of human to cope with the require pace of technology and demand of the time is to reduce the time and improve on what we have by considering unitization and integration of our systems, while being sensitive to everything that concern the environment. Transportation industry should not be left out in this. This paper will discuss hybridization of transportation system by considering comparative advantage and use of benefit provided by the two seas of information and environmental technology that is currently dynamically transforming our world in order to maximized use to improve our transportation system, incorporating new Inland Water Transportation system that will efficiently in an innovative manner link our cities with existing transportation by providing quality facilities and services for people at affordable rate through system hybridization and integration. This will include infrastructure that will link logistics equipment together for a better management, control and the reality of putting concept

of togetherness into practice to achieve greater things that will solve transportation problem. Production associated with linking the land, the sea and air transportation together according comparative advantage, provision of transfer equipment, information and environmental technology solution consideration as needed, cost saving associated with the merging, arrangement of new systems, enhancement derived from transportation information and control system to transportation problem relating to congestion and environment will be discussed will be discussed.

Keywords: At least four key words or phrases, commas should be separating each keyword.

Introduction

In today's transportation congestion and air pollution problem on shore infrastructure is causing more to moderate concern and increasingly damaging growth in the size of the problem cal for need for formulation of policy for air- road to sea integration. By placing focus on waterborne transport, and integrating to road and air issue place a higher demand multimodal transport which in turn give leverage for need to put focus on a number of shortcomings related to the use of ships for community and freight transport in conjunction with other mode of transportation. To aid the implementation of policy for the use of inland water transportation, high number of community research and technical development actions, relevant to waterborne transport is require. Some of which could include concerted action on short sea shipping, designed to identify some of the structural or generic problems in the use of ships for relatively short-haul transport and other that target environmental impacts as well as issue of safe and efficient increase of reliability intermodal transportation. Furthermore, hybrid use of transportation will require the intelligent transportation system that incorporates use of advanced Integrated Ship Control Systems, AIS and extensive use of information technology needed to provide a solution to modern transportation problem.

Inland water transportation either in moving people and freight in a sustainable manner is increasingly becoming important, will be one of the biggest challenges for the 21st Century, an age where environmental pressure is calling for sensitive reactions, adoption of new proactive innovative behavior to relate factors associated with design, construction and operations and utilize them to deal with inherent needs response. Action associated with human life mitigation has always been part of concern of decision making, but to a less extent. In a world where warning of nature regarding need of awareness and sensitivity as well facts to how substantial nature is to the support of life and how much damage reckless human activities has cause imbalance in our planet. A situation that is vividly threatening our plant today and striping hope for our future generation survival in this planet, A situation that is equally calling for all of us to adopt new philosophy of doing things and giving insight in inevitable return to nature earlier ways of doing things from use of sun, water and clean energy store in earth crust to use of inland water transportation. Past engineer work on inland have been dominated with reactive, and today s world has reach a toll whereby there is no chance to wait for accidents whose consequence is environmental degradation at its point form or instantaneous calamity [2].

There is a surmountable barrier to achieving a sustainable multimodal inland water transportation where environmental impacts and risk will be mitigated and integrative components of water recourses will be utilized. However, incorporating holistic systems framework and system engineering tools back with analysis and identification leading to alternative path to short and long term solutions to the problem can facilitate achieving quality management of the evolving new philosophy of sustainability [3]. Such alternative solutions after discounting environmental concern could accommodate increasing inland waterway integration for shipping cargo containers including lock development, intermodal, information technology solution, provision of incentives to alleviate congestion during seasonal congestion hybrid of transportation mode based on best option selection [4]. Sustainable Inland water system contains physical elements that include waterways, ports, and intermodal network of railroads, roadways, and pipelines, that connect the waterborne portions of the system as required. The physical elements also include the vessels and vehicles that move goods and people within the system. The physical network is supported by a series of systems that facilitate the movement of goods and people, and provide access for recreation and to natural resources. Also associated with development of inland water transportation is dredging work to meet size of vessels, maintenance dredging and containment technologies for dredge material disposal or reuse of dredged material may be a feasible alternative that provides an economic benefit.

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Inland Water Transportation System (IWTS)

Civilization has ground up along rivers, lakes, ocean, the great rivers of the world, like Amazon, Mississippi, Ganges Rhine Danube Niger, and Nile influences the lives of millions, not only their very existence but also their political, art, and science. People are inherently drawn to water, this make use of water resources an important part of human development. Properly managed river basin can augment food water supplies, improve transportation, provide energy and develop industry. Development of water resources also carry the good beneficial reward to reciprocal development of waterfront areas that provide multiuse activities; improve social interaction and a sense of community. Hybrid concept requires facilities to be strategically placed in close proximity to other modal transportation system. The design need to pay attention to historic, current and future development patterns.

Inland navigation offers important opportunities to move cargos on river, estuarine and associated tributary in an energy efficient manner, reduced cost of good transportation per tonne - kilometer compare to other mode of transportation in. It remain one of the best option available to mitigating problem associated with global warming, climate change, noise pollution as well as congestion. Capacity building, environmentally and socially friendly, taking advantage of nonstructural measures (such as fleet innovation) [4] as well as infrastructure investments, and multimodal corridor incorporation become increasingly a matter of dire need today [5]. Malaysia has 7,200km of waterways, most of them rivers of this, 3200km are in Peninsular Malaysia, while 1,500km are in Sabah and Sarawak has 2,500km.

Inland water transportation has substantially shaped the growth and development of nations in Europe and North America, however, previous work on transportation are much more based on proactive method, Recent study made by European Union indicated potential for augmentation of percentage of shipping in total transport volume in the Danube region, this lead to agreement for inland navigation improvement in an integrated manner by the ten Danube riparian states there is indication that climate change will have will bring potential development of on the further development of IWT and this make navigation management, planning and development of IWT to take the issue of climate change and ozone depletion into account [6].

The important of transportation and utilizing full advantage of new and emerging transportation technologies remain engine of tomorrow's growth and prosperities as well as supports for safety, security, conservation of energy and environmental quality. Since, Inland transportation cannot stand alone and its efficiency, strength can only be maximized through integrative inter-modalism and diversity, this provide opportunity for cooperative climate for intermodal systems, cooperative climate requires the coordination of more than one mode of transportation. With each mode having its own system-specific advantages: motor carriers have the ability to provide door-to-door service, water carriers that can handle bulk commodities safely at very low cost and rails that can transport a broad range of commodities over long distances. Retaining sustainability principle that public good is best served by the most efficient use of transport resources, regardless of mode, and implementing the new philosophy of its sustainability equally requires `incorporation of use of water resources for other use as required by the environment [7].

Couple with this, recent issue of today especially from environmental domain called for need to adopt new sustainability philosophy, a healthy and responsive transportation system. And method that can yield vitality and growth and the productivity of commerce, the nation needs [8]. Focusing on efficiency and complementation rather than competition between different transportation systems is a key economic growth, sustainability and productivity of a nation. Efficient freight transportation systems play a positive role both in the economic life of industrialized countries and the daily lives of their citizens. These countries realize the importance of the relationship between good systems, services and their economy. However, while these transportation systems are essential to a modern society and there are substantial economic benefits to be realized from them, there are also significant negative environmental impacts, including preemption of land, disruption of topography, use of energy and other resources, and noise and air pollution [9].

In making choice of transportation modes, consideration should be given to the mode that does not contribute to unnecessary increases in fuel use, exhaust emissions, accidents, spill incidents, and congestion. It seems that not a day goes by without some new evidence of the increasing pollution of our environment and its consequences. There are indications everywhere those environmental rights (breathable air, drinkable water, fertile soil), which have been regarded as inexhaustible or renewable, are becoming scarce [8].

Today, with much more environmental awareness and a greater understanding of the consequences of pollution, both government and society are much less tolerant of pollution. On a global scale, pollution is a growing threat to both human health and the environment. Commercial freight transportation, with its almost total dependence on petroleum-based fuels, contributes significantly to pollution levels. Therefore, each form of transportation, as a major energy user, needs to be evaluated both as to the scarceness and future availability of the energy resources that it uses and to its impact on the environment. With each transport mode having its own specific energy-use and environmental characteristics, decisions on transport issues, whether short or long term, have inevitable impacts on the environment, which should be clearly weighed before a final decision is made[10].

Both the environment and the quality of life are receiving greater attention, resulting in a growing demand for not only an environmentally sound transportation system but also for policies where environmental goals are given greater weight in transportation decisions. The result of this concern over the impact of transportation systems on the environment is reflected in how those systems are now being planned for the future. Transportation designers and environmentalists, both of whom recognize the interdependence between transportation systems and the environment, are increasingly concerned about maintaining an appropriate balance between the two. Likewise environmental laws are all over at the verge of established a legal framework aimed at keeping transportation decisions consistent with that goal [11].

Threat and challenge of greenhouse gas, and impact on trio of global warming, ozone depletion on climate change

Recent time has seen environmental calamity and abnormal environmental behavior which today the consensus of scientist have agreed to be linked to human activities. The world of man is made up of the biosphere and the techno sphere, human inherited the earlier and it give all support needed for human to live, however, we neglect to know and even take care of it and we created the later whose buy product are claimed to be responsible for effect of ozone depletion that limit sunlight reaching our planet and consequentially warm up our planet and cause other chain reaction that leads to environmental revolt.

An analysis of temperature records in Malaysia shows a warming trend. For the assessment of the impacts of climate change on agriculture, forests, water resources, coastal resources, health and energy sectors, temperature changes ranging from +0.3°C to +4.5°C and rainfall changes ranging from –30% to +30% were used. Several fixed sea level rise scenarios within the range of 20–90cm in 100 years were adopted for the assessment of impacts on coastal resources. As much as 6% of land planted with oil palm and 4% of land under rubber may be flooded and abandoned as a result of sea level rise. Forests however are more vulnerable to land use change than to climate change. Upland forest can be expected to expand by 5% to 8%, but this could be nullified by a loss of between 15% and 20% of mangrove forests located along the coast as a result of sea level rise [12].

The impact on coastal resources can be classified into four broad categories. The first is tidal inundation, where about 1200km^2 in Peninsular Malaysia alone will be submerged subsequent to bund failure, and mangroves will be lost if sea level rises at a rate of 0.9cm/year. The second is shoreline erosion, which will account for another few hundred meters of shoreline retreat. The third is increased wave action, which can affect the structural integrity of coastal facilities and installations such as power plants. The last is saline intrusion, which can pose a potential threat of water contamination at water abstraction points. Examples of other impacts include submergence of corals, coral bleaching due to increasing levels of CO_2 in the water, and depletion of fisheries resources due to loss of mangrove habitats.

Due to uncertainty attached to knowledge experience, and baseline data available of GHG, it is advisable to use the worst possible scenario in terms of GHG emissions inventory. Such approached has been used to estimate Malaysia greenhouse gas emission which is given bellow Alexia's Greenhouse Gas (GHG) emissions totalled 144million tonnes in terms of carbon dioxide (CO_2) equivalent in 1994. Net emissions, after accounting for sinks of 68 million tonnes, amounted to 76 million tonnes CO_2 equivalent. On a per capita basis, net emissions amounted to 3.7 tonnes CO2 equivalent. In terms of GHGs, CO_2 accounted for 67.5%, methane (CH4) 32.4% and nitrous oxide (N_2O) 0.1% of total CO2 equivalent emissions. The fuel combustion energy sector accounted for 86.7% of total CO_2 emissions, landfills (46.8%) and fugitive emissions from oil and gas (26.6%) accounted for 73.4% of total CH_4 emissions and traditional biomass fuels accounted for 86.4% of total N_2O emissions [12].

The case of Terengganu: Terengganu is coastal state strategically located on the eastern seaboard of Peninsula Malaysia, Terengganu enjoys easy access to both emerging markets and rich resources by land, sea and air. Terengganu has coastlines of 244km offer access to seas rich in marine life. Figure 23

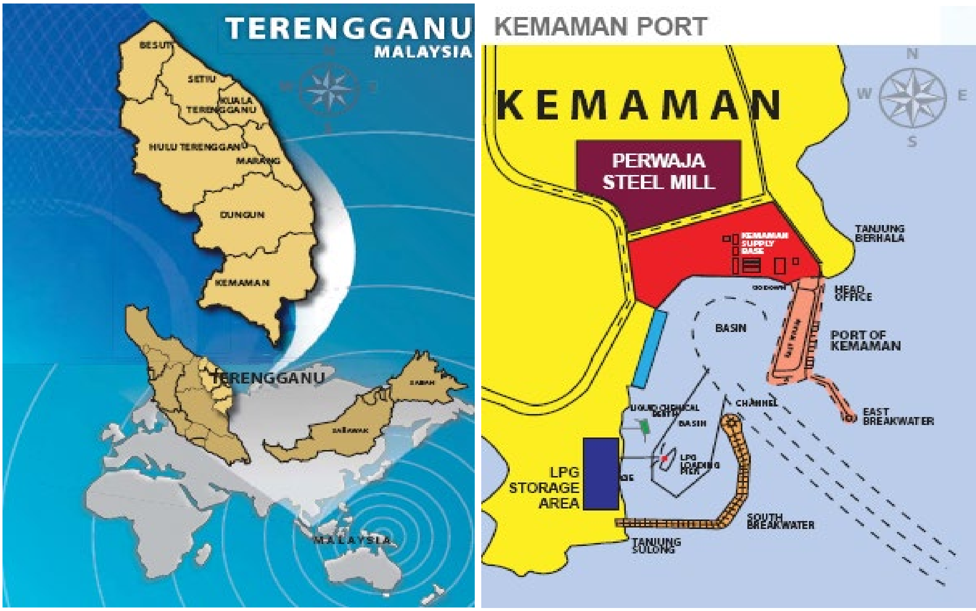

Figure 23: Terengganu transportation network.

Resources	1980	1990	1995	2004
Population	541,608	752,026	898,825	1,023,790
Working Age Group(15-64)	364,659	400,153	465,958	572,343
Labour Force	165,976	270,103	294,346	381,753
Employment	167,329	246,334	283,749	369,155
Crude Petroleum(Billion Barrel)	1.0	1.5	2.4	1.63
Liquefied Natural Gas(Trillion SCF)	24.2	27.1	36.4	31.2
Forest Reserve (Ha)	NA	NA	556,953	557,661
Wildlife Forest Reserve (Ha)	NA	NA	NA	77,507
Agriculture Area (Ha)	267.212	290,449	286,454	306,171
Coastline(KM)	244	244	244	244
Water Total Supply (M/D)	26.659	75,518	202,989	399,302
Sultan Mahmud Hydroelectric Plant, Kenyir	NA	400	400	400
YTL Electrical Plant, Paka	NA	NA	600	800
Sultan Ismail Electrical Plant, Paka	NA	900	900	1,180

Table 10: Resources, (http://www.terengganu.gov.my/v5/bm/).

Terengganu has reserves of natural gas estimated at 31.2 trillion cubic feet and crude oil reserves of about 1.63 billion barrels and her agriculture production land cover about 300,000 hectares Considering trend going towards use of Natural gas (LNG, LPG CNG), Terengganu need multimodal transportation as a generic system to fill capacity building gap needed in the petrochemical corridor that will serve oil-and gas value chain, starting with upstream exploration [13]

The state strategy nature of state of Terengganu place in a best position to consider planned strategy to implement hybrid concept for transportation. Table 10 show the case of Terengganu and the thematic resources areas that will benefit from hybrid based design transportation system. The table below shows the GDP share of sector of various sectors.

Sector	2001	2002	2003	2004
Agriculture, Forestry, Livestock & Fishery	701.3 (18,346)	722.3 (18,315)	744.9 (19,453)	773.5 (21,836)
Mining & Quarrying	8,638.9 (14,106)	8.863.5 (14,883)	9.109.0 (16,581)	9,471.6 (18,250)
Manufacturing	2,006.5 (75,808)	3,076.0 (69.052)	3,147.6 (71,311)	3.238.6 (81,882)
Construction	37.8 (7,066)	353.7 (7,332)	371.9 (7,417)	393.1 (7,205)
Electricity, Gas & Water	216.6 (7,374)	222.7 (7,374)	230.0 (8,229)	237.5 (9,531)
Transport, Storage & Communication	341.4 (17,425)	354.7 (18,438)	371.6 (19,349)	390.4 (22,409)
Wholesale, Retail, Restaurants & Hotel	369.7 (32.333)	396.0 (32,934)	429.3 (36,436)	464.6 (42,196)
Finance, Insurance, Real Estate & Business Service	627.8 (25,390)	664.2 (29,082)	715.8 (29,476)	769.6 (34,138)
Government Services	833.3 (15,265)	871.9 (15,785)	937.3 (17,615)	981.3 (20.401)
Other Services	98.0 (15,911)	99.7 (16,544)	103.5 (8,924)	981.3 (21.917)
GDP In Purchasers Value	14,504.0 (210,188)	14,949.5 (230,710)	15,462.5 (230.710)	6,099.9 (260,323)

Table 11: Gross Domestic Product (Source- http://www.terengganu.gov.my/v5/bm/).

Terengganu also blessed with rich natural beauties and wealth of culture and heritage that place it high among tourist destination it is estimated that Over 1.3million visitors arrived in the first 10 months of 2004 and the state Predicts 15% growth in annual visitor numbers with highlight on building capacity in eco-tourism, agro-tourism, Cultural-tourism, edu-tourism, histrotourism and homestays which require sound transportation that can be offered through multimodalism and intelligent transportation. Figure 24 shows that there is rise in people visiting Terengganu. Table 11

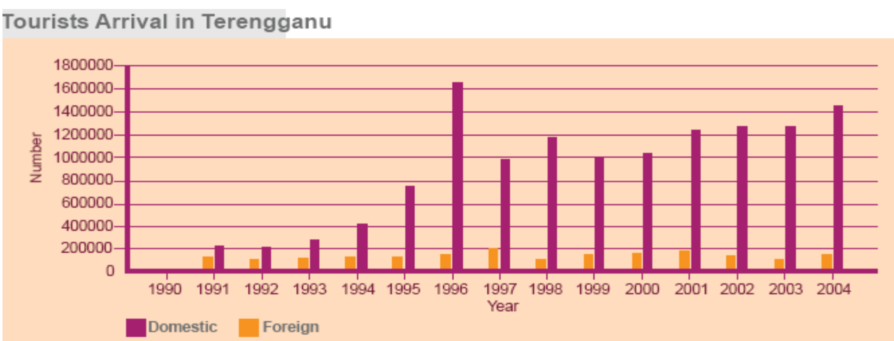

Figure 24: Tourists arrival in Terengganu (Source-http://www.terengganu.gov.my/v5/bm/).

Multimodal integrated intelligent transportation requires robust and networks on land, sea and air and ITC to simplify logistics simplify. Table 12,13,14 shows cargo projection for port Klang. Table 5 shows potential GHG emission release.

Year	Dry	Liquid	General	Container	TOTAL
2001	7,103	4,686	5,523	52,837	70,149
2002	8,093	5,280	5,629	63,269	82,271
2003	8,175	5,658	6,546	68,539	88,888
2004	7,707	5,733	8,179	78,292	99,911
2005	8,649	5,291	7,989	87,729	109,659
2006	8,499	5,652	7,879	99,974	122,005
2007	7,651	5,443	9,048	113,372	135,514

Table 12: Cargo types (`000 FWT).

Year	(tonnes 000)Bulk cargo	(TEUs 000)Container
3297	105932	433637
939	198063	295124
2101	980944	3852753
462	7887	1234395
198	8940	354672

Table 13: Projected throughput for bulk and container at Klang Port.

Emission Source	Tow boat	Other transportation	Other mode
NOX	3297	105932	433637
HC	939	198063	295124
CO	2101	980944	3852753
SOX	462	7887	1234395
Particulate	198	8940	354672

Table 14: Annual emission for air quality.

Terengganu Transportation

Coastal strategic location of Terengganu provide easy access to the region's key shipping lanes via the port of Kemaman and the Kerteh Port, while kemaman port is an multipurpose port that ranging from general cargo and dry bulk to liquid bulk., kerteh is a dedicated facility for the petrochemical industry.

Kemaman Port: strategic location offers easy access to the South China Sea and Asia-Pacific rim, Kemaman's provides fast fast-growing markets and secures passage to users, it has 850m breakwater that acts as a buffer against the seasonal northeast winds. It has can accept vessels as large as 150,000 dwt all year long, maintenance of the navigation channel make Kemaman Port's to maintain leading port status in the region seaports. The Kemaman Port also enjoys high productivity and cargo turnaround rates due to its automated processes and the experience and expertise of a highly-skilled workforce. Currently, the port has 11 berths with a total length of 2,078metres providing a total berth capacity of 14.94million tonnes. It has five major terminals:

i. The East Wharf (with a berth capacity of 5.57 million tonnes) equipped with special handly facilty to handle hazardous and non azadrous cargo range from logs, timber, plywood and steel product.

ii. The LPG export terminal (1.04 million tonnes) equipped with pipeline network support base kemaman supply based for transportation of compressed gases.

iii. The Kemaman Supply Base (832,000tonnes), which is a facility specially geared towards the demands of the oil and gas industry,

iv. The West Wharf (6.46 million tonnes),

v. A liquid chemical berth (1.04 million tonnes)

Kerteh Port: located right in the middle of the PETRONAS Petroleum Industrial Complex in Kerteh, about 30km to the north of Kemaman Port. Fully managed by a PETRONAS subsidiary company, the dedicated Kerteh Port

i. specializes in the shipping of liquid petrochemical products and has six berths that can accept vessels as large as 40,000 dwt, that carry pressurized LPG, propane, and butane gases.

ii. **Air transportation:** Currently, the bulk of cargo in Terengganu passes through the busy seaports, while airports are used primarily for passenger transport. Competitively-priced and frequent flights from Terengganu's two airports located in Kuala Terengganu and Kerteh make flying a convenient mode of transport.

iii. **Roads transportation:** Terengganu has about 1,071 km of federal roads and about 1,660 km of state roads. The main trunk roads are a coastal road that runs from Kuantan in neighbouring Pahang to Kampung Raja in the extreme north and an inner-state road that cuts across the industrial hinterland.

iv. **Rail transportation:** A dedicated industrial railroad meets the needs of companies in the petrochemical corridor in the southern half of Terengganu. Built and operated by PETRONAS, this 77km line runs between Kerteh and Kuantan. One of this railroad's principal roles is to transport cargo back and forth between the key seaports in Kuantan and Kerteh with planned extensions later on to Paka and Kemaman Port.

v. **ICT:** Terengganu currently has integrated fixed line, mobile and satellite communications infrastructure that supports domestic and international services encompassing voice, video, wireless, fiber optics, data and other advanced communications services. Optimum of ICT will be required for hybrid transportation.

vi. **Industrial Estates:** Industrial estates in Terengganu have been strategically designed with comprehensive infrastructural facilities to enable businesses and projects to get off the ground swiftly. Currently, there are 23 industrial estates in Terengganu, occupying slightly more than 10,000 ha or 45% of available land for industrial development. Thus they are built at strategic sites near transportation hubs, use of water inland water to transport the produce has not been maximized. Figure 25

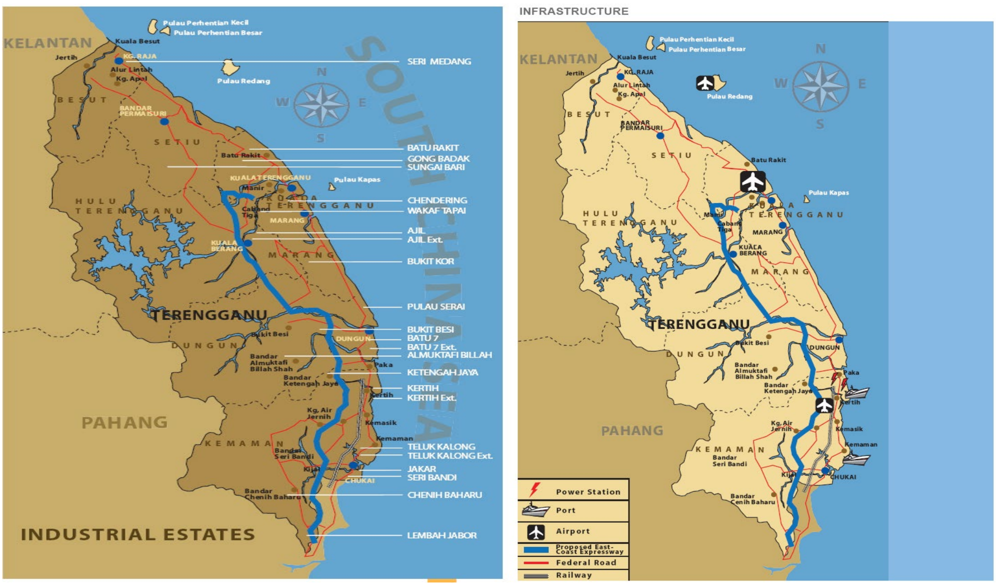

Figure 25: Infract structure.

Water management follows three stages:

i. Unregulated river water become supply – oriented , it remain so as long as water is abundant and the demand can be satisfied without modifying hydrological regime.

ii. Scarcity of water-with increase pressure of demand for water and water related services, water management become resources oriented and the basis for multipurpose development.

iii. Regulated natural regime-as Limit of acceptable stream flow regulation and development are reached, marginal cost of water supply radically increases, and here development management becomes important [2].

The first case apply to Terengganu, the first case apply, and significant, sustainable balancing of economic, environmental development, community involvement maximize benefits of the planning and implementation strategy that could result to dramatically improved public access, provision of new open spaces, improved quality of life, strengthened city and image and community pride.

Environmental risk of IWTS: The environmental impacts of water transportation vary from river to river and project to project but in many cases, the environment is not noticeably affected by waterway freight transport. Where it does have a negative impact, the effect is usually minimal. Because of the concern over the impacts that the different transportation modes have on the environment, there has been a more concerted effort to identify those impacts. Recent time have studies that are similar in nature analyzed the types and levels of impacts of a modal shift on the environment viz. what happens if cargo movements are shifted from one mode to another. What would be the increases in fuel usage, Issues related exhaust emissions, probable accidents, traffic congestion etc. All three studies compared the same cargoes shipped by different modes, and concluded that, ton for ton, produce vessels have fewer accidents, consume less energy, fewer harmful emissions, society in general and are less disruptive. These studies findings show that transporting of bulk commodities by water are environmentally compatible, provides a means to sustainable development, and that the use of this environmentally-friendly mode should be encouraged [14]. Wide variety of human activities can affect the coastal and marine environment. Population pressure, increasing demands for space, competition over resources, and poor economic performances can all undermine the sustainable use of our oceans and coastal areas. The most serious problems affecting the quality and use of these ecosystems surrounding coastal water encompass release to:

i. Water - pollution release directly or washed downed through ground water

ii. Air : air pollution, noise population, vibration

iii. Soil : dredge disposal and contaminated sediments

iv. Flood risk: biochemical reaction of pollution elements with water.

v. Collision : operational

vi. Bio-diversification : endangered and threatened species, habitat

Risk management should involve alternative risk reduction measures and the implementation of those that appear cost effective .where Zero discharge = zero risk but the challenge is to bring the risk to be at acceptable level and at the same time, derive the max Benefit. Simulate extreme condition and model using combination mathematical modeling and stochastic techniques while considering all factors in holistic manner.

Uncertainty is part of risk, but it's an abstract nature and limitation of knowledge of unseen in real world settings makes its quantification a complex work. associated with uncertainty are normally reflect issue of influences on recovery process, Test of new advancements, Influence on policy, Address system changes over time, services & resources.

The sources of a lack of certainty can be several. Moreover, the methods of measurement may be uncertain, or the models used inaccurate. Furthermore, uncertainty can arise from profound misunderstandings of the phenomena that are observed or are attempted to be assessed, perhaps because there is no adequate theoretical knowledge yet.

Environmental Benefits of IWTS: The commodities on which our lives and livelihood depend have to be transported by one mode or another however; the advantage of using Inland water transportation system over other mode of transportation has been described by various comparative studies. Advantage range from issues of concerned in of human modern world. As highlighted above there are inherent risks in shipping by barge, but yet statistics, water transport is the safest and most regulated form of transportation and has fewer accidental spills or collisions than any other mode. This excellent record is directly attributable to both exacting operational safeguards imposed by the carriers themselves as well as strict federally-mandated inspection standards. There is little public awareness of the water transport industry outside the river communities that it serves. This can be attributed primarily to the non-intrusive nature of the industry's operations and its impressive safety record. One of the primary reasons for this lack of intrusiveness is the width of most of the rivers, their location in relation to population centers, as well as levees and floodwalls.

According to the United Nations, human benefit from marine and coastal ecosystem and activities: Coastal tourism =161billion American dollars, Trade and shipping =155billion American dollars, Offshore oil and gas = 132billion American dollars, Fisheries = 80billion American dollars. Therefore, it is important to be careful and maintain balance in dealing our activities. The popular media attention is concentrated on loss of life and property. There is little prospect for preventing many of the disasters from occurring although much could be done to reduce their severity. Many impacts could be mitigated through better vulnerability and risk assessment, predictive modeling, information dissemination, and policy development [14].

Energy efficiency: The use of energy by the different modes of freight transportation has become of increasing concern in setting transportation policy. Energy efficiency is the measure of performance of our system is it structure or mobile Energy efficiency is usually measured in one of two ways: by comparing how many miles each mode of transportation can carry a ton of freight per gallon of fuel, or by how many BTUs are expended per ton mile. In considering the choice of alternative transportation modes, it is imperative to consider energy that will be spent in shifting from one mode to another will result in greater energy consumption by the less fuel-efficient mode. For cargo carriage, vessels is required to move one ton of cargo none mile, with energy efficiency which is the inverse of energy intensiveness Propulsion energy including refinery losses.Combines operating energy with maintenance energy, vehicle manufacturing energy, and construction energy. Table 6 shows energy model comparison and Table 7 show emission for energy sources. Table 15,16

Mode	Operating energy	LINE- Haule energy	Model Energy
Rail	412.5	706.3	1075
Truck	1312.5	1312.5	2137.5
Barge	262.5	262.5	618.8

Table 15: Energy modal comparison.

	NOx	PM	FC	Cox	SOx
	%	%	%	%	%
After traetment					
SCR	-81	-35	-7.5	-7.5	-7.5
PMF	None	-85	2	2	2
Drive Management system					
ATM	-10	-10	-10	-10	-10

Diesel fuel Quality/Substitutes					
(BD)Bio-Diesel	-10	-30	15	65	~-100
BDB (Biodiesel blend,20% BD)	2	-6	3	-13	~-20
LSF(Low Sulfer fuel)	None	-1.7	None	None	~-100
New Engine technology					
NGE (Natural Gas Engine)	-98.5	-97.5	4.5	-10	-100

Table 16: Modal energy comparison.

Numerous studies of fuel efficiency have been done shows that shallow-draft water transportation is the most fuel efficient mode of transportation for moving bulk raw materials is the least energy intensive method of freight transportation when moving equivalent amounts of cargo and consumes less energy than alternative modes [15]

Safety: Since the consequence of not being safe is environmental catastrophic, modal comparison of transportation system has revealed that water transport has the fewest numbers of incidents, fatalities, and injuries compare to other surface mode. The inland water transportation environment, with its slow transit speeds is relatively mild, and shock and vibration levels, which are dampened out by the cushioning effect of the waterway itself are not normally considered a problem. Land based including road and rail cars are susceptible to accidents, often times resulting in a loss of cargo, especially rail transportation are more vulnerable because shipments typically involving a large number of massive units traveling at high speed in a single line. River barges with navigation aid infrastructure ensure right-of-way mostly with pleasure craft that operate primarily both in warmer weather and during daylight hours an intermodal comparison work recently conducted by waterway foundation

Congestion: Pressure relating to technological; change needs and population has led to high demand for road transportation vehicle that has led to un convenient congestion problems and cones, traffic growth in most city of the world is currently outstripped any increase in increase of greenhouse gas release increase, currently hurting our planet. There is currently fringing in infrastructure capacity, where traffic demand exceeds supply leading to delays and safety problems.

Air, noise and vibration pollution: Rise in traffic volumes due to urban population, increase mobility has been identified by recent studies to be main contributors to Noise levels rise and contamination of air quality. Comparative studies has revealed that road transportation is the major offender Road transportation is the major offender more than other mode of transportation. Currently there is limited data exists on noise levels of barge operations, mainly because they are not considered problem. Table 8 shows share of GHG sources. Table 17

GHG	Amount	Industrial Contribution
CO2	67.5%	Combustion energy sector accounted for 86.7% of total co2 emission, landfills (46.8%) and fugitive emission from oil and gas (26.6%).
CH4	32.4%	Landfills (46.8%) and fugitive emissions from oil and gas (26.6%) accounted for 73.4% of total CH4 emission.
N2O	0.1%	Traditional biomass fuels accounted for 86.4% of total N2O emission.

Table 17: Malaysia greenhouse gas release.

Social Impacts: Trucks and trains operate much closer to populated areas and release large amount of pollution and noise to the residence, barges quietly make their way along isolated waterways for most of their trip. By contrast, river barges have little impact on densely-populated areas. Barge transits are relatively infrequent because of the large tonnage moved at one time. River operations take place in channels away from the shore, and the engines of a towboat are usually below the water line, which muffles the sound. Surface traffic, both road and rail, near residential neighborhoods contributes to visual, physical, and psychological barriers that can lead to the fragmentation of those neighborhoods. Reduced social interaction, reduced access to other neighborhoods, and increased traffic congestion Traffic congestion can lead to serious disruptions of police, fire, and medical services, as well as periodic isolation of parts of communities

Cargo capacity: In terms of capacity a study done by COB came up with the following conclusion, which gives inland water a good advantage over other mode of transportation.

Economic of IWTS: The political and economic changes of nation is a big factor that maneuvered and created dynamic emerging economy in and generated needs and perspectives for more trade and transport along the river in Europe and the United States. Such economy analysis and environmental analysis which is being dealt with in this research cold bring assurance to drive the Transport policies that promote modal shift. The making of inland transportation requires economic analyses that identify trade growth consequential rapid rise in the amount of traffic. Commercial transport in Malaysia corridor has soared growing more than 100% in the last decade, with by far the largest increase registered in road transit. It is expected that Malaysia will continue this dynamic economic development in the coming years (with minimum average GDP/capita growth rates of 3-4% per year until 2015) and traffic flows could grow correspondingly [16]. Compare to other mode of transportation, Inland water Transportation is in comparison to air and road transport, seen as more environmentally friendly and energy efficient, and can therefore contribute to sustainable socio-economic development of the region. Multimodal use of available transport possibilities (road, rail and IWT) has to be ensured.

Regulation requirement: Due to international implication of maritime industry, the required to be implemented are finalized by UN agencies following tacit procedure, while the state decide on formulating local legislation towards implementation through marine administration and port state contol. Under above described legal framework for guide to drafting legislation, in the context of maritime transportation, 3 main purposes of legislation under legal framework are:

i. To provide legal framework for maritime transportation – effective legal framework is expected to cover all parties involved in maritime transportation

ii. For implementation of basic objectives of states- to prevent coalition, accident and consequence of pollution that may arise from them- legislation involved monitoring that focus on manning, safety, prevention of collision, salvage.

iii. To achievement of certain economic purpose- policy objective under economics from aim to expand national fleet, boosting of employment of national on board foreign ship.

Technical requirement/Classification of IWTS: River Classification System is n necessary to ensure the orderly and efficient control and maintenance of waterways an inventory of existing infrastructure and transport must be prepared as the base of a sound classification system. This inventory should include numerous quantitative aspects (e.g. minimum depths, width, and vertical clearance of waterways, marking and minimum equipment with navigational aids, and number of vessels), as well as qualitative aspects (e.g. the state of infrastructure and the fleet, transport performance). Data difficulties can be often quite substantial. Each waterway class: I, II, … has its standardized vessel (type, length, beam, draught and carrying capacities to loading draught and minimum height under bridges) or limited standardized integrated barge tow (formation and number of barges in tow, total length of barge tow plus pushboat, total beam of barge tow, draught of most loaded barge in tow and barge tow capacity in loaded state and minimum height under bridges) corresponding to the waterway conditions. Classification adopted by European Conference of Ministers of Transport (ECMT) is shown in the Table 18 below [17].

Classification	Type	Carrying capacity (tonnes)	ECMT Classification (Maximum vessel dimensions in metres			
			Beam	Length	Air Draft	Water Draft
I	Small Barge	300	5	38.5	3.55	2.2
II	Campeenar Barge	600	6.6	50	4.2	2.5
III	Doctmund-Ems	1,200	8.2	67	3.95	2.5
IV	Rhine-Hern	1,350	9.5	80	4.4	2.5
V	Large Rhine	2000	11.5	95	6.7	2.7

Table 18: IWTS classification.

IWTS Vessels Requirements: The Ship is about port and access to port by optimum size of ships and its associated economics implication can be made available through navigable channel where maintenance dredging is needed. Ship production and condition of channel are out of phase. Economic of large scale and demand has begot big ship to emerge within a short period of time after second world war- however less attention has been given to the channels that will continue to accommodate these ships. Large ships typically maneuver with difficulty in confined areas, and channel width is a critical component of deep-draft channels .The requirements for access and protection in harbors and ports often lead to maintenance of channels and engineered structures, such as jetties and breakwaters.

Ship characteristics: Thus as ships are getting bigger, there has been signify technological change link to safe maneuvering and controllability. In reference To this design has focused on mitigating issues like large wind age associated with container ships, which can complicate ship controllability in narrow channels as well as during slow speed maneuvering also Limiting speed in channel remain a critical part of operational maintenance work Direct-technological ship with drive diesel ships with high installed power to achieve design service speeds can, in some cases, have a minimum bare steerage speed of about 8 knots quite a high speed in confined waters, has remain a challenge for terminal operators [17].

Maneuverability of during ship designs focus more on optimum operation of ships in the Open Ocean, and pay les attention to operations in confined areas. Ship Control is important when ships slow to turn, docks, or attached to tugs. Factors contributing to loss of control include slow vessel speed, following currents, waves, and cross-wind. Sailboats traveling under sail require extra maneuvering space. A good navigation channel must accommodate the ships using it. Ships are controlled by propellers and rudders at the stern. Some ships are also equipped with bow thrusters or bow and stern thrusters, which aid in control, especially at low speeds. Often, one or more tugs are needed to assist ships in some phases of entering and leaving a port.

Vessel operations during navigation channel deepening are required to enhance safety, efficiency and productivity of waterborne commerce in ports and harbors. Shallow-draft projects embody similar concerns and often public recreational access as well. The following as related to Vessel operability is important in channel maintenance work. Navigation system this includes the following port harbor operations:

i. Waterway engineering: Navigation channels, environmental factors, dredging and mapping services, shore docking facilities.

ii. Marine traffic: Operational rules, aids to navigation, pilot and tug service, communications, and vessel traffic services.

iii. Vessel hydrodynamics: Vessel design, maneuverability and controllability, human factors, navigation equipment.

Inland waterway channels requirement: Waterway channel involve the sizing of vessels that will transit a waterway, Maintenance dredging Capacity sediments output and estimates with clear objective to reduce channel delay accepts big ships, need to be done in environmental sustainable manner and optimal efficiency (economically). Quantification of channel require quantifying depth that pave wave for dredging requirement to be determined and this lead to optimal choice of dredger .generic analysis of navigation and environmental and sediment, with Iterative process and allowance discounting discussed under the case studies in taking account of impacts to channel during operations and during construction.

Navigation, coastal and geotechnical engineers have a very pronounced problem in regards to this past design in human activities has been based on aftermath assessment of calamity where engineers have dealt with the high level of uncertainty by conservatively assigning or specifying much larger capacities than the projected demand. This ratio of capacity to predicted demand is the classical safety factor approach, which requires significant experience levels to be done right. Complementing, sustainable maintenance balancing wok is also Aids to Navigation/Navigation Information. Channel dimensioning requires channel depth and width characteristics:

i. Channel Depth Characteristics - Channel deepening is considered more important by channel designers, economists and mariners alike.

ii. Channel Width Characteristics - The main characteristics of a channel width may be grouped into the following general categories:

- Channel Layout (i.e., plan view path characteristics such as straight and curved sections)
- Channel Cross-Section (hydrodynamic characteristics such as depth, width, and side-slopes) many factors feed into the determination of the dimensions and specifications of channel characteristics

The quality of aids to navigation, type of channel cross section and current strength impact the required width, experience with ship simulator studies has indicated that traditional channel width design criteria are overly conservative. Navigation is more difficult when channel cross section (overbank depths, channel depth and width) varies significantly. Bank effects and currents become less predictable and extra care is needed for vessel control. Traditional guidance for channel width is the same as for deep-draft channels.

Environmental sustainability and IWTS: Sustainability under UN definition emphasize on 4 tier balancing environment, economics, social and development issue that occupied man, the environment he inherited his survival, and reliability on continuity of the planet for the right of future generation. maritime industry need to adjust to the ways we do things in a world of sensitivity being characterized by sustainability, capacity building, efficiency, optimization of development, practice and operations that meets the needs of the present generation without compromising the ability of future generation to meet their need. Environmental sustainability - “environmental issues” under what surround us, As well as difficulties associated with changes to the bathymetry due to dredging or as a resulted in changes in water currents or other oceanographic effects or as result of sediment transport and need maintain n them ,sustain our living and existence and purpose associated with them. Require historical as well as recent and predictive datasets system and “Now casts” and predictions of these parameters with the use of numerical calculation models that can provides real-time information about water levels, currents, and other oceanographic and meteorological data from bays and harbors, are available.

Transportation Hybrid Process Requirement – Making Transportation Smarter: Hybridizing transportation system will involve:

i. Development of a conceptual standard for Ship Control Centre (SCC) Design-

ii. Development of Advanced Information Processing that will enhance efficiency, and safety including human performance by integration of information and improvement of decision support methods.

iii. Verification of Conceptual Standard for SCC and risk of solution accountability for Design vs, Efficiency and Safety in combination with increased user satisfaction. Safety assessment, the risk of a collision, supports interoperability and interconnectivity.

iv. Conceptual Standard for ISC Systems including use of components for a future standard on ISC systems, including guidelines for the preparation of companion standards and conformance classes.

v. Harmonized Human-Machine Interface (HMI), towards contribution to the safety and efficiency improvements measured in the project.

vi. Standardized Process Network including use of tools required for network performance prediction, reliability as expressed.

Conclusion

Summing it up, building hybrid integrative transportation system that combines land road-water resources is indeed a challenge. To achieve success in such transportation artifact, providing the value and benefits require setting of high goal objectives that can be achieved within designated time, cost benefit should be clearly defined and performance problems and lifecycle issues should be well addressed, risk mitigated. Information transparency and information sharing through dissemination forum should be planned. The fact that environmental issue is of global warming, climate change and ozone depleting is driving today technology touché inland water transportation system were discussed. Need to adopt new transportation strategy warranted and incorporating old transportation system with sustainable Inland Water Transportation that mitigate environmental, technical, economic, social, safety , ecological requirement under integrative integrated transportation system will provide reliable Inland Water Transportation System aggressively growing state like Terengganu with coastline advance should adopt smart multimodal planning for sustainable transportation.

References

1. Evans SM (2000) Marine Antifoulants. In: Seas at the Millennium: An Environmental Evaluation. Sheppard C. (ed.). Elsevier Science p: 247-256.

2. Rackwitz R (2002) How Safe is Safe enough? An Approach by Optimization and Life Quality Index.

3. Abbas BM (1983) River basin development. Tycooly, Dublin.

4. Larry Koss (1996) Technology development for Environmentally Sound Ships of the 21st Century. An International Perspective.Journal of Marine Science and Technology 1:127-137.

5. Pittock B, Wratt D, et al.(2001) In Climate Change 2001: Impacts, Adaptations, and Vulnerability. Contribution of Working Group II to the Thirds Assessment Report of the International Panel on Climate Change. Published by the Press Syndicate of the University of Cambridge. Cambridge, United Kingdom.

6. Laurel Gascho, Henrike Peichert, Sarah Renner (2006) Malaysia /Referral & Comparative experiences/Inland Waterway Transportation System. Environment and Poverty Networks.

7. Mohd. Zamani b.Ahmad (1999)Multimodalism and the Role of Inland Water System as an infrastructure. National Seminar on inland Water Transport, KUCHING, Sarawak.

8. Thomas A. Butts, Dana B. Shackleford (1992) Impacts of Commercial Navigation on Water Quality in the Illinois River Channel. Department of Energy and Natural Resources, Illinois State Water Survey, Champaign, IL p: 1-103.

9. Osterreichische Wasserstrassen (2007) Inland Environmental Performance RINA p: 1- 49.

10. Eastman SE (1980) Fuel Efficiency in Freight Transportation. The American Waterway Operators, Arlington, VA p: 1-7.

11. National Waterways Foundation (1983) U.S. Waterways Productivity: A Private and Public Partnership. Strode Publishers, Huntsville, AL, USA p: 165-167.

12. Malaysia initial national communication (2000).United nation Framework convention on climate change. Malaysian Ministry of Science, Technology and Environment.

13. http://www.terengganu.gov.my/v5/bm/

14. Butts Thomas A, Dana Shackleford B(1992)Impacts of Commercial Navigation on Water Quality in the Illinois River Channel. ISWS Research Report-122 p: 1-103.

15. (1980)Analysis of Environmental Aspects of Waterway Navigation. US Army Corps of Engineers, Institute for Water Resources, Water Resources Support Center, National Waterways Study. Fort Beloit, VA, p: 1-227.

16. Saman AB, Kader Ab (1997) Cost Modeling for Inland Waterway Transportation System. Liverpool p: 1-186.

17. Broils JU (1967) New European norms for size of waterway urgently needed. Hinterland ports, Rotterdam Europort Delata.