

The International Maritime Transport and Logistics Conference  
"Marlog 10"

**Digitalization**  
in Ports & Maritime Industry



## **A Proposed Framework for a Port-area Vessel Speed Reduction system (VSR)**

**Capt. Mohamed S. Rowihil**

Head of Maritime Cooperation Unit, AICC, AASTMT, Egypt

MSc. Maritime Energy Management, WMU, Sweden



# Outline



- Introduction
- Methodology
- The proposed Framework
- Discussion
- Conclusion



# Introduction



- Seaports perform a central role on both the international and domestic scales.
- 80% of worldwide trade by volume, and 70% by value.
- 11 of the largest 15 cities in the world are coastal cities.
- Approximately 40% of world population lives within 100 km of the sea (UN, 2017).
- Therefore, activities in and around the port-area have significant impacts on human population including **health impacts**.



## Introduction (cont.)



- Ship emissions in the port-area include  $\text{NO}_x$ ,  $\text{SO}_x$ ,  $\text{PM}_{10}$ ,  $\text{PM}_{2.5}$ , HC, CO and VOC in addition to GHGs.
- Ship emissions cause **negative health issues** including asthma, heart attacks, hospital admissions, and premature mortality (Winnes, Styhre, & Fridell, 2015).
- Shipping-related PM emissions were responsible for approximately **60,000 cardiopulmonary and lung cancer deaths annually**, with most deaths occurring near coastlines (Corbett et al., 2007).





# Introduction (cont.)



- The 2015 IMO “Study of Emission Control and Energy Efficiency Measures (ECEEMs) for Ships in the Port Area” identified three main categories of ECEEMs in the port area:

- **Equipment;**
- **Energy;** and
- ✓ **Operational measures**
  - ✓ e.g. Vessel Speed Reduction/ Slow steaming



Source: IMO, 2015



Source: IMO

# Argument



- The paper suggests Vessel Speed Reduction system (VSR) as a **simple cost-effective operational measure** that may be employed **to reduce ship emissions in port-areas** worldwide.
- The paper proposes a **universal framework for assessing feasibility of and implementing a VSR** within any port-area.



# Methodology



- What is a VSR system/program
- Benefits? Challenges?
- Examples/Case studies
- Key concepts and features of a VSR
- Propose the Framework



# Benefits of a VSR



- Reduction of ALL ship-related **pollutants and GHGs**.
- Very effective in reducing **NO<sub>x</sub> emissions** during ship transit.
- Reduction in **fuel** consumption.
- Reduces risk of **collision** in port-area.
- Reduces risk of **whale strike**.
- Reduce **underwater noise**.
- Short implementation **time**.
- Easily monitored and verified using **AIS** data.
- **No capital costs!**
- **Low administrative costs**.





# Examples/Case studies



Port	Driver	Evaluated	Active	Start	Distance	Implmn.	Innovations/Challenges/Barriers to Implementation
		VSR Program?	VSR Program?				
Port of Los Angeles	NOx/DPM	✓	✓	2001	20/40	Vol/Inc	Dockside work gang assignment moved to VSR boundaries
Port of Long Beach	NOx/DPM	✓	✓	2001	20/40	Vol/Inc	Marine exchange/USCG participation; Green Flag Program
Port San Diego	NOx	✓	✓	2009	20	Vol/Inc	Set Cruiseship Speed to 15 knots & all others 12 knots
Port of Oakland	NOx	✓	✓				Ships already slow to 10 knots @ Bay Bridge; Strong currents
Port of Seattle	PM	✓	✓				Ships gradually slow naturally; Added costs; Strong currents
Port of Tacoma	PM	✓	✓				Ships gradually slow naturally; Added costs; Strong currents
Port Authority of NY & NJ	NOx	✓	✓	2010	20	Vol/Inc	Set VSR speed limit to match right whale
Port of Houston Authority	NOx	✓	✓				Ships in nonattainment area already constrained by ship channel



## Ports in the United State:

- The Port of Long Beach (POLB)
- The Port of Los Angeles (POLA)
- The Port of San Diego
- The Port Authority of New York and New Jersey (PANYNJ)



# Examples/Case studies

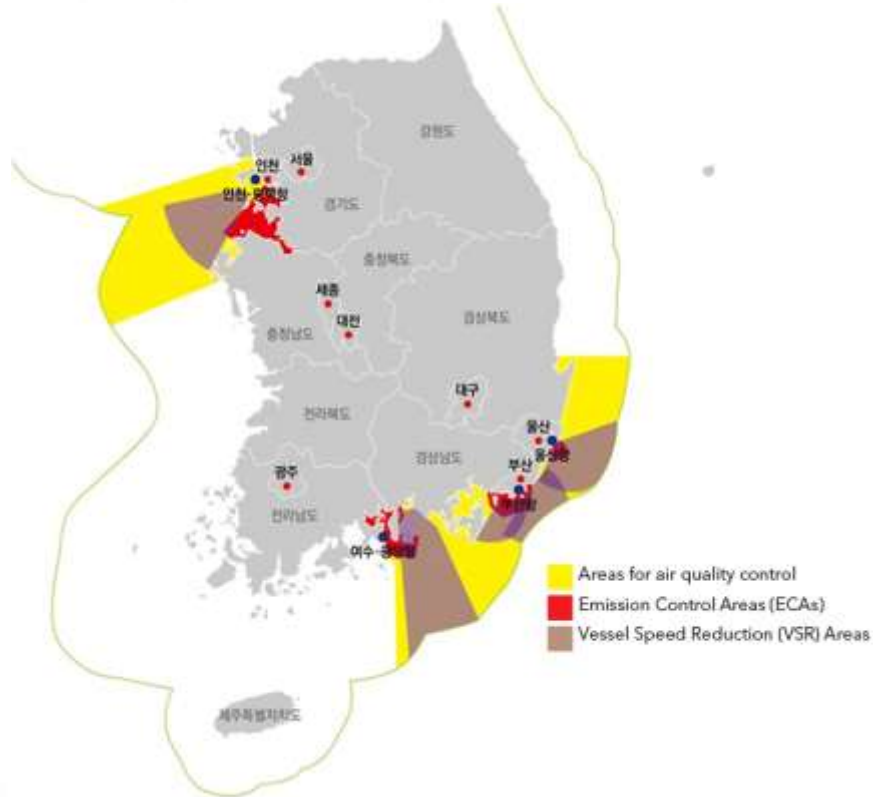


## Ports in Taiwan:

- 7 ports under the Taiwan International Ports Corporation



# Examples/Case studies



## Ports in South Korea:

- Busan
- Ulsan
- Yeosu
- Gwangyang
- Incheon



# Examples/Case studies

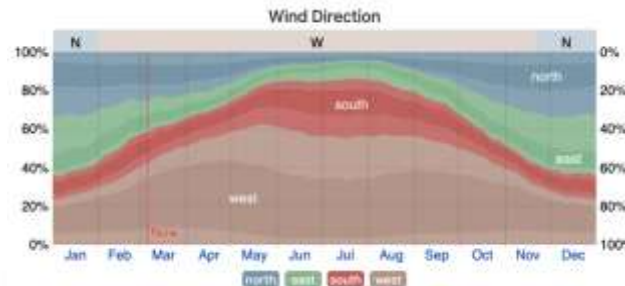


Case studies involved research on:

- Geographical Domain
- VSR themes
- Incentives Scheme
- VSR Monitoring
- Partners
- Effectiveness



s for POLB and POLA. Source: [www.polb.com](http://www.polb.com)



and New Jersey. Source: [www.panynj.gov](http://www.panynj.gov)

Figure 2: Prevailing wind directions for POLB and POLA. Source: [weatherspark.com](http://weatherspark.com)





# VSR Effectiveness



Port	PM	NO <sub>x</sub>	SO <sub>x</sub>	CO <sub>2</sub>	
<b>POLA</b>	90%	48%	98%	33%	2019 emission reduction figures compared to 2005 baseline.
<b>POLB</b>	88%	58%	97%	19%	
<b>PANYNJ</b>	9.0 tons	692.2 tons	42.5 tons	18,874 tons	2019 emission reduction figures compared to 2018.

- TIPC reported a speed reduction attainment rate of 40% for 2017 and 60% for 2018





# The Proposed VSR Framework

## Purpose of the Framework:

- to assess the viability of a VSR system for the intended port,
- to provide a set of guidelines for realizing an effective VSR system in the chosen port.

### APPENDIX 1

#### Proposed Framework for Systematic Implementation of a Vessel Speed Reduction (VSR) Program within any port-area

Table 1: Proposed Framework for Systematic Implementation of a Vessel Speed Reduction (VSR) Program within any port-area

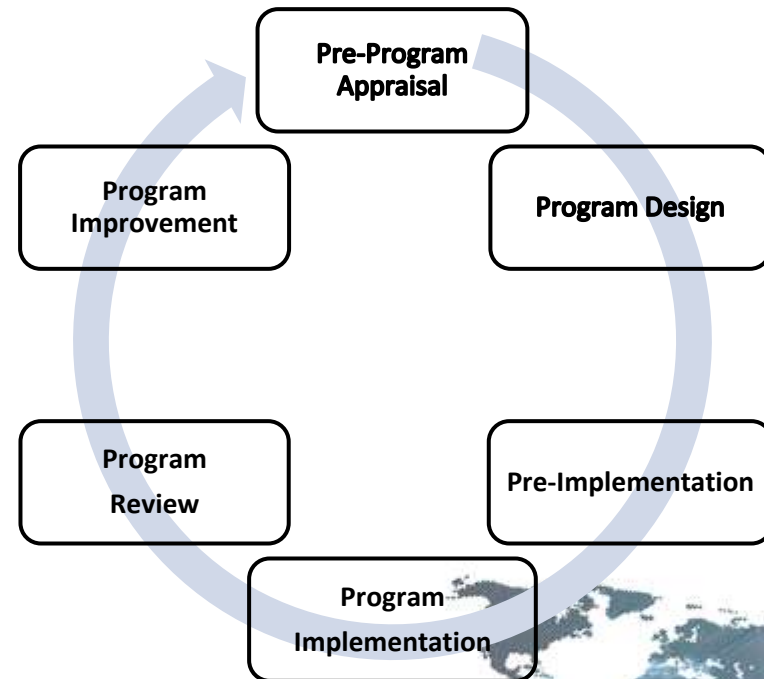
Phase	Stage	Considerations/Measures	Remarks/Examples
PLAN	Stage 1: Pre-Program Appraisal		
	• Need for Emissions Reduction	Subject to: air quality in port area; port inside ECA or not; contribution of ships to emissions in port area; number of vessels visiting port; type of fuel used by vessels; etc. Establish: an emissions inventory; business-as-usual (BAU) scenario*.	VSR Program may be implemented as a stand-alone ECEEM or as part of an existing program. *To be used as a baseline for future evaluation of the Program.
	• Geographic Location	Asses wind direction and speeds; will ship emissions be blown landward*? Frequency throughout the year; population affected; etc. Does port location already cause ships to slow down to intended VSR speed limit**?	*If “No”, no need for VSR. **If “Yes”, no need for VSR.
	• Average Ship Speeds	Subject to: types of ships visiting port; frequency of visits; port location; etc. Determined using AIS/VTS data; etc.	If average speeds are less than intended VSR speed limit, no need for VSR.
	• Potential Partners	Port authority; Terminal operators; City municipality; Governmental agencies; Environmental groups (NGOs); Stakeholders; Local community; etc.	The more the Partners, the greater the commitment and the stronger the Program.
	• Potential Participants	Asses willingness of shipping companies to enrol in a VSR program after advising on possible advantages.	Although willingness may seem weak, actual participation usually is stronger.
	• Funding	Assess need of funds for; monitoring equipment*; running costs including provision of incentives**.	*e.g. AIS & Radar (if not already available); **May affect choice of Program incentives.

# The Proposed VSR Framework (cont.)



## Plan-Do-Check-Act cycle

- ✓ Plan phase:
  1. Pre-Program Appraisal
  2. Program Design
- ✓ Do phase:
  3. Pre-Implementation
  4. Program Implementation
- ✓ Check phase:
  5. Program Review
- ✓ Act phase:
  6. Program improvement



# Plan phase



## Stage 1: Pre-Program Appraisal

- Need for Emissions Reduction
- Geographic Location
- Average Ship Speeds
- Potential Partners
- Potential Participants
- Funding

## Stage 2: Program Design

- Zone
- Speed limit
- Duration
- Eligibility Criteria
- Incentives Scheme
- Monitoring & Validation
- Awarding of Incentives





# Do Phase

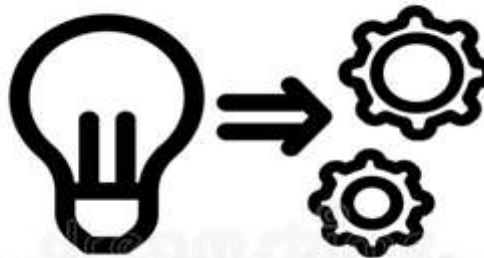


## Stage 3: Pre-Implementation

- Announce Program
- Disseminate Information
- Accept Enrolments

## Stage 4: Program Implementation

- Launch Program
- Carry out Program
  - Effective monitoring
  - Awarding of Incentives



# Check Phase



## Stage 5: Program Review (KPIs)

- Ship Compliance
- Program Effectiveness
- Adequacy of Funds
- Efficiency of Monitoring System



# Act Phase



## Stage 6: Program Improvement

- Analyse Review Outcomes
- Amend the Program



## Discussion (cont.)



- Motivation of ship operators:
  - Financial incentives
  - Corporate social responsibility (CSR) image
  - Public recognition
  - Polluter pays principle





## Discussion (cont.)



- **Monitoring** of vessel speeds using:
  - Automatic Identification System (AIS)
  - RadarTherefore, **easily automated**.
- **Failure to Properly monitor** vessel speeds may lead to:
  - unmerited awarding of incentives,
  - failing to recognize participants worthy of awarding, and
  - eventual failure of the whole program.



# Conclusion



- Vessel Speed Reduction Programs (VSR) is a **simple cost-effective operational measure** that may be employed to **reduce ship emissions in port-areas** worldwide.
- **Introduced in 2001** by the Port of Long Beach (POLB), VSR has been successfully employed by a number of ports worldwide, though **yet to become widespread**.
- The paper identifies the **key concepts, features** and different **perspectives** used in VSR programs in a number of ports in the USA, Taiwan and South Korea.



## Conclusion (cont.)



- The paper assembles these concepts, features and perspectives **into one systematic approach** for implementing a VSR.
- The paper, therefore, **proposes a detailed framework** that may be used by port authorities to guide the process of implementing a VSR.
- The framework uses a **plan-do-check-act approach** and clearly divides the process into **six sequential stages**; from initial appraisal of the program to the periodic evaluation and improvement of the VSR program.





Thank YOU!

