

TABLE OF CONTENTS

Foreword	5
Acronyms and abbreviations	8
1. Introduction	9
2. Ship engines performance assessment methodology	17
2.1. Evaluation of the ship main propulsion effective power and fuel consumption	18
2.2. Measurement program details and methodology	20
2.2.1. The main propulsion shaft torque and speed measurement	23
2.2.2. Mean engine indicated pressure	24
2.2.3. Fuel consumption measurement	25
2.2.4. Exhaust emission measurement and factors	27
3. Ship fuel oil consumption and emissions evaluation	32
3.1. Engine effective power and fuel consumption in direct propulsion	32
3.2. Emissions control strategy of the main engines	36
3.3. Non-direct ship propulsion performance evaluation	40
4. Ship propulsions performance model	47
4.1. General model structure and inputs	48
4.2. The procedure for ship propulsion power evaluation	50
4.2.1. The main engine service performance assessment	50
4.2.2. Auxiliary engine performance assessment	56
4.2.3. Auxiliary boiler performance assessment	58
5. Energy Efficiency Design Index of container carrier – operational approach	60
5.1. Reference lines calculation for EEDI	62
5.2. Energy Efficiency Design Index issue and certification	63
5.3. The EEDI valuation of a container carrier	68
5.4. EEOI applicability to container carriers	71
6. Economic speed of container carriers	73
6.1. Economic conditions of slow steaming	74
6.2. Determinants of feeder shipping	76
6.3. Assumptions for the modelling of the feeder shipping operations	78
6.4. Description of two feeder shipping models	79
6.5. The model calculations	83
6.6. Discussion of results	86

7. Assessment of the speed reduction influence on the navigational safety	88
7.1. Container carriers' slow speed and navigational safety	90
7.2. Sea trials – model structure	94
7.3. The results of model calculation	96
7.4. Conclusions	104
8. On-board measurement results	106
8.1. Container vessel A	106
8.1.1. Trip A1	106
8.1.2. Trip A2	110
8.1.3. Trip A3	114
8.2. Container vessel B	117
8.2.1. Trip B1	117
8.2.2. Trip B2	120
9. Marine engineer's hands-on experience of slow steaming operation ...	125
9.1. The main propulsion engine effects	126
9.2. Engine room systems effects	135
10. Conclusions	139
11. Appendix	153
Bibliography	163
List of figures	169
List of tables	173