

TABLE OF CONTENTS

HEAD PAGE	i
ENDORSEMENT	ii
DECLARATION.....	iii
ACKNOWLEDGEMENT	iv
PREFACE.....	v
TABLE OF CONTENTS	vii
LIST OF TABLES.....	xii
LIST OF FIGURES	xiv
ABSTRACT.....	xvii
INTISARI	xviii
 CHAPTER 1 INTRODUCTION	 1
1.1 Background	1
1.2 Problem Statements.....	2
1.3 Design Objectives	2
1.4 Design Scopes	3
1.5 Design Benefits.....	4
 CHAPTER 2 LITERATURE REVIEW	 5
2.1 Ports.....	5
2.1.1 Docks	6
2.1.2 Dock fenders	7
2.1.3 Moorings	8
2.1.4 Approach Channels.....	11
2.1.5 Turning Basins	12
2.2 Bulk Cargo Shipping Terminals	13
2.2.1 Storage facilities	13
2.2.2 Material handling equipment	14
2.3 Coal Fired Steam Power Plant.....	14

CHAPTER 3	THEORITICAL BASIS	17
3.1	Jetty Design.....	17
3.1.1	Astronomical tides	17
3.1.2	Berthing force	22
3.1.3	Mooring force	22
3.1.4	Current force	25
3.1.5	Vessel characteristics	27
3.1.6	Elevation of jetty	28
3.2	Fender Design.....	29
3.2.1	Approach velocity.....	29
3.2.2	Berthing energy	30
3.2.3	Fender selection.....	34
3.2.4	Fender pitch	39
3.3	Approach Channel Design	40
3.3.1	Channel depth	40
3.3.2	Channel width	40
3.4	Basin Design	42
3.4.1	Turning basin	42
3.4.2	Basin depth	43
3.4.3	Dredged area	43
3.5	Load and Load Combinations	43
3.5.1	Load combinations.....	44
3.5.2	Dead load.....	45
3.5.3	Live load.....	45
3.6	Design Earthquake Load.....	45
3.6.1	Occupancy importance factor and risk category	45
3.6.2	Site classification.....	47
3.6.3	Design response spectrum	48
3.6.4	Equivalent lateral force procedure.....	51
3.7	Pile Foundation Design	54
3.7.1	Standard penetration test	54
3.7.2	Pile load capacity.....	56

3.7.3	Lateral load capacity	58
3.7.4	Lateral deflection.....	60
3.7.5	Critical axial load	61
3.7.6	Inclined pile foundation	63
3.7.7	Modulus of subgrade reaction.....	65
CHAPTER 4 DESIGN CRITERIA		66
4.1	Design Procedure.....	66
4.2	Design Location.....	66
4.3	Flowchart	67
4.4	Data Collection.....	68
4.4.1	Aerial imagery data.....	68
4.4.2	Topography and bathymetry data	68
4.4.3	Barge properties	70
4.4.4	Tide data	70
4.4.5	Current data	71
4.4.6	Wind velocity data.....	72
4.4.7	Seismic data	74
4.4.8	Geotechnical data	74
4.5	Material Properties.....	75
4.5.1	Concrete structures	75
4.5.2	Driven piles.....	76
4.5.3	Bollards	76
4.5.4	Rubber fenders	77
4.6	Jetty layout	78
4.7	Loading.....	79
4.7.1	Dead load.....	79
4.7.2	Live load.....	79
4.7.3	Earthquake load.....	80
4.7.4	Mooring load.....	82
4.7.5	Berthing load.....	83
4.7.6	Current load	85

4.7.7	Load combinations.....	85
CHAPTER 5 RESULT AND DISCUSSION.....		88
5.1	Port Design.....	88
5.1.1	Astronomical tide	88
5.1.2	Mooring force	90
5.1.3	Current force	92
5.1.4	Elevation of jetty	94
5.2	Waterway and Basin Design	94
5.2.1	Approach channel design	94
5.2.2	Port basin design	96
5.2.3	Capital dredging	97
5.3	Fender Design.....	100
5.3.1	Approach velocity.....	100
5.3.2	Berthing energy	100
5.3.3	Fender selection.....	102
5.3.4	Fender pitch	104
5.4	Pile Foundation Design	106
5.4.1	Standard penetration test	106
5.4.2	Pile load capacity.....	108
5.4.3	Lateral load capacity	112
5.4.4	Lateral deflection.....	113
5.4.5	Critical axial load	113
5.4.6	Modulus of subgrade reaction.....	114
5.5	Structural Analysis.....	115
5.5.1	Jetty head	115
5.5.2	Mooring dolphin.....	117
CHAPTER 6 CONCLUSIONS AND RECOMMENDATIONS		119
6.1	Conclusions.....	119
6.2	Recommendations.....	121

BIBLIOGRAPHY	122
APPENDIX.....	126