



EMAS AMC (Singapore)

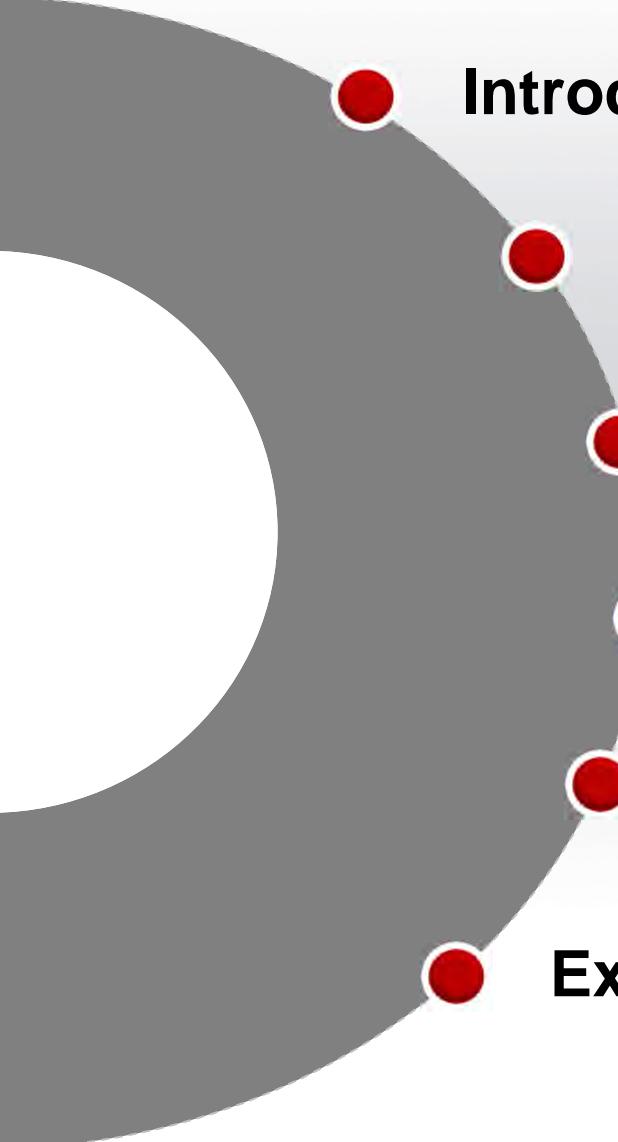
Engineering ‘Lunch & Learn’ Series

Harvesting and Grading of Engineered Rocks at Quarry for Subsea Applications

5th August 2014

WIN – EXECUTE – SAFE DELIVERY

Agenda

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- Introduction**
 - Typical rock extraction operation in an Indonesian Quarry**
 - Rock crushing and grading**
 - Verification of rock grade**
 - Load out and transportation of graded rocks**
 - Examples of application**

Agenda

Introduction

- Typical rock extraction operation in an Indonesian Quarry

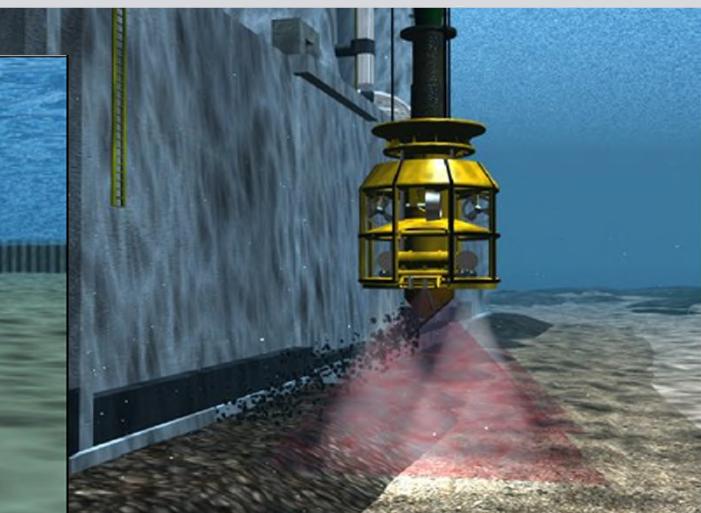
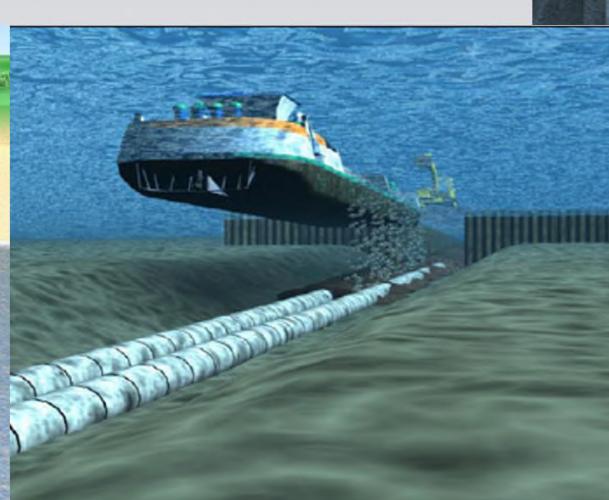
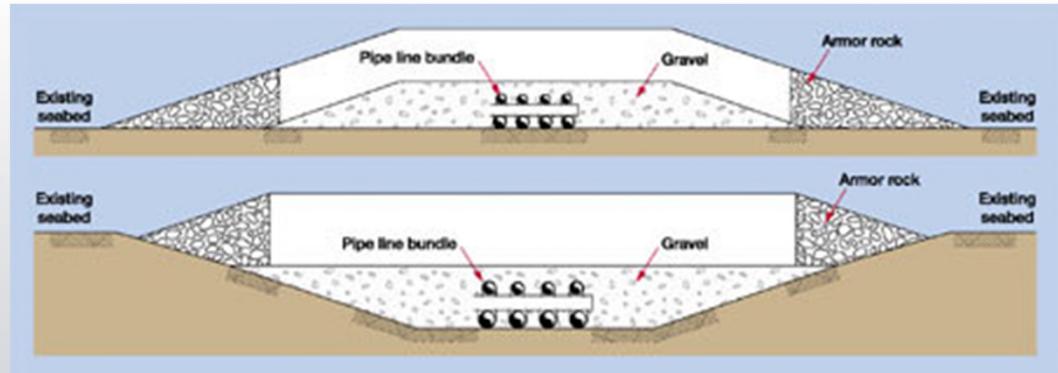
- Rock crushing and grading

- Verification of rock grade

- Load out and transportation of graded rocks

Engineered Rocks – what are these and what are they used for?

Engineered rocks are those conforming to specified grading based on engineering design and used for purpose of pipeline protection and other uses such as shoreline protection, prevention of scouring of offshore structures, etc.



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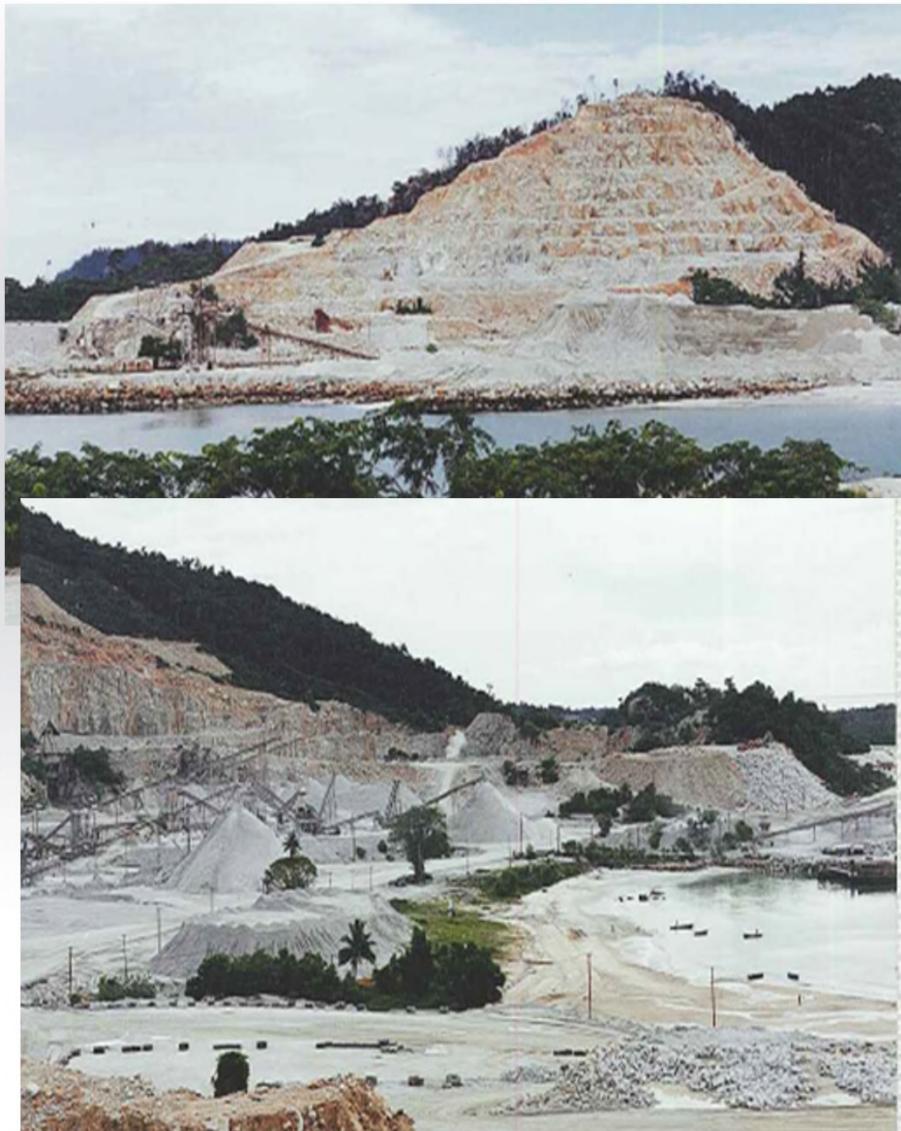
Typical rock extraction operation in an Indonesian Quarry

- Rock crushing and grading

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General View of Typical Indonesian Quarry



Karimun Granite Quarry



General View of Typical Indonesian Quarry (Cont'd)



Extraction of Rocks at Quarry



Systematic Extraction of Rocks at Quarry



Drilling of Holes to Place Explosives



Rock blasting at Quarry (typical)



Loading Extracted Rocks on Heavy Duty Trucks for Transportation to Rock Crushers



Loading Extracted Rocks on Heavy Duty Trucks for Transportation to Rock Crushers (Cont'd)



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Typical rock extraction operation in an
Indonesian Quarry

Rock crushing and grading

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Load out and transportation of graded
rocks

Dumping Extracted Rocks into Rock Crusher



Rock Crusher in Operation



***Above: Dis-used Rock Crusher -
Note its size***

Automated Grading of ‘Smaller Rocks’ and Transfer to Respective Collection Sites by Conveyor Belts



Automated Grading of 'Smaller Rocks' and Transfer to Respective Collection Sites by Conveyor Belts (Cont'd)



'Smaller sized' rocks for 'filter' or 'cushion' layer



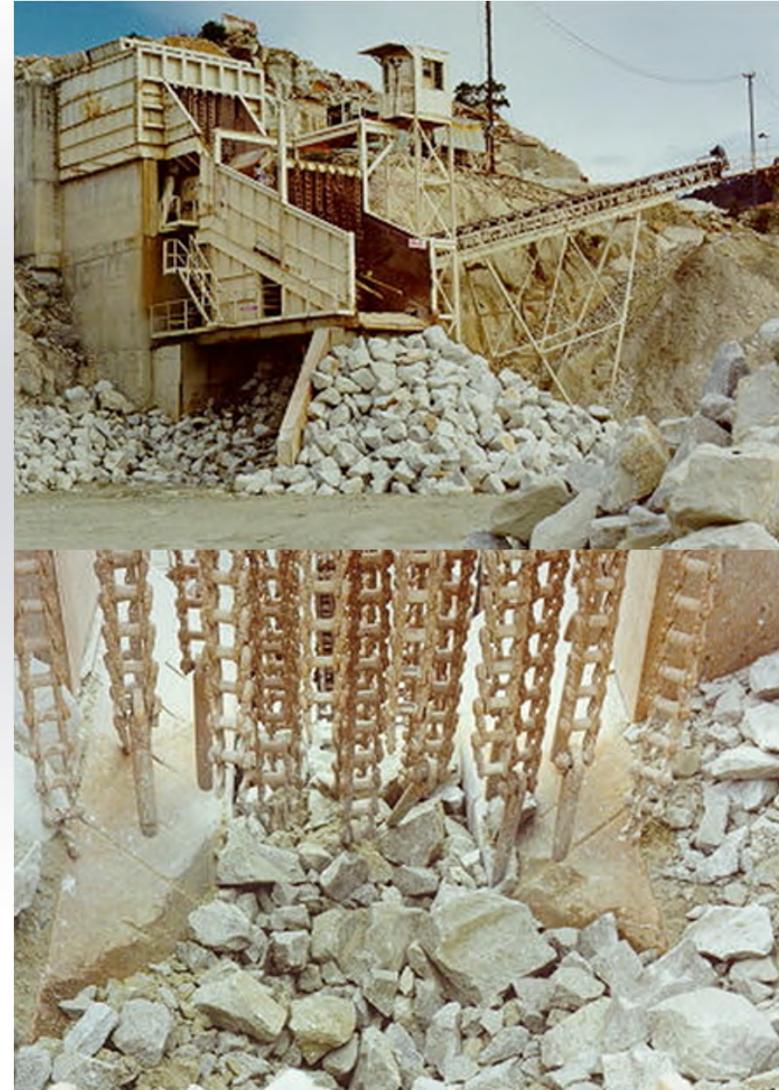
Grading of 'smaller rocks' and subsequent transfer to storage area



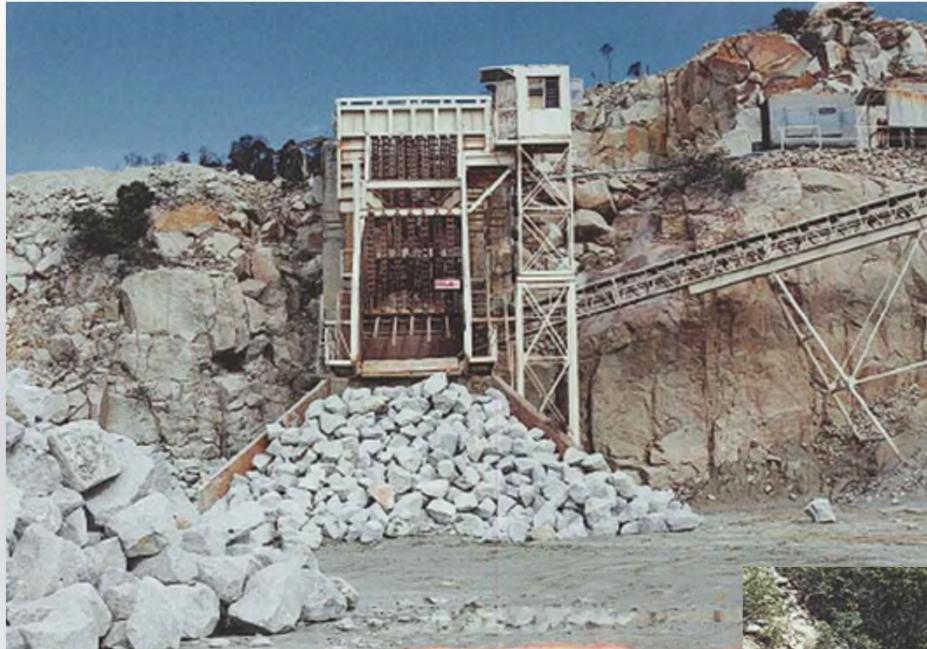
Grading of Armoured Rocks using Quarry's "chain separators" (Quarry's trade secret)



‘Rejected’ Rocks are thrown forward and ‘accepted’ rocks are thrown sideway



Collecting & Transporting Armoured-layer Rocks To Storage Site



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Typical rock extraction operation in an Indonesian Quarry

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Collecting Sample of Cushion Layer Rocks for Grading Check



Manual Grading of Cushion Layer Rocks for Grading Verification



Manual Grading of Cushion Layer Rocks for Grading Verification (Different production batch)



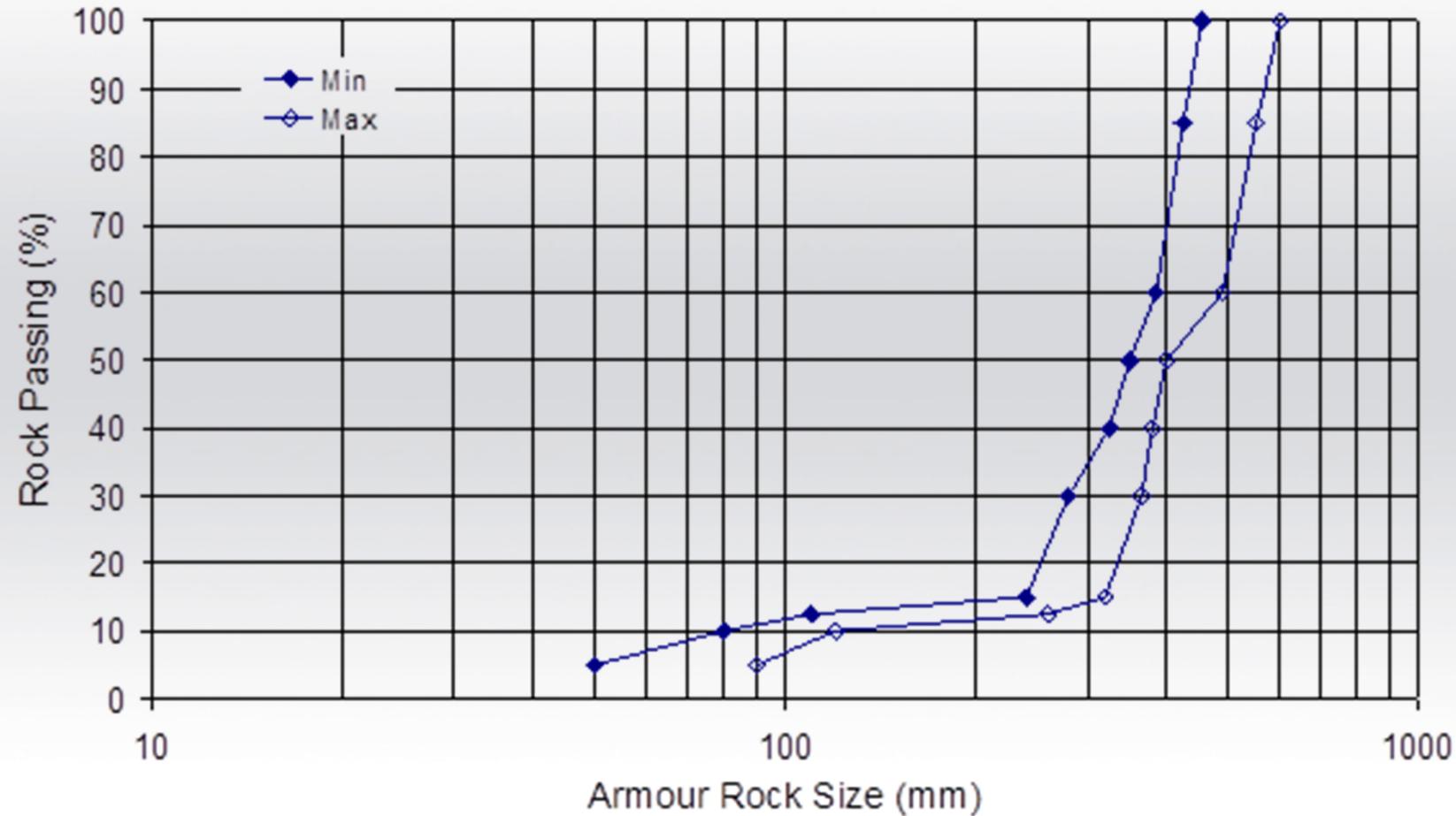
Manual Grading of Cushion Layer Rocks for Grading Verification (Cont'd)



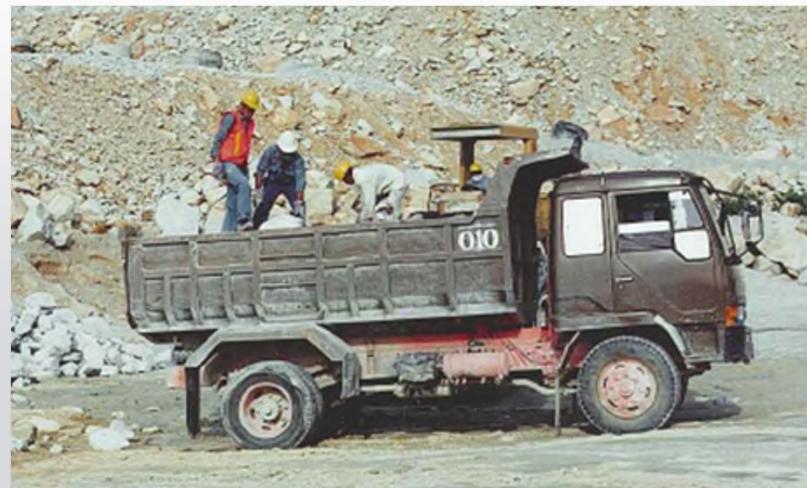
Manual Grading of Armoured Layer Rocks for Grading Verification



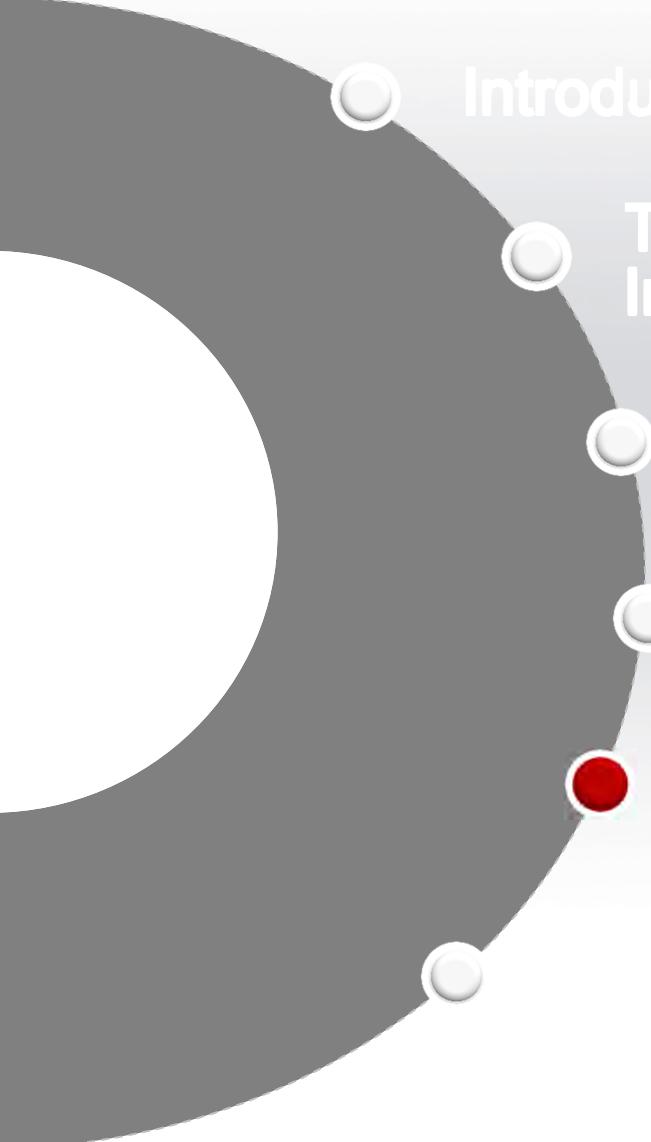
Sample Rock Grading Curve



Bulk Density Test for Armour Rocks



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 - **Load out and transportation of graded rocks**

Loading of Rocks onto Material Barge at Karimun Quarry



Loading of Rocks on Material Barge at Karimun Quarry (Cont'd)



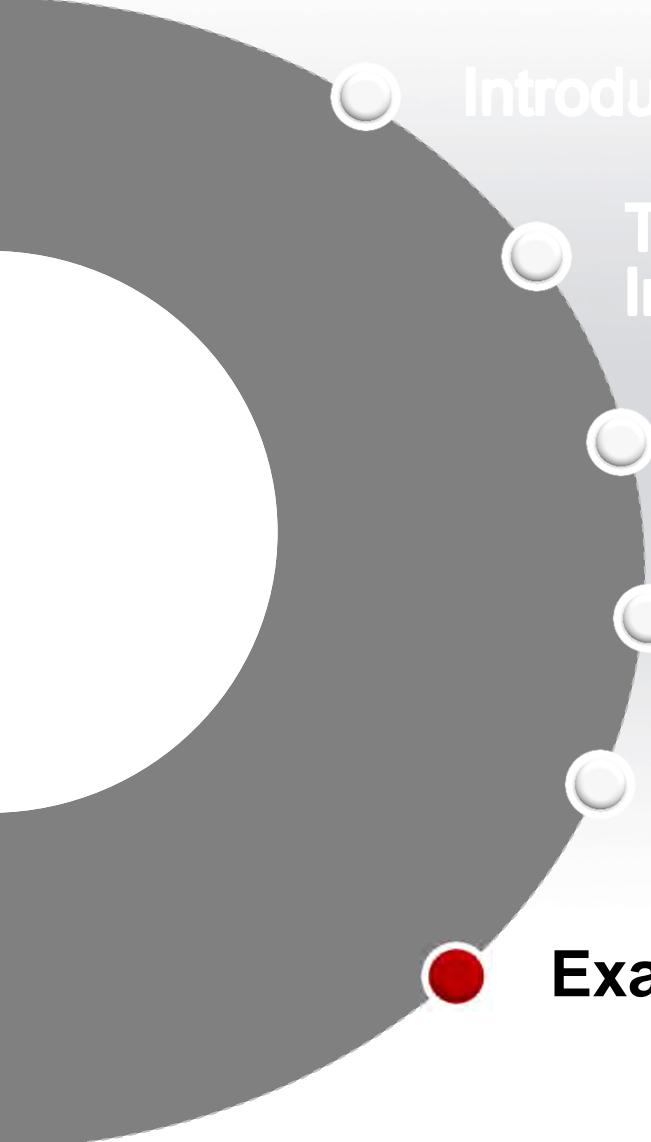
Loading of Rocks on Material Barge at Karimun Quarry (Cont'd)



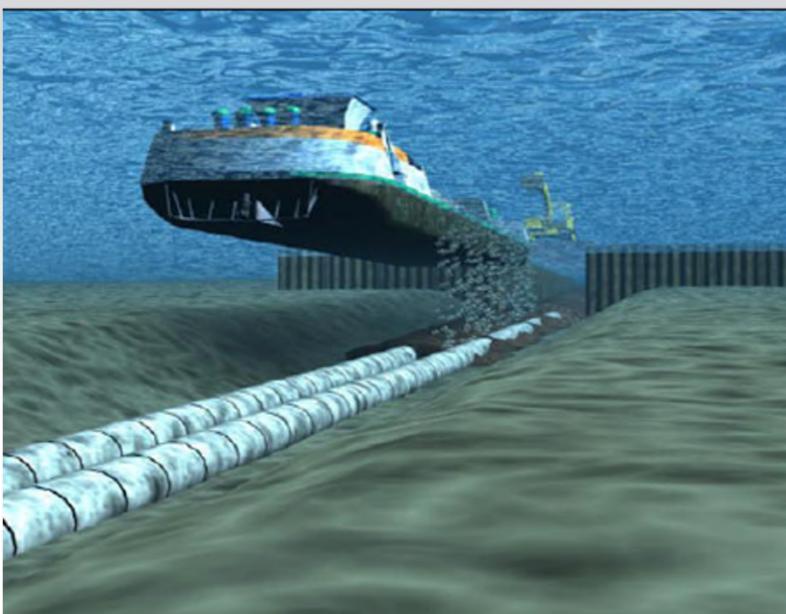
Loading of Rocks on Material Barge at Karimun Quarry (Cont'd)



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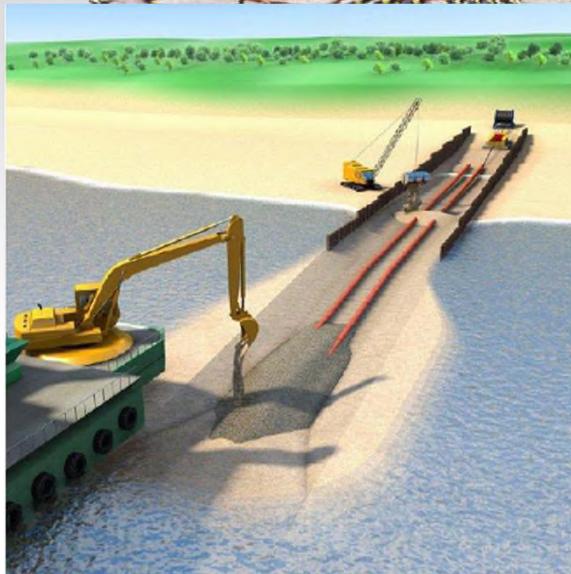
Transfer of Rock from Quarry to Offshore Storage Site, then to Rock Dumping Vessel, and finally, Rock Dumping Operation



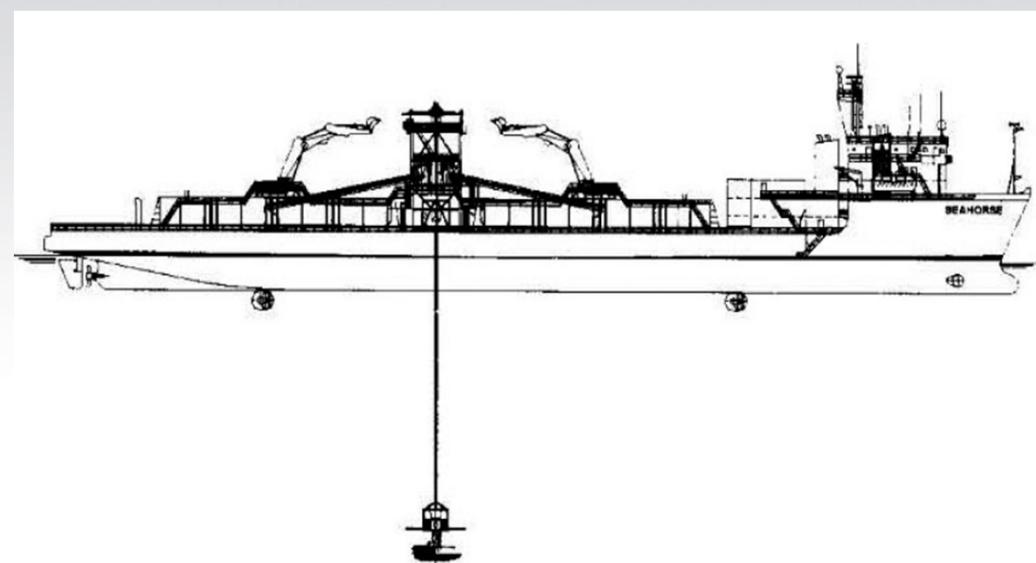
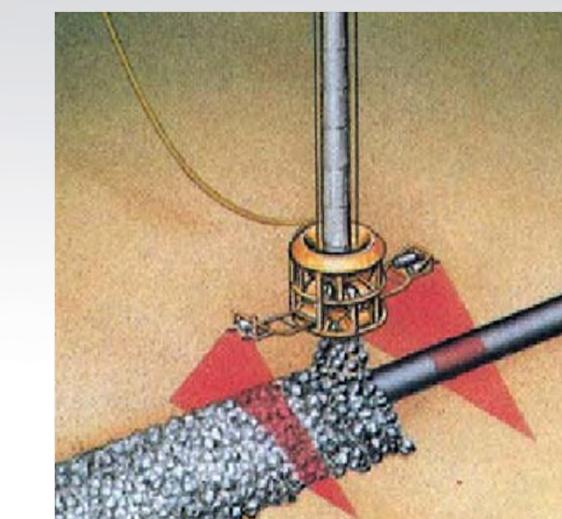
Rock dumping by side stone dumping vessel



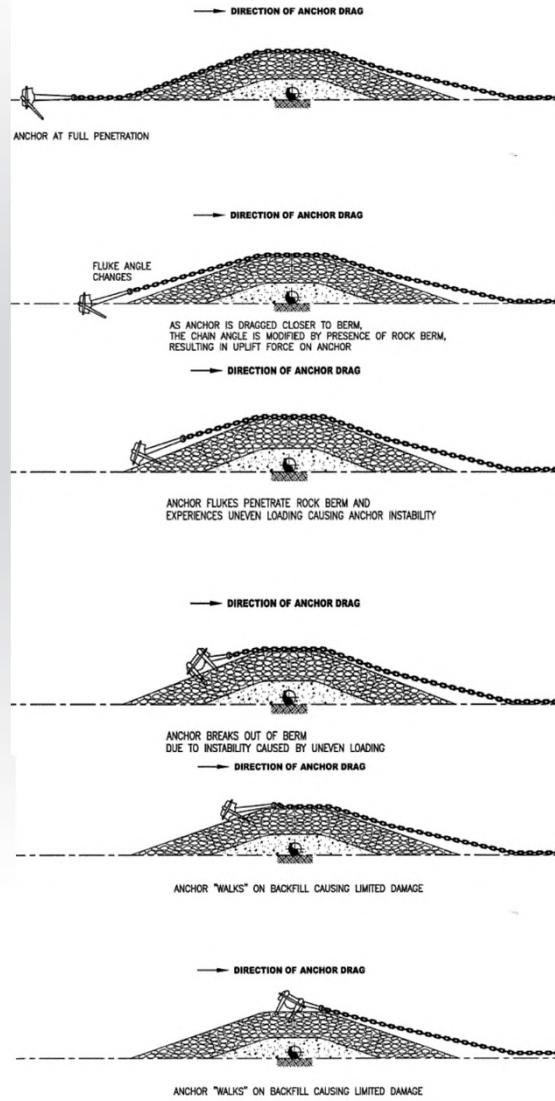
Where Rock Dumping by Specialised Rock-dumping Vessel is not possible (e.g. due to depth), Rock Duming by Conventional Grab Dredger is Used



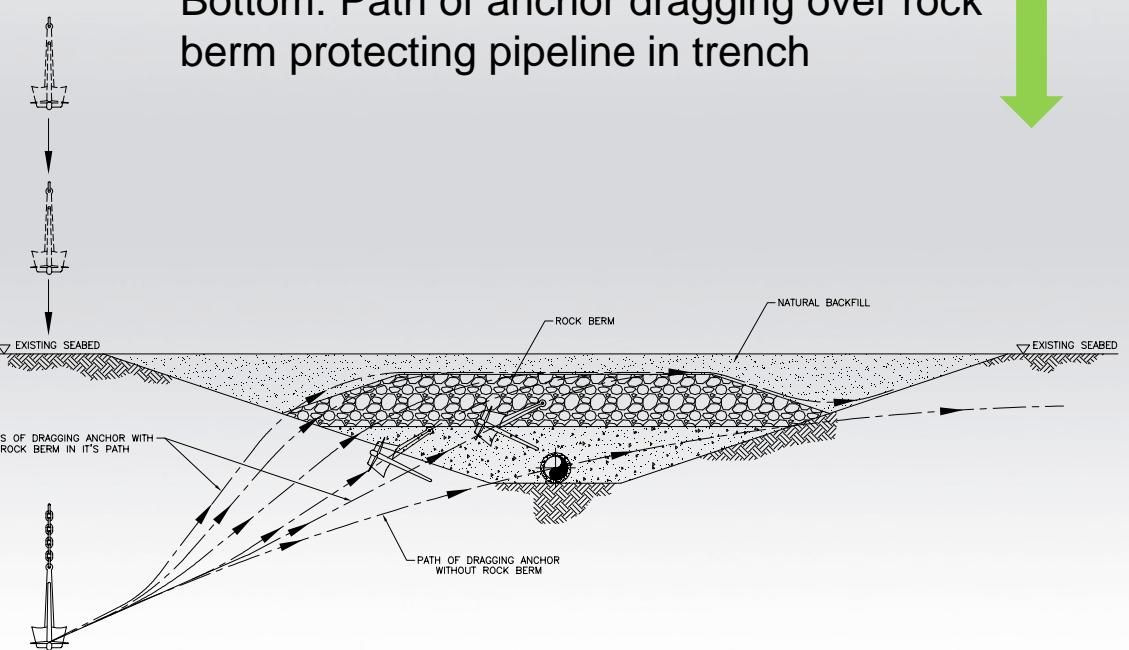
Rock Dumping by Specialised Fall Pipe Vessel (e.g. for pipeline/cable/ structure stabilization, scour protection, seabed preparation, span correction, impact protection, etc.)



Illustrations on how rock berm protects pipeline from dragging anchors (and others, e.g. trawlboards, etc)



Left: Path of anchor dragging over rock berm protecting pipeline on flat seabed





Thank You!

QUESTIONS ???

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