



# **EMAS AMC (Singapore)**

## **Engineering 'Lunch & Learn' Series**

### **Harvesting and Grading of Engineered Rocks at Quarry for Subsea Applications**

**5<sup>th</sup> August 2014**

***WIN – EXECUTE – SAFE DELIVERY***



*Together We Deliver*

# 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**

**Examples of application**

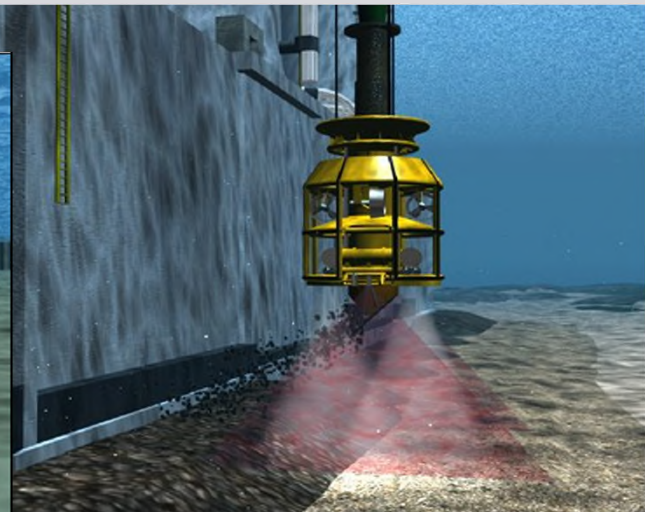
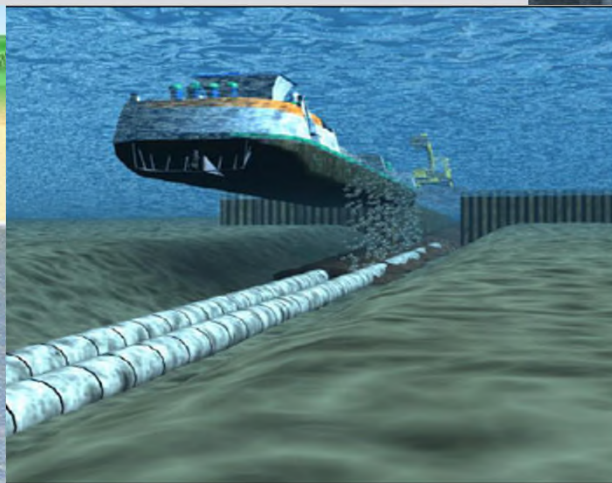
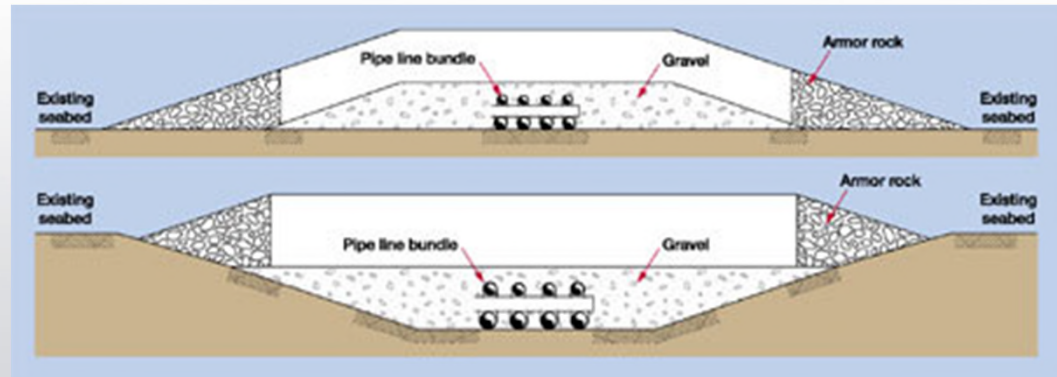
# Agenda

## 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.



# Agenda

○ Introduction

**● Typical rock extraction operation in an Indonesian Quarry**

○ Rock crushing and grading

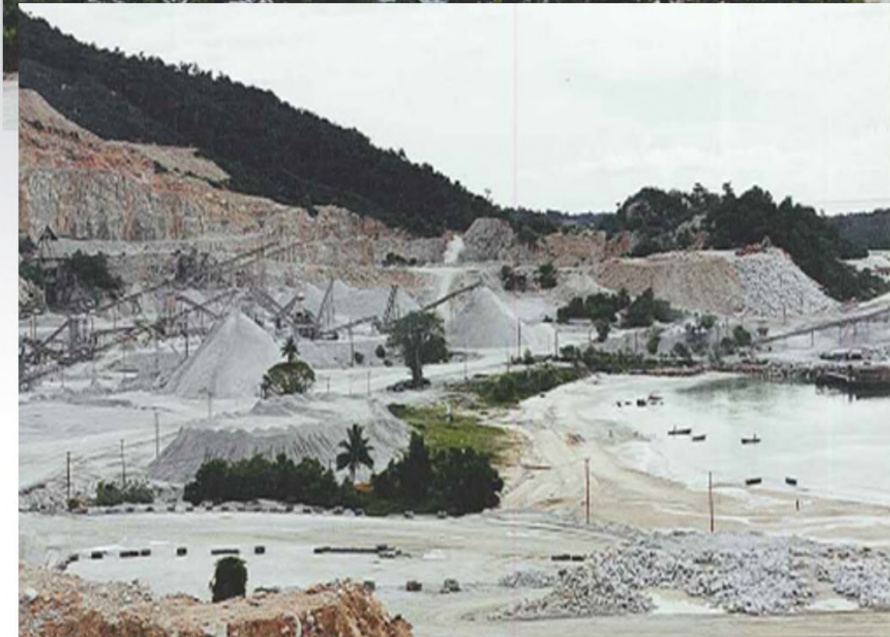
○ Verification of rock grade

○ Load out and transportation of graded rocks

# General View of Typical Indonesian Quarry



Karimun Granite Quarry



# General View of Typical Indonesian Quarry (Cont'd)



# Extraction of Rocks at Quarry

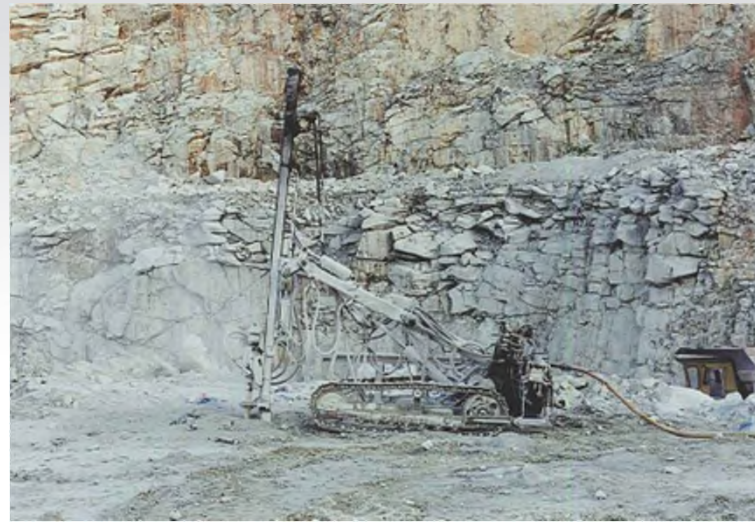




# Systematic Extraction of Rocks at Quarry



# 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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# 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



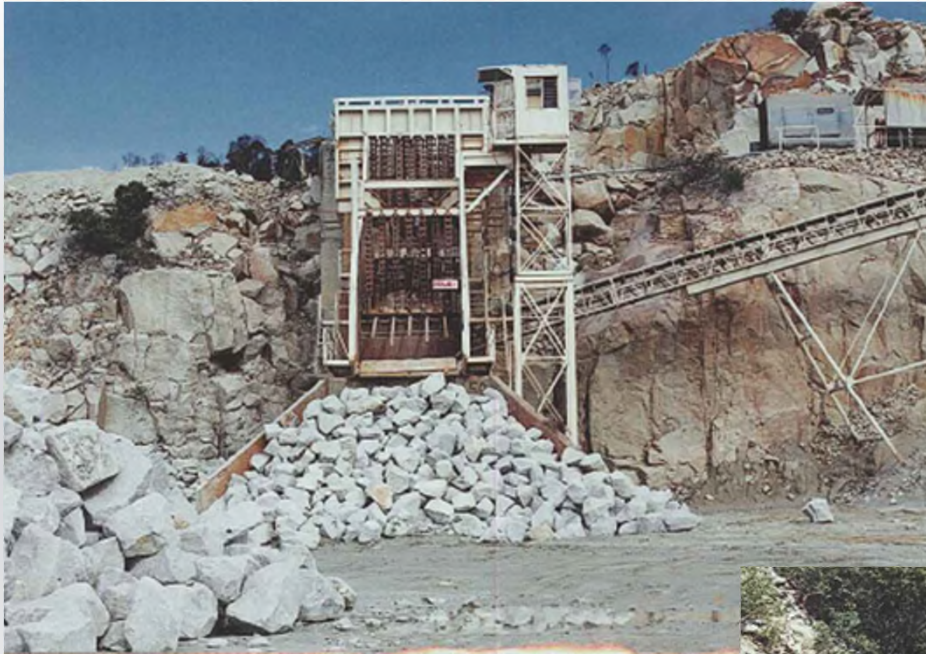
# Grading of Armoured Rocks using Quarry's "chain separators" (Quarry's trade secret)



# 'Rejected' Rocks are thrown forward and 'accepted' rocks are thrown sideways



# Collecting & Transporting Armoured-layer Rocks To Storage Site



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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)



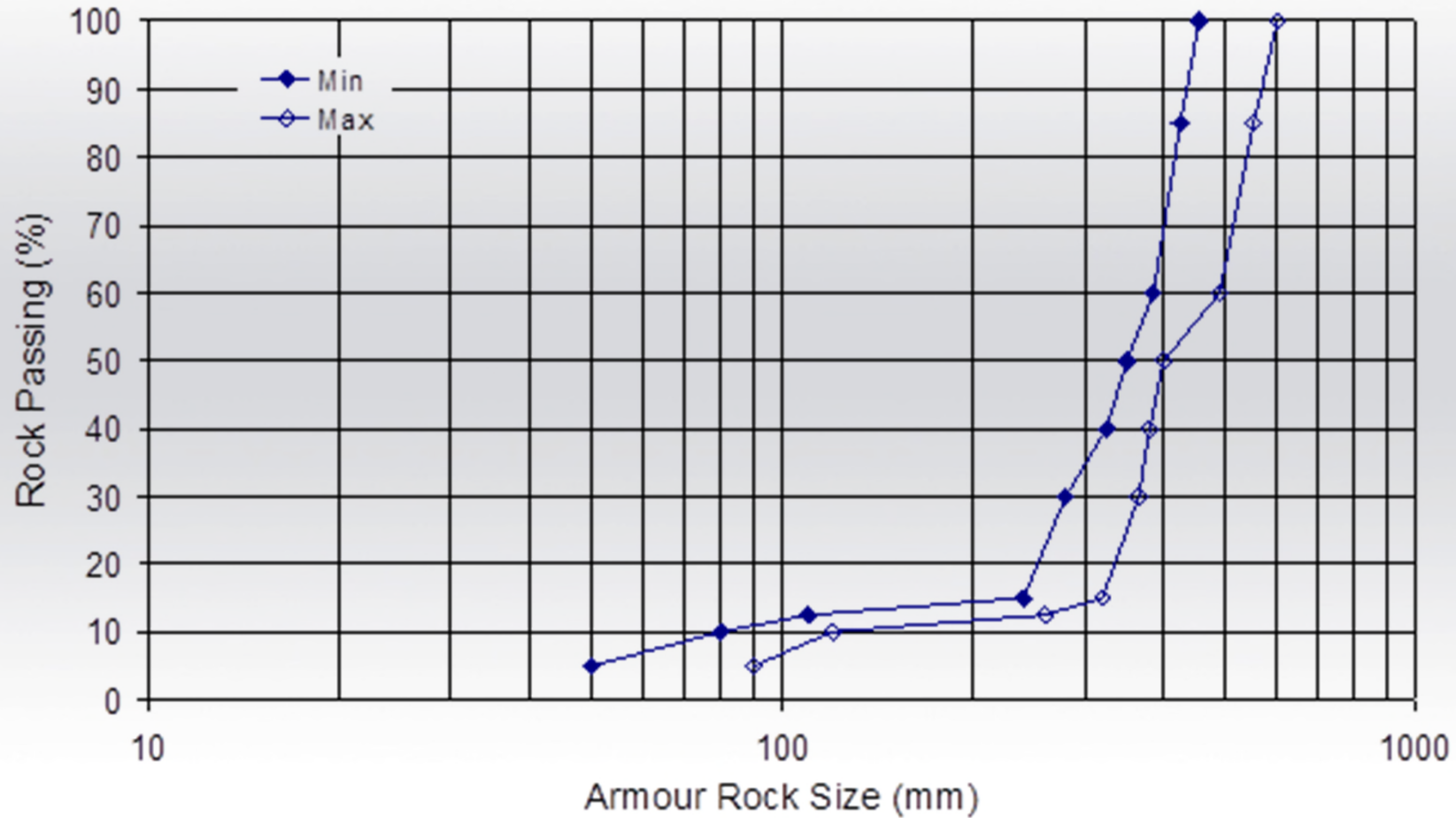
# Manual Grading of Cushion Layer Rocks for Grading Verification (Cont'd)



# Manual Grading of Armoured Layer Rocks for Grading Verification



# Sample Rock Grading Curve



# Bulk Density Test for Armour Rocks



# Agenda

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○ Rock crushing and grading

○ Verification of rock grade

● **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)



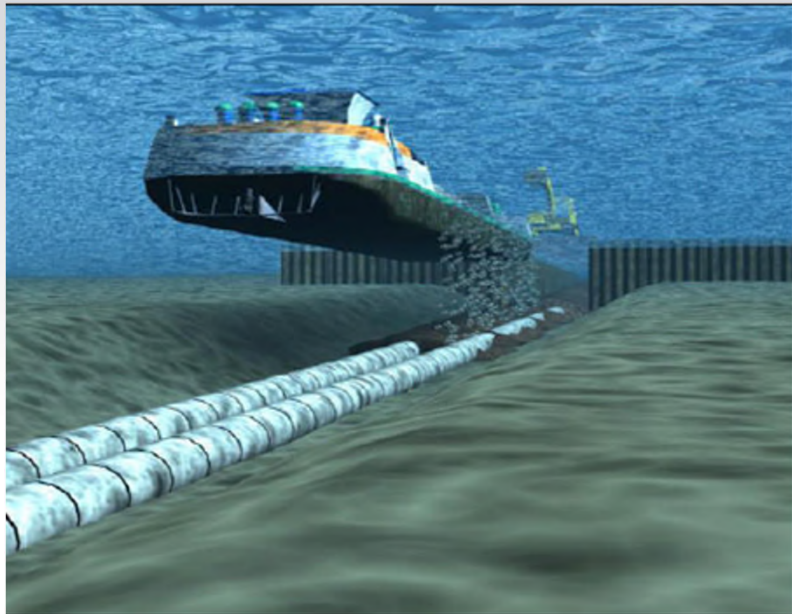
# Loading of Rocks on Material Barge at Karimun Quarry (Cont'd)



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- Typical rock extraction operation in an Indonesian Quarry
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- Load out and transportation of graded rocks
- **Examples of application**

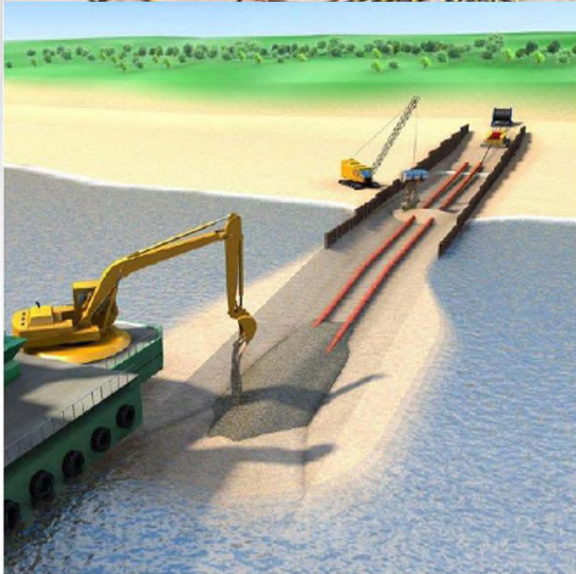
# Transfer of Rock from Quarry to Offshore Storage Site, then to Rock Dumping Vessel, and finally, Rock Dumping Operation



# Rock dumping by side stone dumping vessel

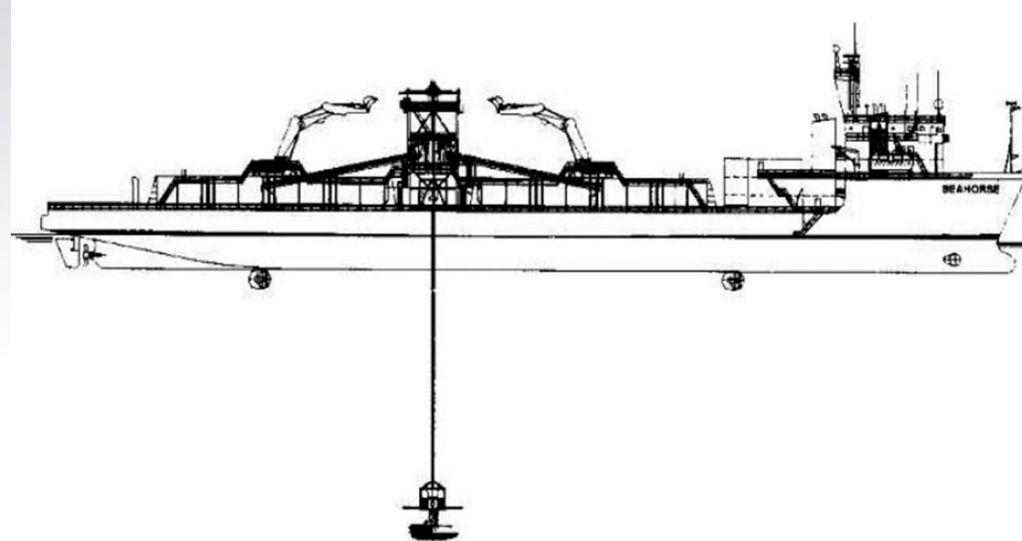
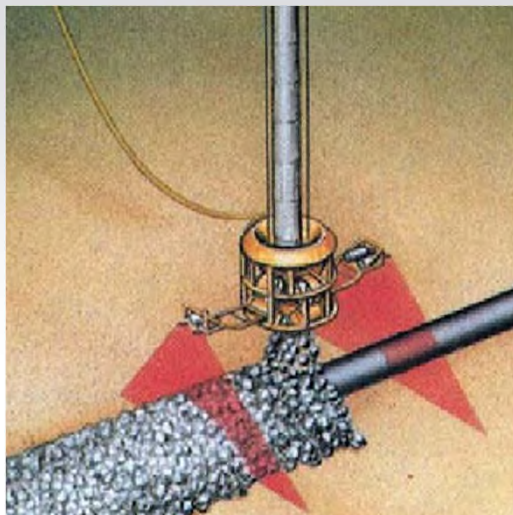
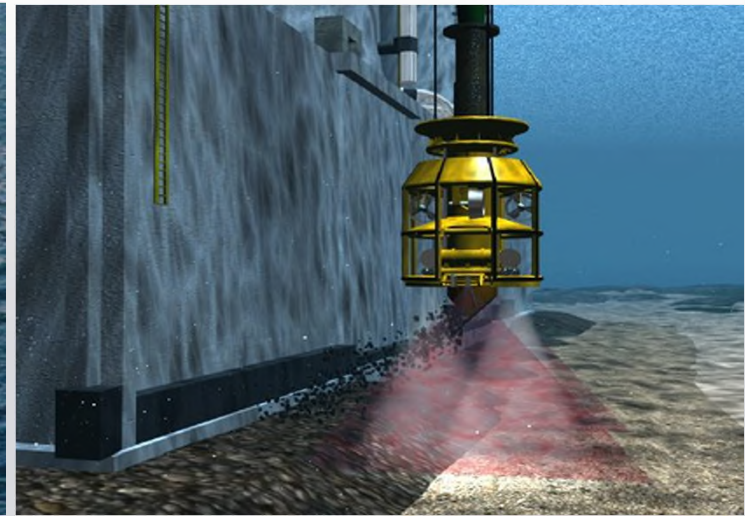


# Where Rock Dumping by Specialised Rock-dumping Vessel is not possible (e.g. due to depth), Rock Dumping by Conventional Grab Dredger is Used

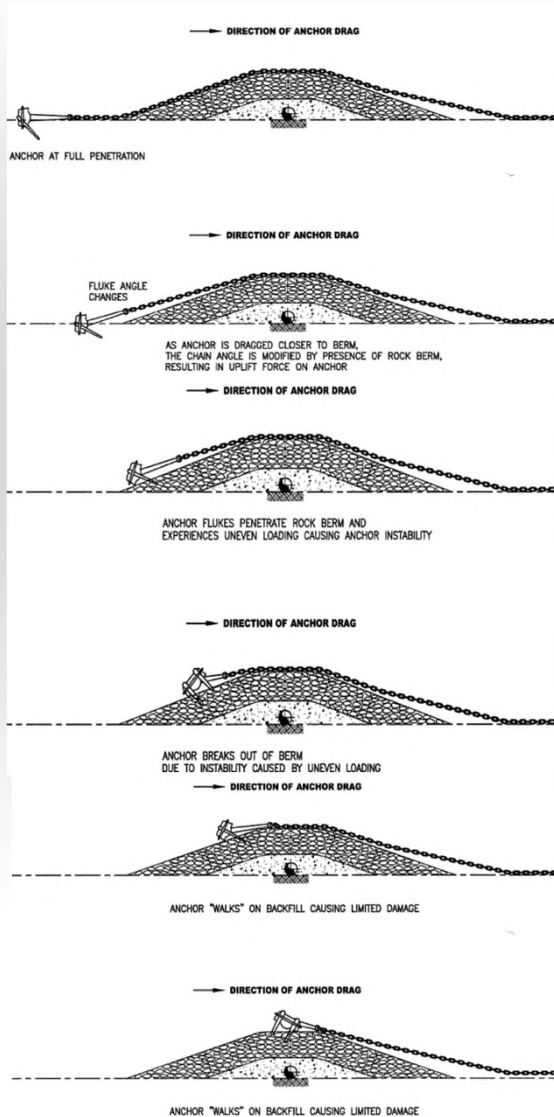




# Rock Dumping by Specialised Fall Pipe Vessel (e.g. for pipeline/cable/ structure stabilization, scour protection, seabed preparation, span correction, impact protection, etc.)

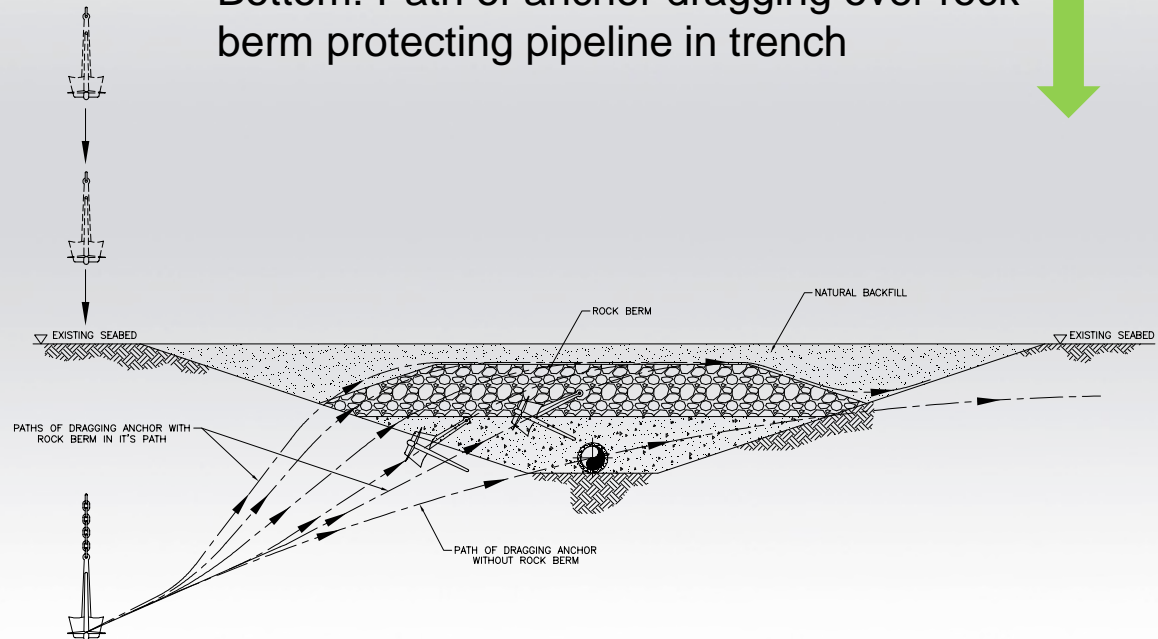


# Illustrations on how rock berm protects pipeline from dragging anchors (and others, e.g. trawlboards, etc)



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

Bottom: Path of anchor dragging over rock berm protecting pipeline in trench





# Thank You!

## QUESTIONS ???

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