

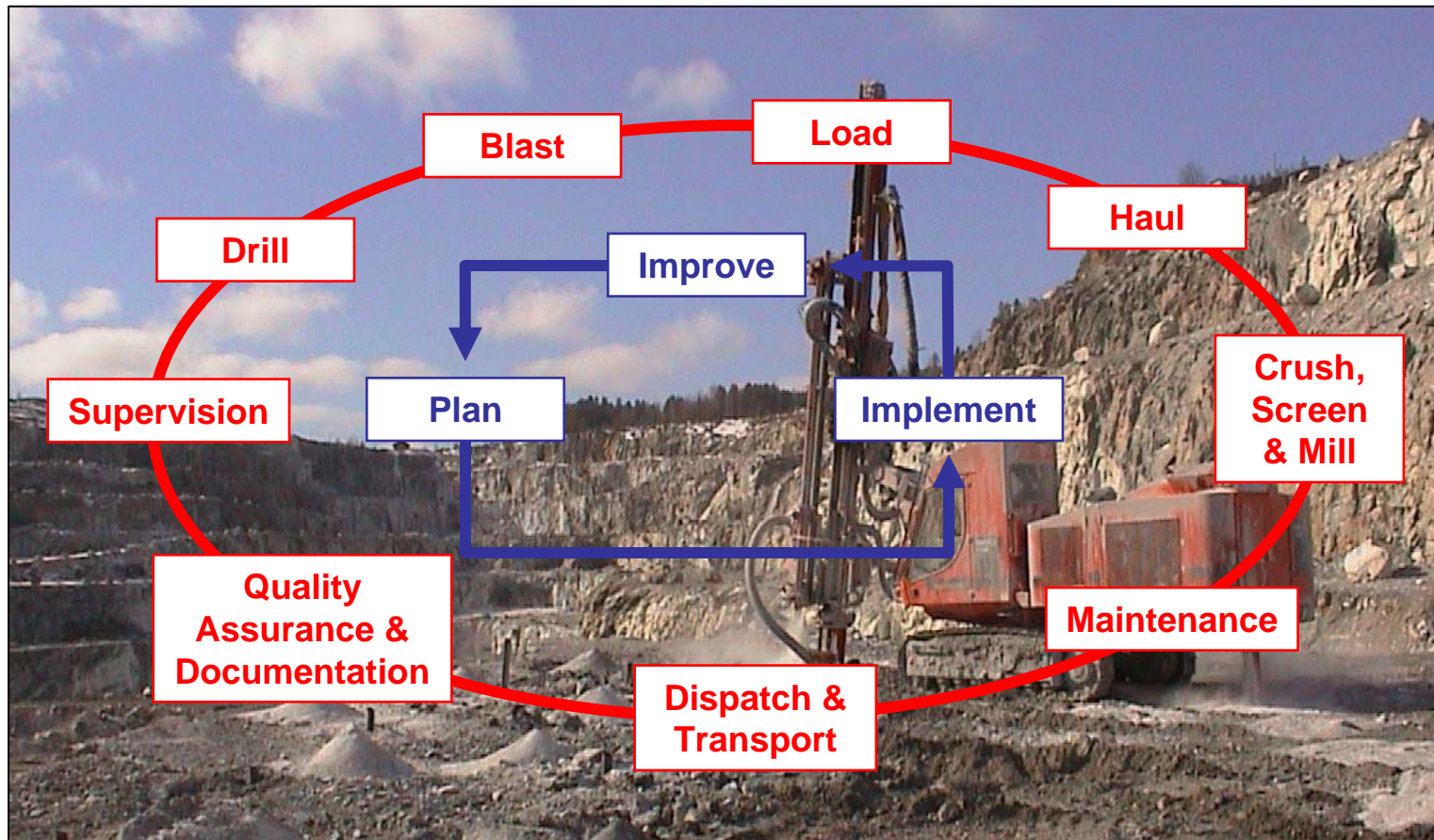
The Quarry Academy™



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The Quarry Academy™

Team Mission: Optimise Aggregate Production Operations



The Quarry Academy™

The Quarrying Process

Quarry Management

Geologic Considerations in Quarrying

Blast Management

Fines and Boulder Management

Drilling Management

Load and Haul Management

Fleet Management

Crushing and Screening Management



The Quarrying Process

Rock aggregate producers for the construction industry *

- Small Quarries** - periodically opened - typically for the summer months for local road and railway construction
- Medium Sized Quarries** - with year round production
- Super Quarries** - for rock aggregate shipments to metropolitan areas
- Rockfill Dam Quarries** - for hydro power and irrigation projects

* main competitors are sand and gravel producers

Mineral producers for the processing industry

- Limestone/Dolomite** - extraction for cement, ceramics, paper, plastic and fertilizer
- Industrial Minerals** - extraction of quartz, feldspars, talc, graphite, apatite, etc. as raw materials for processing industries

The Quarry Process

Typical aggregate end-products



Fractions (mm)	Usage
0 - 0.063	Filler - Paper, plastic, ceramics, ... but mainly waste
1 - 2	Tar paper for roofing
2 - 4	Sand - Concrete, mortar, asphalt, ceramic plates, road construction
0 - 8	Playgrounds, home and garden aggregates
8 - 11 *	Road construction - wearing and base courses
16 - 22 *	Road construction - sub-base layer
0 - 32 *	Road construction - roadbase layer
0 - 64 *	Railway ballast
> 64	Rockfill dams
> 1000	Rip-rap and crown cap for rockfill dams, armourstone for dykes and harbours

* fraction specifications subject to national or regional regulations

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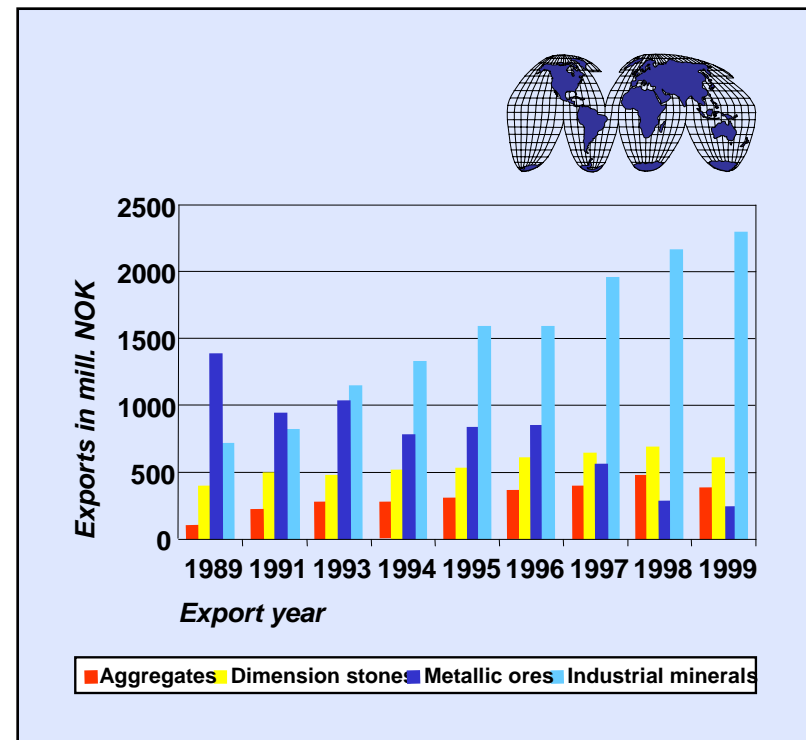
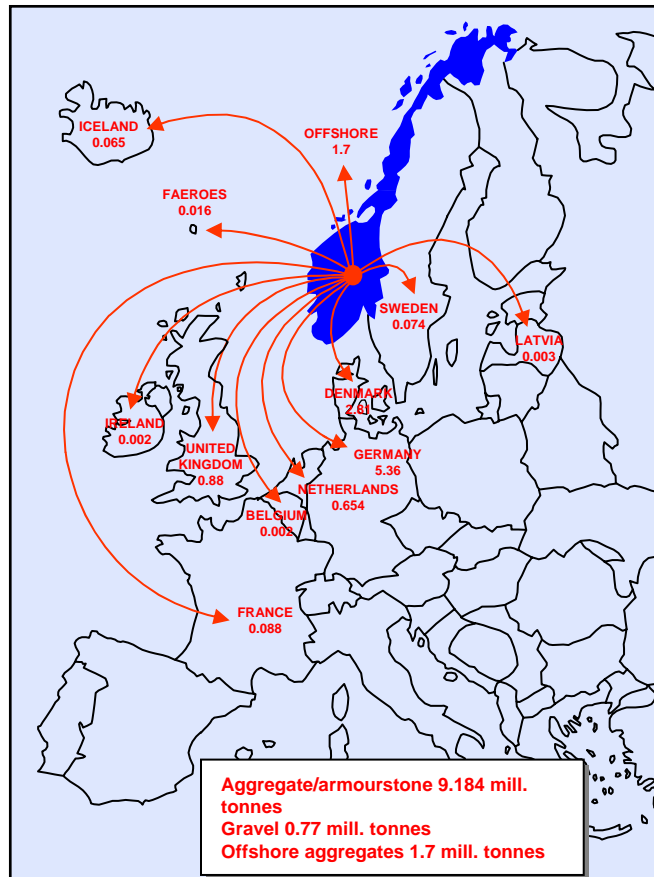
World producers of aggregates and ready-mixed concrete

Aggregates <i>(million tonnes, 1998)</i>		Ready-mixed concrete <i>(million m³, 1998)</i>	
<i>Hanson / Pioneer</i>	216	<i>RMC</i>	47.0
<i>Lafarge</i>	178	<i>Hanson / Pioneer</i>	31.3
<i>Vulcan</i>	162	<i>Lafarge</i>	30.9
<i>Martin Marietta</i>	132	<i>Heidelberger</i>	22.2
<i>RMC</i>	114	<i>Holderbank</i>	20.8
<i>CRH</i>	91	<i>Italcementi</i>	15.5
<i>Tarmac</i>	90	<i>Cemex</i>	14.3
<i>Holderbank</i>	84	<i>CSR</i>	10.9
<i>Aggregates Ind.</i>	49	<i>Tarmac</i>	7.0
<i>Italcementi</i>	48	<i>CRH</i>	7.0

Source: Hanson / Warburg Dillion Reed

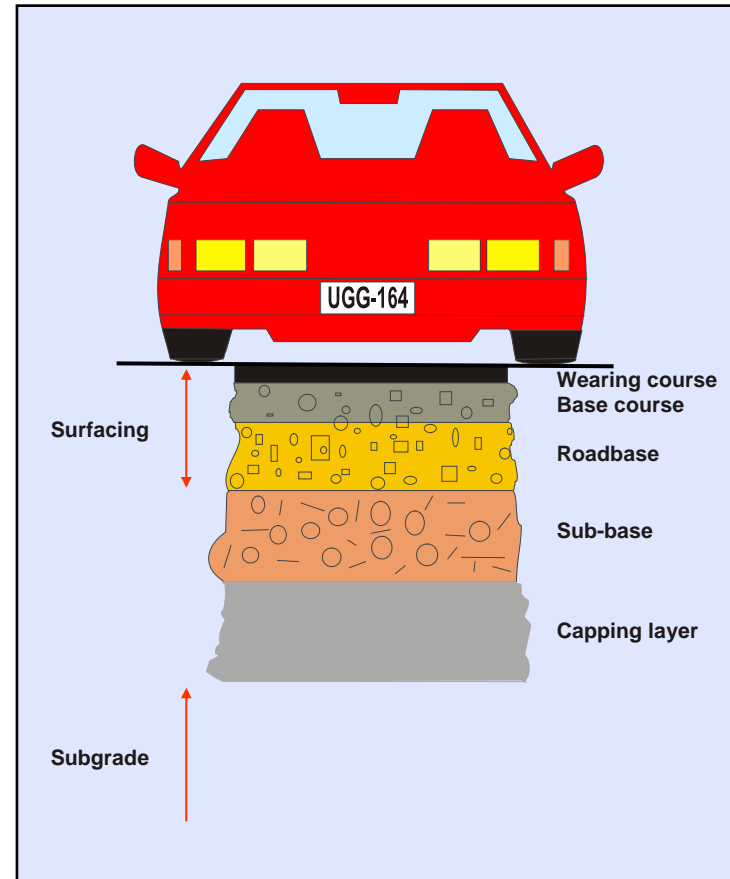
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Norwegian exports of rock products



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Highway construction blasting and aggregate usage



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Rockfill dam construction

