

Quarry design considerations for dimension stone

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Over-arching objective

- Safe, efficient and profitable extraction of the maximum usable material from the available land

whilst causing

- the minimum of environmental and social disturbance

and resulting in

- beneficial final restoration and land-uses and public acceptance

Sustainability

★ SOCIAL
LICENCE TO
OPERATE
("triple bottom
line" or
"win-win-win")

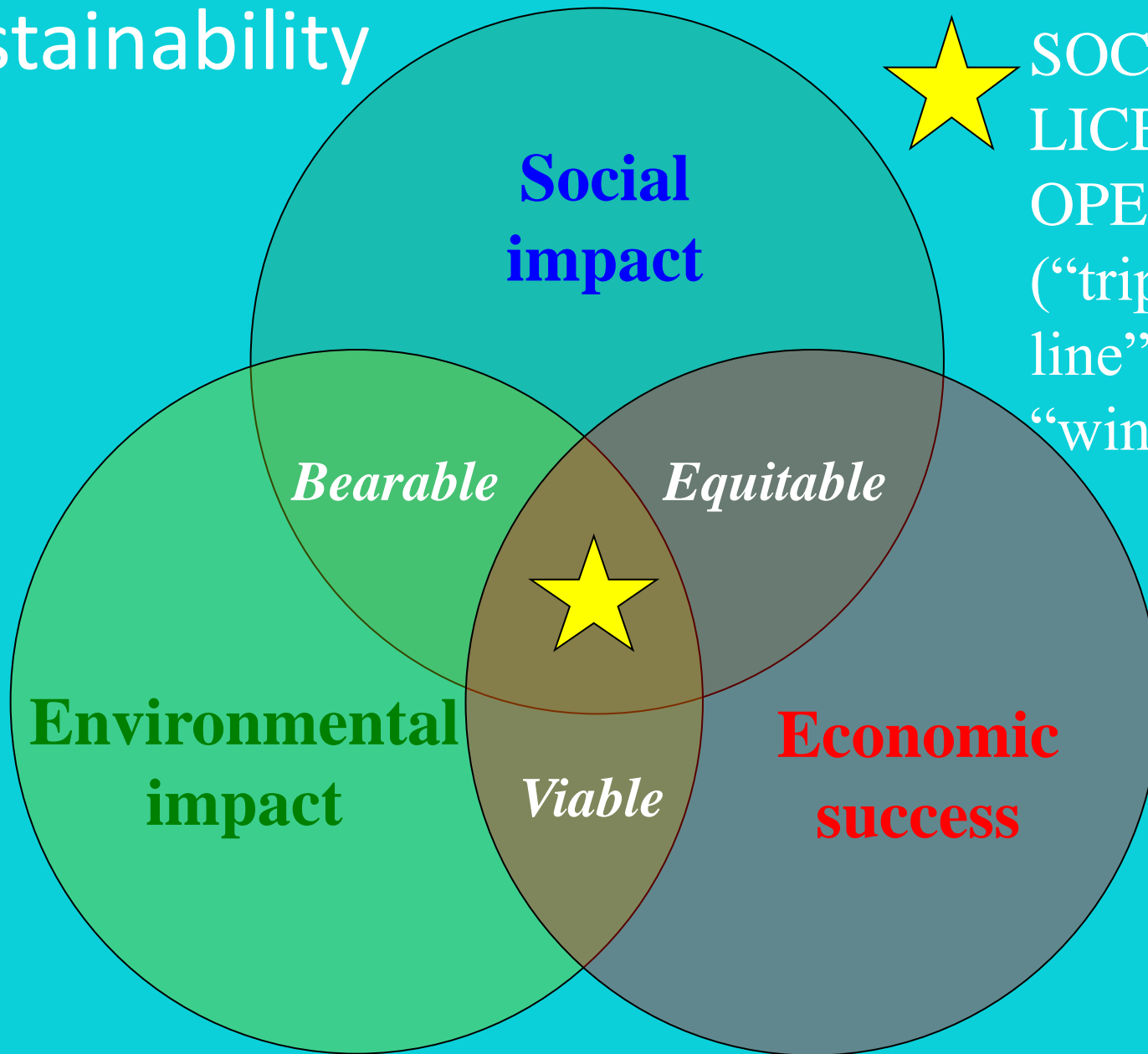


Diagram after Adams, W. M. (2006). "The Future of Sustainability: Re-thinking Environment and Development in the 21st Century". Report of the IUCN Renowned Thinkers Meeting, 29-31 January 2006

Meeting the objective key issues:

- MEETING THE COMMERCIAL OBJECTIVES OF THE PROJECT
- ENSURING SAFETY AND OPERATIONAL EFFICIENCY
- MINIMISING UNACCEPTABLE ENVIRONMENTAL (AND SOCIAL) IMPACT



COMMERCIAL OBJECTIVES

Quarry designs must be **capable of being costed** and their **viability and commercial attractiveness assessed and optimised** as part of business planning, monitoring and management.

HOW?

- **Design** that incorporates financial risk-benefit assessment, allowing for sensitivity analysis relating to design assumptions and preparation of operational and business plans
- **Operation** in accordance with a business plan with all appropriate monitoring of financial and other KPIs

WHO?

Production, Financial, Commercial, Procurement managers/directors; Quarry Manager

SAFETY & OPERATIONAL EFFICIENCY

A quarry design must be capable of being **practically implemented**, with **inherently safe and secure operations and structures** (including after closure).

WHO?

Geotechnical Specialist; Quarry Manager; Safety Officer; Face workers

HOW?

- **Design** that delivers compliance with appropriate regulations and best practice and is based on adequate reliable information and analysis.
- **Operation** in accordance with the quarry design (detailed operational plans) and compliant with all applicable laws and regulations



ENVIRONMENTAL IMPACT

A quarry should cause the **minimum of environmental harm** throughout its operational life and on closure, and aim to deliver **effective environmental management and compliance** at operational stage, and environmentally sustainable final restoration and after-use schemes.

HOW?

- **Design** that includes **environmental assessment** as an integral activity, incorporating compliance with appropriate regulations, legislation and best practice.
- **Operation** in accordance with all applicable permits, licences, regulations and legislation

WHO?

Environmental and Planning Specialists; Estates Managers; Quarry Manager;

Making it happen: 'Departmental' approach

**BRINGING IT TOGETHER
QUARRY DESIGN**

INSTRUCTIONS - REPORTING

**COMMERCIAL
OBJECTIVES**

**SAFETY /
OPERATIONAL
EFFICIENCY**

**ENVIRONMENTAL
IMPACT**

Making it happen: 'Holistic' approach

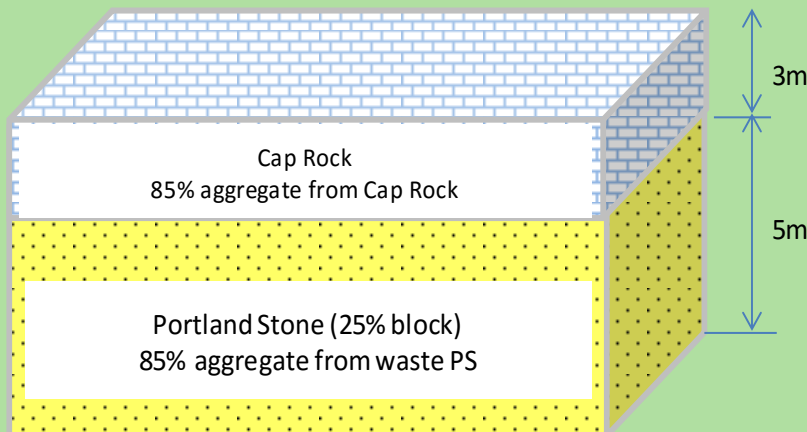


DS quarry waste - specific challenges

- Very low yield of block stone from the rock mass

	Full thickness	Total waste rock		Block		Aggregate from waste		Residual waste	
		% of full thickness	Effective thickness (m)	% of full thickness	Effective thickness (m)	% of full thickness	Effective thickness (m)	% of full thickness	Effective thickness (m)
Cap rock	3	100.0%	3.00			85.0%	2.55	15.0%	0.45
Dimension stone	5	75.0%	3.75	25.0%	1.25	63.8%	3.19	11.3%	0.56
Totals	8		6.75		1.25		5.74		1.01
		8				6.75			

84%



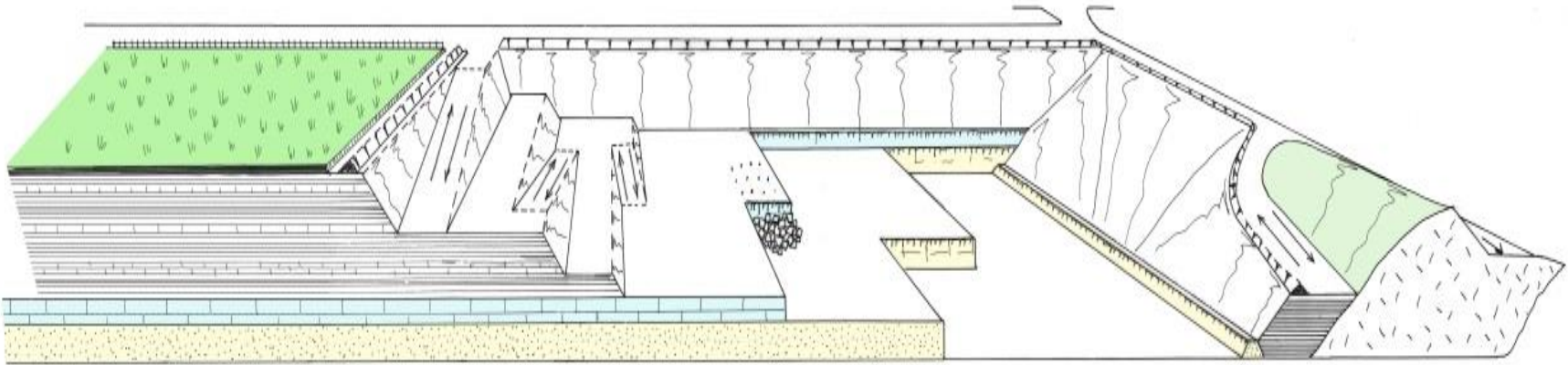
Aggregate yield per hectare	57,375 m ³
	149,175 tonnes
Block yield per hectare	12,500 m ³
	3.13 years
Aggregate tonnes per year	47,736 tonnes

82%

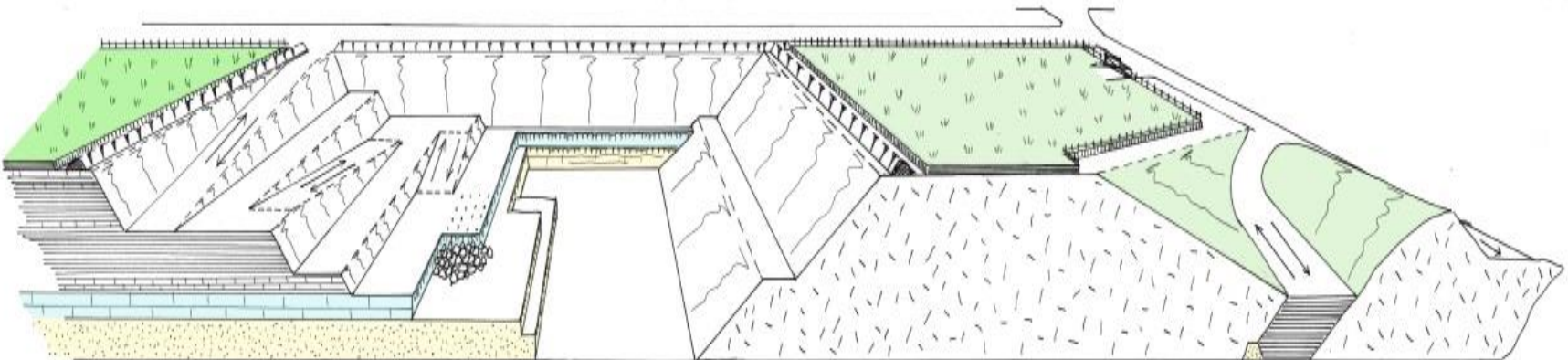
18%

DS quarry waste - specific challenges

- Difficulty of modelling quality variation and making reliable contingency allowances for waste
- Accommodation of waste on site in secure and environmentally acceptable structures or cost or practicability of removal from site
- Bulkage of waste and need to maintain an adequate working void



Creation of an adequate working void may require taking waste offsite (cost/practicality)



When the void is large enough to accommodate backfill, bulkage must be taken into account in planning if operation is not to become 'muck bound'



DS quarry waste – opportunities and threats

- Dimension stone waste may be suitable for sale as an aggregate or general fill
- Secondary commercial objective – sometimes difficult to accommodate within the overall business plan
- Higher than expected aggregate sales can compromise restoration objectives (too little fill remains on site)
- Slump in aggregate sales can compromise access to DS because more waste must be accommodated on site and/or increase operating costs



THANK YOU FOR YOUR ATTENTION

For further information, please contact me via

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Download a free copy of the Quarry Design
Handbook at

www.gwp.uk.com/qdeshbook.html