CARMEUSE

MINING EXPERTISE
IMPACTING EVERYDAY LIFE

AGENDA

- Who is the Carmeuse Group ?
- Carmeuse Mining Expertise
- Q & A

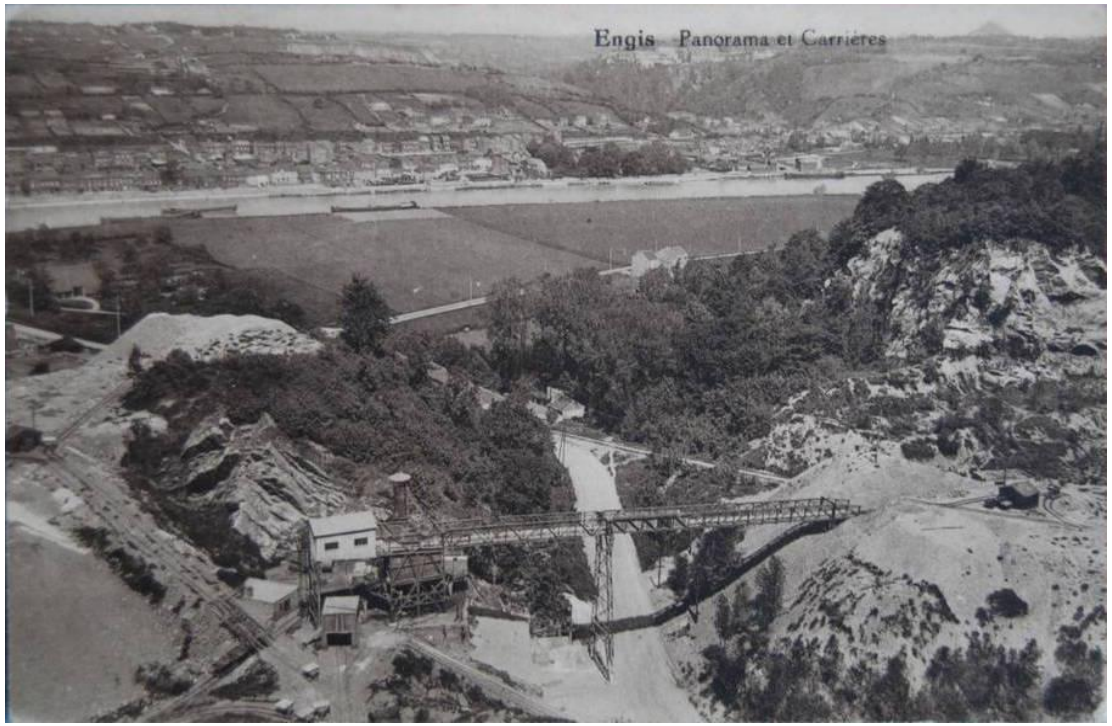
Who is Carmeuse ?

OUR HISTORY

1860

The history begins with Léon Collinet in 1860, near the "Meuse" in Belgium, in a place famous for its pure limestone.

OUR HISTORY

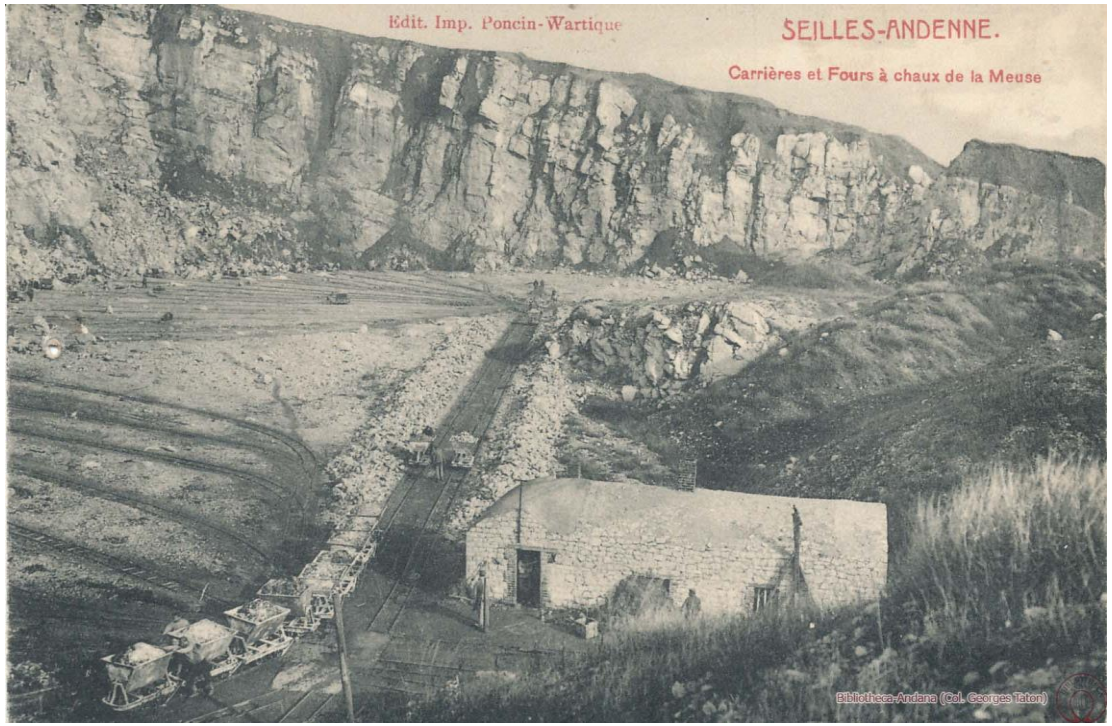


1880

3 sites in operation in Belgium, including Moha and Engis (still active today).
More diversified production (lime, chemical stone, and dimension stone).

1860 1880

OUR HISTORY



1900

6 sites in operation in Belgium.
150 kT of lime/year.
1st exports.

1860 — 1900

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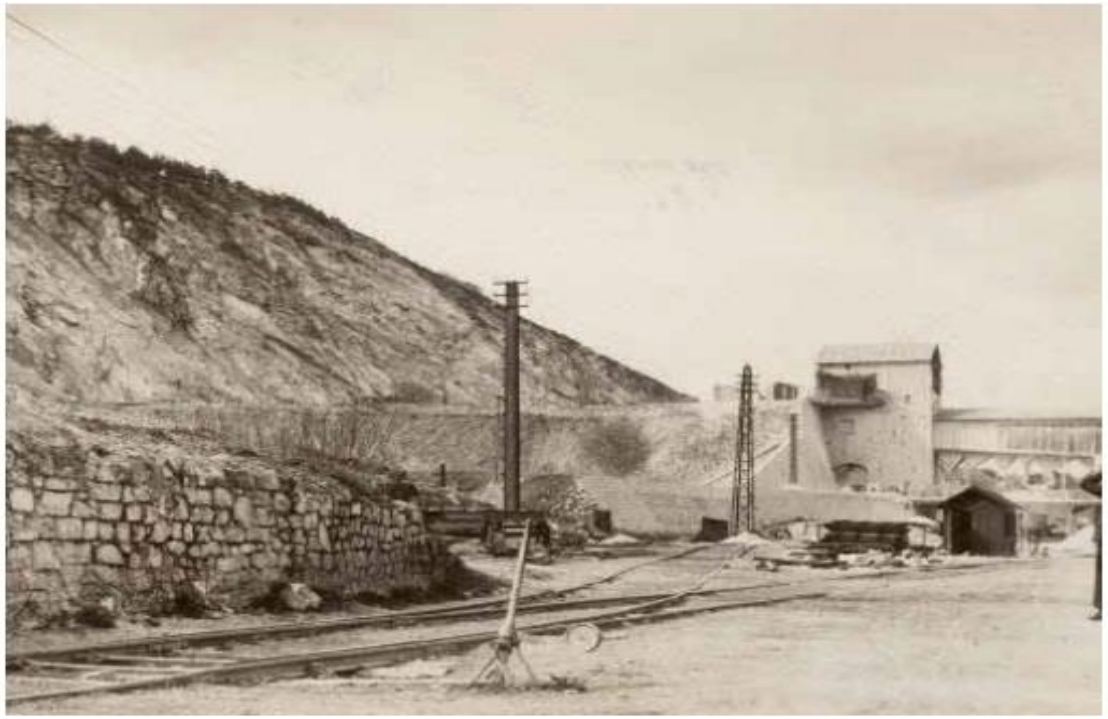
OUR HISTORY



1925

In 1925 the company is given its official name and “Carmeuse” is born.
From 1900, new sites were added and first investments abroad.

1860 1900 1925

CARMEUSE

OUR HISTORY

1950

Mechanization gets underway from extraction to processing.

1860 1900 1950

OUR HISTORY

1953

In 1953, the swan becomes the logo of Carmeuse and it still symbolizes our company today.

1860 1900 1950

OUR HISTORY

1950-1980

Rationalizing production and modernizing the lime kilns.

1860 — 1900 — 1950 — 1980

CARMEUSE

OUR HISTORY

1980 - 2000

In the 1980s, we witness the first wave of geographical expansion for Carmeuse.

1860 — 1900 — 1950 — 1980 — 2000

OUR HISTORY

2000 - 2010

At the turn of the century, Carmeuse took on a new dimension in Central Europe.

1860 — 1900 — 1950 — 1980 — 2000 — 2010

CARMEUSE

OUR HISTORY

2010 - 2019

This period marks the second wave of geographical expansion for Carmeuse.

1860 — 1900 — 1950 — 1980 — 2000 — 2010 — 2019

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OUR HISTORY

2020

Carmeuse celebrated
160 years of passion!

1860 — 1900 — 1950 — 1980 — 2000 — 2010 — 2019 — **2020**

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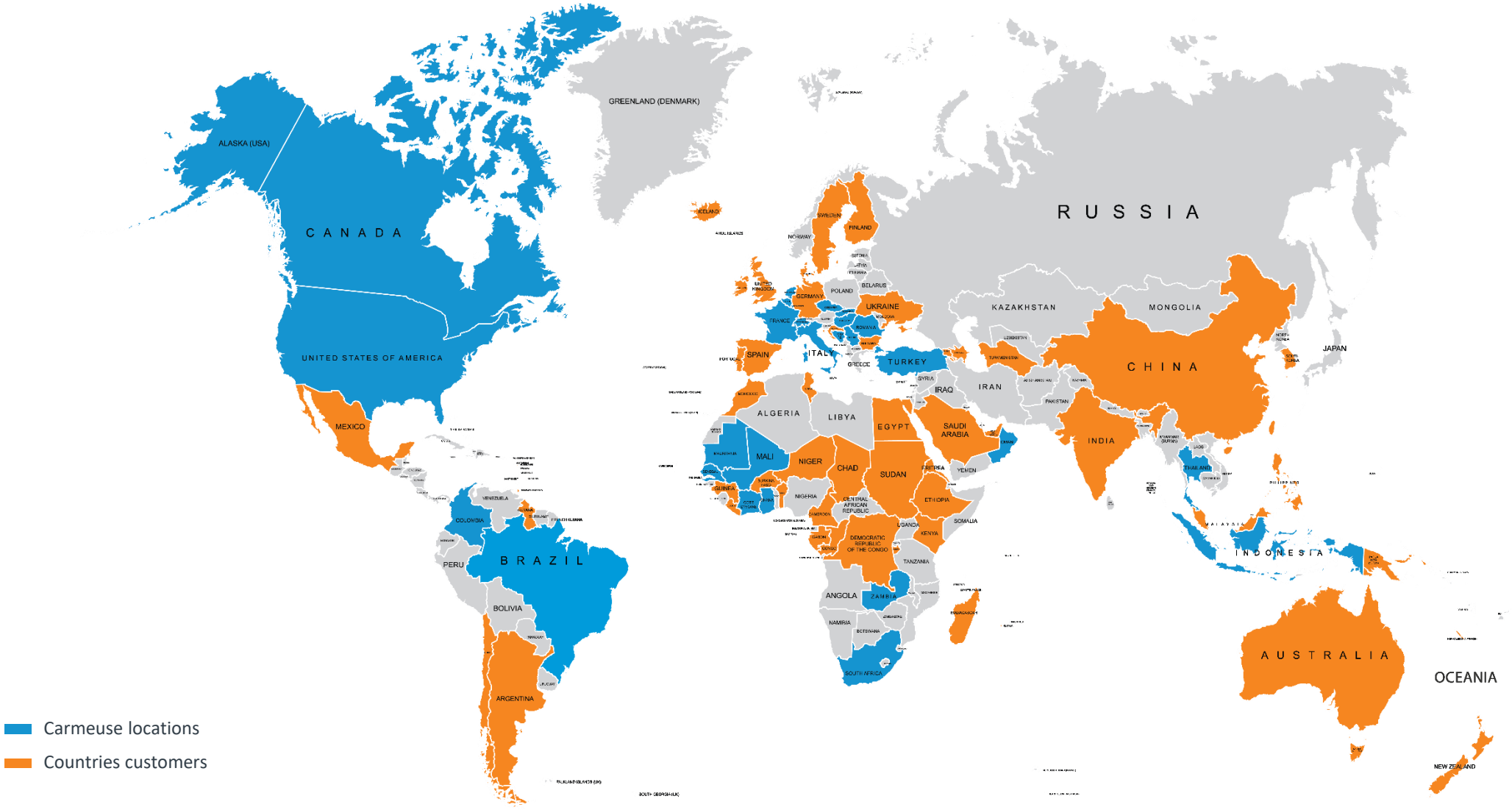
CARMEUSE IN A SNAPSHOT

Turnover 2019	**EUR 1.4 billion**
Number of employees	**+/- 4,500**
Tonne of lime delivered to customers per year	**+/- 9 million**
Number of plants around the world	**90**
Number of limestone quarries around the world	**60**
Number of customer sites served globally	**12,700**

WHO IS **THE CARMEUSE GROUP** TODAY?

WE ARE A GLOBAL LEADER



CARMEUSE

OLDEST ACTIVE CARMEUSE SITES

In operation since 1874

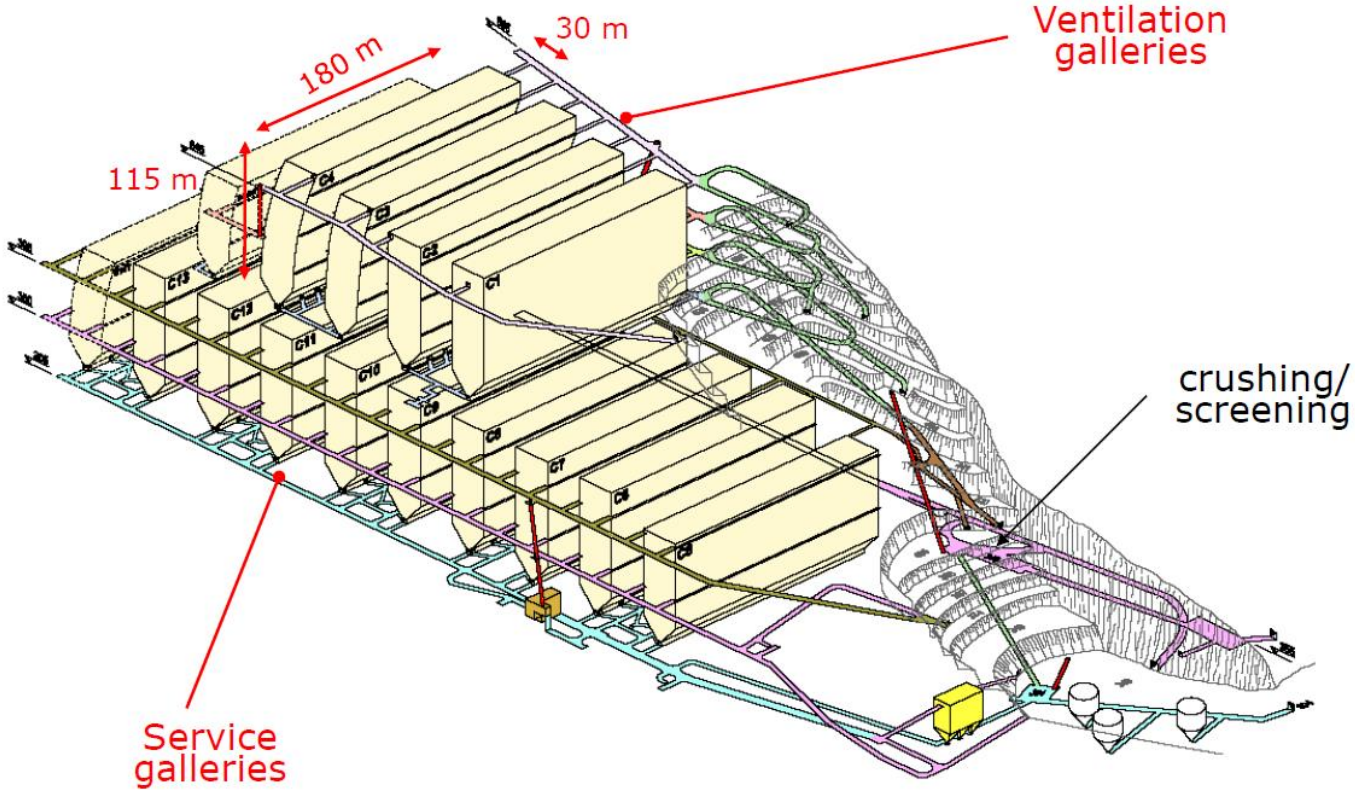
CARMEUSE OPERATES THE WORLD's LARGEST LIMESTONE QUARRY – Calcite (US, Michigan)

In operation since 1912
17 km² mined area

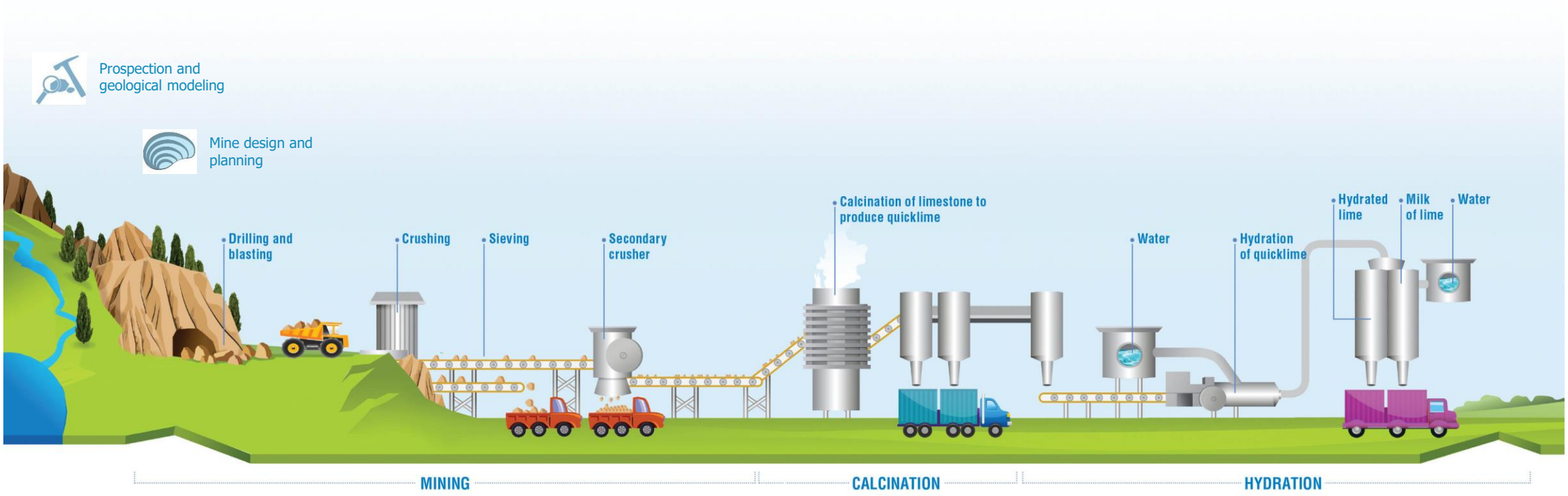
Quarry Fleet :
2 x CAT 994
5 x CAT 789

CARMEUSE CARVES UNDERGROUND CATHEDRALS – Brembilla (Italy, sub-level stoping)

In operation since 1927 (open pit)
Underground since 1993



FROM QUARRY OR MINE TO PRODUCTS



WHO IS **THE CARMEUSE GROUP** TODAY?

36%	IRON & STEEL
14%	CIVIL ENGINEERING
10%	FLUE GAS CLEANING
9%	BUILDING MATERIALS
6%	WATER & WASTE TREATMENT
6%	CHEMICAL
6%	NON-FERROUS
4%	AGRICULTURE
4%	PCC AND PULP & PAPER
2%	GLASS

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BEYOND LIME

Expertise from Geology to Technology and Innovation

GEOLOGY-MINING
- Prospection
- Analyses
- Exploration
- Modelling
- Permitting
- Mine Planning

OPERATIONS
- Extractions
- Handling
- Direct Selling
- Product Transformation
- Material Processing
- Quality control

SUPPLY CHAIN
- Finished products
- Network of plants
- Warehousing facilities
- Deliveries (trucks, railways, barges)
- Storage Solutions

ADVANCED SERVICES OFFERING
- Consulting & Engineering
- Field Support
- Safety & Technical Trainings
- Equipment Design & Building
- Optimization & Customization
- Digitalization

WHO IS **THE CARMEUSE GROUP** TODAY?

IMPACTING
EVERYDAY LIFE

CARMEUSE

Carmeuse Mining Expertise

Carmeuse Europe :

- 6 entities
- 11 countries
- 32 sites

In close collaboration with the geology team, our mission is to ensure a sustainable extraction of Carmeuse resources, with agility, in a fast evolving business environment

Our "nesting dolls" organization

The "EU corporate" mining team :
- Long term mining plans
- M&A and strategy
- Benchmarking & best practices
- Coaching, training & knowledge sharing

The area mining team :
- 1 to 5 Years mining plans
- Technical support for specific projects
- Lead local improvement initiatives

The site mining team :
- Execute the 1 Year Plan and define the detailed mining sequence (monthly and weekly plans)
- Drilling & blasting, loading & hauling and crushing & screening optimization
- Technical reporting and site KPIs follow-up

Carmeuse Mining - We embrace innovation from Quarry to Stone Line

GeoMin

- Eureka and Vulcan
- XRF and/or ICP
- Full stone testing
- Geological Strength Index with 3D laser scanner and fracture analysis software

Drilling

- GNSS hole positioning
- Automatic sampler
- Semi autonomous rig
- Measure while drilling
- Deviation probe

Blast

- 3D laser scanner and drone for blast preparation
- Dedicated blast preparation software / database
- Electronic Det.
- Remote Blasting console
- Track & Trace electronic stock book
- Systematic blast monitoring (video + seismo)
- Drone for ROM PSD

Loading/hauling

- Telematics for Fleet Performances Monitoring
- FMS
- GNSS Location for ROM tracking
- In-house FMS

Crushing/screening

- SL settings
- SL performances
- PSD of key products
- Material balance
- Online turbidity meter

Legend :

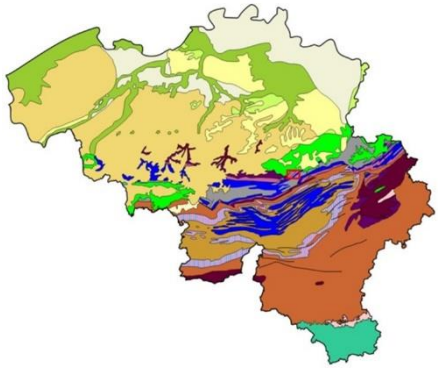
Exist in most sites
Exist already in min. one site
R&D

The Carmeuse Geo-Min Process

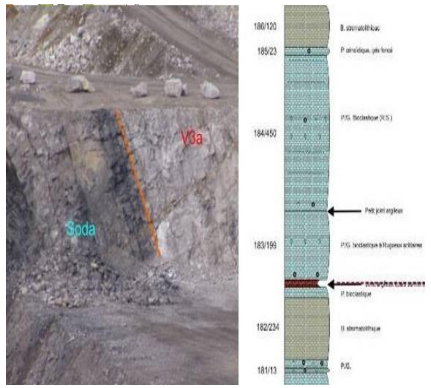
DTM

GEO

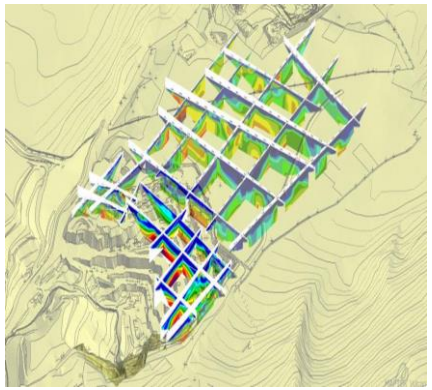
Regional Geology Understanding



Detailed field mapping, logging & sampling

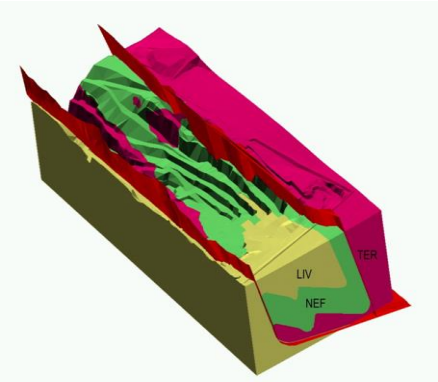


Geophysical investigations



Drilling and stone testing

3D Deposit Model



Hydrogeology and geotechnical Models

3D Geochemical Model

Mining best practices + future equipments

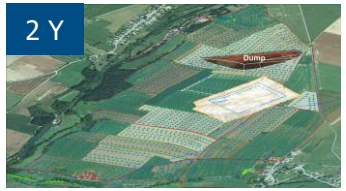
Regulations and permitting

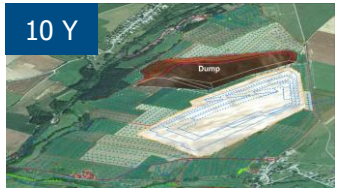
GEOMIN

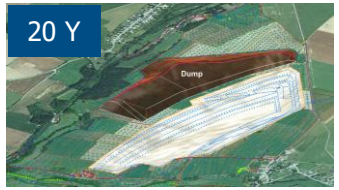
Final Design + Reserves & Resources

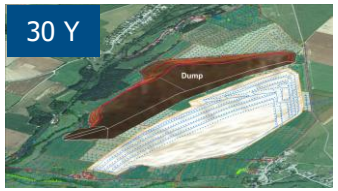
MIN

LOM Planning









Market

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The Carmeuse Mine Design process

Inputs	Process	Outputs
Topographic survey/3D DTM	**Final Pit Design**	Reserves/resources evaluation Geological investigations to improve model reliability
3D Geological Model Geological units and their qualities Hydrogeological Model Geotechnical Model	**Long term mine planning**	Schedule for land acquisitions Global Waste management plan Final reclamation project
Mining area Mining license perimeter Ownership map Legal and environmental constraints (dewatering, vibration, noise, dust)	**5 Years mine planning**	Production figures Pre-budget evaluation Detailed waste management plan (overburden, fines, settling pond) Short to mid term reclamation plan Fleet and stone line design
Available and/or future equipments (drilling, loading, hauling, stone line) Location of the processing plant Road access, railway and/or river Mining ratio Production costs Company best mining practices	**1 year mine planning**	Evolution map of the quarry for the next 6 and 12 months Map of blastings for each bench Estimation of overburden and waste volumes Budget evaluation
Markets and specifications Expected sales	**Very Short term mine planning**	Production and blasting schedules Quarry follow-up

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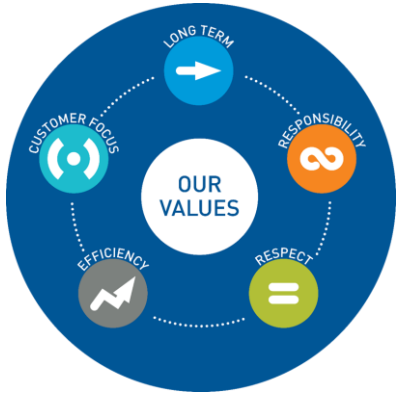
Computer and software assist the design process not the design itself. The design is controlled by the person doing it.

The end-purpose of your pit design will likely be :

- Determining Ore Reserves;
- Defining the Life-of-Mine planning, including location of infrastructures such as plant, roads, conveyor belts, by-product dumps/ponds
- Providing guidance to the team in charge of the shorter term plan design and execution.



Always bare in mind our values and that your design needs to focus on :

- **Safety** (don't build hazards into the design);
- **Long term** (no "high grading");
- **Limited Environmental Impact**;
- Operational **Efficiency** (drilling & blasting, loading & hauling);
- Problem anticipation (**no surprise**).

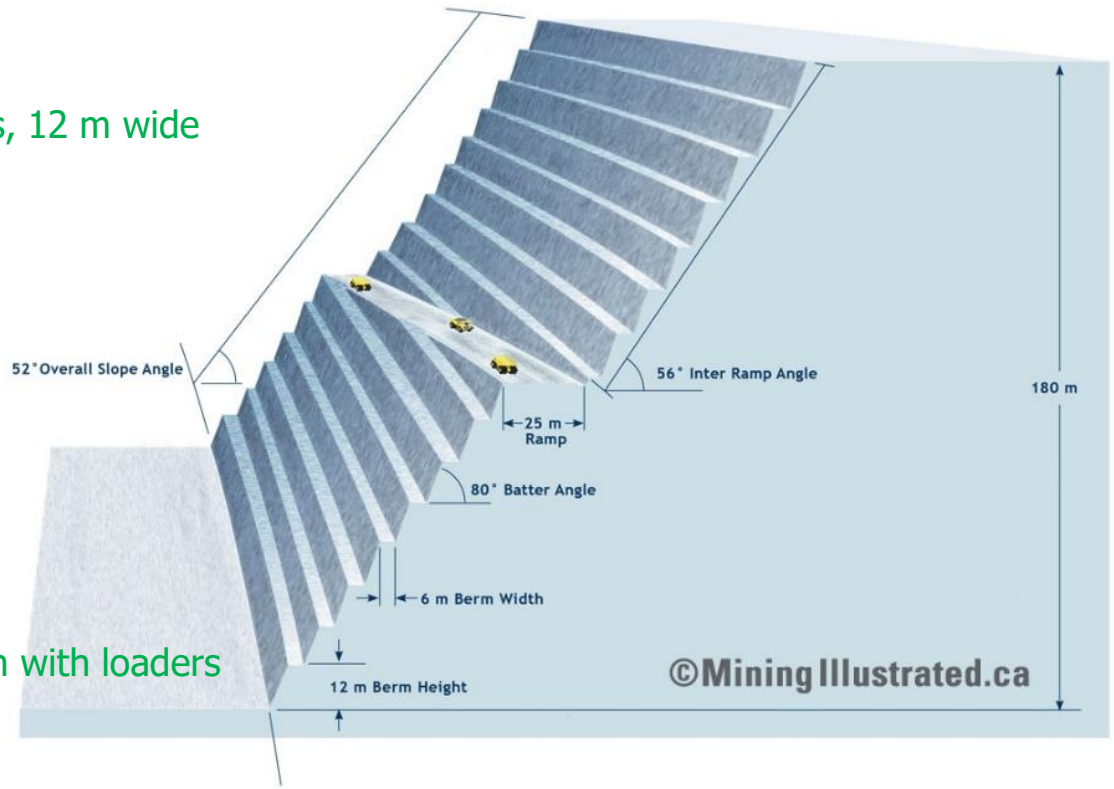
… expect the process to be **iterative**, coming up with a satisfactory design may require several attempts.

… and **document** your design principles and reasoning, make running notes during design steps and keep record of what worked and did not work.

Each project has its specificities, but here are typical parameters used when working with CAT 775 and CAT 988 range of machines

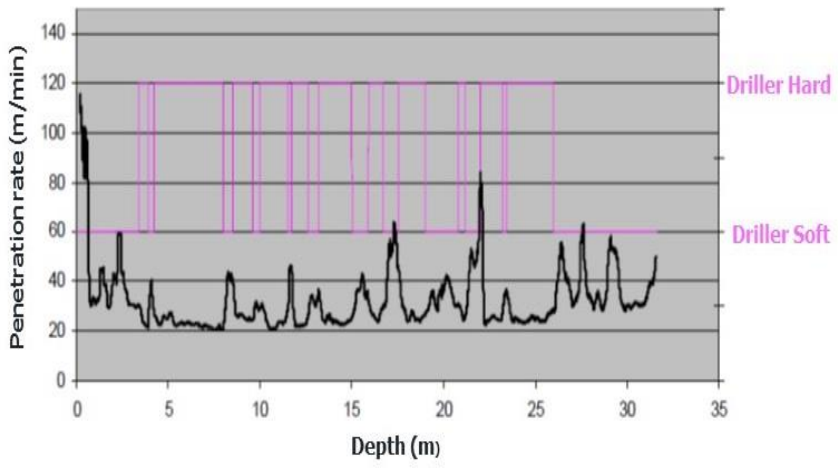
Before starting any project, you will need to know the general expected pit design parameters by material type and/or geotechnical domain, specifically the following:

- Required buffers along license boundaries (or exclusion perimeters); → min. 10 m
- Berm width; → min. ½ of bench height
- Safety Berm with and placement intervals (if required); → Every 3 benches, 12 m wide
- Batter angle (bench face angle); → 75°
- Bench height; → 12 m
- Inter-ramp angle limits; → 55°
- Overall slope angle limits; → Max 45°
- Ramp width; → 25 m for CAT 775 type
- Ramp gradient, → 8%
- Switchback width and gradient; → min. 30 m and flat
- Flat length and ramp access distance; → 50 m and flat
- Minimum mining width (pit bottom, bench ends); → 30 m
- Preferred effective bench mining width; → 40 m with excavators and 75 m with loaders
- Drainage planning needs, including drainage gradients for benches and berms; → 3%
- Dewatering needs;
- Desired space for maneuvering and surge piles at crusher.

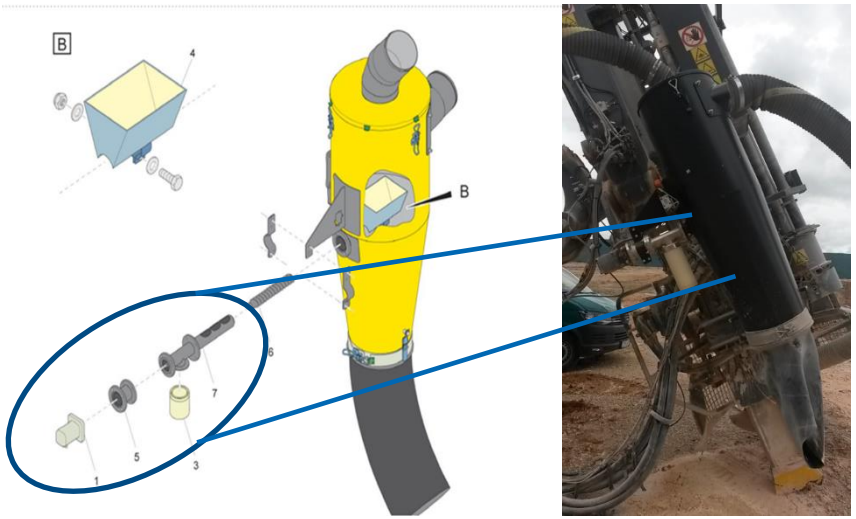


GNSS : accurate hole positioning and semi-autonomous machine set up

Monitoring While Drilling : drilling parameters vs rock mass/driller perception



Automatic sampler : better sampling for better quality control



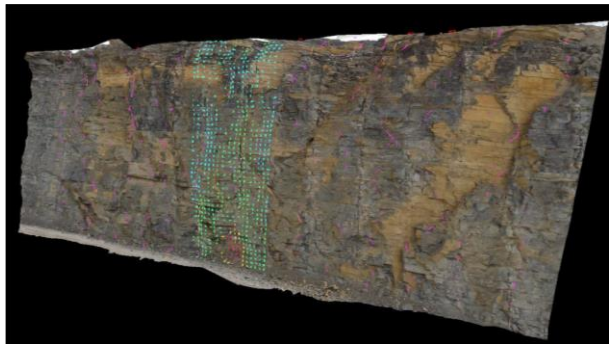
Deviation Probe : actual 3D hole positioning for optimized blasting

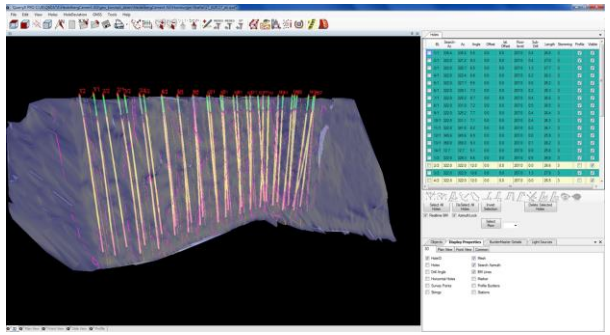
The Field Prep. Tools

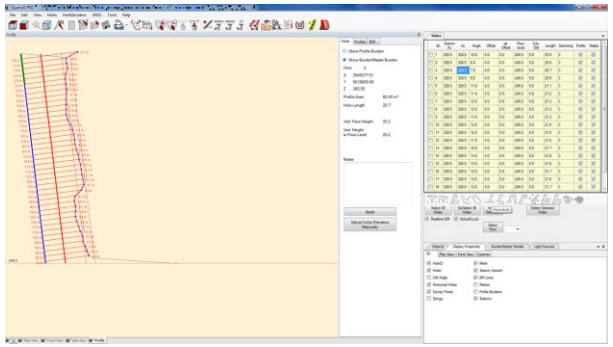
+ Metashape

The Software

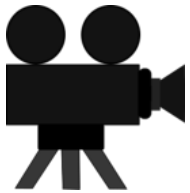
geo-konzept
inventarisieren. kartieren. optimieren.



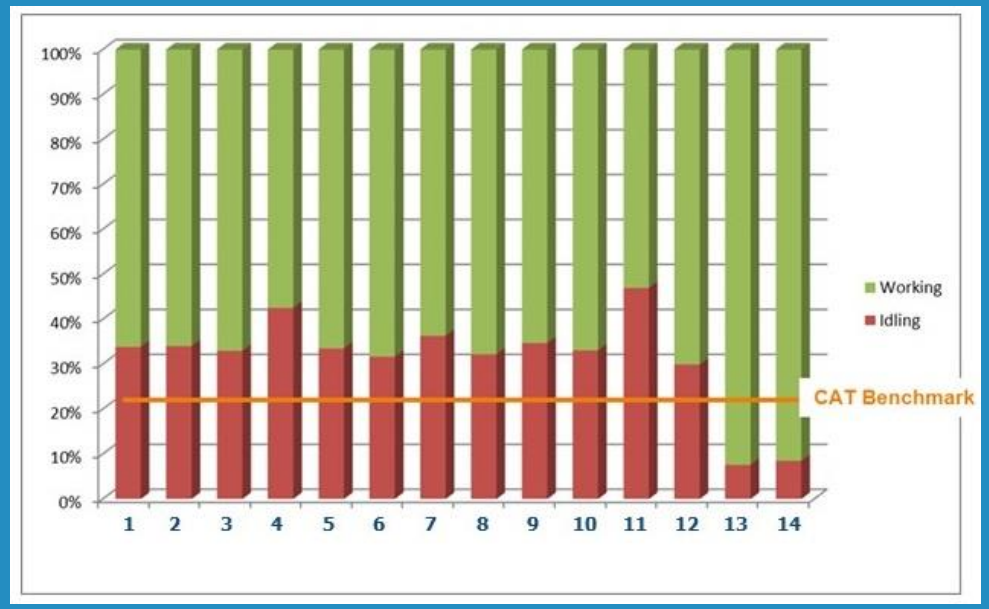




The Execution



Working vs idling



Productivity (T/Whr)

The sites conditions have strong influence over the machine performances .

Carmeuse Mining – We target the maximum recovery and the lowest % of fines

1

+/- 20-25 % of fines in avg

2

+/- 2 % of fines in avg

3

+/- 2 % of fines in avg

4

Low

Interm.

High

+/- 10-25 % of fines in avg

5

+/- 5 % of fines in avg

6

+/- 10 % of fines in avg

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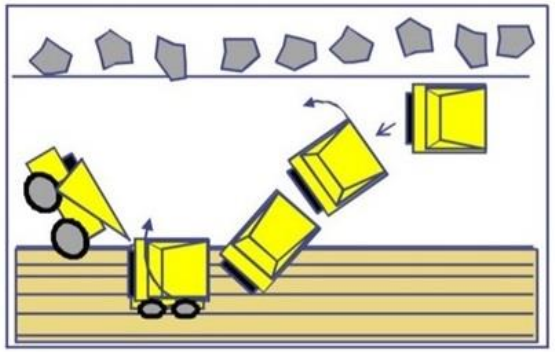
Boulders can't absorb the shock energy !

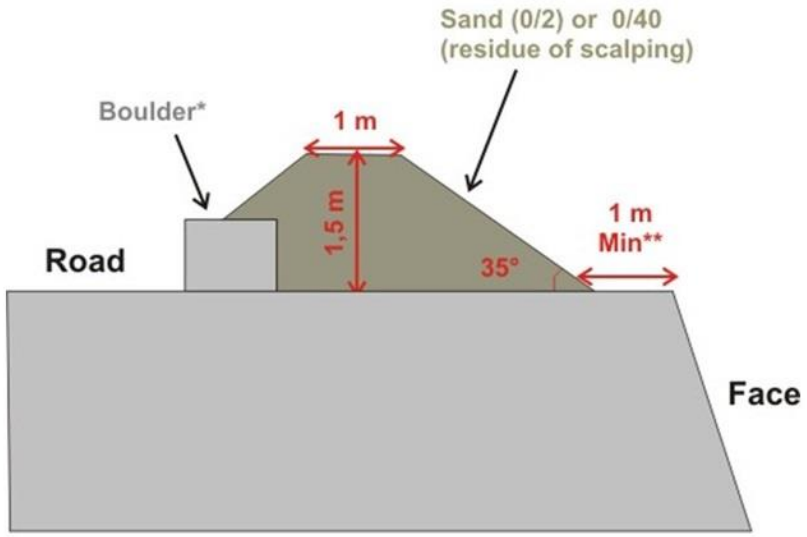
Irregularly spaced boulders only OK along temporary roads.
Distance between boulders < width of vehicle

Without this muddy material the boulder and the truck would have fell

Dumpers can easily climb on low grade berms and being overturned !



Our Best Practice



* « cubic » boulder, min. 75 cm high

** to be widen in case of failure risk

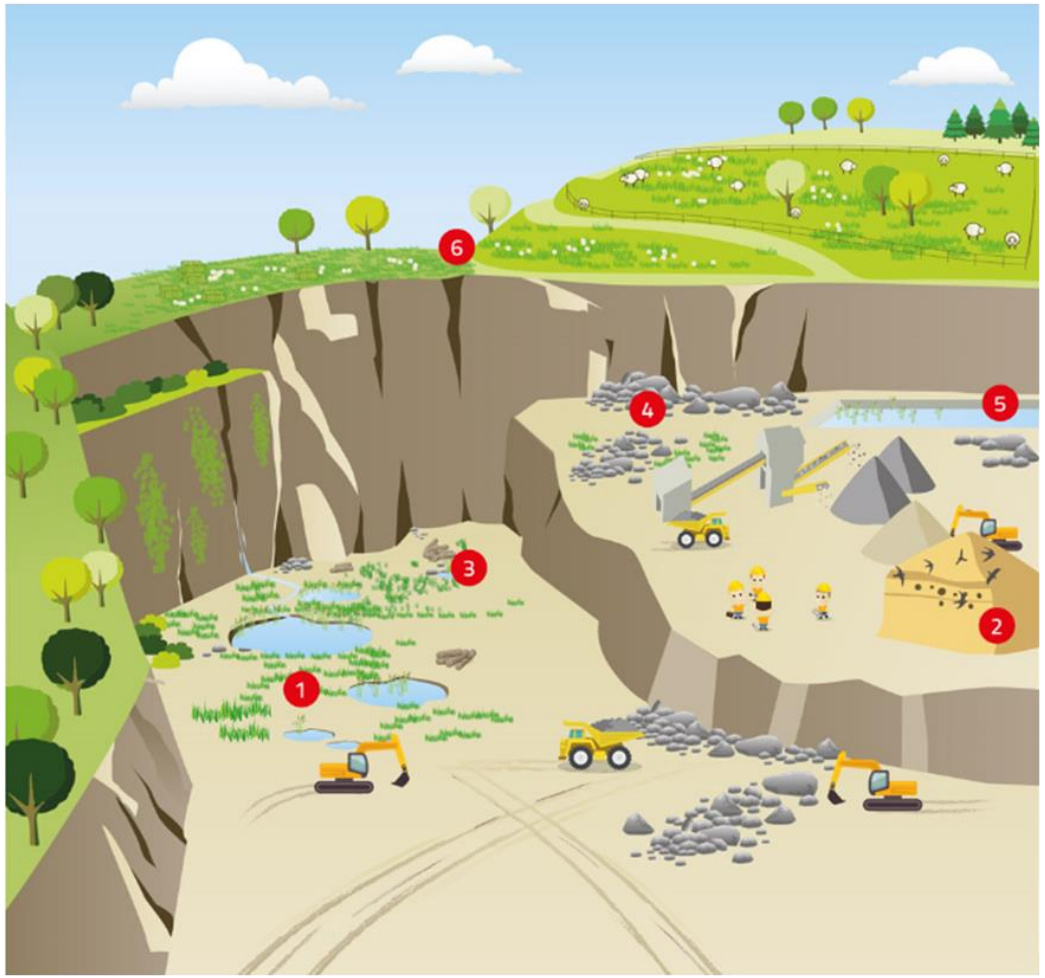
Height never less 1.5 m and to be adapted to the machines' size (min. ½ of the bigger wheel diameter)

Don't forget to include regularly spaced narrow openings to ensure a proper drainage of the road.

LIFE IN QUARRIES

A QUARRY NETWORK SERVING BIODIVERSITY

- 1. DYNAMIC MANAGEMENT OF TEMPORARY PONDS
- 2. REFRESHING OF LOOSE CLIFFS
- 3. INSTALLATION OF SHELTERS
- 4. SCREE MANAGEMENT
- 5. CREATION OF PERMANENT WATER COURSES
- 6. RESTORATION OF GRASSLANDS MANAGED BY MOWING AND GRAZING



Life

FEDIEX
FÉDÉRATION DE L'INDUSTRIE EXTRACTIVE
VERBOND VAN ONTGINNINGSBEDRIJVEN

Wallonie

Gembloux Agro-Bio Tech
Université de Liège

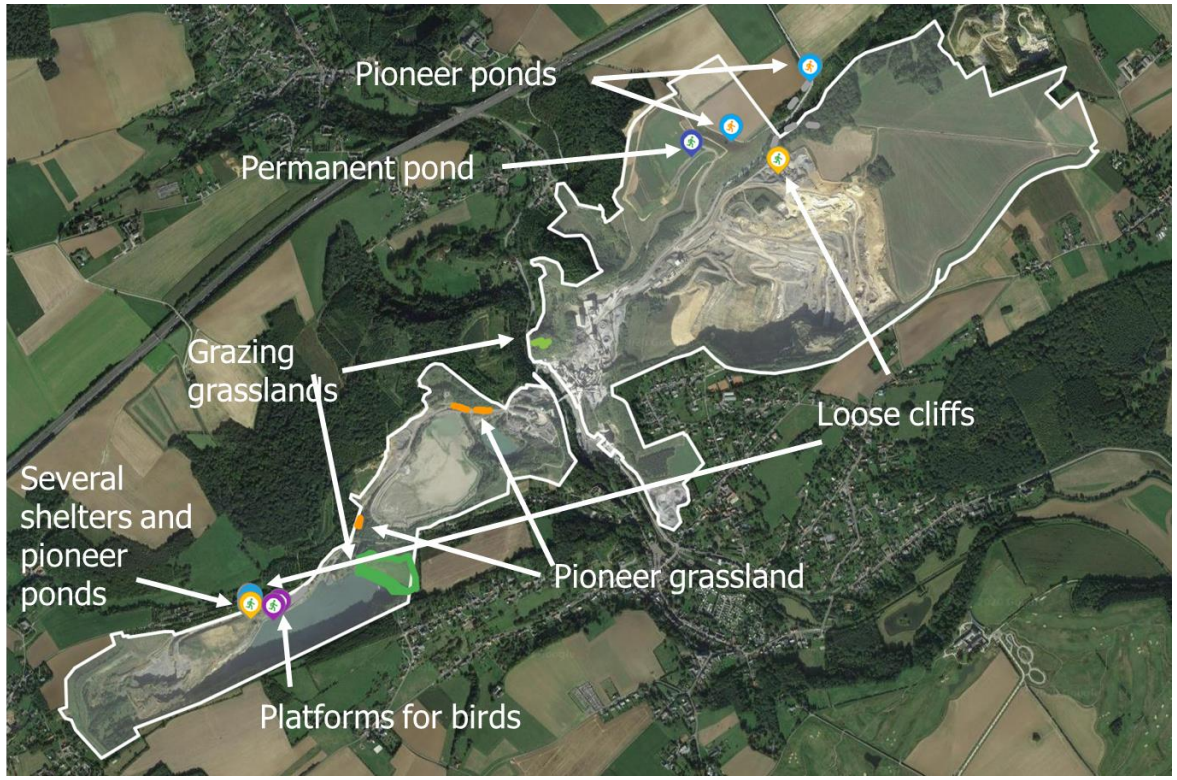
natagora
la nature avec vous

Parc naturel
PLAINES
DE L'ESCAUT

CARMEUSE

Site "Zero State" inventory

284 species of flora whose 26 with high environmental value	3 species of reptiles with high environmental value	13 species of dragonflies and damselflies
74 species of birds with high environmental value	7 species of amphibians whose 6 with high environmental value	17 species of butterflies



New species observed in 2020

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Quarry reclaimed in wetlands or agricultural fields

Solar farms powering our plants

Moha (left)
13200 panels, 3.57 GWh/Year, 19% of plant daytime electricity

Aisemont (right)
8800 panels, 2.5 GWh/Year, 15% of plant daytime electricity

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IMPACTING EVERYDAY LIFE