

Safer Roads Conference

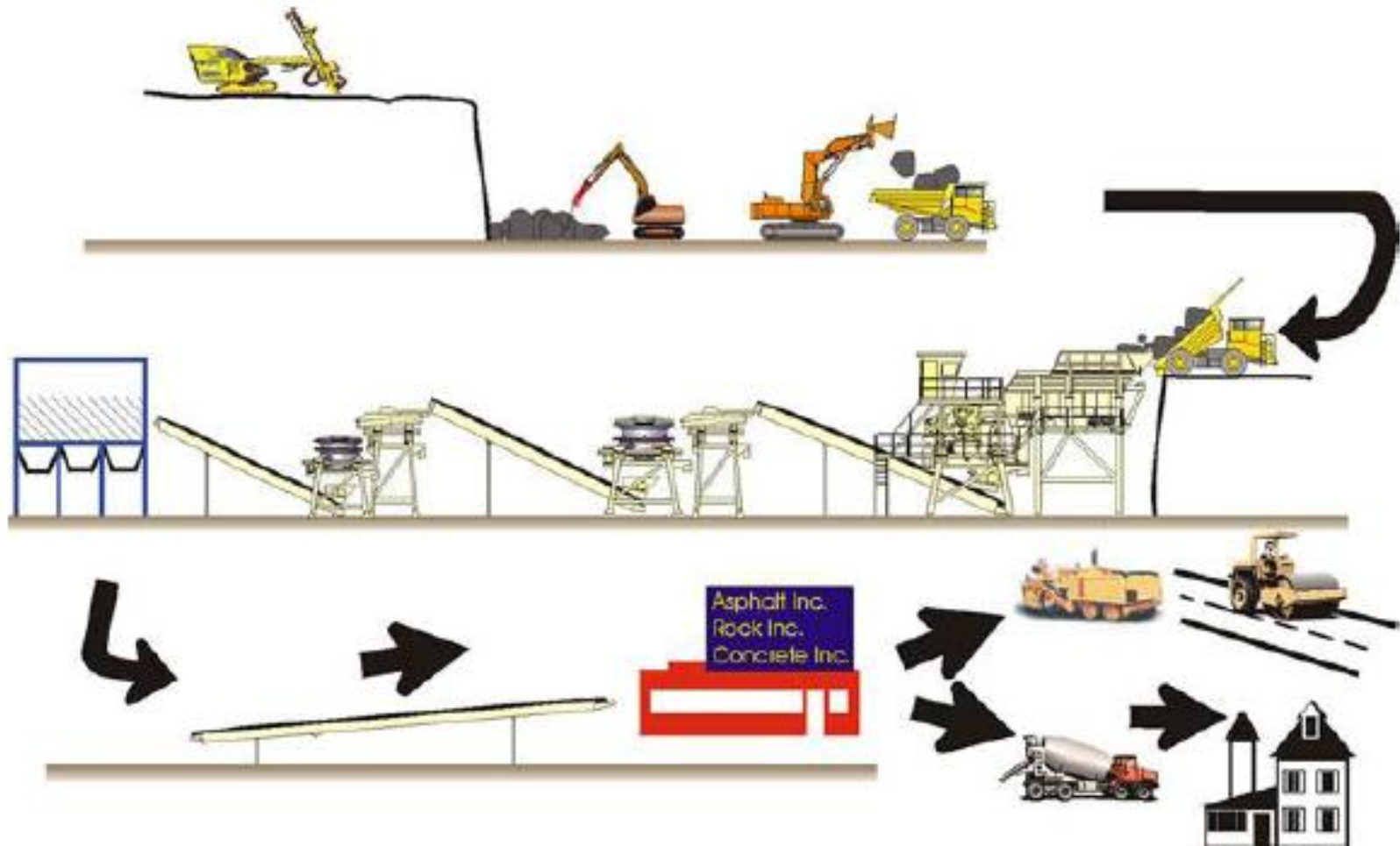
NZ Aggregate Extraction & Processing



MATAMATA INDUSTRIAL MACHINERY IMPORTS LTD

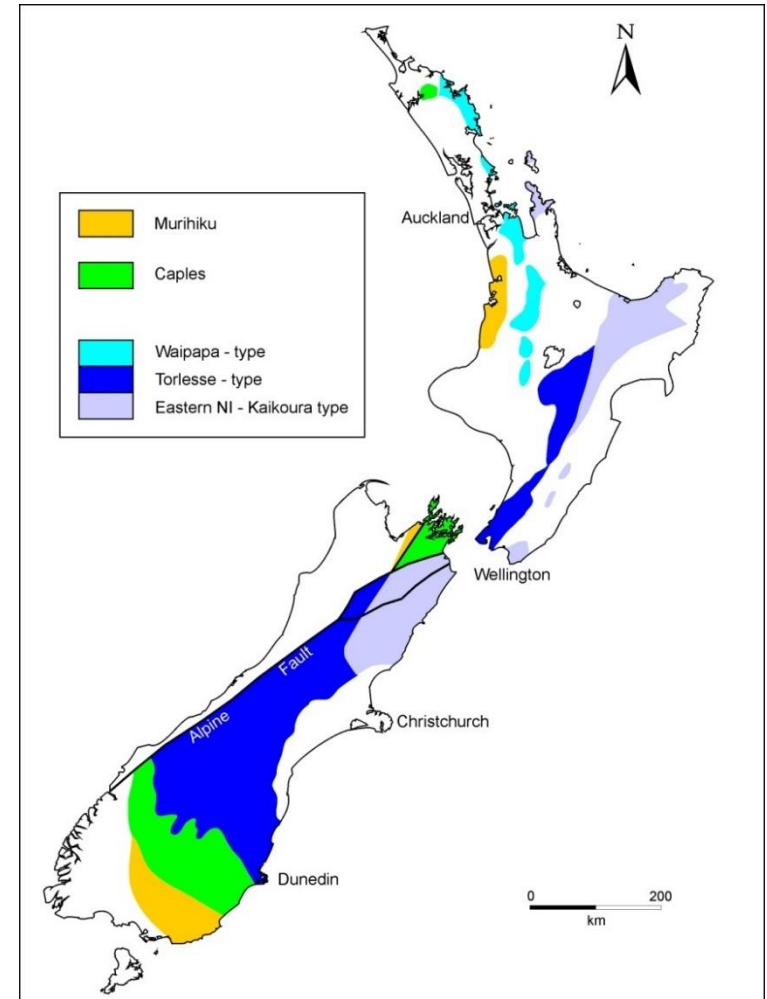
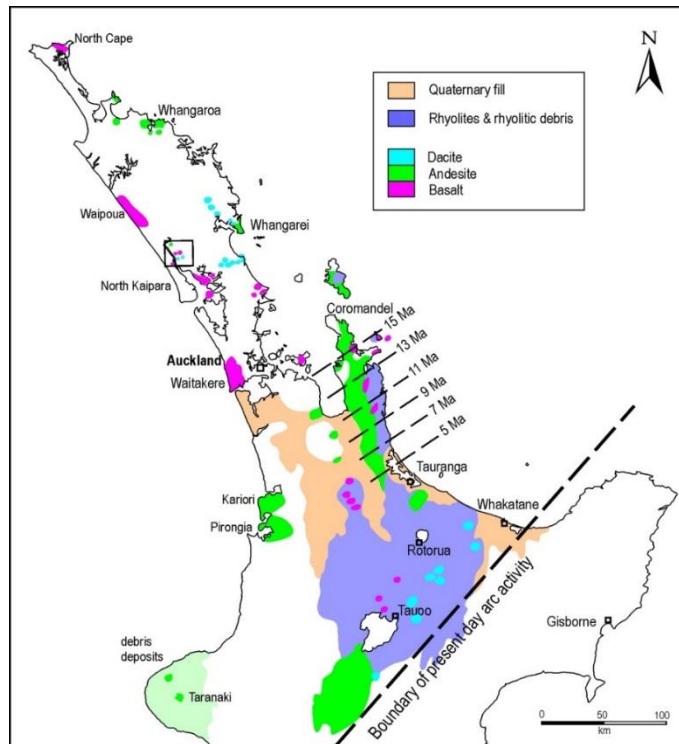


Extraction & Crushing Process



NZ Geological Setting

- Predominate source rock for aggregate production is greywacke.
- Some volcanic rock in the upper NI and bottom of the SI.

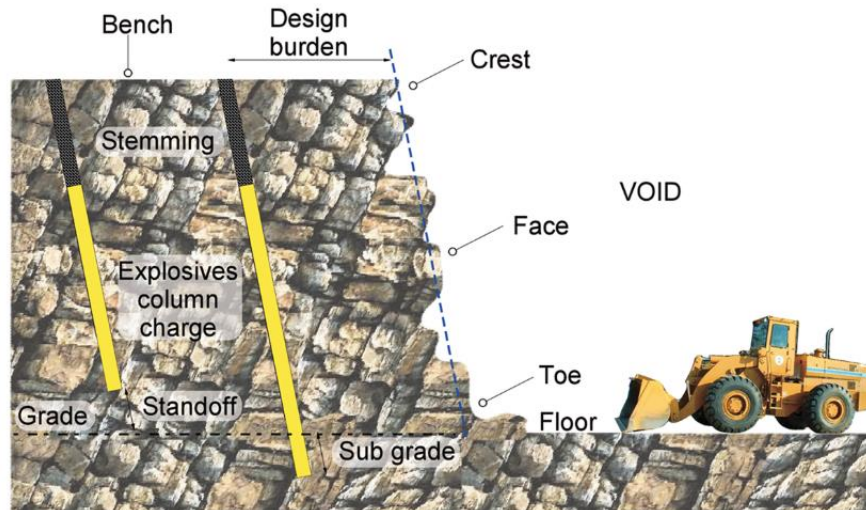


Drilling and Blasting

- The pattern of holes that are drilled in which explosives are placed can be unique to each resource.
- Rock joint spacing and continuity determines the hole pattern and explosives used.
- Electronic detonators commonly used.

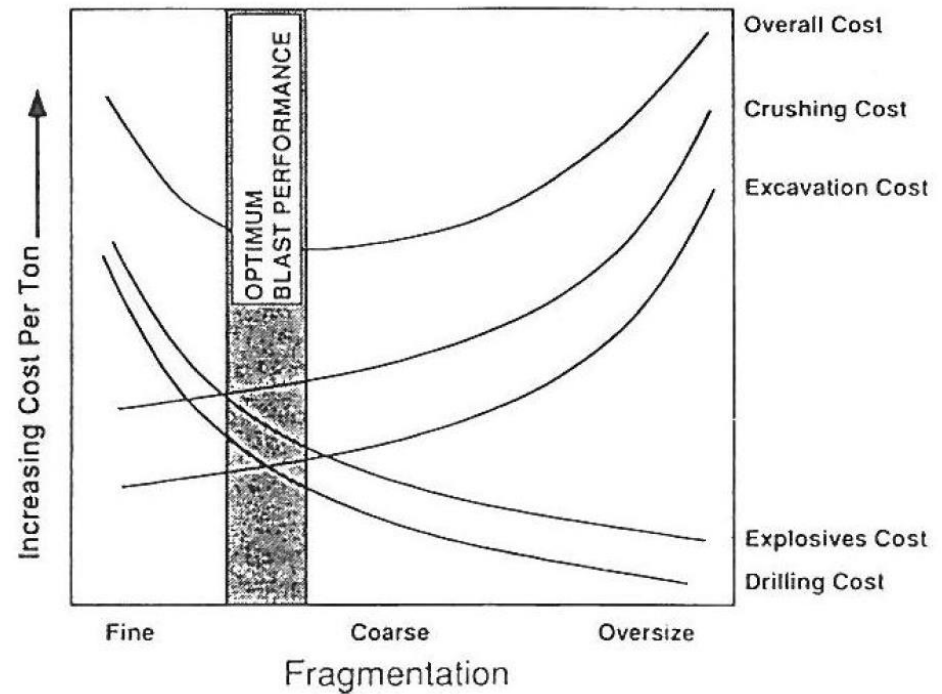


Bench Terms



Load and Haul

- Drill and blast should yield a product that has:
 - Limited amount of oversize
 - Lessen undersize/scalp generation
 - Has good diggability





Mobile vs Fixed Plant

- Fixed plants are preferred due to their lower operating costs. Requires a stable market to justify the capital cost. Generally requires a mix of contracting and manufacturing customers.
- Mobile plant used primarily:
 - Supplement current quarry production during times of higher demand
 - Condition feed for fixed plant production i.e. Loko link
 - Pits where there is no power or the local market isn't sufficient to justify a fixed plant
 - Recycling operations, there is a move towards fixed plant in Europe & US.
 - Used for campaign crushing programs i.e. civil engineering projects



Crusher Selection

- Crusher selection depends on rock type, resource characteristics, maximum particle size and crusher product requirements.
- There are two broad types of crusher:
 - Impact crushing, uses rotating mechanical parts to impact particles to facilitate reduction in particle size.
 - Compression crushing, uses a confined cavity to exert pressure on particle to facilitate particle size reduction.
- Primary dependant on silica content of source rock
- Impact crushing suited to materials with low abrasiveness. Source rocks that has low silica content such as limestone.
- Compression crushing suited to materials that have higher abrasiveness. Applied to source rock that has a high silica content such as granite and quartzite.
- All crushers have a limitation on the maximum particle size of the feed material, therefore need to be sized to suit.



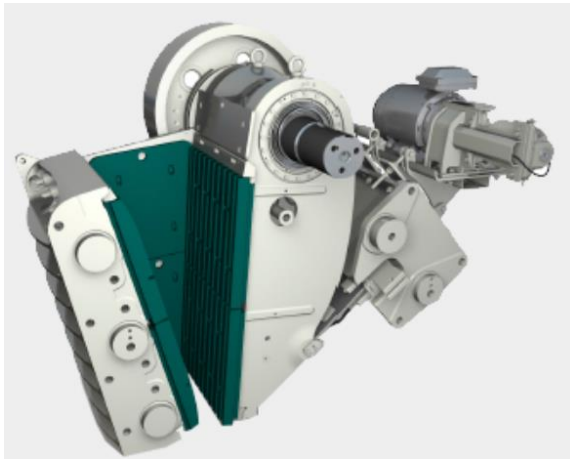
Primary Screening

- First screening station separates the feed material into:
 - Primary Scalp which can report to either:
 - Stockpile as low grade base material
 - For further processing to remove deleterious fines.
 - Alluvial deposits scalp minus 20mm to be sized as concrete aggregates.
 - Oversize can report to either:
 - Primary crusher for further size reduction
 - Stockpile as an armour stone or similar.



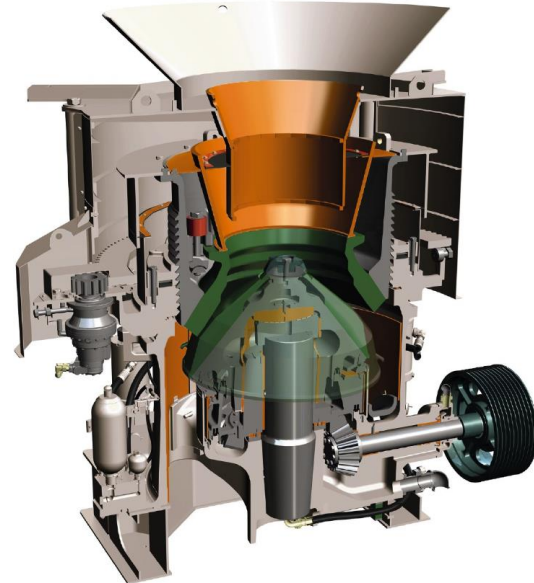
Primary Crushing

- All fixed plants processing greywacke/andesite/basalt hard rock have a Jaw Crusher as the Primary crusher.
- Important that the drill and blast pattern yields a product that can be accepted by the primary crusher. Primary crusher gaue dimensions dictate maximum particle size that can be accepted.



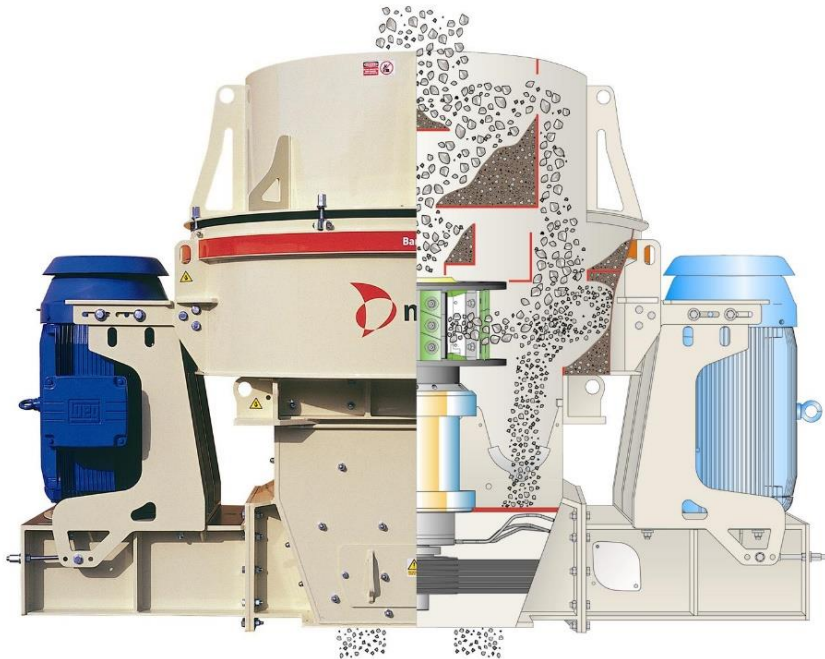
Secondary Crushing

- Predominately a cone crusher is used in the secondary crushing position. Two main types based on setting adjustment:
 - Hydraulic pressure setting adjustment
 - Hydraulic motor setting adjustment
- Crusher set up to take Jaw crusher product or oversize from primary screening operation (alluvial)
- Ideally set up with a bin and feeder to control the feed rate to maintain a “choke fed” condition.
- Three key operational parameters:
 - Closed Side Setting (CSS)
 - Throw or speed setting
 - Liner configuration



Final Crushing Stage

- Barmac Vertical Shaft Impactors (VSI's) are widely utilised as the final stage crusher here in NZ.
- This type of crushing was invented here in New Zealand to overcome the poorer quality shape of product produced by compression crushers.
- Rock on rock crushing has proven to provide the best shaped chip and manufactured sand.



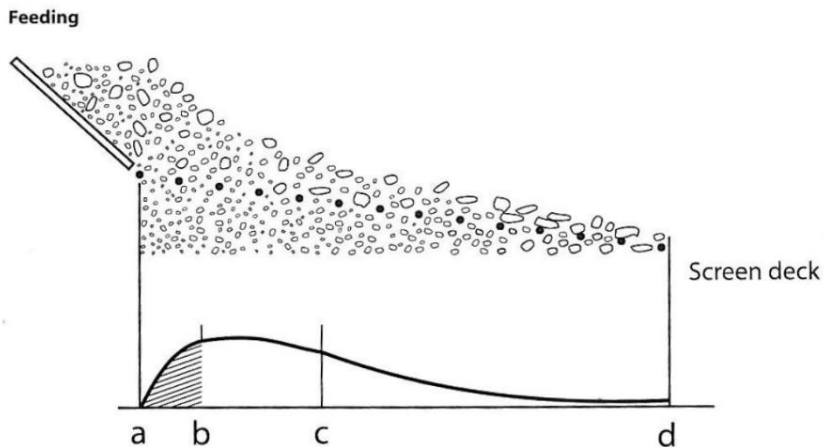
Material Transfer

- Belt Conveyors primarily used in transfer material from crushing and screening equipment.
- Belt conveyors are typically driven by a motor and gear box.
- Factors influencing application and installed power:
 - Conveyor Length
 - Material characteristics i.e. density, lump size etc
 - Inclination (slope factor)
 - Troughing angle
 - Width of Conveyor
 - Belt speed



Screening - Theory

- Screening, separating the big bits from the little bits.
- Screen has a throw which promotes particle movement down the screen.
- Two basic processes taking place:
 - Stratification – The separation of the feed material with the smaller material migrating the bottom to be sized.
 - Probability of separation – Process where particles present themselves to the screen apertures and are rejected if larger and passed if smaller.



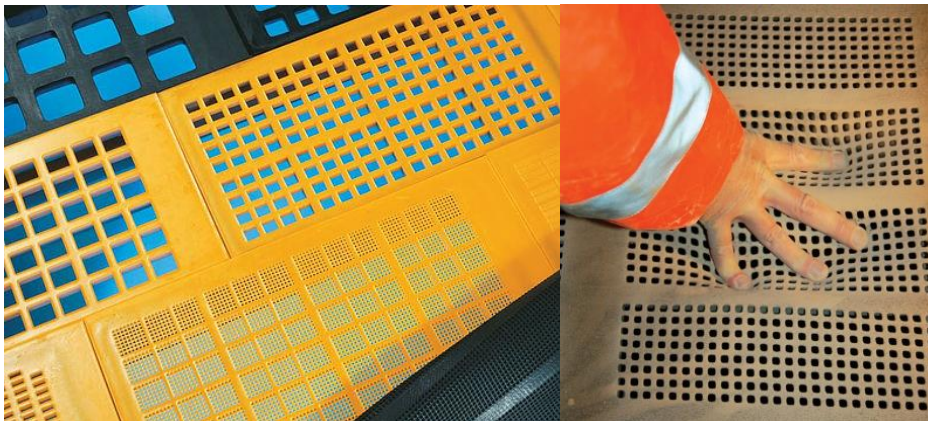
a-b: stratification near the feeding end
 b-c: saturated screening
 c-d: separation by repeated trials





Screening – Types and Media

- Screens work on a mechanical drive which induces a throw to create movement on the screen deck.
- **Types of screen**
 - Circular motion screens (15° – 20° angle)
 - Linear motion screens (horizontal)
 - Elliptical screen
 - Free fall screens
- **Types of screening media**
 - Rubber
 - Polyurethane
 - Wire



Screen Performance

- Screen should be sized based on their intended application.
- What is screen performance?
 - The efficiency of the screen to make a cut. Measured by undersize in the oversize and vice versa
- What influences a screen's performance?
 - Shape of material, i.e. rounded, cubical, flat/elongated
 - Angle of the screen.
 - Bed depth / Screen loading
 - Moisture of the feed material
 - Material half size of the screen hole opening
 - Open area of the screening media
 - Material density



Screening - Wet

- Why wet screen?
 - Achieve the cleanness values required in NZS3121 and M/6
- Optimum wet screening will be achieved by the following factors:
 - Optimum pressure at the spray bars, ideally 30psi/200kPa.
 - Bed depth (discharge end) at 2x the maximum particle size.
 - Amount of water per tonne of aggregate approx. 1.0m³ per tonne
 - Spray nozzles have a full coverage across the screen
 - Clean water





Stockpiling and Load out

- Stockpiles are mostly constructed by end tipping by loader or dump truck.
- Loaders are typically used for load out and material handling within the stockpile area.
- Load out practice to minimise segregation.
- Established quarries have weighbridge and docketing procedures for invoicing. Product sold by the tonne.
- Where no weighbridge is present material is sold on a m3 rate.



Extraction & Crushing Process

