

2 OVERVIEW OF THE SAND MARKET

2.1 Sand Uses and Terminology

Sand is used ubiquitously in the construction industry and is an essential raw material for providing infrastructure and shelter.

Geological terminology defines sand as particles of rock or mineral with a particle size between 2 mm and 0.06 mm. However, the term sand as used in the building and construction industry is synonymous with fine aggregate which is material with a particle size less than 5mm. 'Coarse sand' is defined as material comprising particles less than 5mm and with less than 10% being finer than 0.15 mm. 'Fine sand' is generally regarded a material finer than 1.0 mm.

However the particle size distribution of the sand determines its particular use and so the sand product may be identified as 'roofing tile sand', 'plaster sand', 'concrete fine sand', 'concrete coarse sand', 'masonry sand', 'fill sand', 'grout sand', 'bedding sand', 'filter sand' and so forth.

Sand may be natural and derived from the weathering of parent rock and the accumulation of durable fragments or may be manufactured from a suitable source rock by crushing and sizing using a range of methods. Processing decomposed sandstones and granite may also produce sand. The shape and particle surface properties of manufactured sand are different from natural sand.

The prime use of sand is in the manufacture of concrete and concrete products such as ready mixed concrete, masonry products, poles, stumps, manholes, pipes, panels, beams, walling, roof tiles, pots and a diverse range of other products.

Other uses of sand include:

- fine aggregate in asphalt manufacture
- filter for water and other fluids
- filler for manufactured products (rubber plastic)
- bedding for pipes, slabs and cables
- drainage media
- mortar
- grout
- landscaping
- soft surfaces (playgrounds)
- recreation (artificial beaches, golf bunkers, tennis courts)
- filling for raising or levelling land
- miscellaneous concrete products

Specifications which are generally guided by Australian and International Standards require sand products to have particular physical and chemical characteristics such as particle size distribution limits, hardness, inertness, water absorption limits, density, mineral type, durability and to be free of deleterious matter. Speciality products may require particular colour, surface texture and particle shape.

2.2 Sand Extraction and Processing

Land based sand extraction involves a sequence of operations as follows:

- vegetation clearing
- topsoil removal
- overburden removal
- extraction operations
- processing and distribution
- rehabilitation

Vegetation clearing is necessary as sand extraction generally involves open pit operations extracting from relatively shallow deposits. Potential impacts of vegetation clearing include:

- destruction of habitat
- increased noise
- reduced air quality
- impairment of water quality due to sediment mobilisation
- introduction of weeds and soil pathogens
- visual impairment
- erosion and land degradation

Removed topsoil may be sold or used in rehabilitation works. Potential impacts associated with topsoil management include sediment mobilisation and degradation of the properties of topsoil as a plant growing medium.

Overburden is material overlying the sand deposit which has little value or limited demand and generally comprises sandy clay, clay or very clayey sand. Overburden is used to back fill pits, to construct on site works such as water storages, bunds and road embankments or, if of suitable quality, sold as filling. The thickness of overburden compared to the thickness of the sand deposit (the overburden ratio) to a large degree determines if a deposit is economic to exploit. Overburden is generally removed by scrapers or by excavators and dump trucks.

Overburden removal and disposal operations have the potential to raise dust levels and contaminate stormwater. Overburden may also include potentially acid sulphate materials in coastal areas.

Sand deposited in stream channels, on point bars and coastal dunes may not be covered with vegetation, topsoil or overburden.

Extraction operations comprise two principal types- dry operations and wet operations.

Dry operations

Dry operations include operations above the natural water table and operations where the water table is lowered by dewatering operations. Extraction is generally undertaken by scrapers or hydraulic excavators.

Wet operations

Wet operations generally deploy a floating dredge or a rope operated dragline located on the adjacent bank. There are a number of different dredging methods available, the most popular is a floating dredge comprising a pump, pontoon, and a dredge ladder that is raised and lowered with a winch and anchoring mechanisms. The dredge head is usually fitted with a combination of rotating cutters and high pressure water jets. The material is either pumped to a holding pen and later transhipped to the processing plant or pumped via pipeline to the processing plant.

Materials excavated with a dragline are generally stockpiled and allowed to drain prior to loading with a front end loader or excavator to trucks for haulage to the processing plant.

Processing and distribution – Raw sand or sand and gravel generally requires washing and classification to remove silt and clay sized particles. Processing may simply involve pumping material to a density tank and onto a hydrocyclone for dewatering. Vibrating screens and trommels may be required to separate large stones, sticks, clay balls and the like and specialised products may require the use of classifiers to control the particle size distribution of the sand.

Washing of the product produces a sludge that requires safe and secure disposal.

The wash water is usually returned to the extraction ponds where the fines settle and the water is reused. Alternatively, the wash water is passed through purpose built settling ponds that require clearing out from time to time. Flocculants and coagulants may be used to increase settling efficiency.

Recovering fines using clarifiers and belt presses is presently not carried out in Queensland. Sand products are held in open stockpiles to allow drainage, quality control testing and to ensure that sufficient material is available for peak demand periods.

In South East Queensland, all sand products are delivered from the processing plant by road.

The substrate of alluvial sand pits is generally amenable for re-establishing vegetation and most **rehabilitation** involves regrading steep slopes, topsoiling and seeding or planting. Since the majority of workings are located in flood plains, worked out extraction pits are generally only suitable for non urban, rural and nature conservation uses such as wetlands and water

storages. However, pits have been used for disposal of industrial and construction wastes, and others have provided a landscape and amenity feature of residential development.

2.3 Market Area

Sand market areas are dynamic and depend on a number of factors including integrated investments, product characteristics, competition, access, physical constraints, infrastructure, population distribution, customer preference and construction project requirements.

Although the market area for a particular sand producer is complex and ever changing, in broad terms it may be considered to comprise a primary market area and a secondary market area. The primary market area may be defined as the area into which the majority of sales are delivered. The secondary market area surrounds the primary market and is the area where bids are less successful due to competition although sales of special products and high value products may be successful.

Although the market area for a particular producer is largely determined by the geographical location of competitors particular situations may increase the market area. For example, the concrete mix design for the Pacific Motorway required the sand to have a particular silica content, which ruled out manufactured sand located close to the project.

2.4 Transport Costs

Sand products are high bulk low cost materials. Transport costs can be a considerable proportion of the total cost to the end user.

The majority of sand products are carted in tri-axle trailer, and truck and dog configurations. Body trucks are also used widely and include a range of trucks sizes to suit particular jobs. The hourly hire rate for a tri-axle trailer and dog truck configuration is about \$80 to \$85 per hour. Cartage rates per tonne effectively reflect the hourly rate and therefore may vary from operation to operation to account for traffic and access conditions.

Typical standard cartage rates for trucks and truck and dog combinations are presented in Figure 2.1.

For example, the cost of transporting sand for a distance of 30 km is about \$5.00 per tonne. This could represent about 40 to 50% of the cost of the material to the end user.

However, it should be noted that standard haul rates might be discounted by 10% to 20% for long-term contracts that provide for optimum truck utilisation. The ability to back load other products/ materials can also affect cartage rates.

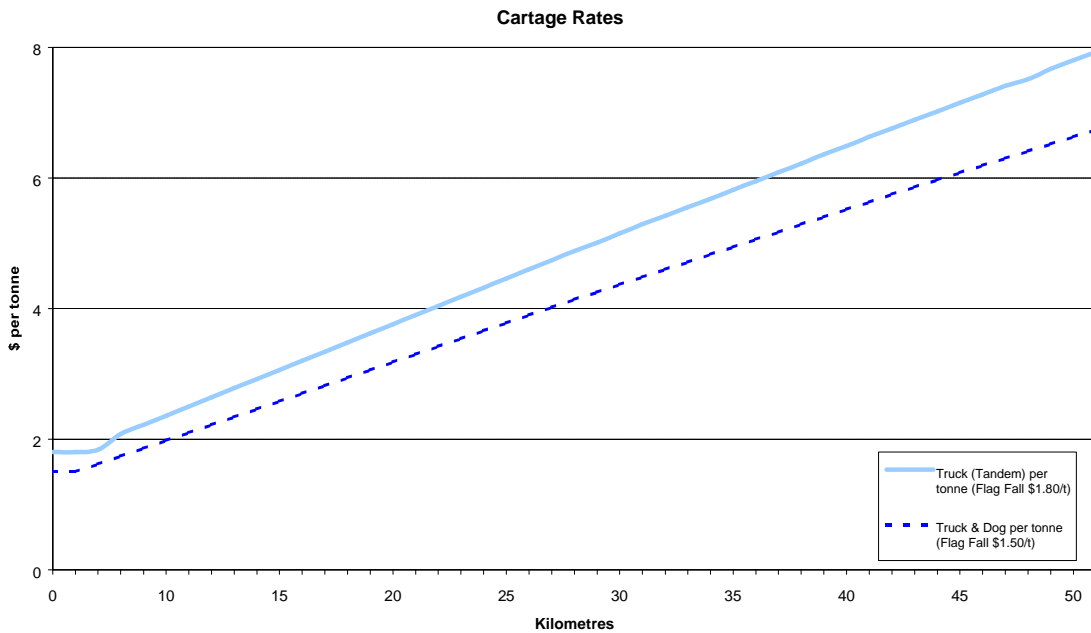


Figure 2.1 Cartage Rates

2.5 Selling Prices

Sand selling prices depend on a range of complex market factors, such as project timing, job size, access, product specification, quality tolerances, and commercial relationships and arrangements. Typical ex bin selling prices in the market are:

- Coarse concrete sand \$11.00 to \$12.00 per tonne
- Fine/medium sand \$9.00 to \$11.50 per tonne

Fill sands such as produced in the Jacobs Well area range from \$5.00 to \$8.00 per tonne.

The sand deposits at Jacobs Well are not well graded, and may be contaminated with shell and organic matter. Thus, the majority of the sand is used for low value applications such as filling and levelling of land. A proportion is used for blending with manufactured sand to adjust gradings and/or enhance workability when used in concrete.

2.6 Demand

The Australian Bureau of Statistics (ABS) collected comprehensive statistics on the production of quarried products in Queensland up until the early 1990s. The statistics were published at least twice yearly until 1990 and involved sending questionnaires to all producers of quarried materials. However, since then production statistics are estimated every three years based on sampling of selected operations.

The categories of information and the level of detail in the data changed over the collection period. During the early 1970s, the statistics probably underestimated actual production.

From at least the mid 1960s until the early 1970s, the ABS statistics were collected on a quarterly basis for the total State and the Brisbane Statistical Division and were reported in both cubic yards and production value, for the following categories:

- river sand, other sand, total sand
- gravel (crushed and uncrushed), “X” gravel (ungraded material, won and used in its natural composition; and prepared mixtures of sand and gravel), total gravel
- total sand, total gravel, total sand and gravel

By the late 1980s, the data was collected half yearly for the total State, each Statistical Division and some Statistical Subdivisions. The information was reported in tonnages and production value. The categories of data used included:

- Sand and gravel production -
 - river or creek sand, other sand, total sand
 - river or creek gravel, gravel and sand mixtures
- Quarry production -
 - non-crushed gravels for road paving, for other uses
 - crushed and broken stone for road paving, for other uses
- Other materials

The then Department of Mines and Energy also collected selected statistics for gazetted hard rock quarries. In the mid 1990s, the Extractive Industry Unit commenced a concerted effort to collect production statistics. Initially the statistics were grossly inaccurate but have improved over very recent years. Further the statistics are rounded to the nearest 50 000 tonnes for natural sand and 10 000 tonnes for soil loam. It is probable that some producers have not been identified.

Table 2.1 presents the annual production of selected extractive materials for 1997/98, 1998/99 and 1999/00 for local authorities in South East Queensland.

The category ‘crushed fine aggregates (<5mm)’ refers to manufactured sand made to specification by crushing rock or reprocessing crusher fines by washing or screening.

‘Natural sand’ includes sand used in ready mixed concrete, concrete products, asphalt, mortar, plaster and other uses. Unprocessed sand and sand used for filling is included in the natural sand category.

Natural sand includes fine medium and coarse sand, however, it is suspected that relatively small quantities of coarse sand are included in the quantities shown in Table 3.2. The category River Gravel is not included in Table 3.2, but is also likely to include small quantities of natural sand as mixtures of sand and gravels.

The production statistics show that substantial quantities of manufactured sand are now produced. The majority of the manufactured sand is used in concrete manufacture as a replacement for medium and coarse-grained natural sand.

Annual production of natural sand during the past 3 years has averaged 4.7 million tonnes. Of that, an average of 385,000 tonnes has been sourced from marine sand deposits in Moreton Bay. Thus, annual production of “land-based” sand is approximately 4.3 million tonnes.

Table 2.1 Annual Production of Selected Extraction Materials in South East Queensland - 1 July 1997 to 30 June 2000

1 July 1997 – 30 June 1998

LOCAL AUTHORITY	CRUSHED FINE AGGREGATES (<5mm) (Manufactured Sand) (tonnes)	NATURAL SAND (tonnes)	UNPROCESSED CONSTRUCTION MATERIALS incl RIDGE GRAVELS (tonnes)	TOTAL (tonnes)
Beaudesert	-	200,000	-	200,000
Boonah	-	-	-	-
Brisbane	-	1,800,000	200,000	2,000,000
Caboolture	100,000	100,000	600,000	800,000
Caloundra	200,000	300,000	-	500,000
Esk	-	300,000	-	300,000
Gatton	-	-	-	-
Gold Coast	600,000	700,000	1,000,000	2,300,000
Ipswich	-	300,000	-	300,000
Kilcoy	-	-	-	-
Laidley	-	-	100,000	100,000
Logan	-	200,000	-	200,000
Maroochy	100,000	100,000	-	200,000
Noosa	-	-	-	-
Pine Rivers	200,000	400,000	100,000	700,000
Redland	-	100,000	200,000	300,000
Toowoomba	100,000	-	-	100,000
Sub TOTAL	1,300,000	4,500,000	2,200,000	8,000,000
TOTAL				8,000,000

1 July 1998 - 30 June 1999

Beaudesert	0	200,000	0	200,000
Boonah	0	0	0	-
Brisbane	100,000	2,200,000	300,000	2,600,000
Caboolture	0	100,000	400,000	500,000
Caloundra	0	400,000	0	400,000
Esk	0	100,000	0	100,000
Gatton	0	100,000	0	100,000
Gold Coast	600,000	900,000	500,000	2,000,000
Ipswich	0	100,000	0	100,000
Kilcoy	0	0	0	-
Laidley	0	0	0	-
Logan	0	200,000	100,000	300,000
Maroochy	100,000	100,000	100,000	300,000
Noosa	0	0	0	-
Pine Rivers	100,000	200,000	0	300,000
Redland	0	100,000	100,000	200,000
Toowoomba	0	0	0	-
Sub TOTAL	900,000	4,700,000	1,500,000	7,100,000
TOTAL				7,100,000

1 July 1999 - 30 June 2000

Beaudesert	100,000	300,000	0	400,000
Boonah	0	0	0	-
Brisbane	200,000	1,100,000	200,000	1,500,000
Caboolture	100,000	300,000	0	400,000
Caloundra	300,000	600,000	100,000	1,000,000
Esk	0	200,000	100,000	300,000
Gatton	0	100,000	0	100,000
Gold Coast	800,000	1,000,000	1,400,000	3,200,000
Ipswich	0	300,000	200,000	500,000
Kilcoy	0	0	0	-
Laidley	0	0	0	-
Logan	0	200,000	200,000	400,000
Maroochy	200,000	200,000	200,000	600,000
Noosa	0	0	0	-
Pine Rivers	200,000	400,000	100,000	700,000
Redland	0	100,000	300,000	400,000
Toowoomba	100,000	0	0	100,000
Sub TOTAL	2,000,000	4,800,000	2,800,000	9,600,000
TOTAL				9,600,000

Source: Land Use and Extractive Industries Unit, Department of Natural Resources and Mines (March 2002)