Island wide Construction Raw Material Survey Report On Matara District

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1. Introduction

Since the beginning of this century, government as well as private sector organizations initiated rapid development work throughout the country in a massive scale.

Of these projects, Port City development project, construction of expressways (i.e. Northern and Central expressways, extension of Southern expressway to Hambantota and Mattala), extension of Southern Railway line from Matara to Kataragama, erection of massive building complex for Ministry of Defense and Three Forces Head Quarters in Pelawatta, erection of other government office complexes in Battaramulla, construction of irrigation and hydro power projects in many parts of the country, construction of multi storied apartment complexes in urban areas in many parts of the country, etc., are significant. For these projects, huge quantities of building raw materials (sand, rock and soil / gravel) are required.

Being the regulatory body of the implementation of Mines and Minerals Act No. 33 of 1992 amended Act No. 66 of 2009, it is the responsibility of the GSMB is to identify mineral resources in the country, including building raw materials, needed for various industries and development projects in the country, initiated by the government as well as the private sector.

In the recent past, numbers of inquiries were made by the contractors of various development projects in the country about the difficulties faced by them when identifying suitable localities for extracting and supplying building raw materials needed for the major development projects, currently initiated in many parts of the country. This results in delaying construction work of some of the government high priority development projects.

This matter was reported to the Mr. R. Paskaralingam, Senior Advisor to the Ministry of National Polices and Economic Affairs by the related parties during the progress meetings of the government development projects, held with the Ministry of National Polices and Economic Affairs. Thereafter, a request was made to the Director General, GSMB by Mr. R. Paskaralingam to immediately initiate an island wide construction raw
material survey to identify suitable localities of building raw materials (sand, rock and soil / gravel) with the intention of opening mines and estimate their reserves in order to use them in the required projects.

Accordingly, GSMB has initiated island wide construction raw materials survey in early 2017. This report and the accompanying maps, tables and annexes discuss the outcome of the construction raw materials survey in Matara District.

2. Objectives

The objectives of this survey are as follows.

- Conducting field survey to identify suitable sites for mining construction raw materials. (Sand, Gravel and Rock)
- Identification of mining related issues and environmental concerns.
- Preparation of construction raw material resource map.
- Assessment of minable quantities of construction raw material in identified locations and their optimum extraction limits.

3. Area and Boundary

Total land area of Matara District is approximately 1282 square kilometers. The District is bounded by Ratnapura Districts on the North, Hambanthota District on the East, Galle District on the West and Indian Ocean on the South. The District comprises Sixteen Divisional Secretariat Divisions namely Kotapola, Pitabedda, Pasgoda, Akuressa, Athuraliya, Mulatiyana, Hakmana, Kamburupitiya, Kirinda-puhulwella, Welipitiya, Malimbada, Thihagoda, Devinuwara, Dickwella, Matara and Weligama (Fig. 1).
4. **Location and Accessibility**

The area covered by Matara District lies within 1:50,000 sheets of Rakwana, Ambalangoda, Morawaka, Galle and Matara. The main town in the District is Matara while Weligama, Hakmana, Akuressa, Kamburupitiya, Kirinda-Puhulwella, Mirissa, Deniyaya, Morawaka and Devinuwara are the other towns located within the District.
Matara is a moderately developed and less populated District in the country. District is accessible via a well-developed road network. To reach Matara District from Colombo, two “A” grade road lies in northern and eastern directions. Colombo – Wellawaya (A - 2) road lies in northern direction while Nonagama – Pelmadulla (A - 18) road lies in eastern direction. Apart from that Express way E-01 is the fastest to reach Matara from Colombo and Colombo –Matara railway line is also provide an easy access to the district.

These main roads are connected by a fair network of provincial roads (“A” & “B” grade) and Pradeshiya Sabha roads (“C”) within the District, except for northern sections where road network is relatively poor due to presence of tea plantations and Forest Reserves.

5. Climate

Central and northern part of the district fall in to low and mid country wet zone of Sri Lanka. The southern coastal part falls into dry zone. The low and mid country wet zone occupies a major part of the district.

Rainfall
The area falling with in the dry zone receives somewhat low annual rainfall. This zone is fed by the SW monsoon rain, usually received during May to September with an annual rainfall figure of between 1500-2000mm. The area falling within the wet zone receives a higher annual rainfall and it is more than 2500mm.

Monthly Average Temperatures
The highest average monthly temperature is recorded in the months of March, April and May (30°C) while the lowest average monthly temperature is encountered in the months of November, December and January (26°C). The mean annual temperature is 26.7°C.
6. **Physiography and Drainage**

Physiographically most of the area covered by Matara District belongs to middle peneplain of Sri Lanka. The District covers a part of Southern Sri Lanka having sixteen divisional secretariats. Among famous tourist attraction within the district are Sinharaja forest reserve, Ellakanda national park, Mirissa beach, Matara beach, Getabaru dewalaya and Wewurukannala temple. Considerably large area of the land is occupied by forests and tea plantations and the population is mostly concentrated towards the Southern part where small town and agricultural settlements, exist.

Topography of the Northern half of the area is rugged where altitude rises up to 1350 m towards Rakwana massif. The topography of the southern part is gently undulating with low relief. The average elevation of ridges are about 100 m above mean sea level and that of the low-lying areas ranges from sea level to about 30 m closer to the coastal area.

Major rivers Nilwala Ganga and Polwatta Oya with a network of minor tributaries drain the area. The water levels in these rivers are high during southwest monsoon period (from May to September) and low in Northeast monsoon period (from November to March).

Several soil types are present and they reflect the underlying lithology as well as topography. Moderately fine-textured well-drained reddish-brown earths are the major soil type occupying Hillcrest and upper and mid-slopes of the ridges. Low humic grey soils cover lower slopes and valley bottoms. Widespread alluvial soils are found on the floodplains of the major rivers.

Vegetation along the coastal strip special where there is a wide low relief beach, is mainly of ground Creeper type. Mangrove vegetation which is mainly restricted to lagoons and river banks and Barringtonia trees are the other prominent types of vegetation along the sandy coastal stretch. Fernlands, scrubs and grassland mixed with tropical hardwood occupy the most of the hinterland. The Northern part of the map is covered with Sinharaja tropical evergreen rainforest. Rubber, coconut palm, Cinnamon and rice are the main cultivated plants. Low-country tea Gardens occupy the hill areas of Akuressa, Deniyaya and Morawaka.
7. **Outline of Geology**

Ninety percent of the island of Sri Lanka is underlain by Proterozoic high grade metamorphic rocks with Quaternary sediments being restricted to the NW, N and NE coastal regions as a narrow strip (Fig. 2). The Precambrian basement is divided into three major lithotectonic units, namely, Highland Complex (HC), Wanni Complex (WC) and Vijayan Complex (VC) (Fig. 2).

Geologically the Matara District lies within the Highland Complex of Sri Lanka. However, the coastal stretch is overlain by a Quaternary sediment which unconfirmably which rest on the basement rock (Fig. 2).

![Figure 2: Simplified Geological Map of Sri Lanka showing Boundary of Matara District](image-url)
The total area of the district is underlain by HC rocks. The HC is an ancient crustal domain (between 2.8 and 2.0 Ga) metamorphosed at granulite grade in 610-510 million years ago. HC rocks exposed in the area is composed of interlayered metasedimentary rocks including garnet-biotite-sillimanite-graphite gneiss (Khondalite), marble, calc-gneiss, quartzofeldspathic gneiss, garnet-biotite gneiss and massive charnokites.

The coastal strip is located in the southern boundary of the District. In this coastal strip, unconsolidated and superficial Quaternary to Recent sediments are encountered. These include sandy beaches, sandy berms, sand dunes, blown sands, lagoonal and estuarine deposits with minor beach rock and coral formations.

8. **Initial Study**

Upon awarding the study, GSMB commenced project related activities in August 2017. GSMB assigned a geologist with supportive staff (comprising of Technical Officer and a Cartographer) to perform mineral survey in the District. A senior geologist was identified to co-ordinate the project related activities.

Initially, all the available data on mineral occurrences and the details of ongoing mining operations within the District were collected (Annex 04) and a resources map of the District was prepared (both soft and hard copies). This map also contain information on wild life Forest reserves and data available in 1:50,000 topographic sheets relevant to the Matara District.

9. **Field Investigations**

After preparing the baseline data map of Matara District, the assigned field crew left for Matara District to commence field investigations in early September 2017. The field camp was established in Malimbada from where it is easily accessible to other parts of the district.
Field work in entire district was conducted in one and a half months and during this period all the accessible areas in the district were covered. After completing field investigations, field camp was closed and the field crew returned to head office in mid-October 2017 and commenced final map preparation work.

This report, along with accompanying maps and tables, discuss the results of the construction raw material survey in Matara District.

Mineable quantities of construction materials identified in all the investigated locations were assessed during field investigations. For the calculation of resources, mineable depths, widths, and lengths of rock/soil/gravel occurrences were identified / estimated based on the field relations of each and every identified body. The mineable quantities of rock/soil/gravel commodity at each location are given in the Annex – 2 and 3.

In addition to the information related to mineable quantities of rock/soil/gravel, following additional information on each studied location was also gathered during field investigations. These data are also displayed in Annex – 2 and 3.

- Mineral Type
- GPS Co-ordinates
- Divisional Secretariat Division
- Grama Niladari Division
- Occurrence (above surface / below surface)
- Mined Out Volume (Currently Mining and Previously Mined Bodies)
- Mineable Depth
- Mineable Height
- Mineable Width
- Mineable Quantity (New Occurrences)
- Remaining Mineable Quantity (Currently Mining & Previously Mined Bodies)
- Present Status (New Occurrence / Currently Mining Body / Abandoned Body)
- Geology
- Lithology
- Land used Type
- Land ownership
- Distance to Close by Structures (well, house, religious place, school, etc.)
- Number of Houses within 100m Distance
- Availability of Access Roads to Identified Locations
10. Construction Raw Material Occurrences

The occurrences of following building materials were identified.

10.1. Soil /Gravel
10.2. Rock
10.3. River and inland Sand

10.1. Soil /Gravel

Soil/Gravel is a residual deposit representing the alteration products of subjacent Precambrian hard rocks. In some sections, relict foliation of gneissic rock is well visible within this formation. It is noted that this formation is always exposed on topographic heights. Exact thickness of soil/gravel layer can be varied depending on the profile.

Soil/Gravel materials are mainly used for road construction work in Matara district. With the construction of Hambanthota harbor and Mattala airport, a massive road development programme connecting the commercial centers has been initial. Also the extension of railway from Matara to Beliatta is in progress. As a result, the demand for gravel and soil within the area, increased rapidly. The first three sections of the expressway and the rail road is running through ridges and valleys. Therefore, most of the soil /gravel demand is fulfilled by cut and fill of the road trace. But there is a substantial demand for gravel as extensive filling is required at some places. Large scale gravel/soil extraction has caused environmental and social problems.

During the field investigations it was noted that most of the gravel and soil formations located in close proximity to expressway and rail road extension within the district have either been partly mined out or being mined out or being mined for use as a raw material in road construction work. It was noted that most of the gravel beds are being mined since the Expressway construction is in the final stages. The major working and newly identified areas are located in Malimbada, Thihagoda, Matara, Dikwella and Hakmana DS divisions. Matara and Thihagoda DS Divisions have the most of the soil/gravel resources. In other parts of the district tea is cultivated in most of the land.
The identified locations of soil/gravel occurrences are shown in Annex 1 and the details of the identified Soil/gravel occurrences are given in the Annex 2. Mining would be authorized after considering the possible impact to the environment and the mitigatory methods.

The following photograph show some of the locations of soli/gravel occurrences partially mined out or currently being mined or new occurrence within the District.

Plate – I: Location No. CMS/MT/GR/19  Plate – II: Location No. CMS/MT/GR/08

Plate – I & II: New gravel occurrences (CMS/MT/GR/19 and GR/08).
Plate – III: Location No. CMS/MT/GR/17

Plate – IV: Location No. CMS/MT/GR/12

Plate – III & IV: Images showing working soil/gravel deposits (CMS/MT/GR/17 and 12).

Plate – V: Location no. CMS/MT/GR/24

Plate – VI: Location No. CMS/MT/GR/24

Plate – V & VI: Images showing abandoned soil/gravel deposits (CMS/MT/GR/24 and 19).
10.2. **Rock**

Broken rocks is one of the most essential commodities used in the construction industry. Different sizes of broken and crushed rocks, varying from fine power to boulder size, are produced according to the requirements of construction industry, mainly in road construction and other related development activities.

Any rock, to be used as a construction material, must be strong and be able to withstand the stresses placed upon it. In this respect, many of the crystalline rocks of the country can be considered as suitable rocks for production of rock aggregates.

However, in order to set-up an economically viable quarry project, sufficient reserves of suitable rocks should be made available in an easily accessible location. In order, to operate it in a sustainable manner, it should also be located in an environmentally non/less sensitive area where impacts are not significant or impacts could be mitigated without causing detrimental damages to the existing environment.

When considering the above facts, finding suitable locations to set-up rock quarry projects is not an easy task. Therefore, it is necessary to carry out extensive field surveys to assess the feasibility of possible quarry sites.

With the improvement of infrastructure, the government of Sri Lanka has initiated an extension of the expressway from Matara to Hambanthota and extension of the railroad from Matara to Beliattha. For these projects, massive amount of rock aggregates are required. Therefore, in order to maintain adequate supply of aggregate for these development projects, it is necessary to discover suitable quarry sites in proper locations within the district.

Exposures of Proterozoic metamorphic rocks are abundant in some areas within the district. Outcrops are suitable as they are suitable to produce good quality aggregates.

The rock types found at the outcrops are charnockite, charnockitic gneiss and garnet granulites. More than 60 locations of working and abandoned quarries and new rock exposures were identified within the District. Most of them are located in the southern part of the District. Rock quarries are scarce in the northern part due to tea plantations, Sinharaja forest reserve and low population.
Matara district does possess good quality large rock exposures suitable for opening IML – A category quarries site in some places. To meet the demand for hard rocks, most of the identified rock exposures are being utilized and also below surface mining is conducted.

Since the below surface rock mining is being conducted in some of these quarry sites, accumulation of water within the mined area (pit) is observed during heavy monsoonal rains. It is necessary to pump out all the accumulated water to avoid stagnation. As stagnation water at some sites has already created adverse impacts.

The resources have been estimated based on the tentative mining depths and identified surface areas of rock exposures identified during field investigations. However, actual allowable mining depths as well as allowable surface areas for mining will have to be determined only after a comprehensive assessment of environmental and sociological issues. Thereafter it will be possible to determine the allowable limits of mining below the ground level. Post mining rehabilitation of these quarries are very important and it should be done in a proper manner. Surface outcrops identified during field investigations are marked in Annex 01 and their details including total estimated extractable volume of each rock outcrop is mentioned in Annex – 03. Some of these surface rock exposures are shown in following photographs.
Plate – VII: Location No. CMS/MT/RC/54  

Plate – VIII: Location No. CMS/MT/RC/41

Plate – VII & VIII: Quarry faces of two currently mining quarries (RC/56 & RC/51)

Plate – IX: Location No. CMS/MT/RC/56  

Plate – X: Location No. CMS/MT/RC/51

Plate – XI: Location No. CMS/MT/RC/47

Plate – XII: Location No. CMS/MT/RC/53

Plate – XI & XII: Abandoned quarries with more resources. (RC/47 & RC 53).

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Plate – XIII: Location No. CMS/MT/RC/06

Plate – XIV: Location No. CMS/MT/RC/24

Plate – XIII & XIV: Mined pits with stagnant water (RC/06 & RC 24).
10.3. **River and inland Sand**

River sand is available in Nilwala river bed and due to excessive mining the river bed was deepened and the embankment was eroded. Presently, by a court order sand mining is suspended in Nilwala River. The sand requirement of the district is met by inland sand supply from Hambantota district.

Many environmental issues and crocodile threat have discontinued the sand exploitation in Nilwala River. But small scale sand mining could be observed in Akuressa, Pasgoda, Pitabeddara, Kotapola and Mulatiyana divisional secretariat divisions.

Due to lack of unexploited sand deposits within the district no field survey was conducted in search of sand deposits and available data of the existing licenses included in the report. Annual legal sand production is given in the following table,

<table>
<thead>
<tr>
<th>District</th>
<th>AL/A (m³)</th>
<th>AL/B (m³)</th>
<th>IML/B (m³)</th>
<th>Total (m³)</th>
<th>Total in cubes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matara</td>
<td>-</td>
<td>-</td>
<td>12000</td>
<td>12000</td>
<td>4286</td>
</tr>
</tbody>
</table>
11. **Conclusion**

- Most of the identified locations of Rock and Soil/Gravel occurrences can be considered as potential minable resources.
- During the survey it is not possible to identify the future rock quarry locations that will be uncovered by excavating the soil layer on basement rock on hills or slopes.
- The total estimated minable resources of Rock, Soil/Gravel and Sand within Matara district in cubic meters are as follows,

<table>
<thead>
<tr>
<th>Material</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rock</td>
<td>$1.0226 \times 10^7$ m$^3$</td>
</tr>
<tr>
<td>Soil/gravel</td>
<td>$1.489 \times 10^6$ m$^3$</td>
</tr>
<tr>
<td>Sand</td>
<td>$1.2 \times 10^4$ m$^3$</td>
</tr>
</tbody>
</table>

12. **Recommendation**

- Suitable action should be taken to reserve minable locations with demarcated buffer zones to limit further settlements until the resource is mined out and properly rehabilitated.
- Development of proper rehabilitation plan for new and existing mining is recommended and it should be a master plan for a given area (Ex: DS Division) considering the individual mining locations.
- Recommended to adopt safety measures and best practices for all mining sites for the safety of the workers hanging out on high excavation faces, reduce hazards of high excavation faces etc.
Acknowledgements

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Finally, all the Geologists, Mining Engineer and the staff of the regional office of Matara and rest of the staff members of the GSMB are acknowledged for helping in various ways during the entire field survey and compilation of the report.
References


Geological Map of Rakwana – Tangalla (Sheet No. 20), 1:100,000 scale, published by Geological Survey and Mines Bureau, 2009.