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A Study of Quarry Site for Second International Airport (Nijgadh International Airport)

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Abstract: ***Second International Airport is seen as alterative to relieve the flow of flights with higher capacity compared to TIA and enhance the air transport connectivity between Nepal and rest of the world as an international hub airport including transit facilities. The project site is located in the Bara district with Boundary as Bakaiya River in the east and Pasaha River in the west. There are three quarries namely Bakaiya River, Bagmati River and Rapti River near to the project site with approximately 50 km distance with crusher plant established. These quarries have sufficient amount of raw material for the SIA project to be built. Raw materials collected from these quarries meet the standard specification of Department of Roads as well as Manual of Tribhwan International Project for the undergoing construction project of two bay in south of bay no: 1. Raw materials are tested for Gradation, Los Angeles Abrasion (LAA), Aggregate Crushing Value (ACV), Sodium Sulphate Soundness (SSS), Specific Gravity(G), California Bearing Ratio(CBR) and are found to meet the specifications.***

Keywords: Second International Airport, LAA, ACV, SSS, G, CBR

1. Introduction

Tribhuwan International Airport (TIA) has reached its saturation level and Second International Airport is seen as alterative to relieve the flow of flights with higher capacity compared to TIA and enhance the air transport connectivity between Nepal and rest of the world as an international hub airport including transit facilities. Second International Airport is the proposed International Airport located at Kolhavi Municipality, Province 2, Nepal. Proposed Airport covers approximately about 80 sq. km. of area with east boundary as Bakaiya River and West boundary as Pasaha River respectively.

Location of Second International Airport provides free maneuvering airspace of minimum 20 km radius with 150 km distance from the capital which will be connected with Kathmandu-Terai Expressway. Second International Airport is expected to have two parallel run ways with capacity of 15 million passenger annually with as well as Airbus A380.

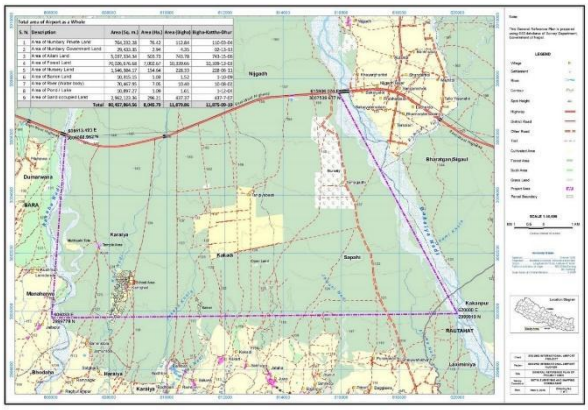

Figure 1: Location of SIA

Building such a national pride project needs a lot of raw materials such as Aggregate, Sand, Boulders, cement, Bitumen, etc. Among these materials, raw materials such as Aggregate, Sand, Boulders, are used from locally available quarry nearest to the construction site. These construction materials should be strong enough to make durable infrastructures built for the designed category. There are different tests conducted to make sure the materials collected from these quarries meet the specification for the designed period and loading.

2. Problem Statement

Construction of such a huge project requires a lot of raw material. Inferior construction material which does not meet the standard design and specification will result in both serviceability and economy of the Project. Therefore, construction materials meeting the standard specification must be used and construction should be supervised. Thus, Identification of such quarry sites near to the project will not only provide the standard construction material but also make the project economical.

3. Objectives

Objective of this study is to conduct tests of different materials from different quarries to meet the minimum standard as per specification in abundant quantity.

Specific objectives:

- To conduct lab test of raw materials collected from the quarry sites investigated.
- To verify the results with standard specifications.
- To find out quarries investigated could yield enough material for the completion of project.

4. Literature Review

Raw materials for the construction of pavement must have desirable properties to give the pavement desired life and service of the airport. Aggregate must be strong enough to resist abrasion, impact, weathering. Furthermore it must

meet gradation, moisture effect from stripping, water absorption, etc.

"Newark airport, in New Jersey (USA) experienced asphalt shearing in the heavy aircraft braking zone associated with aircraft landings [27]. It was concluded that inadequate aggregate interlock resulted in a reduction in shear strength." Grey White, 2018, Volume 11

Total Construction material necessary for the completion of Project is estimated as:

Table 1: Requirement of Construction Material

SI	Key Construction Material	Unit	Tentative Quantity
1	Earth Fill	m³	5,800,000.00
2	Sub Grade	m³	330,000.00
3	Aggregates		
	Subbase	m³	625,000.00
	CS Base	m³	415,000.00
	Asphalt	m³	275,000.00
	Concrete Pavement	m³	120,000.00
	Structural Concrete	m³	250,000.00
4	Sand	m³	375,000.00
5	Boulders	m³	150,000.00

(Source: EIA report of SIA)

Capacity of Quarries selected for study are:

4.1 Bakaiya River

Bakaiya river in the east boundary of the project site and located in Bara district. This quarry is the nearest quarry to the project site. Capacity of this quarry is:

Table 2: Capacity of Bakaiya River

SI	Key Construction Material	Unit	Tentative Quantity
1	Sand/Silt/Clay	m³	2,868.000.00 (30 %)
2	Gravel	m³	5,736,000.00 (60 %)
3	Gabion/Boulder	m³	956,200.00 (10 %)
	Total	m³	9,560,000.00

Figure 2: Raw material of Bakaiya River

4.2 Bagmati River

Bagmati River is 40 km east of the Project site in Rautahat district. Capacity of the Quarry is:

Table 3: Capacity of Bagmati River

SI	Key Construction Material	Unit	Tentative Quantity
1	Sand/Silt/Clay	m³	6,083,200.00 (40 %)
2	Gravel	m³	7,604,000.00 (50 %)
3	Gabion/Boulder	m³	1,520,800.00 (10 %)
	Total	m³	15,208,000.00

Figure 3: Raw Material of Bagmati River

4.3 Bagmati River

Rapti River is 57 km west of the Project site in Makwanpur District. The capacity of Quarry is:

Table 4: Capacity of Rapti River

SI	Key Construction Material	Unit	Tentative Quantity
1	Sand/Silt/Clay	m³	20,000.00 (30 %)
2	Gravel	m³	40,000.00 (60 %)
3	Gabion/Boulder	m³	6670.00 (10 %)
	Total	m³	66,703.5

Raw Material of Rapti River

5. Methodology

A quarry near to the project location is identified. A raw material from the crusher is collected for the lab tests and different tests are conducted to find the quality of raw materials. Results from the tests are compared with the standard specifications.

Table 5: Specification for Aggregate

Property	Test	Specification	Method of Test
Particle Shape	Combined Flakiness and Elongation Indices	Max 25%	IS: 2386 Part I
Strength	Los Angeles Abrasion Value	Max 30%	IS: 2386 Part IV
Durability	Soundness Sodium Sulphate	Max 12%	
Water Absorption	Water Absorption	Max 2%	IS: 2386 part III

Table 6: Gradation of Aggregate for Base coarse (TIA Manual)

Sieve Designation (Square Opening)	Percentage by Weight passing Sieves
50	100
37	90-100
25	70-95
19	55-85
4.75	30-60
0.6	12-30
0.075	0-8

6. Result and Analysis

After going through the river basins, the capacity of the river to yield raw material for the construction purpose has been estimated. Furthermore, the raw materials collected from these quarry sites were tested in lab. The test results of the quarries are summarized below:

6.1 Gradation

Raw materials collected from the crushers were checked for gradation and results are:

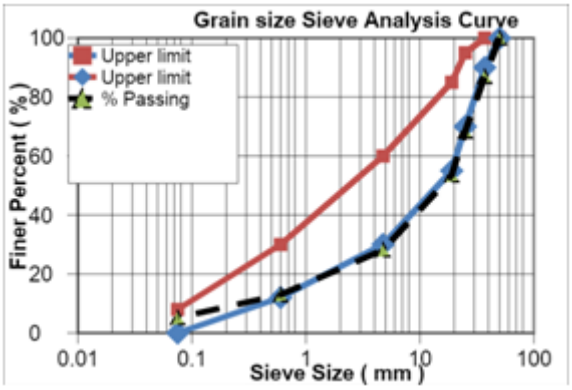

Figure 5: Gradation Curve of Bakaiya River (Base Coarse)

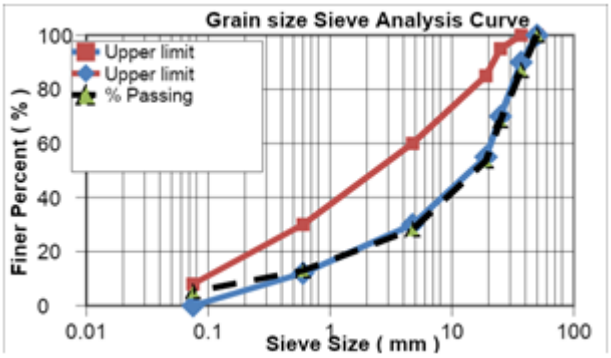

Figure 6: Gradation Curve of Bagmati River (Base Coarse)

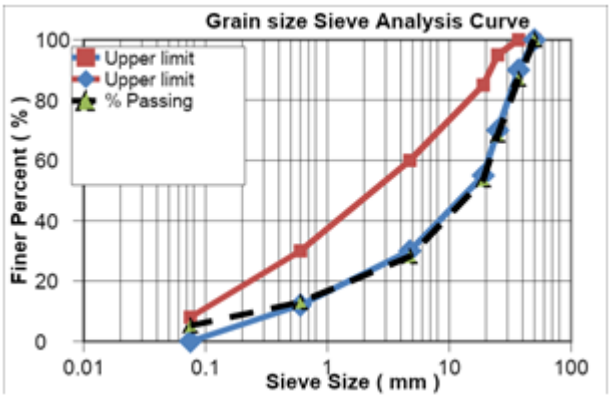

Figure 7: Gradation Curve of Rapti River (Base Coarse)

6.2 Los Angeles Abrasion

Table 7: Test Results of LAA

SN	Quarry Site	Los Angeles Abrasion (LAA)
1	Bakaiya River	21.8
2	Bagmati River	28.7
3	Rapti River	29.94

6.3 Aggregate Impact Value

Table 8: Test Results of AIV

SN	Quarry Site	Aggregate Impact Value (AIV)
1	Bakaiya River	14.52
2	Bagmati River	20.92
3	Rapti River	19.1

6.4 Sodium Sulphate Soundness

Table 9: Test Results of SSS

SN	Quarry Site	Sodium Sulphate Soundness (SSS)
1	Bakaiya River	3
2	Bagmati River	2.7
3	Rapti River	3.4

6.5 Flakiness Index

Table 10: Test Results of FI

SN	Quarry Site	Flakiness Index (FI)
1	Bakaiya River	10.58
2	Bagmati River	17.07
3	Rapti River	22.3

6.6 California Bearing Ratio

Table 11: Test Results of CBR

SN	Quarry Site	California Bearing Ratio (CBR)
1	Bakaiya River	88
2	Bagmati River	86
3	Rapti River	83

6.7 Specific Gravity

Table 12: Test Results of Specific Gravity

SN	Quarry Site	Specific Gravity (G)
1	Bakaiya River	2.649
2	Bagmati River	2.652
3	Rapti River	2.646

7. Conclusions

Thus, from above results and discussion it is clear that the selected quarries can yield sufficient raw materials for the successful completion of project. Furthermore, the Physical Properties of the raw material meet the standard specification of Dor and TIA manual. Thus, using raw materials from these quarries will result in strong and durable infrastructure if proper supervision and other standards are met.

Crusher plants producing base course material should be adjusted to meet the gradation curve of gradation curve specified in TIA manual for the construction of Two Bay on Southside of Bay No. 1 of International Apron.

8. Limitations

Quantity required is taken into account from feasibility study of SIA, which may differ from actual necessary quantity.

Alkali test of Aggregate are not done
Anti-Stripping test of aggregate are not done.

References

[1] Construction Materials Investigation Report on Detailed survey and design of electrified railway line of Simara – Bardibas Section of Mechi – Mahakali Railway and Simara – Birgunj Link.)
[2] Environment Impact Assessment of Second International Airport Project, GEOCE, consultants Pvt. Ltd.
[3] Initial Environment Examination of Rapti River, Hetauda Sub-Metropolitan City.
[4] Initial Environment Examination of Lal Bakaiya River, Nijgadh Municipality.
[5] Construction of Two Bay on Southside of Bay No. 1 of International Apron., Tribhuwan International Airport
[6] AASHTO, 2005, “Standard Specification for Transportation Materials and Methods of Sampling and Testing, 22nd Edition, Washington D.C.”
[7] State of the art: Asphalt for airport pavement surfacing, Greg White
[8] Standard Specifications for Road and Bridge work 2073, Government of Nepal, Ministry of Physical Infrastructure and Transport, Department of Road