भारतीय राष्ट्रीय राजमार्ग प्राधिकरण
(सड़क परिवहन और राजमार्ग मंत्रालय, भारत सरकार)
NATIONAL HIGHWAYS AUTHORITY OF INDIA
(MINISTRY OF ROAD TRANSPORT AND HIGHWAYS, GOVT. OF INDIA)

परियोजना निदेशक का कार्यालय, परियोजना कार्यान्वयन इकाई
Office of the Project Director, Project Implementation Unit
एन एच ए आई कॉम्पलेक्स, सेक्टर-२(ए), विधाननगर
NHAI Complex, Sector-2(A), Bidhannagar
दुर्गापुर - 713212, Durgapur - 713212

दुरभाष / Phone No. : (0343) 253 5766
: 253 4815
फैक्स नo / Fax No. : (0343) 253 4676
ई-मेल / E-mail : dur@nhai.org
: nhaipiudgp@yahoo.com

Ref. No. : 11021/3/2020/PIU(DUP)/BCREC /4315

Dated : 28.10.2020

To

Sh. Piyush Pal Roy
Director
Dr. B.C. Roy Engineering College
Jemua Road, Fuljhore, Durgapur - 713206

Sub: MOU for working together with mutual co-operation for dissemination of respective expertise in civil / highway engineering field through the road infrastructure development.

Sir,

Please find enclosed herewith a copy of the Memorandum of Understanding (MOU) dated 15.10.2020 for working together with mutual co-operation for dissemination of respective expertise in civil / highway engineering field through the road infrastructure development, duly signed by Chief General Manager (Tech), NHAI, Regional Office, Kolkata on behalf of National Highways Authority of India, for your information and necessary action.

Yours faithfully

(S.K. Mallik)
Project Director

Encl. : MOU (in original)

Copy to :-

1. The Chief General Manager (Tech), NHAI, Regional Office, Kolkata for kind information please.
2. The General Manager (Tech)WB, NHAI HQ for kind information please.

MEMORANDUM OF UNDERSTANDING

This Memorandum of Understanding (hereinafter referred to as "MoU") entered into on this 15th day of Oct 2020 by and between:

National Highways Authority of India (NHAI) (which expression shall unless repugnant to the context or meaning thereof be deemed to mean and include its successors and permitted assigns) of the First party;

AND

The **Dr. B. C. Roy Engineering College Durgapur, West Bengal-713206, INDIA** (hereinafter called as **The Technical Institute** which the expression shall unless repugnant to the context or meaning thereof be deemed to mean and include its successors and permitted assigns of the Second Party
WHEREAS

Both the Technical Institute (TI) and NHAI are desirous of working together with mutual cooperation for dissemination of respective expertise in civil / highway engineering field through the road infrastructure development.

NOW, THEREFORE, IT IS HEREBY AGREED BY THE PARTIES AS FOLLOWS:

1. INTENT:

National Highways Authority of India (NHAI) intends to associate the TI who shall voluntarily contribute its share of experience for betterment of the highway infrastructure.

2. SCOPE OF THE MOU

The primary scope of MOU inter alia includes the following:

(i) NHAI shall facilitate the faculty, researchers and students of the Institute to familiarize with the latest trends in the highway/transportation/bridge engineering/structural engineering/Geotechnical Engineering sector with a common objective of sharing the knowledge in their respective domain which may lead to joint supervision of Ph.D. research and projects of postgraduate students. This will, in one hand, facilitate to bridge the industry institute gap and familiarize students with the latest trends in industry and on the other hand the research output could be suitably adopted in practice by NHAI and the Technical Institute.

(ii) The Institute shall adopt nearby stretches of NHs as specified in the Appendix-1 as a voluntary initiative under ambit of Institutional Social Responsibility (ISR). The list of stretches may be modified by deletion / addition by mutual consent of NHAI and the Technical Institute.

(iii) The adopted stretch may be used as a field of study for faculty researchers and students.

(iv) NHAI shall offer internship to 20 number of undergraduate/postgraduate students of the Institute for 2 months duration in a year extendable from time to time.

Pijush Pal Roy
DIRECTOR
Dr. B. C. Roy Engineering College
DURGAPUR

R. P. SINGH
CGM (T) / RO
NHAI, Kolkata

(v) NHAI shall pay stipend @ **Rs 8,000/- (Rupees Eight Thousand Only)** per month for **undergraduate students** and @ **Rs 15,000/- (Rupees Fifteen Thousand only)** per month to Postgraduate students. All other arrangements including stay shall be responsibility of the Institute. However, depending upon availability, NHAI may extend transportation facility to the interns within the project jurisdiction.

(vi) Both the parties may form joint research groups leading to students' projects at different levels and collaborative research programmes.

(vii) Both the parties may jointly organize events such as seminars, workshops, conferences and training programmes.

(viii) No party shall have the right to use the name or logo of the other party without the prior approval of that party in writing.

(ix) The terms of this MoU may be modified/ amended at any time subject to mutual written agreement. Such modifications/changes shall be effective from the date on which both the parties execute them in writing.

(x) Any other research collaboration not covered above, shall have separate agreement/terms of contract that addresses issues such as Intellectual Property Right (IPR), funding pattern, disclosure of confidential information etc.

(xi) Any other matter(s), as mutually agreed, which are not covered above

3. Roles and Responsibilities:

The scope of this MOU shall be carried out in a collaborative mode between NHAI and the Technical Institute. The Roles & Responsibilities of NHAI are the Technical Institute in performing the defined objective shall be as follows:

NHAI

a. NHAI shall provide the list of potential stretches of National Highway for adopting by the Technical Institute

b. NHAI shall facilitate availability of relevant data required with specific reference to the above stretches through its field office consultants/concessionaire/contractor engaged in the project.

c. NHAI Will nominate an officer as a Node of contact for all correspondence in carrying out the defined objective.

d. NHAI shall facilitate the faculty, researchers and students of the Institute to give access to the site of the identified stretch being adopted by the Technical Institute, relevant documents for the purpose of activities to be carried by these intellectuals of the Institute.

e. NHAI through its field office Consultant Concessionaire Contractor engaged in the project as per reasonable requirement will disseminate and familiarize the latest trends and know how in highway/transportation/bridge engineering/Structural and Geotechnical Engineering(s) sector in general and the identified project in specific to the authorized faculty, researchers and students of the Institute.

f. NHAI may suitably adopt the research output and feedback received from the Technical Institute in practice for qualitative improvement as deemed fit at appropriate stage of implementation.

Pijush Pal Roy
DIRECTOR
Dr. B. C. Roy Engineering College
DURGAPUR

R. P. SINGH
CGM (T) / RO
NHAI, Kolkata

g. NHAI may support creation of Lab infrastructure in the Institute and can sponsor relevant research project that helps in using alternative resource material and improving quality of roads/bridges.

h. The NH stretch adopted can be co-branded with the associated technical institute by NHAI

The Technical Institute

a. The Institute shall adopt stretches of NHs as specified in the Appendix 1 as a voluntary initiative

b. The Technical Institute through its authorized faculty researchers and students will carry out periodic investigation on formal demands/ intimation and give suitable suggestions for improving the efficiency of existing highway asset covering the following aspects :

(i) Improvements in safety provision by removing existing deficiencies;

(ii) Improvements in continual existing maintenance of the stretch using new alternatives/ technologies;

(iii) Localized solutions for removal of congestion points, if any, so as to increase the average speed of traffic flow;

(iv) Improvements in the riding comfort through cost effective measures, if required, based on innovative technologies on practices applicable in the area;

(v) Viability of new way side amenities for road user based on the existing traffic pattern and user expectations;

(vi) Potential and probable solutions to old recurring problems based on local experience etc., wherever applicable.

(vii) Improvements in structural performance of bridges using new technologies;

(viii) Any other matter(s) such as structural performance audit of bridges, implementation of new innovative alternative technologies and construction materials, etc. on mutual agreement, which are not covered above;

c. The Institute may also associate with the Consultant/NHAI during conceptualization, design and project preparation of new projects and suggest the relevant parameters and innovations based on experience specific to the site climate, topography and resource potential for better socioeconomic outcome.

d. The Technical Institute will nominate a nodal officer for all correspondence in carrying out the defined objective as well as inform from time to time.

Pijush Pal Roy
DIRECTOR
Dr. B. C. Roy Engineering College
DURGAPUR

R. P. SINGH
CGM (T) / RO
NHAI, Kolkata

4. EFFECTIVE DATE AND PERIOD OF MOU

This MoU shall come into effect for all its intents and purposes from the immediate effect and shall remain valid for a period of 5 years from the date of signing. In the event of any dispute or difference arising in the implementation of the MoU, such disputes shall be resolved amicably by mutual discussions by both parties. All such decisions shall take into account the status of students working/projects under this arrangement and the interest of such students/ projects shall be protected. The MoU may be terminated by mutual consent by either party by giving 60 days' notice in writing to the other party.

For the Technical Institute
(Dr. B.C. Roy Engineering College, Durgapur)

15/10/2020

(Authorized Signatory)
Pijush Pal Roy
DIRECTOR
Dr. B. C. Roy Engineering College
DURGAPUR

Witness:

1. Sanjay Sengupta.
(Dr. SANJAY SENGUPTA)
HoD, Dept. of Civil Engg.
2. Soumyadip Das
Asst. Prof., Dept. of Civil Engg.
(Specialized in Transportation Engg.)

For National Highways Authority of India

(Authorized Signatory)
R. P. SINGH
CGM (T) / RO
NHAI, Kolkata

Witness:

1. (SHAILENDRA SHAMBHU)
MANAGER(Tech.), Ro-Kolkata, NHAI.
2. S.K. Mallik.
S.K. Mallik, PD
NHAI, PIU-Durgapur

==========

APPENDIX – 1

The institute shall adopt the following stretch(es) of NHs as a voluntary initiative under the ambit of Institutional Social Responsibility (ISR).

Sl. No.	Details of the stretch (from Chainage to Chainage)	NH No	Length(In Km)	Stage of implementation (completed/under construction/under maintenance/project preparation)	Remarks
1	Rehabilitation and up-gradation of existing road to 2-lane with paved shoulders configuration in Purulia (Jhr Border) – Chandil (Junction with NH-33) section of NH-32 from Km. 70.524 (JH/WB Border) to Km. 84.400 (near Sainik School, Purulia) and from Km. 94.300 (near Simulia Junction, Purulia) to Km. 153.705 (near Chandil, Junction with NH-33 in the state of Jharkhand)] in the states of West Bengal and Jharkhand under NHDP IV-B on EPC basis **(Adopted Stretch From Km.70.524 to Km.84.400)**	NH-32 (New NH-18)	13.876	Under construction	
2	6-laning of Panagarh-Palsit(from Km.521.120 to Km.588.870) Section of NH-19 in the state of West Bengal **(Adopted Stretch From Km.521.120 to Km.540.000)**	NH-02(New NH-19)	18.88	Under maintenance/project preparation	

Above list of stretches may be modified by deletion/addition by mutual consent of NHAI and the Technical Institute.

15/10/2020.

Pijush Pal Roy
DIRECTOR
Dr. B. C. Roy Engineering College
DURGAPUR

R. P. SINGH
CGM (T) / RO
NHAI, Kolkata

PIJUSH PAL ROY
2021.03.24 16:30:11 +05'30'

भारतीय राष्ट्रीय राजमार्ग प्राधिकरण
(सड़क परिवहन और राजमार्ग मंत्रालय, भारत सरकार)
National Highways Authority of India
(Ministry of Road Transport & Highways, Govt. of India)

भारतमाला
प्रगति के पथ पर अग्रसर
BHARATMALA
ROAD TO PROSPERITY

परियोजना निदेशक का कार्यालय, परियोजना कार्यान्वयन इकाई
Office of the Project Director, Project Implementation Unit
एन एच ए आई कमप्लेक्स, सेक्टर-२(ए), विधाननगर,
NHAI Complex, Sector-2(A), Bidhannagar,
दुर्गापुर-१२, Durgapur-713212

दुरभाष / Phone No. : (0343) 253 5766
253 4815
फैक्स नo / Fax No. : (0343) 253 4676
ई-मेल / E-mail : dur@nhai.org
nhaipiudgp@yahoo.com

Ref. No. : 11021/3/2020/PIU(DUP)/BCREC/ 808 **Date: 17.05.2021**

To,

Dr. Sanjay Sengupta
Nodal Officer
HOD, Dept. of Civil Engineering
Dr. B.C. Roy Engineering College
Jemua Road, Fuljhore, Durgapur - 713206

Sub.: MOU with Dr. B.C. Roy Engineering College - Request for suggestions for improving the efficiency of existing highway assets - reg.

Ref: MOU dated 15.10.2020.

Sir,

Please refer MOU dated 15.10.2020 signed between your College (Technical Institute) and NHAI, wherein Technical Institute through its authorized faculty researches and students will carry out periodic investigation on formal demand / intimation and give suitable suggestion for improving the efficiency of existing highway asset covering the aspects outlined under MOU.

Since, 5 no. of students of your College has successfully completed internship at NH-32 project site for the month of April' 2021 therefore it is requested to submit a feedback report on construction activity and also forward further improvement in the ongoing construction work / maintenance work of NH-32.

Yours faithfully

(S.K. Mallik)
Project Director

Copy to: for information and necessary action.
1. The Team Leader, M/s L N Malviya Infra Projects Pvt. Ltd., Purulia.
2. The Project Manager, M/s DRA Infracon Pvt. Ltd., Purulia.

Copy also to: for information:
1. The Chief General Manager(Tech)-RO-Kolkata, NHAI, Kolkata.

Certificate

This is to certify that the Internship Report entitled "Rehabilitation and upgradation of existing road to 2 lane with paved shoulder configuration of NH-32 (from Km 70.524 to Km 84.400 and from Km 94.300 to Km 153.705) in Purulia (Jharkhand Border)-Balrampur-Chandil (Junction with NH-33) Section in the State of West Bengal and Jharkhand under NHDP IV-B on EPC Mode" being submitted by the following students of Dr B. C. Roy Engineering College, Durgapur:

1. Rakhi Agrawal,
2. Prem Kumar Patel,
3. Kisalay Kumar,
4. Arpita Bhattacharjee,
5. Santanu Bala

The Internship has been conducted in the month of April 2021 in light of the MOU on 15.10.2020 between NHAI and Dr. B. C. Roy Engineering College, Durgapur. The report, submitted for the award of Internship, is a record of confide research work carried out by them under my supervision.

(Durgesh Kumar)
Team Leader
M/s L.N Malviya Infra Projects Pvt. Ltd.
Purulia Chandil NH-32 Project

Date: 1 May 2021

Place: Purulia

SITE VISIT REPORT

Name of site: Purulia (Jharkhand Border)-Chandil (Section of NH-32, near Sainik School).

Date of visit: 04th August 2021

Objective of visit: To understand the progress of work and suggest suitable modifications, if required.

Nodal Officer: Dr. Sanjay Sengupta

Faculty Members for Visit: Dr. Sanjay Sengupta, Mr. Arijit Kumar Banerji, Mr. Amit Kotal and Mr. Soumyadip Das

Introduction:

The visit to the NH-32 site in Purulia (Jharkhand Border, Purulia-Chandil section) was conducted by the faculty members of the department of Civil Engineering, Dr. B.C. Roy Engineering College, Durgapur on wednesday, 04th august 2021. Mr. Durgesh Kumar, team leader, Purulia Chandil NH-32 project, accompanied four faculty members including the nodal officer to the site as well the plant. Further, Md. Shamshe Alam (General Manager), Mr. Anoop Kumar Singh (Dy. Manager, QA & QC) along with other team helped for observing and understanding the functioning of the plant in order to enhance the knowledge about how the project is being executed. This visit was scheduled between 10:00 a.m. to 4:00 p.m. Faculty members were allowed to see each unit of plant and their queries were also answered by the general manager and Dy. Manager, QA & QC during the visit.

Brief report on the visit:

During the site visit we have observed the construction of base layer, use of fly ash, bridge pier construction and different material testing and quality control procedures available in the construction plant. The site engineer has explained the importance of local available soil type, pre-cast concrete blocks and the utility of geotextiles in the bridge guard wall to prevent loose mud/sand diluted washout as shown in Fig. 1. Fly ash has been used in carrying out intermediate

भारतीय राष्ट्रीय राजमार्ग प्राधिकरण
National Highways Authority of India

NATIONAL HIGHWAYS AUTHORITY OF INDIA

INTERNSHIP REPORT

Rehabilitation and upgradation of existing road to Two Lane with paved shoulder configuration of NH-32 in purulia (Jharkhand Border) Balrampur- Chandil (junction with NH-32) section in the state of West Bengal and Jharkhand under NHDP IV-B on EPC mode.

Certificate

This is to certify that the Internship Report entitled "Rehabilitation and upgradation of existing road to 2 lane with paved shoulder configuration of NH-32 (from Km 70.524 to Km 84.400 and from Km 94.300 to Km 153.705) in Purulia (Jharkhand Border)-Balrampur-Chandil (Junction with NH-33) Section in the State of West Bengal and Jharkhand under NHDP IV-B on EPC Mode" being submitted by the following students of Bengal Engineering College, Durgapur:

1. Rakhi Agrawal,
2. Prem Kumar Patel,
3. Kisalay Kumar,
4. Arpita Bhattacharjee,
5. Santanu Bala

The Internship has been conducted in the month of April 2021 in light of the MOU between NHAI and Bengal Engineering College. The report, submitted for the award of Internship, is a record of confide research work carried out by them under my supervision.

Date: May 2021

Place: Purulia

(Durgesh Kumar)
Team Leader
M/s L.N Malviya Infra Projects Pvt. Ltd.
Purulia Chandil NH-32 Project

ACKNOWLEDGEMENT

The internship opportunity we had with National Highway Authority of India (NHAI) was a great chance of learning and professional development. Therefore we consider ourselves as a very lucky individual to be a part of it. We are also grateful to our college and specially Mr. Sanjay Sengupta (HOD), Mr. Arijit Kumar Banerji (Asst. prof.), Mr. Soumyadip Das(Asst. prof.) for facilitating us with this opportunity.

This study work would not have been possible without the valuable guidance of Mr. Durgesh Kumar (Team Leader), Md. Samshe Alam (GM), Mr. Anoop Kumar Singh (Dy. Manager QA&QC), Debasish Pradhan (HR). we show our deepest gratitude and special thanks for their careful and precious guidance which was extremely valuable for our study both theoretically and practically.

CONTENTS

1. Administration structure of NHAI

The National Highways Authority of India (NHAI) is an autonomous agency of the Government of India, set up in 1988 and is responsible for management of a network of over 50,000 km of National Highways out of 1,32,499 km in India.

NHAI has a three-tier structure:
The Headquarters (HQ)
The Regional Offices (ROs)
The Project Implementation Units (PIUs)

The PIUs, headed by Project Directors, are responsible for implementation of projects assigned to them and ROs, headed by a CGM level officer, have been set-up in various parts of the Country for decentralizing and strengthening the field level operations in NHAI. The HQ is responsible for overall supervision of the works assigned to NHAI. The HQ of NHAI is in Dwarka, Delhi.

2. Stages of Highway construction

a. Project Preparation:

i. Pre-feasibility Study**:** Prefeasibility studies are an early stage analysis of a highway construction project. They are conducted by a small team and are designed to give company the basic information they need to green light a project. These studies typically give an overview of the location and confirming its feasibility for the construction of the highway.

ii. Feasibility Study: Feasibility studies are in-depth reports on many of the same topics as prefeasibility studies. They are meant to be much more accurate and require more resources to conduct. Feasibility studies should offer estimates that are within 10 to 20 percent accuracy, whereas prefeasibility studies are allowed to run between 20 and 30 percent.

iii. Detailed Engineering and Plan of Construction: Detailed Project Reports (DPRs) are the outputs of planning and design phase of a project. DPR is a very detailed and

elaborate plan for a project indicating overall programme, different roles and responsibilities, activities and resources required for the project.

It is a final, detailed appraisal report on the project and a blue print for its execution and eventual operation. It provide details of the basic programme, the roles and responsibilities, all the activities to be carried out and the resource required and possible risk with recommended measure to counter them.

b. Construction:

i. Planning – The first step in any road construction and maintenance project is properly planning and evaluating the needs it is intended to serve. Local traffic patterns both current and future should be studied, and a cost-benefit analysis should be performed by private organizations to ensure they will actually receive good value for their investment in construction. Potential funding, legal, and environmental issues will be brought up at this time as well to address in advance.

ii. Design – The next phase in a typical construction and maintenance project is the design. Surveyors will physically visit the site and use laser technology to pinpoint the alignment, shape, and direction of the road. Location, terrain and soil properties, potential water access and drainage issues, and the potential for future expansion in the immediate physical vicinity are all addressed during this portion of the project, as well as potential impact on nearby residents, if any.

iii. Earthworks – The earthworks are the first step that most people would recognize as part of a road construction and maintenance project on sight. The intent of this step is to provide a firm, stable foundation that the pavement will then rest on top of. If the earthworks are not executed correctly, the road surface will definitely experience premature failure at some point. Embankments, leveling, fill, compacting, drainage and sewers are all installed and inspected before the project continues – the final step is typically placing 12 inches of gravel on the bed before a final series of compactions to reach the desired height. Employing GRT soil stabilization and dust control products can dramatically cut costs and time spent on this phase of a project.

iv. Laying Pavement – Most modern road construction and maintenance projects employ either asphalt or concrete for this purpose, though this is slowly changing as organizations realize the benefits of alternative solutions such as those offered by Global Road Technology. The physical surface of the road is created, smoothed, and trimmed off to the appropriate level, then sealed, connected, and reinforced to prevent cracks in the future.

v. QC – After the surface is successfully constructed, typically another battery of quality control tests will be performed to close out the road construction and maintenance project before it is truly considered finished. Drainage will be checked again, grading levels, landscaping and rehabilitation, and everything else. If all tests get positive results, the road can be opened and is ready to use.

c. Maintenance: Over time, traffic and environmental effects will damage traditional road surfaces, which require rehabilitation. Life expectation of road construction and *maintenance* projects varies from country to country, but a standard expectation of several decades of service can be expected, with major rehabilitation efforts performed every ten years or so. Another benefit offered by Global Road Technology and their road construction methods is that maintenance is exponentially simpler and less costly, with only a few construction workers and a water truck required to keep things up rather than extensive and expensive efforts every few years.

3. Modes of Implementation of Highway Project

i. **Bill of Quantity**: The bill of quantities (sometimes referred to as 'BoQ' or 'BQ') is a document prepared by the cost consultant (often a quantity surveyor) that provides project specific measured quantities of the items of work identified by the drawings and specifications in the tender documentation.

The quantities may be measured in number, length, area, volume, weight or time. Preparing a bill of quantities requires that the design is complete and a specification has been prepared.

ii. **Engineering Procurement and Construction**: In the construction industry, EPC is an acronym for Engineering, Procurement and Construction in connection with projects such as tank terminals. It is a standard term that refers to a special form of project execution and contract design.

This form of contracting EPC services is one possible form of project management in plant construction. It obliges the contractor to hand over the completed construction (turnkey), such as a tank terminal, to the client. In this type of contract, the contractor is responsible for all engineering services, the procurement and production of all necessary construction materials and parts, as well as construction and commissioning.

iii. **Build – Operate – Transfer(TOLL)**: It is a form of project delivery method, usually for large-scale infrastructure projects, wherein a private entity receives a concession from the public sector (or the private sector on rare occasions) to

finance, design, construct, own, and operate a facility stated in the concession contract. This enables the project proponent to recover its investment, operating and maintenance expenses in the project .

BOT is usually a model used in public–private partnerships. Due to the long-term nature of the arrangement, the fees are usually raised during the concession period. The rate of increase is often tied to a combination of internal and external variables, allowing the proponent to reach a satisfactory internal rate of return for its investment.

iv. **BOT (ANNUITY):** The BOT Annuity model is a PPP model for infrastructure projects especially road projects. Under BOT annuity, a developer builds the highway, operates it for a specified duration and transfers it back to the government. The government starts payment to the developer after the launch of commercial operation of the project.

Payment will be made on a six-month basis.

v. **Hybrid Annuity**: Hybrid Annuity Model is a **mix of the EPC and BOT models**. The government will contribute to 40% of the project cost in the first five years through annual payments (annuity).

The balance 60 per cent is arranged by the developer, and is recovered as variable annuity amount after the completion of the project from NHAI which collects revenue.

4. Organisation involved In Construction of NH Project

I. National Highway Authority Of India (Client): NHAI behaves as a client body, Once everything in the tender procurement process is finalised, contracts are awarded to the selected bidders.

II. Authority Engineer/Independent Engineer/Supervisor Consultant: In India the PPP format of roads projects are generally based on Model Concession Agreement and Independent Engineer jointly appointed by the Authority and the Concessionaire plays a key role in ensuring that timely completion of the Projects. AGICL has been appointed as Independent Engineer on various BOT projects by NHAI and state road development agencies. AGICL as Independent Engineers has ensured timely completion and start of commercial operations of many BOT Projects

III. EPC Contractor/Concessionaire: The role of an EPC contractor is to provide engineering designs, procure equipment, and utilize them offering the functioning product for the client's asset.

5. Road Classification

As per constitution of India, Union Government through the Ministry of Road Transport & Highways (MORTH) is responsible for development and maintenance of National Highways.

State governments and Union Territories are responsible for the same, for roads other than National Highways in their respective jurisdiction.

a. Non-urban Roads

Non-urban roads in the country are classified into following five categories:

1.1) National Highways

These are main highways running through the length and breadth of the country connecting major ports, highways of neighbouring countries, State capitals, large industrial and tourist centers, etc The total length of National Highways is 1,32,500 km.

1.2) State Highways

These are arterial routes of a state linking district headquarters and important cities within the state and connecting them with National Highways of the neighbouring States. The total length of State Highways is 1,56,694 km.

1.3) Major District Roads

These are important roads within a district serving areas of production and markets, and connecting these with each other or with the main highways.

1.4) Other District Roads

These are roads serving rural areas of production and providing them with outlet to market centres, taluka/tehsil headquarters, block development headquarters or other main roads.

1.5) Village Roads

These are roads connecting villages or group of villages with each other and to the nearest road of a higher category. Other District Roads and Village Roads have been combined and known as Rural Roads. The total length of Major District Roads and Rural Roads is 53,12,117 km.

b. Urban Roads:

Urban roads are classified into the following four categories:

i. **Arterial Streets:** This system of streets, along with expressways where they exist, serves as the principal network for through traffic flows. Significant intraurban travel, such as, between central business district and outlying residential areas or between major suburban centers take place on this system. These streets may generally be spaced at less than 1.5 km in highly developed central business areas and at 8 km or more in sparsely developed urban fringes. The arterial streets are generally divided highways with full or partial access. Parking, loading and unloading activities are usually restricted and regulated. Pedestrians are allowed to cross only at intersections.
ii. **Sub-arterial Streets:** These are functionally similar to arterial streets but with somewhat lower level of travel mobility. Their spacing may vary from about 0.5 km in the central business district to 3-5 km in the sub-urban fringes.
iii. **Collector Streets:** The function of collector streets is to collect traffic from local streets and feed it to the arterial and sub-arterial streets or vice versa. These may be located in residential neighborhoods, business areas and industrial areas. Normally, full access is allowed on these streets from abutting properties. There are few parking restrictions except during the peak hours.
iv. **Local Streets:** These are intended primarily to provide access to abutting property and normally do not carry large volumes of traffic. Majority of trips in urban areas originate from or terminate on these streets. Local streets may be residential, commercial or industrial, depending on the predominant use of the adjoining land. They allow unrestricted parking and pedestrian movements.
v. **Non-Motorized Transport (NMT) Streets and Greenways:** All motorized traffic will be prohibited, using barrier and enforcement of regulations to prevent their entry and encroachment of NMT space. Such streets will be designed in compliance with universal accessibility guidelines with bicycle parking and access for emergency response vehicles.

There are following types of roads according to the cross section of the roads.

1) **Expressways** – These are arterial highways for motorized traffic, with divided carriageways for high speed travel, with full control of access and provided with grade separators at locations of intersection and for high mobility. Generally, only fast moving vehicles are allowed access on expressways.

2) **4 Lane/6 Lane/8 Lane roads** – These roads have divided carriageway and also partially controlled for access. Each carriageway are of either two lane or three or more lane standard.

3) **Two lane roads with or without shoulders**- These road have 7 m wide carriageway and the shoulders on both sides. Part of the shoulders may be paved or unpaved.

MORTH has taken a policy decision that all National Highways, except on hill roads will be improved to a minimum standards of two lane carriageway with paved shoulders on both sides irrespective of the traffic intensity on the road.

4) **Intermediate lane roads:** The intermediate carriageway width of 5.5 m is adopted in exceptional circumstances particularly in hill sections. It has been decided to adopt 5.5 m carriageway in hilly stretches of National Highways carrying traffic less than 8000 pcu.

5) **Single lane road** – These are roads with single lane carriageway of 3.75 m width. These are provided for roads having low density of traffic.

6. GEOMETRIC DESIGN AND GENERAL FEATURES OF EXPRESSWAYS

a. Design Speed

The design speeds given in shall be adopted for various terrain classifications.

Nature of Terrain	Cross Slope of the Ground	Design Speed (km/hr)
Plain	Less than 10 percent	120
Rolling	Between 10 and 25 percent	100

Table 2.1. Design Speed of Expressways

b. Right-of-Way

The recommended minimum Right of Way in Plain/Rolling terrain for expressways is given in Table.

Section	Right of Way Width* (ROW)
Rural Section	90 m - 120 m
Rural Sections passing through semi- urban areas	120 m

Table 2.2. Right of Way in Plain/Rolling Terrain for Expressways

Note: The ROW width includes 2 m wide strip on either side reserved for placement of utilities outside fencing.
in case an elevated expressway is proposed, the width of ROW may be reduced

as per site conditions and availability of land.

Additional land at bridge approaches, grade separated structures, interchange locations, toll plazas and for project facilities shall be acquired as per design.

No service roads shall be provided within the ROW of the Expressway.

c. Lane Width of Carriageway

The standard lane width of the Project Expressway shall be 3.75 m.
Expressways shall have a minimum of two lanes for each direction of travel.

d. Width of Median

Type of Median	Recommended Median Width (m)	
	Minimum	Desirable
Depressed	12.0	15.0
Flush	4.5	4.5
Flush (to accommodate structure/pier on median)	8.0	8.0

Table 2.3. Width of Median for Expressways

e. Crossfall

The crossfall on straight sections of expressway carriageway shall be as given in Table .

Each carriageway shall have unidirectional crossfall.

Cross-Sectional Element	Annual Rainfall	
	1000 mm or more	Less than 1000 mm
Carriageway, Paved shoulders. Edge Strip, Flush Median	2.5 percent	2.0 percent

Table 2.4. crossfall for Expressways

f. Superelevation

Super elevation shall be limited to 7 percent, if radius of curve is less than the desirable minimum radius.

It shall be limited to 5 percent if radius is more than or equal to the desirable minimum.

Super elevation shall not be less than the minimum specified crossfall.

g. Radii of horizontal curves

The desirable minimum and absolute minimum radii of horizontal curves are given in Table.

Design Speed (km/h)	120	100	80
Absolute Minimum Radius (m)	670	440	260
Desirable Minimum Radius (m)	1000	700	400

Table 2.5. Minimum Radii of Horizontal Curves for Expressways

h. Transition curves

Properly designed transition curves shall be provided at both ends of the circular curve. The recommended minimum length of transition curves is given in Table.

Design Speed (km/h)	**Minimum Length of Transition Curve (m)**
120	100
100	85
80	70

Table 2.6. Minimum Length of Transition Curves for Expressways

i. Sight Distance

Design Speed (km/hr)	Safe Stopping Sight Distance (m)	Desirable Minimum Sight Distance (m) (Intermediate Sight Distance)
120	250	500
100	180	360
80	120	240

Table2.7. Safe Sight Distance for Expressways

7. GEOMETRIC DESIGN AND GENERAL FEATURES OF SIX LANING OF HIGHWAYS

a. Design Speed

Nature of Terrain	Cross Slope of the Ground	Design Speed (km/h)	
		Ruling	Minimum
Plain and Rolling	Up to 25 percent	100	80
Mountainous and Steep	More than 25 percent	60	40

Table 3.1. Design Speed for Six Laning of Highways

b. Right-of-Way

A minimum Right of Way (ROW) of 60 m should be available for development of a 6-lane highway. The Authority would acquire the additional land required, if any.

c. Lane Width of Carriageway

The standard lane width of project highway shall be 3.5 m.

d. Median

Type of Section	Minimum Width of Median (m)		
	Plain and Rolling terrain		Mountainous and Steep terrain
	Raised*	Depressed median	Raised*
Open country with isolated built-up area	5.0	7.0	2.5
Built up area	2.5	Not Applicable	2.5
Approach to grade separated structures	5.0	Not Applicable	2.5

Table 3.2. Width of Median for Six Laning of Highways

e. Shoulders

Width of shoulders

The shoulder width on the outer side (left side of carriageway) shall be as given in Table.

Type of Section	Width of Shoulder (m)		
	Paved	Earthen	Total
Open country with isolated built up area	2.5	1.5	4.0
Built up area	2.5	-	2.5
Approaches to grade separated structures	2.5	-	2.5
Approaches to bridges	2.5	1.5	4.0

Table3.3. Width of Shoulders in Plain and Rolling Terrain for Six Laning of Highways

Type of Section		Width of Shoulder (m)		
		Paved	Earthen	Total
Open country with isolated built up area	Hill Side	1.5	-	1.5
	Valley Side	1.5	1.0	2.5
Approaches to grade separated structures	Hill Side	0.25+1.5 (raised)	-	1.75
	Valley Side	0.25+1.5 (raised)	-	1.75

Table 3.4.Width of Shoulders in Mountainous and Steep Terrain (Hilly Area) for Six Laning of Highways

f. Extra Width

Radius of Curve	Extra Width
75-100 m	0.9 m
101-300 m	0.6 m

Table 3.5. Extra Width of Pavement and Roadway in Each Carriageway for Six Laning of Highways

g. Crossfall

The crossfall on straight sections of road carriageway, paved shoulders and paved portion of median shall be 2.5 percent for bituminous surface and 2.0 percent for cement concrete surface.

The crossfall for earthen shoulders on straight portions shall be at least 0.5 percent steeper than the slope of the pavement and paved shoulder subject to a minimum of 3.0 percent.

h. Super elevation

Super Elevation shall be limited to 7 percent, if radius of curve is less than desirable minimum radius. It shall be limited to 5 percent, if radius is more than desirable minimum and also at section where Project Highway passes through an urban section or falls on a major junction.

i. Radii of horizontal curves

The desirable minimum and absolute minimum radii of horizontal curves for various classes of terrain are given in Table 6.

Nature of Terrain	Desirable Minimum Radius	Absolute Minimum Radius
Plain and Rolling	400 m	250 m
Mountainous and Steep	150 m	75 m

Table 3.6. Radii of Horizontal Curves for Six Laning of Highways

j. Sight distance

Design Speed (km/h)	Safe Stopping Sight Distance (m)	Desirable Minimum Sight Distance (m)
100	180	360
80	130	260
60	90	180
40	45	90

Table 3.7. Safe Sight Distance for Six Laning of Highways

8. GEOMETRIC DESIGN AND GENERAL FEATURES OF FOUR LANING OF HIGHWAYS

a. Design Speed

Nature of Terrain	Cross Slope of the Ground	Design Speed (km/h)	
		Ruling	Minimum
Plain and Rolling	Up to 25 percent	100	80
Mountainous and Steep	More than 25 percent	60	40

Table 4.1 Design Speed for Four Laning of Highways.

b. Right-of-Way

A minimum Right of Way (ROW) of 60 m should be available for development of a 4-lane highway. The Authority would acquire the additional land required, if any.

c. Lane Width of Carriageway

Lane Width of Carriageway The standard lane width of project highway shall be 3.5 m.

d. Median

The median shall be either raised or depressed

Type of Section	Minimum Width of Median (m)		
	Plain and Rolling Terrain		Mountainous and Steep Terrain
	Raised*	Depressed Median	Raised*
Open country with isolated built-up area	5.0	7.0	2.5
Built up area	2.5	Not Applicable	2.5
Approach to grade separated structures	5.0	Not Applicable	2.5

Table 4.2 Width of Median for Four Laning of Highways

e. Shoulders

Type of Section	Width of Shoulder (m)		
	Paved	Earthen	Total
Open country with isolated built up area	2.5	1.5	4.0
Built up area	2.5	-	2.5
Approaches to grade separated structures	2.5	-	2.5
Approaches to bridges	2.5	1.5	4.0

Table 4.3 Width of shoulders for Four Laning of Highways

Type of Section		Width of Shoulder (m)		
		Paved	Earthen	Total
Open country with isolated built up area	Hill Side	1.5	-	1.5
	Valley Side	1.5	1.0	2.5
Approaches to grade separated structures	Hill Side	0.25+1.5 (raised)	-	1.75
	Valley Side	0.25+1.5 (raised)	-	1.75

Table 4.4.Width of Shoulders in Mountainous and Steep Terrain (Hilly Area) for Four Laning of Highways.

f. Extra Width of Pavement

Radius of Curve	Extra Width
75-100 m	0.93 m
101-300 m	0.6m

Table 4.5 . Extra Width of Pavement and Roadway in Each Carriageway for Four Laning of Highways

g. Crossfall

The crossfall on straight sections of road carriageway, paved shoulders and paved portion of median shall be 2.5 percent for bituminous surface and 2.0 percent for cement concrete surface.

h. Super elevation

Super Elevation shall be limited to 7 percent, if radius of curve is less than desirable minimum radius. It shall be limited to 5 percent, if radius is more than desirable minimum IRC:SP:84-2019.

i. Radii of Horizontal Curves

The desirable minimum and absolute minimum radii of horizontal curves for various classes of terrain are given in Table.

Nature of Terrain	Desirable Minimum Radius	Absolute Minimum Radius
Plain and Rolling	140 m	250 m
Mountainous and Steep	150 m	75 m

Table 4.6 Radii of Horizontal Curves for Four Laning of Highways

j. Sight distance

Design Speed (km/h)	Safe Stopping Sight Distance (m)	Desirable Minimum Sight Distance (m)
100	180	360
80	130	260
60	90	180
40	45	90

Table 4.7 Safe Sight Distance for Four Laning of Highways

9. GEOMETRIC DESIGN AND GENERAL FEATURES OF TWO LANING OF HIGHWAYS WITH PAVED SHOULDER

a. Design Speed

Nature of Terrain	Cross Slope of the Ground	Design Speed (km/h)	
		Ruling	Minimum
Plain and Rolling	Up to 25 percent	100	80
Mountainous and Steep	More than 25 percent	60	40

Table 5.1 Design Speed for Two laning of Highways with Paved Shoulder.

b. Right of Way

Two laning shall be accommodated within the existing ROW to the extent possible. However, additional land, if required for accommodating the two laning cross sections, improvement of geometrics, realignment, junctions, bypasses etc., ROW of 30 m shall be acquired by the Authority.

For bypasses, Right of Way shall be 45-60 m depending upon the provision of the carriageway.

c. Lane Width of Carriageway

The standard lane width of the Project Highway shall be 3.5 m.

d. Median

In 4/6 lane bypasses, the median and median drainage shall be provided as per IRC:SP:84 and IRC:SP:87

e. Shoulders

Type of Section	Width of Shoulder (m)		
	Paved	Earthen	Total
Open country with isolated built up area	2.5	1.5	4.0
Built up area (2-lane section)	2.5	-	2.5
Built up area (4-lane section)	-	-	-
Approaches to grade separated structures	2.5	-	2.5
Approaches to bridges	2.5	1.5	4.0

Table 5.2 Width of shoulders for Two laning of Highways with Paved Shoulder.

Type of Section		Width of Shoulder (m)		
		Paved	Earthen	Total
Open country with isolated built up area	Hill Side	1.5	-	1.5
	Valley Side	1.5	1.0	2.5
Approaches to grade separated structures	Hill Side	0.25+1.5 (raised)	-	1.75
	Valley Side	0.25+1.5 (raised)	-	1.75

Table 5.3 Width of Shoulders in Mountainous and Steep Terrain (Hilly Area) for Two laning of Highways with Paved Shoulder.

f. Extra Width of Pavement

On horizontal curves with radius upto 300 m, width of pavement and roadway shall be increased as per Table.

Radius of Curve	Extra Width
75-100 m	0.93 m

101-300 m	0.6m

Table 5.4 Extra Width of Pavement and Roadway for Two laning of Highways with Paved Shoulder.

g. Camber or Cross Fall

The crossfall on straight sections of road carriageway, paved shoulders and paved portion of median shall be 2.5 per cent for bituminous surface and 2.0 per cent for cement concrete surface.

h. Super Elevation

Super elevation shall be limited to 7 per cent, if radius of curve is less than the desirable minimum.

It shall be limited to 5 per cent, if the radius is more than desirable minimum and also at section where Project Highway passes through an urban section or falls on a major junction.

i. Radii of Horizontal Curves

Nature of Terrain	Desirable Minimum Radius	Absolute Minimum Radius
Plain and Rolling	140 m	250 m
Mountainous and Steep	150 m	75 m

Table 5.5 Minimum Radii of Horizontal Curves for Two laning of Highways with Paved Shoulder.

j. Sight Distance

Design Speed (km/h)	Minimum Sight Distance (m)	Overtaking sight Distance(m)
100	360	640
80	240	470
60	180	340
40	90	165

Table 5.6 Sight Distances for Various Speeds for Two laning of Highways with Paved Shoulder.

10. ABOUT THIS PROJECT

Name of the Project:

Rehabilitation and upgradation of existing road to Two Lane with paved shoulder configuration of NH-32 in purulia (Jharkhand Border) Balrampur- Chandil (junction with NH-32) section in the state of West Bengal and Jharkhand under NHDP IV-B on EPC mode.

Client:

National Highway Authority of India(NHAI).

Authority Engineer:

L.N. MALVIYA INFRA PROJECT PVT LTD.

Contractor:

DINESHCHANDRA R AGRAWAL INFRACON PVT LTD.

11. TYPICAL CROSS SECTION USED IN THIS PROJECT

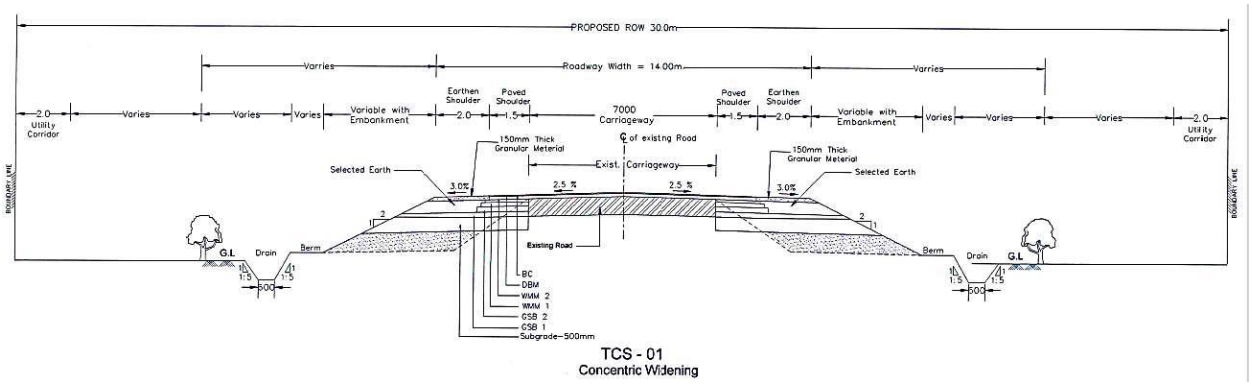
Chainage (Km)		Improvement Type and Applicable Typical Cross Section (TCS)
From	To	
70524	71000	TCS - 02; Concentric Widening (4- Lane) with Raised Footpath & Masonry Drain in Built-up Area
71000	71200	TCS - 01; Concentric Widening of Existing Road
71200	71420	TCS - 04; Eccentric Widening of Existing Road
71420	71520	TCS - 03; New Construction
71520	72480	TCS - 01; Concentric Widening of Existing Road
72480	72700	TCS - 03; New Construction
72700	72940	TCS - 04; Eccentric Widening of Existing Road
72940	73750	TCS - 02; Concentric Widening (4- Lane) with Raised Footpath & Masonry Drain in Built-up Area
73750	75600	TCS – 05; At ROB Approaches
75600	75970	TCS - 03; New Construction
75970	76100	TCS - 04; Eccentric Widening of Existing Road
76100	78920	TCS - 01; Concentric Widening of Existing Road
78920	79130	TCS - 03; New Construction
79130	79230	TCS - 01; Concentric Widening of Existing Road
79230	79620	TCS - 04; Eccentric Widening of Existing Road
79620	80570	TCS - 02; Concentric Widening (4- Lane) with Raised Footpath & Masonry Drain in Built-up Area
80570	80790	TCS - 01; Concentric Widening of Existing Road
80790	82280	TCS - 03; New Construction
82280	84000	TCS - 01; Concentric Widening of Existing Road
84000	84400	TCS - 03; New Construction
94300	94550	TCS - 01; Concentric Widening of Existing Road
94550	95500	TCS - 02; Concentric Widening (4- Lane) with Raised Footpath &Masonry Drain in Built-up Area

95500	**96189**	**TCS - 01; Concentric Widening of Existing Road**
96189	**96440**	**TCS – 06; Bridge Approaches**
96440	**96670**	**TCS - 03; New Construction**
96670	**96800**	**TCS - 01; Concentric Widening of Existing Road**
96800	**97100**	**TCS - 04; Eccentric Widening of Existing Road**
97100	**97380**	**TCS - 01; Concentric Widening of Existing Road**
97380	**97440**	**TCS - 03; New Construction**
97440	**98030**	**TCS - 01; Concentric Widening of Existing Road**
98030	**98200**	**TCS - 03; New Construction**
98200	**98300**	**TCS - 01; Concentric Widening of Existing Road**
98300	**98510**	**TCS - 03; New Construction**
98510	**98570**	**TCS - 01; Concentric Widening of Existing Road**
98570	**98880**	**TCS - 03; New Construction**
98880	**99030**	**TCS - 01; Concentric Widening of Existing Road**
99030	**99190**	**TCS - 03; New Construction**
99190	**99590**	**TCS - 01; Concentric Widening of Existing Road**
99590	**99690**	**TCS - 03; New Construction**
99690	**100250**	**TCS - 01; Concentric Widening of Existing Road**
100250	**100960**	**TCS - 03; New Construction**
100960	**101990**	**TCS - 01; Concentric Widening of Existing Road** **TCS - 03; New Construction**
101990	**102060**	**TCS - 03; New Construction**
102060	**102150**	**TCS - 04; Eccentric Widening of Existing Road**
102150	**103050**	**TCS - 03; New Construction**
103050	**103150**	**TCS - 04; Eccentric Widening of Existing Road**
103150	**103530**	**TCS - 03; New Construction**
103530	**103750**	**TCS - 04; Eccentric Widening of Existing Road**
103750	**104070**	**TCS - 03; New Construction**
104070	**104140**	**TCS - 01; Concentric Widening of Existing Road**
104140	**104800**	**TCS - 03; New Construction**
104800	**106400**	**TCS – 05; At ROB Approaches**
106400	**107230**	**TCS - 03; New Construction**
107230	**107770**	**TCS - 01; Concentric Widening of Existing Road**
107770	**108640**	**TCS - 03; New Construction**

108640	**108700**	**TCS - 01; Concentric Widening of Existing Road**
108700	**108830**	**TCS - 03; New Construction**
108830	**108970**	**TCS - 01; Concentric Widening of Existing Road**
108970	**109070**	**TCS - 03; New Construction**
109070	**109150**	**TCS - 01; Concentric Widening of Existing Road**
109150	**109350**	**TCS - 03; New Construction**
109350	**109950**	**TCS - 01; Concentric Widening of Existing Road**
109950	**110090**	**TCS - 03; New Construction**
110090	**110280**	**TCS - 01; Concentric Widening of Existing Road**
110280	**110520**	**TCS - 03; New Construction**
110520	**110780**	**TCS - 01; Concentric Widening of Existing Road**
110780	**110920**	**TCS - 03; New Construction**
110920	**110990**	**TCS - 01; Concentric Widening of Existing Road**
110990	**111600**	**TCS – 06; Bridge Approaches**
111600	**112150**	**TCS - 03; New Construction**
112150	**112590**	**TCS - 01; Concentric Widening of Existing Road**
112590	**113470**	**TCS - 03; New Construction**
113470	**114120**	**TCS - 02; Concentric Widening (4- Lane) with Raised Footpath & Masonry Drain in Built-up Area**
114120	**114810**	**TCS - 01; Concentric Widening of** - 25
114810	**116330**	**TCS - 03; New Construction**
116330	**116600**	**TCS - 04; Eccentric Widening of Existing Road**
116600	**116970**	**TCS - 01; Concentric Widening of Existing Road**
116970	**117160**	**TCS - 03; New Construction**
117160	**117550**	**TCS - 01; Concentric Widening of Existing Road**
117550	**118060**	**TCS - 03; New Construction**
118060	**118240**	**TCS - 01; Concentric Widening of Existing Road**
118240	**119330**	**TCS - 03; New Construction**
119330	**119470**	**TCS - 04; Eccentric Widening of Existing Road**
119470	**119700**	**TCS - 03; New Construction**
119700	**120030**	**TCS - 01; Concentric Widening of Existing Road**
120030	**120430**	**TCS - 03; New Construction**
120430	**120530**	**TCS - 04; Eccentric Widening of Existing Road**
120530	**122150**	**TCS - 03; New Construction**

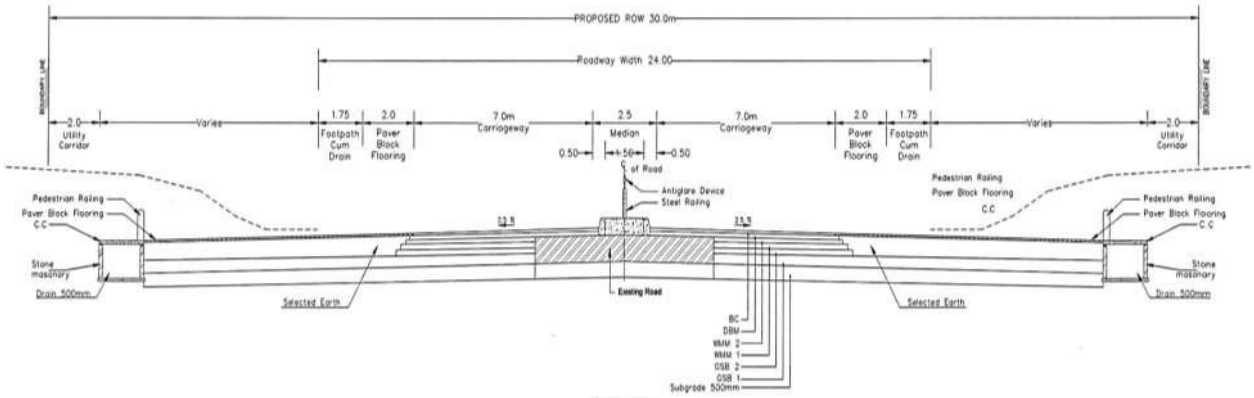
122150	**122850**	**TCS – 05A; VOP Location**
122850	**125000**	**TCS - 03; New Construction**
125000	**125570**	**TCS - 01; Concentric Widening of Existing Road**
125570	**125800**	**TCS - 03; New Construction**
125800	**125990**	**TCS - 01; Concentric Widening of Existing Road**
125990	**126300**	**TCS - 03; New Construction**
126300	**127350**	**TCS – 05; At ROB Approaches**
127350	**127800**	**TCS - 01; Concentric Widening of Existing Road**
127800	**128100**	**TCS - 03; New Construction**
128100	**128360**	**TCS - 01; Concentric Widening of Existing Road**
128360	**128900**	**TCS - 03; New Construction**
128900	**129150**	**TCS - 01; Concentric Widening of Existing Road**
129150	**130450**	**TCS - 03; New Construction**
130450	**130790**	**TCS - 04; Eccentric Widening of Existing Road**
130790	**131100**	**TCS - 03; New Construction**
131100	**131230**	**TCS - 04; Eccentric Widening of Existing Road**
131230	**131700**	**TCS - 03; New Construction**
131700	**132370**	**TCS - 01; Concentric Widening of Existing Road**
132370	**132550**	**TCS - 03; New Construction**
132550	**132900**	**TCS - 01; Concentric Widening of Existing Road**
132900	**133140**	**TCS - 03; New Construction**
133140	**133650**	**TCS - 04; Eccentric Widening of Existing Road**
133650	**134320**	**TCS - 01; Concentric Widening of Existing Road**
134320	**134520**	**TCS - 03; New Construction**
134520	**137830**	**TCS - 01; Concentric Widening of Existing Road**
137830	**138100**	**TCS - 03; New Construction**
138100	**140100**	**TCS - 01; Concentric Widening of Existing Road**
140100	**140200**	**TCS - 03; New Construction**
140200	**141200**	**TCS – 05; At ROB Approaches**
141200	**141900**	**TCS – 06; Bridge Approaches**
141900	**142870**	**TCS - 03; New Construction**
142870	**143110**	**TCS - 01; Concentric Widening of Existing Road**
143110	**144700**	**TCS - 03; New Construction**

144700	**146450**	**TCS – 05; At ROB Approaches**
146450	**150300**	**TCS – 06; Bridge Approaches**
150300	**151000**	**TCS – 05B; At VUP Location**
151000	**153705**	**TCS - 03; New Construction Existing Road**



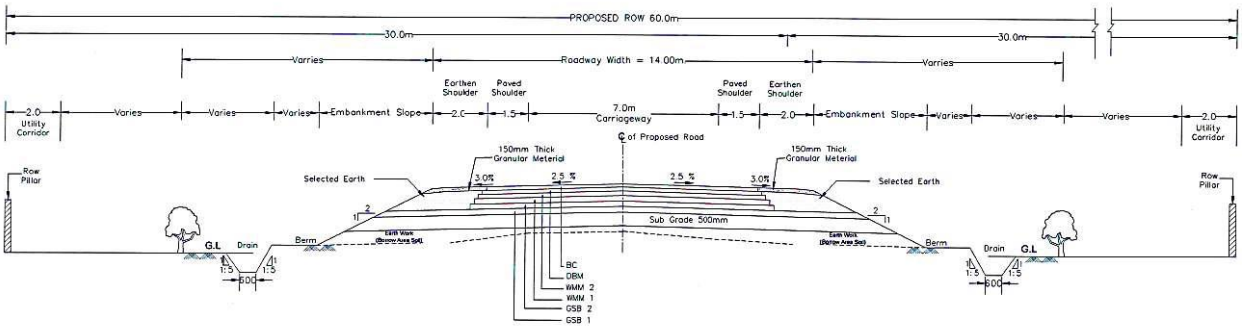
TCS - 01
Concentric Widening

TCS-01



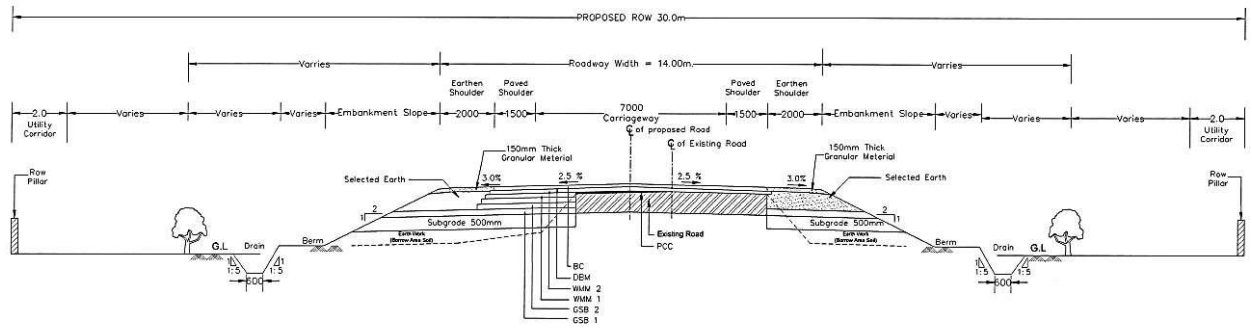
TCS - 02
Concentric Widening with Provision of Raised Footpath & Stone Masonary Drain in urban locatons (Existing Location)

TCS-02



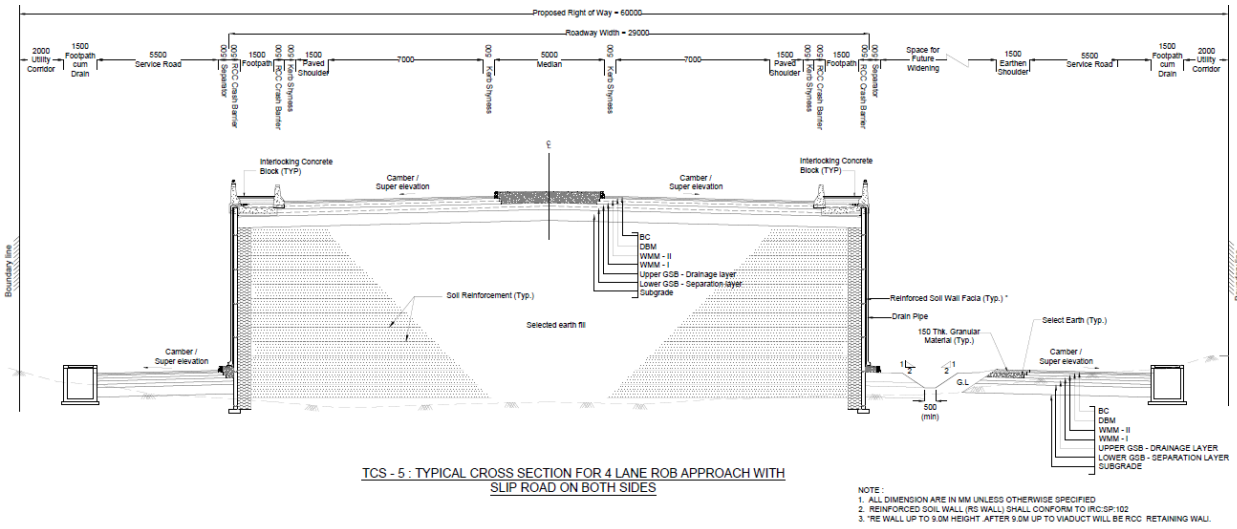
TCS - 03
New Construction / Realignment

TCS-03



TCS - 04
Eccentric Widening

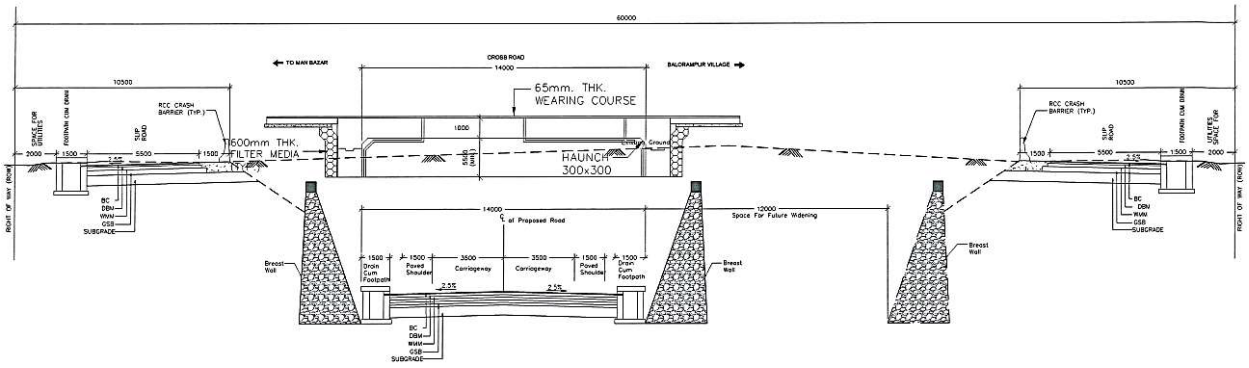
TCS – 04



TCS - 5 : TYPICAL CROSS SECTION FOR 4 LANE ROB APPROACH WITH SLIP ROAD ON BOTH SIDES

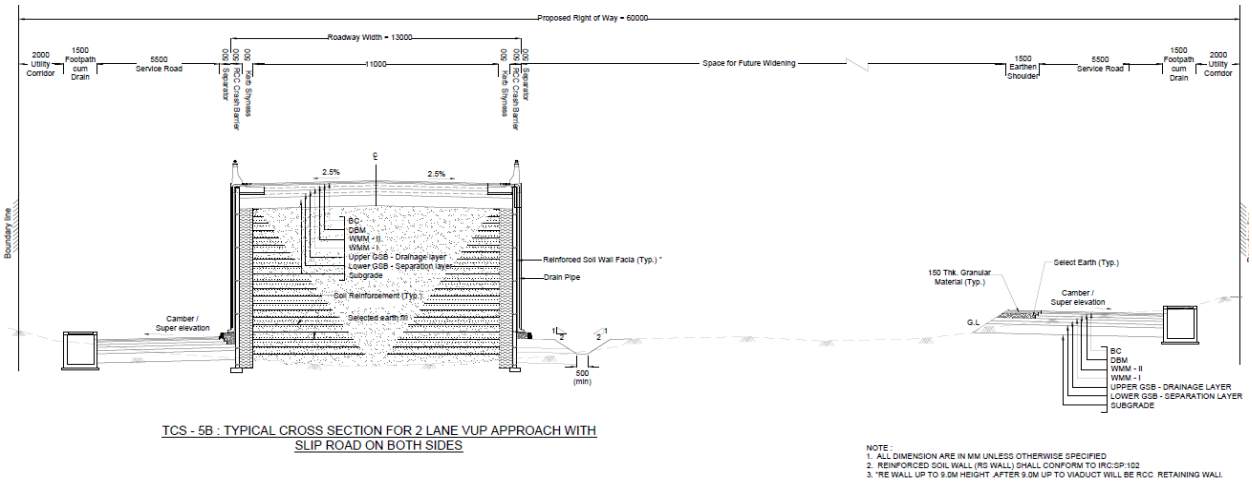
NOTE :
1. ALL DIMENSION ARE IN MM UNLESS OTHERWISE SPECIFIED
2. REINFORCED SOIL WALL (RS WALL) SHALL CONFORM TO IRC:SP:102
3. *RE WALL UP TO 9.0M HEIGHT .AFTER 9.0M UP TO VIADUCT WILL BE RCC RETAINING WALL

TCS – 05



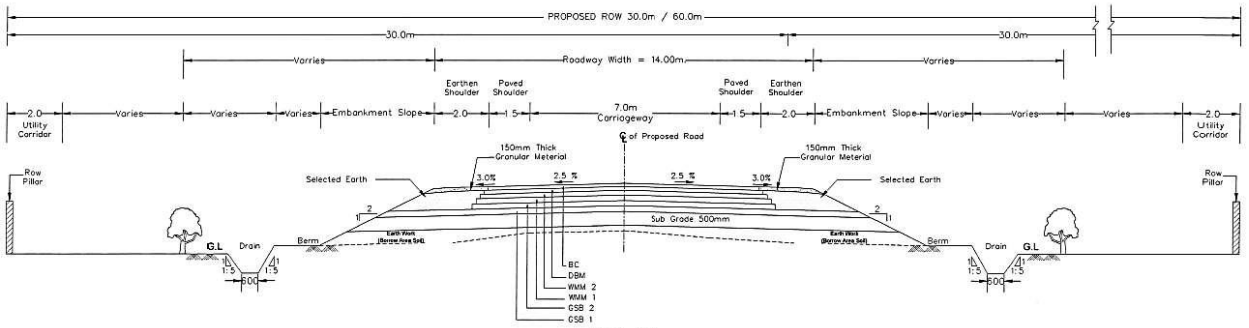
TCS-5A
AT VOP LOCATION WITH FUTURE EXPANSION

TCS – 5A



TCS - 5B : TYPICAL CROSS SECTION FOR 2 LANE VUP APPROACH WITH SLIP ROAD ON BOTH SIDES

TCS – 5B



TCS - 06
New Construction / Realignment (At Bridge Location)

TCS -06

12. SALIENT FEATURES OF THIS PROJECT

Project Name	Rehabilitation and upgradation of existing road to 2-lane with paved shoulder configuration of NH-32(from Km. 70.524 to Km. 84.400 and from Km. 94.300 to Km. 153.705) in Purulia (JHR Border)- Balarampur – Chandil(Junction with NH-33) section in the state of West Bengal and Jharkhand under NHDP IV-B on EPC Mode.
NH No. (New/ Old)	NH-18/NH-32
Mode of the execution (BOT Toll/BOT Annuity/EPC/HAM/Item Rate /Others)	EPC
No. of Lanes/Configuration	2-Lane with paved shoulders.
Length of the Project(in Km)	73.281Km
Total Project Cost(in Cr)	Rs. 708,30,000/-
No. of Bypass(Name of town, Length)	02 Nos. (Balarampur & Chandil) (4.15Km & 9.975Km)
No. of Toll Plazas(Number and Location)	05 Nos. (Km. 74.654, Km. 105.741, Km 126.892, Km 140.974, Km. 145.226)
No. of ROB(No. and location)	05 Nos. (Km. 74.654, Km 105.741, Km. 126.892, Km. 140.974, Km. 145.226)
Name of DPR Consultant	Intercontinental Consultant & Technocrats Pvt. Ltd.
Lead & Consortium Members of Banks	N.A.
EPC Contractor (SPV And Parent Company)	Dineshchandra R. Agrawal Infracon Pvt. Ltd.
Date of Award(LOA Date)	31st March 2018
Appointed Date	12th Dec 2019
Construction Period (in days)	910 days
O&M Period	04 Years

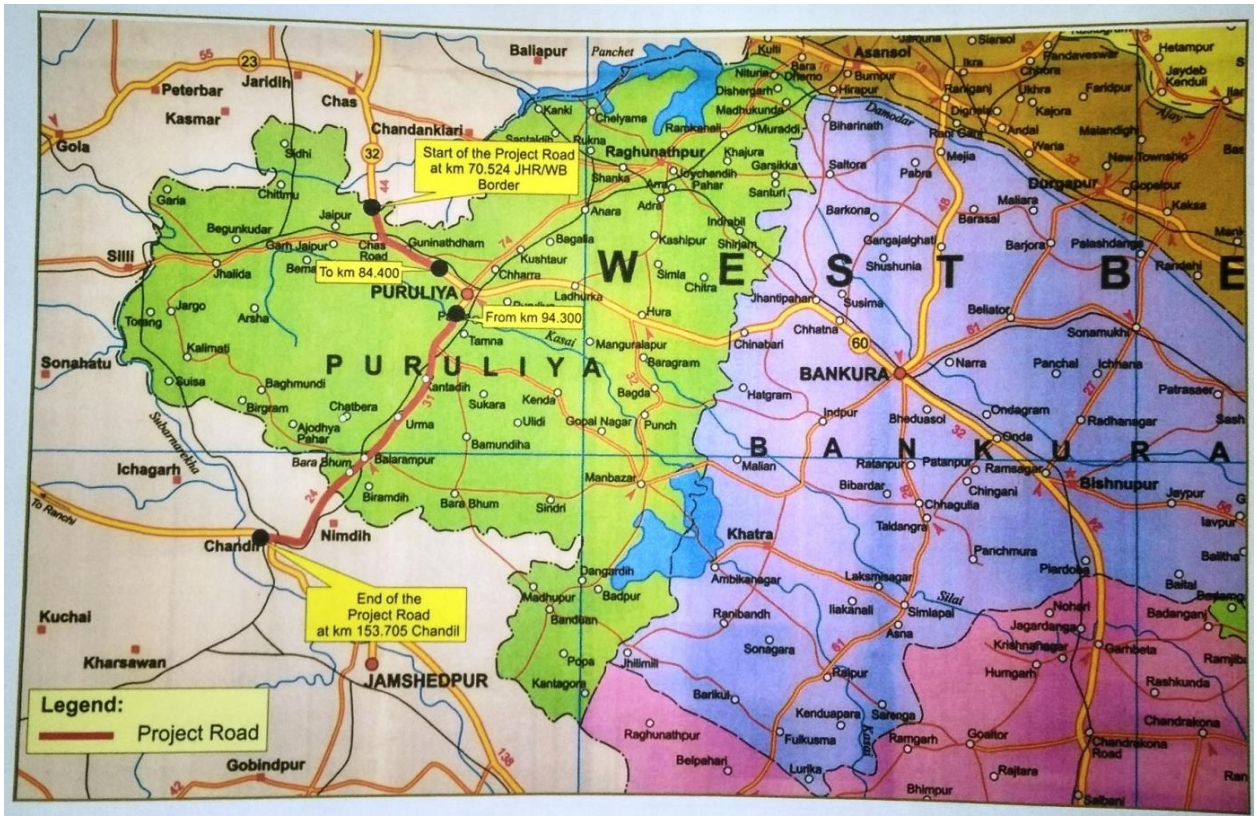
Scheduled Date of Completion	8th June 2022
Authority Engineer	M/S. L.N. Malviya Infra Projects Pvt. Ltd.
IE/AE Agreement Date	12th March 2020
IE/AE Mobilization Date	24th March 2020

13. PROJECT FACILITIES

The following project facilities have been provided by the contractor in accordance with the provision of the agreement:

a. Toll Plaza;
b. Roadside Furniture;
c. Street Lighting;
d. High Mast;
e. Pedestrian Facilities;
f. Landscaping and Tree Plantation;
g. Rest Area;
h. Way side amenities cum truck parking;
i. Truck Lay-byes;
j. Bus stops/shelters and Bus Bays;
k. Development of site for wayside amenities;
l. Traffic Aid Posts;
m. Medical Aid Post;
n. Vehicle Rescue Post;
o. Telecom System;
p. Highway Traffic Management System.

14. MAP DETAILS



15. PAVEMENT LAYERS USED IN THIS PROJECT

a. Sub grade

In this project, Sub grade of total thickness of 500mm is taken .

0

Fig 11.1 . Preparation of sub grade layer

b. Granular sub base

In this project, Granular Sub Base (GSB) of 200mm thickness is taken.

Fig 11.2 . Preparation of GSB layer

c. Cement Treated Base (CTB)

In this project, 175 mm thickness of CTB is taken.


Fig. 11.3. laying of CTB layer

d. Aggregate Relief Layer (ARL)

In this project, WMM of 100mm thickness is used as ARL.

Fig.11.4. Laying of ARL

e. Dense Bitumen Macadam (DBM)

In this project, DBM of 60mm thickness is taken.

Fig. 11.5. Laying of DBM Layer

f. Bituminous concrete

In this project, B.C of 40mm is taken.

Fig. 11.6. Laying of B.C layer

Fig.11.7. Side view of pavement layers.

16. CAMP DETAILS

1. Steel Yard

Fig.12.1. Steel Yard

2. Batching Plant of concrete

Fig12.2. Batching Plant

3. Hot Mix Plant

Fig12.3 Hot Mix Plant

4. Fuel Pump

Fig12.4 . Fuel pump

5. WMM & CTB Batching Plant

Fig.12.5 WMM and CTB

6. Aggregate Storage Area

Fig12.6 Aggregate storage

17. Cube Casting of M40 Grade Concrete

For the casting of M40 grade concrete we have done the following experiments to know the properties of Cement ,Coarse aggregate, Fine aggregate ,Fly ash, Admixture and Water used for the casting purpose.

1. **TESTING OF CEMENT** :

   Grade: OPC 43

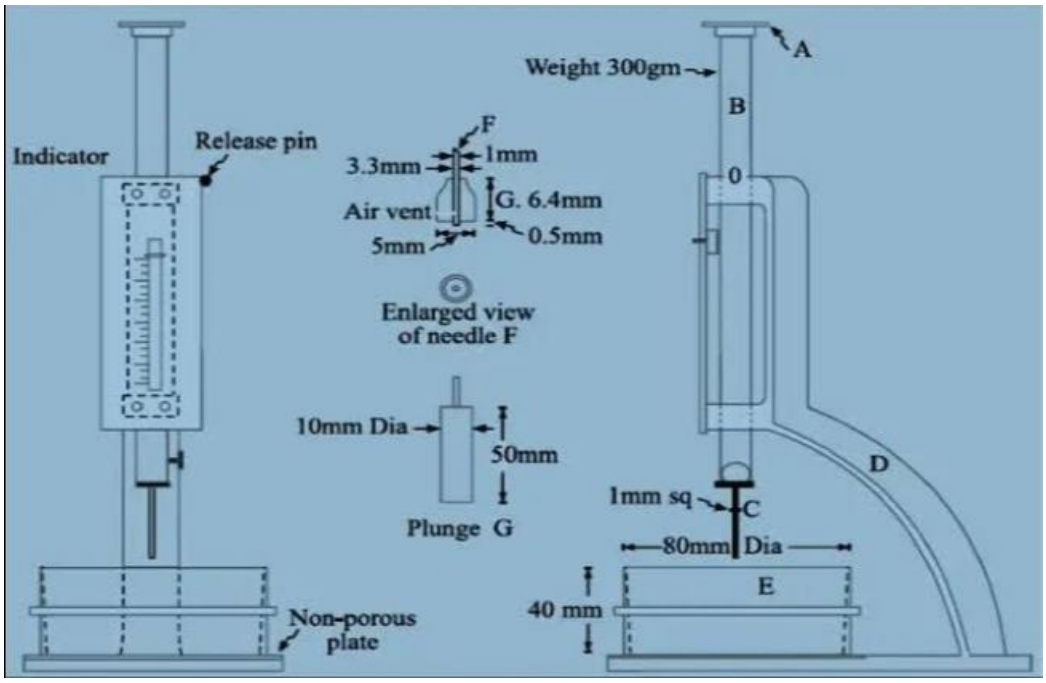
   Company: Emami

a. DETERMINATION OF CONSISTENCY OF CEMENT :-

The consistency of cement paste is defined as the percentage of water requirement of cement paste at which the viscosity of paste in such a way that it determines the amount of water needed to make a paste. It is necessary to determine the consistency of cement because the amount of water affects the setting time of cement.

IS 4031:1988(Part-4) deals with the consistency of cement. The usual range of values of the consistency of OPC cement is between 26 to 33 percent by weight of the dry cement.

APPARATURS REQUIRED:



VICAT APPARATUS

OBSERVATIONS:

Weight of cement taken = 350gms.

Percentage of water taken	Penetration (mm)
30	15
31.5	13
31	06

Hence the normal consistency of the cement is 31%.

a. DETERMINATION OF INITIAL AND FINAL SETTING TIME OF CEMENT :-

Initial setting time of cement is the time at which it starts losing its plasticity. Initial setting time test is important for the transportation, placing and compaction of cement concrete. Initial setting time duration is required to delay the process of hydration or hardening.

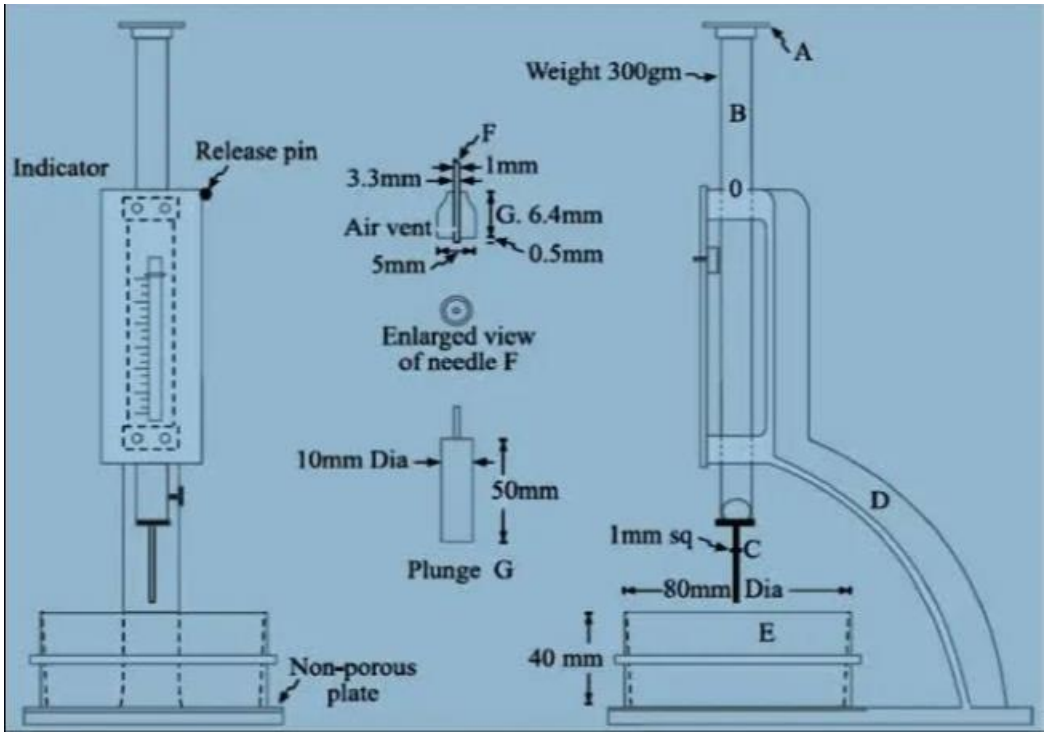
Final setting time is the time when the paste completely loses its plasticity. It is the time taken by the cement or the concrete to harden sufficiently and attain the shape of the

mould in which it is cast. During this period of time primary chemical reaction of cement with water is almost completed.

IS 4031:1988(Part 5) deals with the determination of initial and final setting time of cement. The range of initial and final setting time of OPC cement varies from 30mins to 600mins respectively.

APPARATUS REQUIRED:

VICAT APPARATUS



OBSERVATION

Initial setting time: 105 minutes

Final setting time: 245 minutes

b. **DETERMINATION OF SPECIFIC GRAVITY OF CEMENT** :-

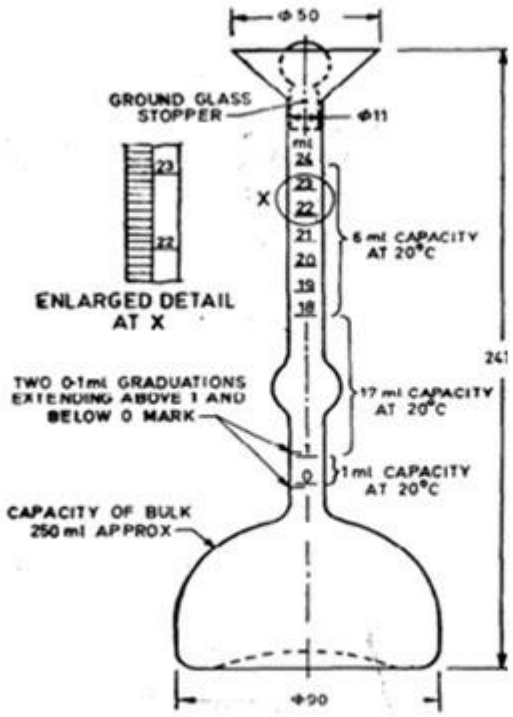
The cement particles have pores or particles that can contain water within it. A nominal mix is prepared with a cement of specific gravity 3.15. Any change in this value of specific gravity will affect the mix design. Hence it is necessary to test the specific gravity of the cement procured before mixing process.

Value of specific gravity of cement greater than 3.19 shows that the cement was not properly minced into fine powder during its production or the cement has more moisture content. The presence of moisture content in the cement is easily identified by the presence of chunks in cement.

IS 4031 (part 11) deals with the specific gravity of cement. The range of specific gravity of cement varies from 3.1-3.16 g/cc.

APPARATUS REQUIRED:

Le-Chatelier Flask or Specific Gravity Bottle



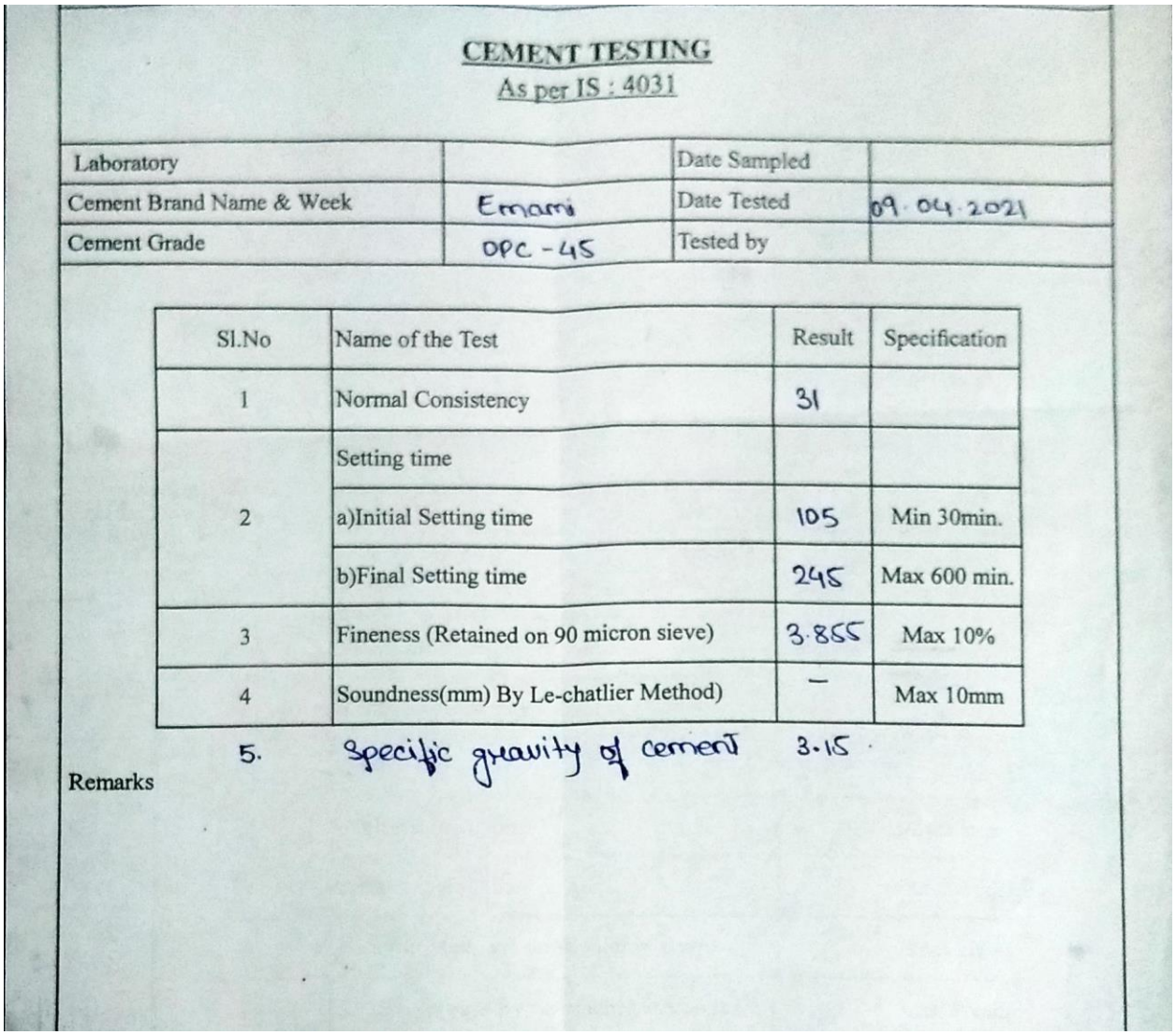
Le-Chatelier Flask Diagram

Kerosene in flask

OBSERVATION:

Weight of empty bottle (W1): 62.30 gm

Weight of (bottle + cement) (W2): 107.30 gm
Weight of (bottle + cement + kerosene) (W3): 146.37 gm
Weight of bottle+ Full kerosene (W4): 112.65 gm
Weight of bottle + Full Water (W5): 128.08 gm
Specific Gravity of Kerosene (Sk): (W4-W1)/ (W5-W1) = 0.79
Specific Gravity of Cement (Sc): (W2-W1)/ (W4-W1)-(W3-W2) = 3.15



CEMENT TESTING
As per IS : 4031

Laboratory		Date Sampled	
Cement Brand Name & Week	Emami	Date Tested	09.04.2021
Cement Grade	OPC-45	Tested by	

Sl.No	Name of the Test	Result	Specification
1	Normal Consistency	31	
2	Setting time		
	a)Initial Setting time	105	Min 30min.
	b)Final Setting time	245	Max 600 min.
3	Fineness (Retained on 90 micron sieve)	3.855	Max 10%
4	Soundness(mm) By Le-chatlier Method)	–	Max 10mm
5.	Specific gravity of cement	3.15	

Remarks

c. **DETERMINATION OF COMPRESSIVE STRENGTH OF CEMENT MORTAR:-**

Compressive strength is one of the most important properties of mortar or concrete. The strength of the binder (cement) therefore has a significant effect on the performance characteristics of the mixture and ensures the overall quality of the finished product. The test for compressive strength is generally carried out by crushing

cubes of hardened cement-sand mortar in a compression machine .The compressive strength of the cube is determined by the highest stress applied to a cube specimen that causes to fracture.

IS 4031:1988(Part-6) deals with the determination of compressive strength of hydraulic cement.

APPARATUS REQUIRED :

Compression Testing Machine

Before Test

After Test

OBSERVATION:

COMPRESSIVE STRENGTH OF CEMENT

Laboratory				Date of casting	
Cement Grade					
Brand name of cement					
Comp. Strength Reqd.		N/mm^2		Batch/Week No.	
Age in 03 Days				**Date of Testing :-**	
Sl.No.	Wt of Cube(g)	Density (gm/cc)	Load(KN)	Compressive Strength N/mm^2	Average Strength N/mm^2
01	841	2.389	126.5	25.38	26.16 N/mm2
02	839	2.384	131.2	26.32	
03	847	2.407	133.4	26.77	
Age in 07 Days				**Date of Testing :-**	
04	825	2.344	188.2	37.76	37.85 N/mm2
05	827	2.349	191.2	38.36	
06	834	2.369	186.5	37.42	
Age in 28 Days				**Date of Testing :-**	
7	841	2.389	239.5	48.05	48.95 N/mm2
8	832	2.364	245.3	49.22	
9	834	2.369	247.2	49.60	
Remarks:					

2. Testing of Aggregate:-

a. DETERMINATION OF AGGREGATE IMPACT VALUE:

The aggregate impact value is a measure of resistance to sudden impact or shock, which may differ from its resistance to gradually applied compressive load. The property of a material to resist impact is known as toughness. Due to movement of vehicles on the road the aggregates are subjected to impact resulting in their breaking down into smaller pieces. The aggregate should therefore have sufficient toughness to resist their disintegration due to impact. This characteristic is measured by impact value test.

IS 2386-part 4(1963) deals with the determination of aggregate impact value. The sample passing from 12.5mm IS sieve and retained on 10mm IS sieve is taken for the test.

APPARATUS:

OBSERVATION:

RECOMMENDED AGGREGATE IMPACT TEST VALUES:

Aggregate Impact Value	Classification
<20%	exceptionally strong
10-20%	strong
20-30%	satisfactory for road surfacing
>35%	Weak for road surfacing.

b. **DETERMINATION OF FLAKINESS AND ELONGATION INDEX**:

Flaky aggregate is defined as an aggregate particle with a least dimension (thickness) less than 0.6 of the mean of the smallest sieve size through which the particle passes and the largest sieve size on which the particle is retained.

The flakiness index is defined as the percentage (by mass) of stone in an aggregate having an ALD of less than 0.6 times their average dimension.

Flaky aggregate tend to produce seals with less voids due to their tendency to pack more tightly than cubical aggregates, consequently flaky particles requires less binder.

Elongation index of an aggregate is the percentage by weight of particles whose greatest dimension (length) is greater than one and fourth-fifth times (1.8 times or 9/5 times) their mean dimension.
Presence of Elongated Aggregate in a mix disturbs the packing of particles and creates more space. Elongated particles have high ratio of surface area to volume which reduces the workability of concrete. If elongated particles are used for pavement base course construction, they may break down easily under heavy load which will cause damage to the pavement. So, it is necessary to know the elongation index of given aggregate mix.

IS 2386 (part 1)-1963 deals with both the flakiness index and elongated index of aggregates. Flakiness and Elongation index is not applicable to the aggregate of size less than 6.3mm. Both Flakiness and Elongation index of aggregate used in road construction should not be less than 15% and normally does not exceed 25%.

APPARATUS:

OBSERVATION:

COMBINED FLAKINESS AND ELONGATION INDEX

[As per IS 2386, (Part - I)]

Type of Material		Date of Sampling	
Source		Sampled By	
Location		Date of Testing	
Proposed Use		Tested By	

IS Sieve Size		Total Weight of Aggregate retained on Sieves (g)	Weight of Aggregate passing from thickness gauge (g)	Weight of Aggregate retained on thickness gauge (g)	Weight of Aggregate retained on length gauge after retained on thickness gauge (g)
Passing	Retained				
mm	mm	W1	W2	W3	W4
63	50				
50	40				
40	31.5				
31.5	25				
25	20	2885	503	2382	357
20	16	1715	292	1423	299
16	12.5	1045	213	832	273
12.5	10	442	114	328	113
10	6.3	280	67	213	119
Total		W= 6367	1188	5178	1161

Flakiness Index = W2 / W1 X 100 = 18.6 %

Elongation Index = W4 / W3 X 100 = 22.4 %

Combined Flakiness & Elongation index = 41.0 %

Specification limits(Max) = %

Remarks :

c. **DETERMINATION OF SPECIFIC GRAVITY AND WATER ABSORPTION TEST OF COARSE AGGREGATE**:

Specific gravity is the measure of material's density (mass per unit volume) as compared to the density of water at 23 degree Celsius. Aggregate specific gravity is used to determine weight to volume relationships and to calculate various volume related quantities such as void in mineral aggregate and void filled by asphalt.

Absorption is a measure of the amount of water that an aggregate can absorb into its pore structure. Pores that absorb water are also referred to as "water permeable voids". Absorption can be used as an indicator of aggregate durability as well as the volume of asphalt binder it is likely to absorb.

IS: 2386 -1963(part-3) deals with the specific gravity and water absorption test of coarse aggregate. Specific gravity should be in the range of 2.5 to 3.0. Maximum

water absorption limit for coarse aggregate in any climatic condition should not be more than 2%.

APPARATUS:

Oven

Airtight container

Setup of Specific Gravity Test

OBSERVATION:

SPECIFIC GRAVITY AND WATER ABSORPTION TEST OF COARSE AGGREGATE
AS PER IS:2386 Part - 3 - 1963

Source of Sample — Date of Sampling:

Aggregate — Date of Testing : 13th Apr, 21

Description/Trail No:	1	2	3	
A. Wt. of Density Basket in Water	1205.9			
B. Wt. of Density Basket + Aggregate in Water	2495.5			
C. SSD Wt. Of Aggregate	2000.0			
D. Wt. of Oven dried Aggregate	1988.0			
E. Bulk Specific Gravity (OD) : D/(C-(B-A))	2.798			
F. Bulk Specific Gravity (SSD) : C/(C-(B-A))	2.814			
G. Apparent Specific Gravity : D/(D-(B-A))	2.846			
H. Water Absorption : (C-D)/D X 100 %	0.60			

Remarks: Specific gravity should be in the range of 2.5 to 3.0. Maxm water absorption limit for coarse agg. in any climatic condition should not be more than 2%.

d. SIEVE ANALYSIS OF COARSE AND FINE AGGREGATE FOR CONCRETE:

The sieve analysis determines the gradation in order to determine compliance with design, production control requirement, and verification specifications. Grading limits and maximum aggregate size are specified because these properties affect the amount of aggregate used as well as cements and water requirements, workability, pumpability, and durability of concrete. The gradation data may be used to calculate relationships between various aggregates or aggregate blends, and to predict trends during production by plotting gradation curves graphically.

IS:2386(Part 1) deals with the sieve analysis of coarse aggregate. Here we have done the sieve analysis of 10mm and 20 mm coarse aggregate.
IS:383-1970 deals with the sieve analysis of fine aggregate.

APPARATUS REQUIRED:

OBSERVATION TABLE FOR 10mm AGGREGATE:

SIEVE ANALYSIS OF COARSE AGGREGATE FOR CONCRETE
As per IS 2386 Part - 1

Laboratory	01	Date Sampled	13.04.21
Location/Source	DRA. CRA	Sampled by	Jointly
Type of Materials	10 mm Agg.	Date of Test	13.04.21
Proposed use		Tested by	Jointly
Wt. of sample	24710 gms.		

Description of Sample :

Sieve Size	Weight Retained (g)	Cumulative weight retained (g)	% Cumulative weight Retained	% Passing	Spec. % Passing		
					40 mm	20 mm	10 mm
63 mm					100	100	100
40 mm					85-100	100	100
20 mm					0-20	85-100	100
12.5 mm	0	0	0	100	-	-	100
10 mm	1838	1838	7.44	92.56	0-5	0-20	85-100
4.75 mm	20221	22059	89.27	10.73	-	0-5	0-20
2.36 mm	2073	24132	97.66	02.34	-	-	0-5

Remarks:

OBSERVATION TABLE FOR 20mm AGGREGATE:

SIEVE ANALYSIS OF COARSE AGGREGATE FOR CONCRETE
As per IS 2386 Part - 1

Laboratory	01	Date Sampled	13.04.21
Location/Source	DRA. CRA	Sampled by	
Type of Materials	20mm Agg.	Date of Test	13.04.21
Proposed use		Tested by	
Wt. of sample	25310 gms.		

Description of Sample :

Sieve Size	Weight Retained (g)	Cumulative weight retained (g)	% Cumulative weight Retained	% Passing	Spec. % Passing		
					40 mm	20 mm	10 mm
63 mm					100	100	100
40 mm	0	0	0	100	85-100	100	100
20 mm	1663	1663	6.57	93.43	0-20	85-100	100
12.5 mm	—	—	—	—	-	-	100
10 mm	20706	22369	88.38	11.62	0-5	0-20	85-100
4.75 mm	2552	24920	98.46	01.54	-	0-5	0-20
2.36 mm					-	-	0-5

Remarks: _____

OBSERVATION TABLE FOR FINE AGGREGATE:

SIEVE ANALYSIS OF FINE AGGREGATE FOR CONCRETE
As per IS 383-1970

Laboratory		Date Sampled	
Location/Source		Sampled by	
Type of Materials		Date of Test	
Proposed use		Tested by	
Wt. of sample	1000 gm		

Sieve Size	Weight Retained (g)	Cumulative weight retained (g)	% Cumulative weight Retained	% Passing	Spec. % Passing		
					Zone I	Zone II	Zone III
10 mm	–	–	–	100	100	100	100
4.75 mm	74·6	74·6	7·46	92·54	90-100	90-100	90-100
2.36 mm	57·6	132·2	13·22	86·78	60-95	75-100	85-100
1.18 mm	155·6	287·8	28·78	71·22	30-70	55-90	75-100
600 mic	650·3	938·1	93·81	46·19	15-34	35-59	60-79
300 mic	153·7	784·4	78·44	21·56	5-20	8-30	12-40
150 mic	173·2	957·6	95·76	4·24	0-10	0-10	0-10
75 mic							

Fineness Modulus =

Remarks

CONCRETE MIX DESIGN OF M-40 as per IS: 10262-2019

1. STIPULATIONS FOR PROPORTIONING

a) Grade designation : M40

b) Type of cement : OPC 43 grade conforming to IS 269

c) Type of mineral admixture : Fly ash conforming to IS 3812 (Part1)

d) Maximum nominal size of aggregate : 20 mm

e) Minimum cement content and maximum water-cement ratio to be adopted : Severe(for reinforced concrete) and/or Exposure conditions as per Table 3 and Table 5 of IS 456

f) Workability : 125 mm in 3 hrs. (slump)

g) Method of concrete placing : Pumping

h) Degree of supervision : Good

i) Type of aggregate : Crushed angular aggregate

j) Maximum cement content (OPC content) : 450 kg/ m^3 As per IS 456

m) Chemical admixture type : KUNAL PC 50 (Superplasticizer)

2 .TEST DATA FOR MATERIALS

a) Cement used : OPC 43 grade conforming to IS 269

b) Specific gravity of cement : 3.15

c) Fly ash : Conforming to IS 3812 (Part 1)

d) Specific gravity of fly ash : 2.017

e) Chemical admixture : KUNAL PC 50 (Superplasticizer) conforming to IS 9103

f) Specific gravity of

1) Coarse aggregate , 20 mm (at SSD condition) : 2.70

2) Coarse aggregate , 10 mm (at SSD condition) : 2.666

3) Fine aggregate (at SSD condition) : 2.60

4) Chemical admixture: 1.06

g) Water absorption

1) Coarse aggregate, 20mm: 0.5 percent

2) Coarse aggregate, 10mm: 1.2 percent 2) Fine aggregate: 1.5 percent

h) The coarse and fine aggregates are wet and their total moisture content is 2 percent and 5 percent respectively. Therefore, the free moisture content in coarse and fine aggregate shall be as shown in (j) below j) Free (surface) moisture 1) Coarse aggregate: Free moisture = Total moisture content – Water absorption = 2.0 – 0.5 = 1.5 percent 2) Fine aggregate: Free moisture = Total moisture content – Water absorption = 5.0 – 1.0 = 4.0 percent

k) Sieve analysis

i) Coarse Aggregate

ii) Fine Aggregate (confirming to Zone –II of IS:383)

3. TARGET STRENGTH FOR MIX PROPORTIONING

f'ck = fck + 1.65 S or

f'ck = fck + X

whichever is higher.

where f'ck = target average compressive strength at 28 days,

fck = characteristic compressive strength at 28 days

S = standard deviation, and

X = factor based on grade of concrete

From Table 2, IS: 10262-2019 standard deviation, S = 5 N/mm2.

From Table 1, IS: 10262-2019, X = 6.5

Therefore, target strength using both equations, that is,

a) f'ck =fck+1.65 S = 40 + 1.65 × 5 = 48.25 N/mm2

b) f'ck = fck + 6.5 = 40 + 6.5 = 46.5 N/mm2

The higher value is to be adopted. Therefore, target strength will be 48.25 N/mm2 as 48.25 N/mm2 > 46.5 N/mm2.

But as per Table 1700-5 of MORTH 5^{TH} revision, current margin for initial design mix of M40 grade of concrete is 12 so

Target mean strength of M40 Grade of concrete as per MORTH specification is 52 N/mm2

4 APPROXIMATE AIR CONTENT

From Table 3, IS: 10262-2019 , the approximate amount of entrapped air to be expected in normal (non-air-entrained) concrete is 1.0 percent for 20 mm nominal maximum size of aggregate

5 SELECTION OF WATER-CEMENT RATIO

From Fig. 1 IS: 10262-2019, the free water-cement ratio required for the target strength of 52 N/mm2 is 0.337 for OPC 43 grade curve. Take 0.33 as free water- cement ratio.

This is lower than the maximum value of 0.45 prescribed for 'severe' exposure for reinforced concrete as per Table 5 of IS: 456 – 2000. 0.33 < 0.45,

Hence, O.K.

6 SELECTION OF WATER CONTENT

From Table 4, IS: 10262-2019 water content = 186 kg (for 25-50 mm slump) for 20 mm maximum nominal size of aggregate.

Estimated water content for 125 mm slump (increasing at the rate of 3 percent for every 25 mm slump) = 186*(1.09) = 202.74 kg.

As super plasticizer is used, the water content may be reduced.

Based on trial data, the water content reduction of 16 percent is considered while using super plasticizer at the rate 0.9 percent by weight of cementitious material .

Hence the arrived water content = 202.74 × 0.84 = 170.301 kg ≈ 170 kg.

7 CALCULATION OF CEMENT CONTENT

Water-cement ratio = 0.33

Cement content = 170/ 0.33 = 515.15 kg/m3 ≈ 515 kg/m3

Fly ash @ 25 percent of total cementitious material content = 515 × 0.25 = 128.75 ≈ 129 kg/m3

Cement (OPC) = 515 – 129 = 386 kg/m3

From Table 5 of IS: 456-2000,

minimum cementitious content for 'severe' exposure condition = 320 kg/m3

515 kg/m3 > 320 kg/m3 , hence O.K.

8 PROPORTION OF VOLUME OF COARSE AGGREGATE AND FINE AGGRAGETE CONTENT

On preparing job mix formula of aggregate size 10 mm & 20mm (as per IS:383)

% of 10 mm aggregates required = 0.65

% of 20 mm aggregates required = 0.35

On preparing combined job mix formula,

Volume of coarse aggregate content = 0.62 m^3

Volume of fine aggregate content = 0.38 m^3

9 MIX CALCULATIONS

The mix calculations per unit volume of concrete shall be as follows:

a) Total volume = 1 cubic meter

3 b) Volume of entrapped air in wet concrete = 0.00 m3

c) Volume of cement = (Mass of cement / Specific gravity of cement)*(1/1000)

= (386/3.15)*(1/1000) = 0.122 m^3.

d) Volume of fly ash = (Mass of fly ash / Specific gravity of fly ash)*(1/1000)

= (129/2.017)*(1/1000) = 0.0639 m3

e) Volume of water = (Mass of water / Specific gravity of water)*(1/1000)

= (170/1)*(1/1000) = 0.170 m3

f) Volume of chemical admixture (superplasticizer) (@0.9 percent by mass of cementitious material) = (Mass of chemical admixture / Specific gravity of admixture)*(1/1000)

= (4.635/1.06)*(1/1000) = 0.004377 m3

g) Volume of all in aggregate = [(a-b)-(c+d+e+f)}]

= (1-0.00)-(0.122 + 0.0639 + 0.170+0.004377) = 0.6397 m3

h) Mass of coarse aggregate of 20mm size

= g × volume of coarse aggregate of 20mm × Specific gravity of coarse aggregate of 20 mm × 1000

= 0.6397 *(0.65*0.62) * 2.7 * 1000 ≈ 696 kg

i.) Mass of coarse aggregate of 10 mm size

= g × volume of coarse aggregate of 10 mm × Specific gravity of coarse aggregate of 10mm × 1000

= 0.639 * (0.35*0.62) * 2.666*1000 = 370 kg

j) Mass of fine aggregate

= g × Volume of fine aggregate × Specific gravity of fine aggregate × 1000

= 0.6397 × 0.38 × 2.60 × 1 000 ≈ 632 kg

Specific Gravity of Sand	2.6	As Per 10262-2009
Water Absorption of Sand	1.5	
		Emaml OPC 43 Grade Cement
Specific Gravity of 20mm	2.7	
Water Absorption of 20mm	0.7	
Specific Gravity of 10mm	2.666	
Water Absorption of 10mm	1.2	
		Coarse Aggregate Ratio 0.62
Specific Gravity of cement	3.15	
		20 mm 0.403 65%
Specific Gravity of Water	1	10 mm 0.217 35%
Specific Gravity of Admixture	1.06	
Specific Gravity of Flyash	2.017	
Total Cement+Flyash Content	515	
Cement Content 75%	386.25	Fine Aggregate Ratio 0.38
Flyash Content 25%	128.75	
W/c Ratio	0.33	
Water Qty is in Kgs	169.95	
% Of Admixture	0.9	Wt of Admixture 4.635

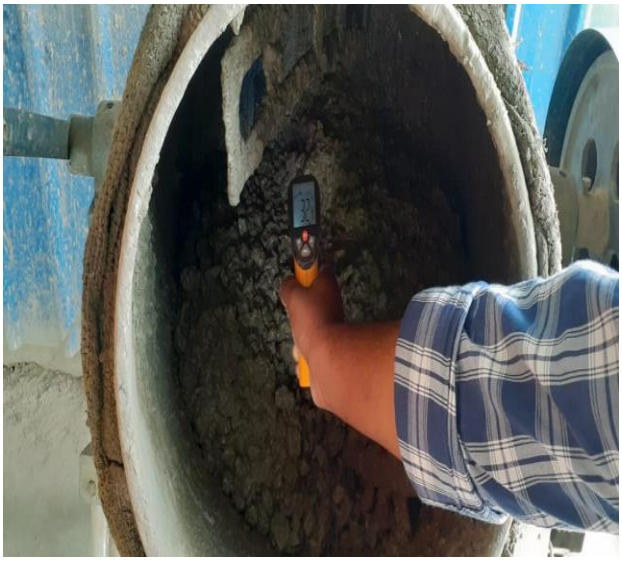
A-8 MIX CALCULATION

		1m3		
a)	Volume Of Concrete			
b)	Volume Of Cement = (=	0.123		
C)	Volume Of Fly Ash = (=	0.064		
D)	Volume of water	0.1700		
E)	Volume of Admixture	0.00437		
F)	Volume of All in Aggregate	0.639		
G)	Mass of 20mm Aggregate	695.54	20mm	696
	Mass of 10mm Aggregate	369.81	10mm	370
H)	Mass of Fine Aggregate	631.56	Sand	632

Mix Propotions in ssd	IN Kg's
Cement Content	386
Flyash	129
Water	170
20mm	696
10mm	370
Sand	632
Admixture	4.6

For 10 Cobes	0.03375
Cement Content	13.04
Flyash	4.35
Water	5.74
20mm	23.47
10mm	12.48
Sand	21.31
Admixture	0.156

MIXING OF CONCRETE

Mixing temperature should not be greater than 35 degree C.

CASTING OF CONCRETE

As per IS: 516-1959

SLUMP TEST

As per IS: 1199 - 1959

Fig . Testing of slump of concrete.

RESULT OF SLUMP TEST ON CONCRETE

i.) 15 minutes - 210mm
ii.) 60 minutes - 180mm
iii.) 120 minutes – 150mm
iv.) 180 minutes – 120mm

TESTING OF COMPRESSIVE STRENGTH OF CONCRETE

Testing is done in compression testing machine (CTM) at 7 days, 14 days and 28 days.

Fig . concrete cube after testing

7-days

S.No.	Weight of the Cube (g)	Density (gm/cc)	Load (KN)	Compressive Strength (N/mm^2)	Average Compressive Strength (N/mm^2)
1.	8225.0	2.437	1044.8	46.435	45.62
2.	8308.4	2.462	1048.8	46.613	
3.	8410.9	2.492	985.5	43.817	

Average compressive Strength: N/mm^2

Remarks:

Fig. Observation of compressive strength of concrete at 7 days

18. LAB TESTING OF BITUMEN

a. BITUMEN EXTRACTION TEST:

Bitumen Extraction Test is used to determine the percentage of bitumen content present in the asphaltic pavement by cold solvent extraction. The properties of flexible pavement such as durability, compatibility, and resistance from defects bleeding, raveling, and aging of flexible pavement are majorly dependent on the percentage of bitumen used with the aggregate to lay the pavement. The result should be equal to the percent which were mixed with HMA.

IRC: SP11- 1988 (Appendix-5)

ASTM D 2172

APPARATUS REQUIRED:

OBSERVATION:

BITUMEN EXTRACTION TEST

Sl No.	DESCRIPTION		Sampel-1	Sampel-2
1	Weight of Bituminous Mix in gm.	(A)	1000	
2	Initial Weight of Filter Paper in gm.	(B)	3.330	
3	Weight of Mix after Extraction in gm.	(C)	951.1	
4	Weight of Filter paper after Extraction in gm.	(D)	3.57	
5	Weight of fines gm.	E=(D-B)	0.24	
6	Weight of Binder in gm.	F=((A-C-E)	48.66	
7	Binder Content in (%)	G=(F/A)*100	4.86	
8	Avg. Binder Content in (%)			

GRADATION AFTER EXTRACTION SAMPLE

Weight of sample taken (gm.):

IS Sieve (mm)	Weight retained (gm)	Cumulative Wt. retained (gm)	Cumulative retained (%)	Cumulative Passing (%)	MORT&H Specification limits	
37.5					100	100
26.5					90	100
19.0					71	95
13.2					56	80
4.75					38	54
2.36					28	42
0.30					7	21
0.075					2	8
Pan						

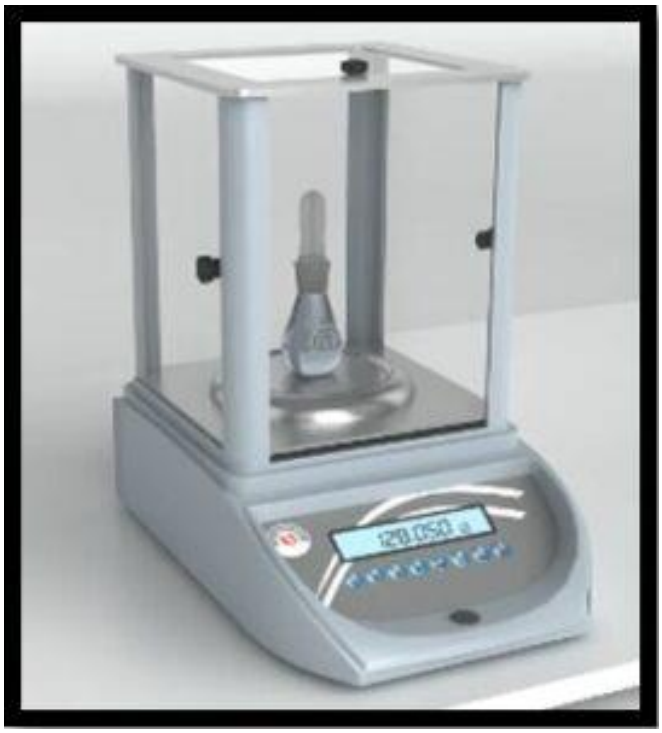
Remarks :

b. MAXIMUM SPECIFIC GRAVITY OF BITUMINOUS MIX (GMM):

The theoretical maximum specific gravity (GMM) of a Hot Mix Asphalt (HMA) mixture is the specific gravity excluding air voids. Thus, if all the air voids were eliminated from an HMA sample, the combined specific gravity of the remaining aggregate and asphalt binder would be the theoretical maximum specific gravity. Theoretical maximum specific gravity is a critical HMA characteristic because it is used to calculate percent air voids in compacted HMA. This calculation is used both in Super-pave mix design and determination of in-place air voids in the field. It is determined by taking a sample of loose HMA, weighing it and then determining its volume by calculating the volume of water it displaces. Theoretical maximum specific gravity is then the sample weight divided by its volume.

The range of maximum specific gravity of bituminous mix is between 2.4 to 2.7. AASHTO T 209 and ASTM D 2041: Deals with the Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixture.

APPRATUS REQUIRED:



OBSERVATION:

MAXIMUM SPECIFIC GRAVITY OF MIX (GMM)

Source of Material:		Date of Sampling:	
Kind of Material:	DBM II.	Date of Testing:	21.04.2021

	Description Trial No.	1	2	3
A	% Binder Content	4.5		-
B	Weight of Flask + Corks (gm)	1047.5		
C	Weight of Flask + Corks + Water (gm)	3219.3		
D	Weight of Sample in Air (gm)	1200.4		
E	Weight of Flask + Corks + Water + Sample (gm)	3956.2		
F	Temperature of Water °C	27.5±2.5		
G	Weight of Replaced water (gm) = (D-(E-C))	163.5		
H	Maximum Specific Gravity of Mix =D/G	2.589		

Remarks :

c. DETERMINATION OF DENSITY OF COMPACTED BITUMINOUS LAYER:

The compacted layers of Dense Graded Bituminous Macadam (DBM) shall have a minimum field density equal to or more than 92% of the density based on theoretical maximum specific gravity (GMM) obtained on the day of compaction in accordance with ASTM D 2041. After laying and compacting DBM layer we have to check whether the compaction is done right. Five numbers of core are cut on every 700mm, and test is performed on that core.

APPRATUS REQUIRED:

OBSERVATION:

DETERMINATION OF DENSITY OF COMPACTED BITUMINOUS LAYER

Laboratory						RFI No.			
Chainage						Date of Laying			
Layer No.						Date of Cutting			
Type of Mix						Date of Testing			
						Lab (GMM)	2.526		
Sl. No.	Location	Offset in (m)	Avg Core Thickness (mm)	Wt of specimen in Air (gms)	Wt of specimen in Water (gms)	Wt of specimen in SSD (gms)	Volume specimen in (CC)	Density Of Specimen (Field) (g/cc)	Compaction (%)
1				1187.6	697.4	1188.6	491.2	2.41	95.4
2				1013.1	604.4	1016.3	411.9	2.45	96.99
3				927.5	552.8	924.9	372.1	2.49	98.57
4				820.4	482.0	818.9	336.9	2.435	96.39
5				1099.2	641	1092.7	451.7	2.433	96.31
6				A	B	C	C-B	D=A	E=D x100
7								C-B	GMM
8									
9									
10									
11									
12									
13									
14									
15									
Remarks:									

d. DETERMINATION OF WATER CONTENT – DRY DENSITY RELATION USING HEAVY COMPACTION:

Compaction is the densification of unsaturated soil by the reduction in the volume of voids filled with air, while the volume of soils and water content remains the same.

The major aim of compaction of soil is to increase shar strength, decrease compressibility, reduce permeability, and to control swelling and shrinkage of soil.

Here we have used modified proctor test to determine the compaction of the soil and the properties of the soil with a change in moisture content and the relationship between dry density and moisture content. In this test, the soil is compacted in the given mould in five layers with a rammer of 4.5 kg with a fall of 45 cm.

IS:2720 (Part 8) deals with the Modified Proctor's Compaction Test.

APPARATUS REQUIRED:

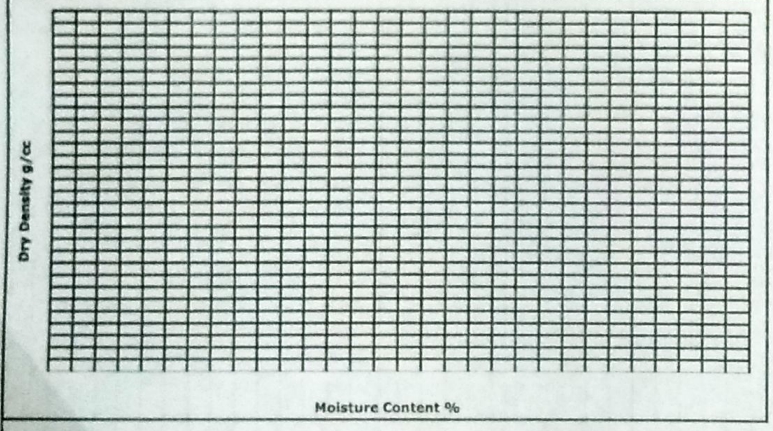
OBSERVATION:

MODIFIED PROCTOR'S COMPACTION TEST

[As per IS 2720, (Part-VIII)]

Laboratory no	:		Date Sampled	:	
Type of material	:		Sampled by	:	
Location/Source	:		Date Tested	:	
Sampling Location	:		Tested by	:	
Proposed Use	:		NMC	: -	

B	Mould No. :-		Wt.of mould (A) =		g	Volume of mould (V)=	cc
C	Trial No.		1 (9)	2 (6)	3 (8)	4 (10)	5 (12)	6 (14)
D	Wt.of wet soil + mould	g	5794.8	5819.3	6006.4	6116.6	6149	6088.8
E	Wt.of wet soil (E = D-A)	g	1953.8	1978.3	2165.4	2275.6	2308.1	2247.8
	Wet density of soil, (F = E/V)	g/cc	1.9538	1.9783	2.1654	2.2756	2.3081	2.2478
G	Container No.	g	13	7	5	11	32	16
H	Wt.of container	g	37.57	36.32	39.85	38.20	36.50	37.32
	Wt.of wet soil+Cont.	g	164.6	168.70	162.7	152.8	164.6	159.80
K	Wt.of dry soil+Cont.	g	161.27	162.24	156.46	144.18	153.82	147.87
L	Wt.of water(L=J-K)	g	3.33	6.46	6.24	8.62	10.78	11.93
M	Wt.of dry soil(M=K-H)	g	123.7	125.92	116.61	105.98	117.32	110.55
N	Water content [N = 100X(L/M)] %		2.69	5.13	5.35	8.130	9.19	10.791
	Dry density[P=100x(F/(100+N))]	g/cc	1.902	1.880	2.056	2.104	2.113	2.028



Method used:- Modified

Rammer Wt.:- 4.9 kg

No. of blows/layer :- 25 / 55

No. of layers :- 5

MDD = g/cc

OMC = 14 %

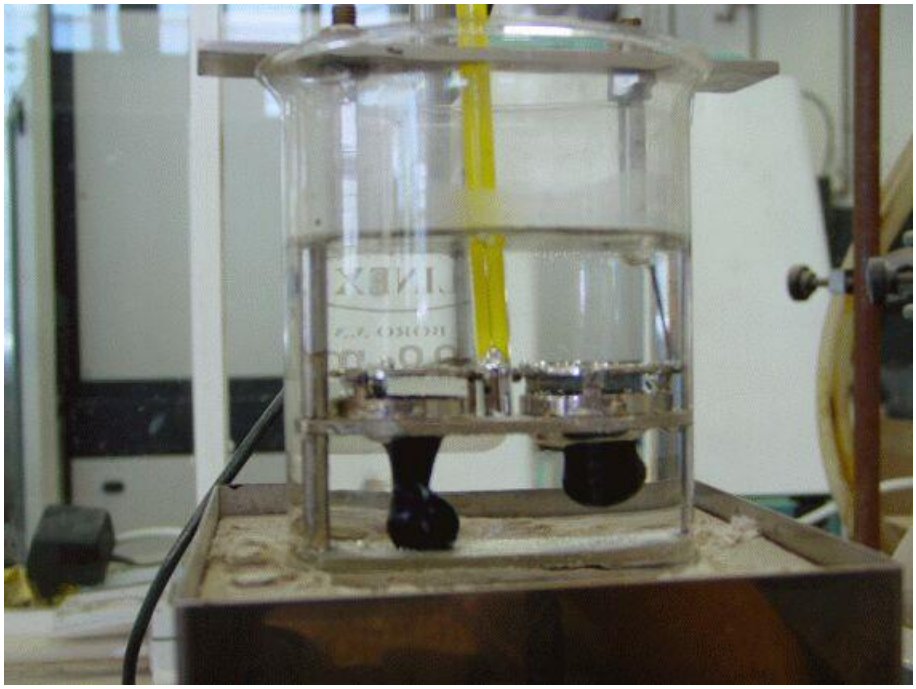
Remarks:

e. DETERMINATION OF SOFTENING POINT OF BITUMEN:

The softening point of bitumen is the temperature at which the substance attains particular degree of softening. It is the temperature in degree C at which a standard ball passes through a sample of bitumen in a mould and falls through a height of 2.5 cm, when heated under water or glycerine at specified conditions of test. The binder should have sufficient fluidity before its application in road uses. The determination of softening point helps to know the temperature upto which a bituminous binder should be heated for various road use applications. Softening point is determined by ring and ball apparatus. The softening point of VG 40 should be minimum 50.

IS: 1205(1978) deals with softening point of bitumen.

APPARATUS:



OBSERVATION:

SOFTENING POINT OF BITUMEN
As per IS : 1205

Source of Sample	:-	Date of Sampling :-	
Type of Sample	:-	Date of Testing :-	

Liquid Used in the Bath : Water

Period of Cooling : 30 Minute

Period of Cooling in Water Bath at 5°C : 15 Minute

OBSERVATIONS :

Testing Activity	Sample No		Mean Value of Softing Point (°C)
	1	2	
Temp at which sample touches bottom plate (in centigrade)	54	55	54.5

Remarks :

f. ABSOLUTE VISCOSITY TEST FOR BITUMEN:

Viscosity is simply a measure of a fluid's resistance to flow and is described by the following equation: Asphalt binder viscosity is typically measured at 60° C (140° F) because it approximates the maximum HMA pavement surface temperature during summer in the U.S.

IS 1206-Part- 2 : Deals with the absolute viscosity of bitumen.

APPARATUS:

OBSERVATION:

ABSOLUTE VISCOSITY TEST FOR BITUMEN

(AS PER IS:1206 PART II) (3200 - 3800)

Grade of Bitumen:		Date of Sampling	
Source of Bitumen:		Date of Testing	
Test Temp °C :	60.0 °C	To be Used	

Sr. No.	Viscometer Size No.	Calibration Factor 'K' (30 cm Hg) Poise per sec.		Observed Flow Time 't' (Sec.)		Absolute Viscosity (K x t) Poise		Avg. Absolute Viscosity (Poise)
		Bulb 'B'	Bulb 'C'	Bulb 'B'	Bulb 'C'	Bulb 'B'	Bulb 'C'	
1		40.155	15.175	93	280	3734.41	4249	3991.70
AVERAGE								

Remarks:

g. PENETRATION TEST FOR BITUMEN:

Penetration test is used to measure the consistency of bitumen, so that they can be classified into standard grades. It determines the hardness or softness of bitumen by measuring the depth in millimeter to which a standard loaded needle will penetrate vertically in five seconds while the temperature the bitumen sample is maintained at 25 C. Greater value of penetration indicates softer consistency. Generally higher penetration bitumen is preferred for use in cold climate and smaller penetration bitumen is used in hot climate areas.

IS: 1203- 1978 : Deals with the penetration test of bitumen.

APPARATUS:

OBSERVATION:

BITUMEN PENETRATION TEST
AS PER IS:1203

Source of Sample:		Date of Sampling :	
Type of Sample:		Date of Testing :	

Pouring Temperature	: 90C	Period of cooling in atmosphere	: 1 hour
Room Temperature	: 27°C	Period of cooling in water bath	: 1 hour
Actual Test Temperature	: 25°C		

Readings	Test - 1	Test - 2	Test - 3
Penetrometer Dial Reading			
(i) Initia			
(ii) Final			
Penetration Value	35	38	45
Average Value	39.33.		

Remark:

h. MARSHALL STABILITY TEST:

Marshall stability test is the performance prediction measure conducted on the bituminous mix. It is a popular and proven method to measure the load and flow rate

of asphalt specimens. The procedure consists of determination of properties of mix, Marshall stability and flow analysis and finally determination of optimum bitumen content. The concept of phase diagram is used for the calculations.

ASTM D6927-06 is used for the procedure of Marshall stability test.

APPARATUS:

OBSERVATION:

Marshall Test Data

Date of Casting :		Source of Coarse Agg.:	
Date of Testing :	22.4.21	Source of Fine Agg.:	
Bulk Sp. Gr. Of total Aggregate (Gsb):	2.673	Grade of Bitumen:	VG-40
Apparent Sp. Gr. Of total Aggregate (Gsa):	2.747	Specific gravity of Bitumin (Gb):	1.03
Effective Sp. Gravity of Aggregate (Gse):	2.710	Proving ring calibration factor 1 Div:	8.22 kg

% Bit by wt.of mix Sample	Wt of Specimen.in grams			cc Bulk volume	g/cc Bulk Sp.Gr. of sample (Gmb)	Mix sp.gr.of sample (loose) (GMM)	% Absorbed Bitumen (Pba)	Effective Bitumen (Pbe)	Air voids (VA)	Voids in mineral Aggrgate (VMA)	% Voids filled with Bitumen (VFB)	Stability, KN				Flow	
	in air	in water	SSD in air									Dial Reading	Measured Kg	Corre-ction Ratio	Adjusted KN	Dial Reading	Flow mm
	1244.5	735.6	1248.2	512.6	2.428							430	1384.6	1.00	13.58		3.20
	1248.2	739.7	1252.3	512.6	2.435							440	1416.8	1.00	13.90		2.90
	1250.0	740.0	1255.4	515.3	2.426							420	1352.4	1.00	13.27		3.50
Average					2.430	2.526	0.53	4.01	3.80	13.20	71.21				13.58		3.20
	1245.2	737.5	1250.5	513.0	2.427							425	1368.5	1.00	13.42		3.30
	1240.0	735.4	1245.4	510.0	2.431							435	1400.7	1.00	13.74		2.80
	1248.7	738.0	1252.6	514.6	2.425							415	1336.3	1.00	13.11		3.60
Average					2.428	2.526	0.53	4.01	3.88	13.27	70.76				13.42		3.23
Average					2.429	2.526	0.53	4.01	3.84	13.24	70.99				13.50		3.20
Average																	

Remarks:

19. LAB TESTING OF SOIL

a. GRAIN SIZE ANALYSIS OF SOIL:

Grain size analysis is widely used in classification of soils. The data obtained from grain size distribution curves is used in the design of filters for earth dams and to determine suitability of soil for road construction, air filled etc. Information obtained from grain size analysis can be used to predict soil water movement although permeability tests are more widely used.

Here Sieve Analysis is used to find the grain size analysis of the soil.

IS:2720 (part 4) deals with the grain size analysis of soil. Sieve Grain Size Analysis is capable of determining the particle's size ranging from0.075mm to 100mm.

APPARATUS:

OBSERVATION:

GRAIN SIZE ANALYSIS

[As per IS 2720 (Part - 4)]

Laboratory	:	Date Sampled	:
Type of Material	:	Sampled by	:
Source	:	Date Tested	:
Location	:	Tested by	:
Proposed Use	:	Weight of Dry Sample in grams	: 1000 gms

IS Sieve Size (mm)	Weight Retained (g)	Cumulative Weight Retained (g)	Cumulative Perentage Retained (%)	Cumulative Percentage Passing (%)	Remarks
100.0					Gravel
75.0					
19.0					
4.75	152	152	15.2	84.8	
2.00	113	265	26.5	73.5	Sand
0.425	322	587	58.7	41.3	
0.075	167	754	75.4	24.60	
Pan					Slit & Clay

DESCRIPTION OF PARTICLE		SIEVE SIZE (mm)	PERCENTAGE	
Gravel	Coarse			15.2
	Fine			
Sand	Coarse			60.2
	Medium			
	Fine			
Silt & Clay		Passing through 0.075		24.60

Remarks:

b. DETERMINATION OF FREE SWELLING INDEX OF SOIL:

Free swelling index is the increase in the volume of a soil, without any external constraints, on submergence in water. Free swell index determination of soil helps to identify the potential of the soilto swell which might need further detailed investigation regarding swelling and swelling pressures under different field condition.

IS:2720(Part-40) deals with the determination of free swell index of soil. Free swelling index exceeding 50% shall not be used as fill material. We can determine the below given properties of soil from free swell index value:

Free Swell Index	Degree of Expansiveness	PL
<20	Low	0-35%
20-35	Moderate	25-50%
35-50	High	35-65%
>50	Very high	>45%

APPARATUS:

OBSERVATION:

FREE SWELL INDEX

[As per IS 2720 (Part - 40)]

Laboratory No.		Date sampled	
Type of Material		Sampled by	
Source		Date tested	
Location		Tested by	
Proposed Use			

Sl.No.	Sample level in Water (V_w) ml	Sample level in kerosene (V_k) ml	Free Swell in Water (V_w-V_k) ml	Free Swell Index 100x(V_w-V_k)/V_k (%)	Remarks
1	12	10	2	20	
2	12	10.5	1.5	14.28	
				Avg: 17.14	

Note :
1. Test sample shall be passing 425 micron sieve
2. Take 10gm of each sample.
3. As per MORT&H clause 305.2.1.2 Free Swelling Index exceeding 50% shall not be used as fill material.

Remarks:

c. **DETERMINATION OF ATTERBERG LIMITS OF SOIL**:

The Atterberg limits are a basic measure of the critical water content of a fine grained soil, its shrinkage limit, plastic limit, and liquid limit. The Atterberg's limit can be used to distinguish between silt and clay, and to distinguish between different types of silt and clays. The water content t which the soil change from one state to the other are known as consistency limits or Atterberg's limit.

Liquid Limit (LL) is defined as a liquid water content separating the viscous liquid state and plastic state of soil consistency. Value of liquid limit is used to classify fine grained soil. It gives us information about the state of consistency of soil

on site. It can also be used to find the consolidating properties of soil while calculating allowable bearing capacity and settlement of foundation.

Plastic limit is the water content, in percentage, at which a soil can no longer be deformed. It is used to calculate the activity of clay and toughness index of soil.

On the basis of liquid limit and plasticity limit, the plasticity index can be calculated as:

PI+LL-PL

The plasticity index is expressed in percent of the dry weight of the soil sample. It shows the size of the range of the moisture contents at which the soil remain plastic.

It indicates the fineness of the soil and its capacity to change shape without altering its volume.

APPARATUS:

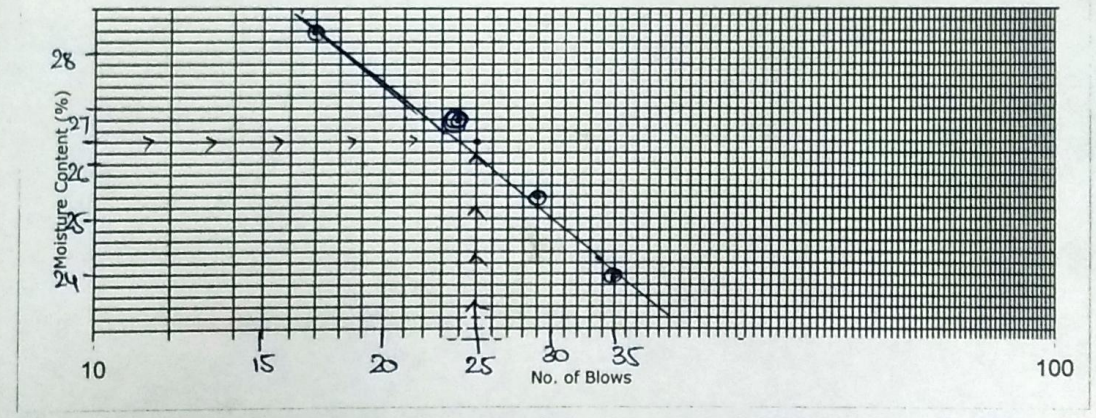
OBSERVATION:

ATTERBERG LIMITS

[As per IS 2720 (Part - 5)]

Laboratory no		Date Sampled	
Type of material		Sampled by	
Source		Date Tested	
Location		Tested by	
Proposed Use			

	Liquid Limit				Plastic Limit	
Determination No.	1	2	3	4	1	2
Container No.	56	57	58	59	60	61
Empty Wt.of Container (W1) g	11.95	10.89	11.51	11.78	12.35	11.78
Wt.of Container and Wet Soil (W2) g	34.87	36.95	38.64	37.27	21.16	19.79
Wt.of Container and Dry Soil (W3) g	30.40	31.64	32.86	31.62	19.60	18.34
Wt.of Moisture (W4=W2-W3) g	4.47	5.31	5.78	5.65	1.56	1.45
Wt.of dry Soil (W5=W3-W1) g	18.45	20.75	21.35	19.84	7.25	6.56
Moisture Content w = 100*(W4/W5) (%)	24.23	25.59	27.07	28.48	21.52	22.10
No. of blows	35	29	23	18	Avg :	21.61



Results: LL : 26.40 PL: 21.81 PI : 4.59

Calculation for PI shall made as follows:-

1. The Plasticity index is calculated as the difference between its Liquid limit & Plastic limit
2. In case of sandy soil PL should be determined first, When PL can not be determined, The PI should be reported as Non-Plastic (NP)
3. When the plastic limit is equal to or greater than the liquid limit, The PI shall be reported as zero

d. DETERMINATION OF CALIFORNIA BEARING RATIO OF SOIL:

The California bearing ratio test is a penetration test used to evaluate the subgrade strength of road and pavements. The result of these test are used with the curves to determine the thickness of pavement and its component layers. The test procedure should be strictly adhered to if a high of reproducibility is desired. The CBR test may be conducted on a remoulded or undisturbed specimen in the laboratory.

IS:2720(Part 16) deals with the determination of California bearing ratio of soil. In some cases, the ratio at 5mm may be greater than that at 2.5mm. If this occurs, the ratio at 5mm should be used.

APPARATUS:

OBSERVATION:

CALIFORNIA BEARING RATIO

[IS 2720 (PART 16)]

Laboratory Job No.		Date Sampled		M.D.D.	g/cc
Location/Source		Sampled by			
Type of Materials		Tested by		O.M.C.	%
Proposed use:		Date of Casting			
Period of Soaking		Date of Testing			

MOISTURE CONTENT AND UNIT WEIGHT OF TEST SAMPLES

	Mould No.		Mould No.		Mould No.	
No. of layers						
No. of blows per layer						
CONDITION OF SAMPLE	Before soaking	After soaking	Before soaking	After soaking	Before soaking	After soaking
wt. of Mould, W_1 (g)	6699	6699	6427	6427	6425	6425
wt. of Wet Soil + Mould, W_2 (g)	11744	11764	11467	11487	11479	11506
wt. of Wet Soil, $W_3=(W_2-W_1)$ (g)	5045	5065	5040	5060	5054	5081
Volume of mould, V (cc)	2250	2250	2250	2250	2250	2250
Wet Density, $\gamma_b = W_3/V$ (g/cc)	2·242	2251	2240	2·299	2·246	2·258
MOISTURE DETERMINATION	Before soaking	After soaking	Before soaking	After soaking	Before soaking	After soaking
Container No.	01	02	03	01	02	03
wt. of container, W_5 (g)	62·45	79·12	81·30	82·45	79·70	81·30
wt. of Wet soil +Cont., W_6 (g)	220·73	215·15	214·7	221·48	218·99	221·34
wt. of dry soil + Cont., W_7 (g)	209·96	203·33	204·1	209·13	208·01	208·84
wt. of water, $W_8=(W_6-W_7)$	10·77	11·98	10·59	12·35	10·98	12·50
wt. of dry soil, $W_9=(W_7-W_5)$ (g)	127·51	124·67	122·81	126·60	128·92	127·54
Water content $W = W_8/W_9$ (%)	6·45	9·61	8·62	9·75	8·52	9·80
Dry Density $\gamma_d = \gamma_b/(1+ w/100)$ (g/cc)	2·067	2·054	2·052	2·049	2·070	2·058

LOAD- PENETRATION TEST DATA :

Proving ring No. Proving Ring Calibration Factor

Sl. No.	Penetration (mm)	Mould No.		Mould No.		Mould No.	
		Proving ring Reading	Corrected load (Kg)	Proving ring Reading	Corrected load (Kg)	Proving ring Reading	Corrected load (Kg)
1	0.50	14	74·2	11	514·3	16	84·8
2	1.00	'	148·4	29	153·7	27	143·1
3	1.50	44	233·2	41	317·3	42	222·6
4	2.00	53	280·9	55	391·5	55	291·5
5	2.50	65	344·5	60	318·0	62	328·6
6	3.00	76	402·8	70	377·0	70	371·0
7	4.00	87	461·1	83	439·9	84	445·2
8	5.00	104	551·2	96	508·8	100	430
9	7.50	132	699·6	121	641·3	127	673·1
10	10.00	151	800·3	143	757·9	145	768·5
11	12.50	167	885·1	155	831·5	161	853·3

CBR CALCULATION

Mould No.	Corrected Unit Load in kg(from graph)		CBR%		CBR % reported
	2.5 mm	5.0 mm	2.5 mm	5.0 mm	
01	344·5	551·2	25·15	26·82	25·79
02	388	508·8	23·81	24·76	
03	388·6	530·0	23·99	25·79	
	Average CBR Value				

Note:

1) Graph for load vs penetration attached
2) CBR = (corrected load/standard load) x 100
3) Standard unit load : @ 2.5mm Penetration = 1370 Kg
: @ 5.0 mm Penetration = 2055 Kg

Degree of compaction :

20. SITE VISIT

1. CHAINAGE: 111- MAJOR BRIDGE

Fig.1 Foundation of Pier 1

Fig.2 Concreting of Raft Foundation

Fig.3 Pier 1

Fig.4 RCC Girder before casting

Fig.5 Girder after casting

2. CHAINAGE: 140- RAIL OVER BRIDGE:

Fig.1 Foundation of Pier

Fig.2 Pier with Pedestal

Fig.3 Series of Pier

Fig.4 Foundation with Pier

Fig.5 Site view

3. CHAINAGE: 152- RAIL OVER BRIDGE:

Fig.1 Pier

Fig.2 Girder

SITE VISIT REPORT

Name of site: Purulia (Jharkhand Border)-Chandil (Section of NH-32, near Sainik School).

Date of visit: 04th August 2021

Objective of visit: To understand the progress of work and suggest suitable modifications, if required.

Nodal Officer: Dr. Sanjay Sengupta

Faculty Members for Visit: Dr. Sanjay Sengupta, Mr. Arijit Kumar Banerji, Mr. Amit Kotal and Mr. Soumyadip Das

Introduction:

The visit to the NH-32 site in Purulia (Jharkhand Border, Purulia-Chandil section) was conducted by the faculty members of the department of Civil Engineering, Dr. B.C. Roy Engineering College, Durgapur on wednesday, 04th august 2021. Mr. Durgesh Kumar, team leader, Purulia Chandil NH-32 project, accompanied four faculty members including the nodal officer to the site as well the plant. Further, Md. Shamshe Alam (General Manager), Mr. Anoop Kumar Singh (Dy. Manager, QA & QC) along with other team helped for observing and understanding the functioning of the plant in order to enhance the knowledge about how the project is being executed. This visit was scheduled between 10:00 a.m. to 4:00 p.m. Faculty members were allowed to see each unit of plant and their queries were also answered by the general manager and Dy. Manager, QA & QC during the visit.

Brief report on the visit:

During the site visit we have observed the construction of base layer, use of fly ash, bridge pier construction and different material testing and quality control procedures available in the construction plant. The site engineer has explained the importance of local available soil type, pre-cast concrete blocks and the utility of geotextiles in the bridge guard wall to prevent loose mud/sand diluted washout as shown in Fig. 1. Fly ash has been used in carrying out intermediate

layer foundation work as shown in Fig.2 and briefed how the operations are implemented throughout the process. Fig.3 shows the sample image of piers is to carry the bridge load divide the total length of bridge into suitable spans with minimum obstruction to the railway.

(a) **(b)**

Fig 1. (a) Use of Geotextile to prevent sand/mud percolation, and (b) Guard wall concrete blocks

Fig 2. Use of Fly Ash in Intermediate Layer of Base

Fig 3. Bridge Pier Construction location

Fig. 4 Storage of Aggregate in Bins and stockpiling

Fig. 4 shows the plant has storage bins of sufficient capacity to supply the mixer when it is operating at full capacity. Bins are also arranged to assure separate and adequate storage of appropriate fractions of the mineral aggregates. When mineral filler is used, separate dry storage is provided, and the plant is equipped to feed the filler into the mixer. Near to that bitumen storage tanks are present, which designed for storing liquid Bitumen used during production of hot mix asphalt for DBM and surface course layer. Overall, they have evolved to a good level of aptness.

Fig. 5 Bitumen Plant

Interestingly, they are also using recycled old asphalt pavement for environmental protection, economy and for maintaining the contours of the road. In this site, the use of RAP is catching up but the authorities, quite rightly so, are cautious in the % of RAP used. They collected RAP samples and optimize the percentage of usable RAP to 10% for the DBM layer.


Fig. 6 Use of Reclaimed Asphalt Pavement in construction

Fig. 7 Silos for Base-Subbase Material Storage

Fig. 8 Cement treated base layer construction plant

As per the IRC 37 codal provision, they are also using cement treated base layer. In cement-treated base construction, the objective is to obtain a thorough mixture of an aggregate/granular material with the correct quantity of portland cement and enough water to permit maximum compaction. The aggregate/granular material, cement and water are typically mixed in such central mixing plant. The samples are also cured as shown in Fig. 9 and checked for mix design evaluations. Their laboratory setup are also well equipped for the proper design and material testing.

Fig. 9 PQC Sample Curing

Fig. 10 Laboratory visit with the members

Conclusion:

Site in-charge was very co-operative and described informative portrayal about the work progress and the methodologies used during the construction. The laboratory set up is also well equipped in the site for evaluating material characteristics. As per our MOU, they also provided a great opportunity to the five undergraduate final year students by allowing them to visit this construction site and this will help the students in understanding various concepts of construction process and quality control management. Report made by the students and their observations are also attached with this report. In the collaboration process it is expected that more students will be benefitted by the internship offered by NHAI as well the institute industry collaboration will be further enhanced in the coming years through more participation from the faculty and staff members of the department.

Future information to look out for in the next site visit:

1. Inspection during laying of bituminous concrete and DBM.
2. Rolling temperatures
3. Roller Marks
4. Temperature Monitoring
5. Compaction Testing

Name & Signature of the Faculty Members:

1. Dr. Sanjay Sengupta (Nodal Officer)

2. Mr. Arijit Kumar Banerji

3. Mr. Soumyadip Das

4. Mr. Amit Kotal

भारतीय राष्ट्रीय राजमार्ग प्राधिकरण
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nhaipiudgp@yahoo.com

Dated : 17.12.2021

To Whom It May Concern

This is certified that **Miss Arpita Bhattacharjee** of Dr. B.C. Roy Engineering College, Durgapur has successfully completed internship in the project Purulia Chandil of NH-32 of National Highways Authority of India during the period from **01.04.2021** to **30.04.2021** under the supervision of the Contractor, M/s Dineshchandra R. Agrawal Infracon Pvt. Ltd. and Authority's Engineer, M/s L.N. Malviya Infra Projects Pvt. Ltd.

(S.K. Mallik)
Project Director

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Dated : 17.12.2021

To Whom It May Concern

This is certified that **Mr. Kisalay Kumar** of Dr. B.C. Roy Engineering College, Durgapur has successfully completed internship in the project Purulia Chandil of NH-32 of National Highways Authority of India during the period from **01.04.2021** to **30.04.2021** under the supervision of the Contractor, M/s Dineshchandra R. Agrawal Infracon Pvt. Ltd. and Authority's Engineer, M/s L.N. Malviya Infra Projects Pvt. Ltd.

(**S.K. Mattik**)
Project Director

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Dated : 17.12.2021

To Whom It May Concern

This is certified that **Mr. Prem Kumar Patel** of Dr. B.C. Roy Engineering College, Durgapur has successfully completed internship in the project Purulia Chandil of NH-32 of National Highways Authority of India during the period from **01.04.2021** to **30.04.2021** under the supervision of the Contractor, M/s Dineshchandra R. Agrawal Infracon Pvt. Ltd. and Authority's Engineer, M/s L.N. Malviya Infra Projects Pvt. Ltd.

(**S.K. Mallik**)
Project Director

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Dated : 17.12.2021

To Whom It May Concern

This is certified that **Miss Rakhi Agarwal** of Dr. B.C. Roy Engineering College, Durgapur has successfully completed internship in the project Purulia Chandil of NH-32 of National Highways Authority of India during the period from **01.04.2021** to **30.04.2021** under the supervision of the Contractor, M/s Dineshchandra R. Agrawal Infracon Pvt. Ltd. and Authority's Engineer, M/s L.N. Malviya Infra Projects Pvt. Ltd.

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Project Director

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Dated : 17.12.2021

To Whom It May Concern

This is certified that **Mr. Santanu Bala** of Dr. B.C. Roy Engineering College, Durgapur has successfully completed internship in the project Purulia Chandil of NH-32 of National Highways Authority of India during the period from **01.04.2021** to **30.04.2021** under the supervision of the Contractor, M/s Dineshchandra R. Agrawal Infracon Pvt. Ltd. and Authority's Engineer, M/s L.N. Malviya Infra Projects Pvt. Ltd.

(S.K. Mallik)
Project Director

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सत्यमेव जयते

F. No. AICTE/IDC/IDEA202000139/2021 Dated -- 17.06.2021

To

THE PRINCIPAL/ DIRECTOR
DR. B.C. ROY ENGINEERING COLLEGE, DURGAPUR(PID - 1-3634031),
JEMUA ROAD, FULJHORE,DURGAPUR.DURGAPUR,
713206, West Bengal.

Sub: AICTE-IDEA Lab Project Offer/ Acceptance Letter (AQIS ID –IDEA202000139).

Madam /Sir,

We are pleased to inform that your institution is selected for establishing an AICTE IDEA Lab with following budget and fund flow.

Total Project Cost, Rs. (in lakh)	Contribution, Rs. (in lakh)					
	AICTE			Industry /Institute		
	NR	R	Total	NR	R	Total
78.99	24.50	15.00	39.5	24.50	15.00	39.50

[NR- Non-Recurring Expenditure, R- Recurring Expenditure]

AICTE shall be, as per scheme document, releasing 80% of its contribution as first instalment, only after matching grant (80% of contribution from industry/ institution) is deposited in an exclusive Bank Account of AICTE IDEA Lab and proof submitted to us. Further your institution must ensure continuous flow of funds into project over and above your contribution in the table above, towards sustenance of IDEA Lab beyond 2 years. You must ensure sustenance of IDEA Lab, to be eligible for grants from AICTE in future.

We would also like to recall among other things the following towards smooth initiation of project.

a) Your institution must provide a built-up and furnished space of at least 3000 sq. ft. to house the IDEA Lab (2000 sq ft for Lab & 1000 sq ft for student activities).
b) Your institution should open a separate bank account for this project within a week and the same be intimated to us through the Mandate Form (enclosed). This is required for issuing Sanction Order from our end.
c) Your institution must abide by Terms and Conditions provided in the Scheme Document (accessible from our website).
d) The institution must observe Code of Conduct for AICTE-IDEA Lab, given in Scheme Document.
e) The logo of AICTE IDEA Lab can be used by the institution as long as it has a valid Extension of Approval (EoA).

We will shortly be organising an online awareness programme for selected institute to detail the subsequent steps toward effective implementation of the project.

We look forward to an Acceptance Letter (giving reference to this offer letter) within a week and hope that the institute will implement the prestigious project with all sincerity and commitment.

Yours sincerely

Dr. Neeraj Saxena
Adviser – II (IDC)

Capgemini Technology Services India Limited
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Memorandum of Understanding (MOU)

This MEMORANDUM OF UNDERSTANDING (MOU) is entered on 13.04.2022 by and between:

I. **Capgemini Technology Services India Limited,** a company incorporated under the Companies Act, 1956 with its office at Plot No. 14, Rajiv Gandhi Infotech Park, Hinjewadi Phase-III, MIDC-SEZ, Village Man, Taluka Mulshi, Pune – 411057 Maharashtra (hereinafter referred to as "**CAPGEMINI**" which expression shall unless excluded by or repugnant to the context, be deemed to mean and include its successors-in-interest, assigns and affiliates,

AND

II. **Dr. B. C. Roy Engineering College**, located at Jemua Road, Fuljhore, Durgapur-713206 West Bengal Hereinafter referred to as the "**BCREC**" which expression shall unless excluded by or repugnant to the context, be deemed to mean and include its successors-in-interest, assigns and affiliates).

CAPGEMINI and BCREC are also referred to as the "**Parties**" in the collective and as the "**Party**" in the singular.

1. This MOU between CAPGEMINI and BCREC is executed with the objective of fostering collaboration between the two institutions to promote industrial and academic interaction to help enhance the pool of student talent ("Collaboration"). The collaboration hereunder shall commence on 13/4/2022 and will be valid for 2 years from the date of commencement. The educational programs conducted under this Collaboration will offer an opportunity: (Refer Annexure I)

2. Either party shall make available appropriate infrastructure facilities for the collaboration, which may include general access to the facilities, faculty, staff, teaching content, classrooms, library facilities, computer and communication facilities, stationery and other materials as may be required for the various programs to be offered. This shall however be subject to the requirements of clause 7 and 8 below.

3. This Collaboration is non-exclusive and each party shall be free to enter into similar collaborations with other institutions/organizations.

4. Institution agrees to unconditionally grant CAPGEMINI a preferential status for recruiting its students from the campus

5. The parties to this collaboration, unless expressly stated in any subsequent written agreement, shall have no obligation to compensate the other in any manner. Each party shall bear their respective expenses incurred under this Collaboration.

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6. Neither party shall:
   a) Infringe the intellectual property belonging to the other party.
   b) Use any trade name, trade mark, symbol or designation belonging to the other without prior written approval of the other party.
   c) Be or represent itself as a representative of the other.
   d) Create any liability for the other.

   The parties shall keep the other indemnified against the breach of this clause.

7. Confidential Information shall mean all proprietary information or data furnished by either Party and/or its affiliates before or after the effective date hereof, whether written or oral which includes but is not limited to Parties trade secrets, processes, devices, designs, concepts, improvements, know-how, algorithms, models, inventions (whether or not patentable or copyrighted), developments, decision technology, specifications, techniques, sketches, works of authorship, applications processes, strategies, designs, photographs, profile of its subsidiaries, branches or details of shareholding, financials, projections, track record, profile of product, any data or information regarding either Parties employees, prospective employees, business objective / criteria, employee lists, employee profiles, employee information, and other documentation relating to past, present or future business activities and services, which is disclosed by the party within thirty (30) days of the disclosure and which was designated as 'Confidential' or with a similar legend at the time of disclosure.

   Both Parties agrees and confirms that it shall not use, share, and reveal any Confidential Information provided by either Parties for any purpose other than for rendering services under this MoU and provide it only on a need to know basis to its Personnel (including subcontractors wherever applicable) for provision of Services under this MoU with prior written permission from the other Party. The Parties will ensure that all Personnel assigned to provide the Services under this MoU have signed appropriate confidential and non- disclosure agreement (NDA) (with terms no less onerous than terms appearing in this MoU) to ensure either Parties Confidential Information disclosed under this MoU is protected from unauthorized use and disclosure. Both Parties hereby assumes full liability for the actions of its Personnel who have access to the Confidential Information provided by each other and agrees that it shall be liable for all such actions as though those actions where the actions of the other.

   Save as permitted in clause above:
   - either Party shall not mention or otherwise use the name or trademark of each other or its affiliates in any publication, press release, promotional material or other form of publicity without the prior written consent of the appropriate individual designated for the purpose by concern Party;

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- the receiving Party shall take all steps as may be reasonably necessary to protect the integrity of the Confidential Information and to ensure against any unauthorized disclosure thereof;
- promptly inform the other of any potential or accidental disclosure of the Confidential Information and take all steps, together with the aggrieved Party, to retrieve and protect the said Confidential Information;
- use the Confidential Information only for the purpose for which it was provided and not profit from the same in any unauthorized manner to the exclusion of the disclosing Party.

Both Parties acknowledges that in the event of any breach or threatened breach of this clause by either Party or its Personnel, monetary damages may not be an adequate remedy, and therefore, the Parties shall be entitled to injunctive relief to restrain the other or its Personnel from any such breach, actual or threatened.

8. Either Party shall not be liable for any indirect, exemplary, special, punitive, consequential or incidental losses, damages, claims, liabilities, charges, costs, expenses or injuries (including, without limitation, loss of use, data, revenue, profits, business and for any claims of customers of other Party or other third parties claiming through such other Party) that may arise out of or be caused in connection with or result from this MoU or any other obligations undertaken under the terms of this MoU.

9. The Institution agrees to ensure that all personnel from the Institution (including students) abide by the applicable CAPGEMINI policies when working on CAPGEMINI premises with regard to Collaboration. The Institution agrees to keep CAPGEMINI fully indemnified against any unlawful activity or breach of instructions from CAPGEMINI by any personnel (including students) admitted to the Collaboration hereunder, including acts of hacking.

10. All or any dispute arising between the parties in respect of this MoU of whatsoever nature shall be resolved under the laws of India and any or all such disputes will be subject to the exclusive jurisdiction of the courts in Mumbai/Kolkata, India.

11. This MoU is not intended to create any relationship in the nature of franchise, joint venture, or agency between the Parties. Neither Party shall act in a manner that expresses or implies a relationship other than that of independent contractors, nor bind the other Party. Either Party or any of its employees/ personnel shall not, under any circumstances, be deemed to have any employer-employee relationship with the other Party.

12. This MoU has been signed in duplicate, each of which shall be deemed to be an original.

IN WITNESSES WHEREOF the parties have signed this MoU on this date, month and year first above written:

Capgemini Technology Services India Limited
(Formerly known as IGATE Global Solutions Limiced)
Candor Tech Space IT/ITES SEZ, Tower A1-2nd Floor,
Tower A2-1 & 2nd Floor, Tower A3-1st to 4th Floor,
Action Area -1D,Block-DH, Newtown, Rajarhat,
North 24 Parganas, Kolkata - 700156, West Bengal, India.
Tel: + 91 33 6621 5000 | Fax: + 91 33 6621 5032
www.capgemini.com/in-en

Annexure I

Work Place Services

Commitments from Capgemini:

- Ice breaker session and fun activity
- Orient Faculty members on Cloud Infra Services opportunities and career path
- Plan for two days faculty development program once in a year on Cloud Infra technology road map and developmental skills
- Conduct orientation session for students on Cloud Infra and career opportunities
- Subject matter experts of Capgemini would interact with students once in a month at minimum to create interest on Cloud Infra skills
- Provide project ideas and remotely mentor students to execute projects in College Campus
- Conduct awareness sessions and optionally run mock tests to help students prepare for placement
- Provide assistance and feedback for the CIS course curriculum and suggest enhancements
- Provide internship opportunities to qualified students trained in the last semester
- Train the trainer and utilize the services for pre-training activities of recruited students in the campus itself, after confirmation and agreement on the standards.
- Guest lectures on technical and life skills
- Create month on month schedule
- Deliver minimum of 2 guest lectures on leading technologies or mutually agreed topics subject to expert's availability
- Conduct workshops to make students embrace new technologies or methodologies
- Provide opportunity for BCREC's Students and Faculties to participate in Capgemini's TechFiesta
- Capgemini Tour for Final Selects (max 30) and Happy Hour for Final Selects (Connect with Senior Leaders, HR)
- Capgemini to provide pre joining learning opportunities (e.g. ADAPT) to Campus selects
- Capgemini to provide Exhibition/Project Expo Panelists (min 2)
- Capgemini can get help of the teaching faculties of BCREC for contributing to the professional activities based on expertise and experience in the respective field.

Commitments from BCREC

- Closely work with Capgemini Relationship Sponsor to agree on Engagement Charter.
- Finalise and agree on dates, topics, time slots for Guest Lecture, Faculty Development Program and other activities.

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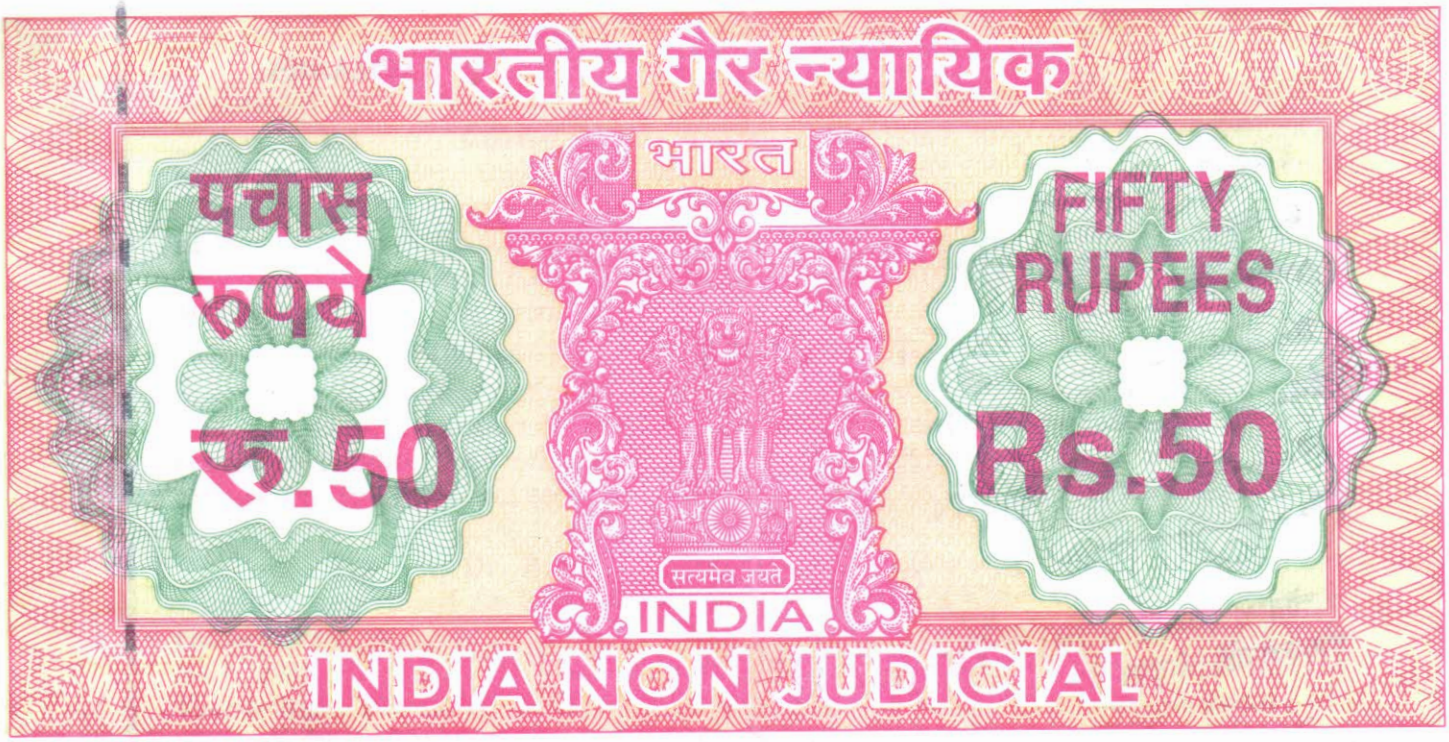
www.capgemini.com/in-en

- Invest/Upgrade in WPS labs as needed
- The Physical infrastructure of WPS Academy will be maintained and managed by BCREC.
- Encourage students to actively participate in all engagement activities and provide necessary support
- Invite Capgemini representatives to participate in BCREC's TechFest
- Include Capgemini representatives on the Advisory board/Committee to give inputs on Curriculum and the CoE roadmap.
- Support during Campus drives and provide preferential hiring slot to have access to 90% of campus pool
- Provide extensive support to launch new initiatives
- Invest, Train and develop BCREC's faculty on WPS technologies / process.

Capgemini Technology Services India Limited
(Formerly known as IGATE Global Solutions Limiced)
Candor Tech Space IT/ITES SEZ, Tower A1-2nd Floor,
Tower A2-1 & 2nd Floor, Tower A3-1st to 4th Floor,
Action Area -1D,Block-DH, Newtown, Rajarhat,
North 24 Parganas, Kolkata - 700156, West Bengal, India.
Tel: + 91 33 6621 5000 | Fax: + 91 33 6621 5032
www.capgemini.com/in-en

Accepted for and on behalf of **Capgemini Technology Services India Limited**	Accepted for and on behalf of **Dr. B. C. Roy Engineering College**
Signed:	Signed:
Name: DAVID SALDANHA	Name: SANJAY S. PAWAR
Position: VICE PRESIDENT	Position: PRINCIPAL
Date: 13/04/2022	Date: 13/04/2022



पश्चिमबंगाल पश्चिम बंगाल WEST BENGAL AC 575075

THE MEMORANDUM OF UNDERSTANDING

THIS Memorandum Of Understanding is made on 18th day of December, 2021 at Durgapur

Between

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH, a Society registered under the Societies Registration Act XXI of 1860 and having its Registered Office at Anusandhan Bhawan, 2, Rafi Ahmed Kidwai Marg, New Delhi – 110 001 (hereinafter called '**CSIR**' which expression shall include its successors-in-interest and assigns) of the one part;

AND

Dr. B.C. Roy Engineering College, located at **Durgapur**, India and having its campus at **Fuljhor, Jemua Road, Durgapur Pin-713206** (hereinafter called '**BCREC**' which expression shall unless repugnant to the context includes its successors and assigns, of the second part;

However for any reference on execution of this agreement on behalf of the **CSIR** on all developmental matters, **CSIR-Central Mechanical Engineering Research Institute**, a constituent laboratory under **CSIR** having its office at Mahatma Gandhi Avenue, Durgapur-713 209 (hereinafter called **CSIR-CMERI**) may be referred in the first instance.

C.M.E.R.I. BUSINESS DEVELOPMENT GROUP DURGAPUR-9

1. PREAMBLE

1.1 CSIR-CMERI is the apex R&D institute for mechanical engineering under the aegis of the Council of Scientific and Industrial Research (CSIR). Being the only national level research institute in this field, having expertise in Advanced Design And Analysis, Aero-systems, Industrial Research & Services, Farm Machinery, Business Innovation and Skills, Design Management and System Engineering ,Energy Research and Technology , Environmental Engineering, Foundry , Information Technology, Materials Processing & Microsystems, Robotics and Automation and Surface Engineering and Tribology, Condition Monitoring, Residual Life Assessment with proven track record in product and process development for engineering applications, is also engaged in the high end technology areas.

1.2 Dr. B. C. Roy Engineering College, Durgapur, has been set – up by a registered Society named after the legendary Chief Minister of partition-ridden West Bengal, Dr. Bidhan Chandra Roy. The industrial city of Durgapur had, and still has, a State - run Engineering College – National Institute of Technology (formerly Regional Engineering College), but the demand for engineering education far outstripped supply. Emboldened by the policy directions of the State and Central Government to widen the scale of engineering education, the Society, in 2000 embarked on the dream project of extending engineering education at Dr. B. C. Roy Engineering College with four disciplines – Computer Science and Engineering, Information Technology, Electrical Engineering and Electronics and Communication Engineering at the under – graduate level with sixty seats intake in each discipline, after gaining approval from All India Council for Technical Education, New Delhi and affiliation from the University of Burdwan. In the year 2001, the affiliation was transferred to West Bengal University of Technology, now renamed as Maulana Abul Kalam Azad University of Technology.

This Engineering College gradually enlarged the ambit and added three more undergraduate engineering disciplines – Applied Electronics and Instrumentation Engineering in 2001, Mechanical Engineering in 2003 and Civil Engineering in 2009. Also introduced were Masters level courses in Management and Computer Applications in the years 2004 and 2005.

Likewise, Masters degree courses in Electrical Engineering in 2007, Electronics and Communication Engineering in 2007, Computer Science and Engineering in 2009, were introduced, and in 2012, the M. Tech programme in Mechanical Engineering was introduced at the College.

In 2021 two undergraduate degree programmes in Artificial Intelligence and Machine Learning, and Computer Science and Design have been introduced. These courses of study are in contemporary and emerging areas of Science and Technology, and have gained recognition and popularity amongst learners.

The College received National Board of Accreditation for three under graduate disciplines in 2008 – Computer Science and Engineering, Electrical Engineering and Electronics and Communication Engineering. Presently two undergraduate programmes are **NBA Accredited**, and two more – Mechanical Engineering and Information Technology are awaiting accreditation since 2019.

Two other programmes – Electrical Engineering and the Masters degree programme in Management have also submitted documents relating to the accreditation process, and hopefully the much awaited inspection by the NBA Authorities shall not be too far away.

C.M.E.R.I. BUSINESS DEVELOPMENT GROUP DURGAPUR-9

To promote great learning opportunity for the students who would be able to gain first-hand knowledge in the applied fields of Embedded System, Electrical Drives, Solar and Renewable energy, Mechanical, Robotics, Micro-Manufacturing, Patent filling and to also extend the knowledge- base utilizing the expertise and infrastructure of **CSIR-CMERI** as a part of the **CSIR** Integrated Skill Initiative, the two institutions, i.e. **CSIR-CMERI** and **BCREC** agree to the following broad terms of co-operation.

NOW IT IS HEREBY AGREED AND DECLARED BY AND BETWEEN THE INSTITUTIONS HERETO AS FOLLOWS:

2.0 **SCOPES OF MoU**

2.1 Both the Institutions will support each other's endeavors in delivery of industry-ready skilled youth force through the following, though not limited to:

a. Hands-on skill promotion to 100 no. of students per year on mutually agreed date(s), jointly organizing skill development programmes and events such as seminars, workshop, and conferences.

b. Exchange of information for effective conduct of need based skill development programmes in response to students' requirements.

c. Both the Institute shall collaborate with each other in various common interest research problems.

d. Enable Faculty members to submit research proposal jointly with the CSIR-CMERI Scientist(s) to various Govt. bodies (DST, DBT, AICTE, MSME) and Private Organization in their common interest. IP generated from these research works will be shared mutually.

2.2 Both Institutions acknowledge and understand that all financial arrangements in respect of Students' training programmes would be borne by the students (training fee = Rs. (X) / student (depends on Online and offline training course) and deposited by the college to bank account of CSIR-CMERI prior to each training program. The related Bank Account number shall be shared by CSIR-CMERI.

C.M.E.R.I. BUSINESS DEVELOPMENT GROUP DURGAPUR-9

2.3 No Institution shall have the right to use the name or logo of another Institution without the prior approval of that Institution in writing.

2.4 The terms of this MoU may be modified / amended at any time subject to mutually consent, in writing. Such modifications/changes shall be effective from the date on which both the Institutions execute them in writing.

3.0 RESPONSIBILITIES OF BOTH THE INSTITUTIONS

3.1 **CSIR-CMERI** shall conduct the skill development programmes at **CSIR-CMERI** premises and shall also make available the necessary infrastructure and facilities for accomplishing the above laid down objectives.

3.2 **BCREC** shall depute batches (**100 students/year**) of UG students for undergoing training at CSIR-CMERI at mutually identified time periods throughout the year.

3.3 **BCREC** shall also pay the training fees to **CSIR-CMERI** prior to the commencement of each training programme.

3.4 **BCREC** shall also ensure observance of disciplined behaviour within the CMERI Campus by the deputed student batches and shall financially compensate for any damage to machine and property, if any, incurred during the training.

3.5 **Students'** accommodation, if required, during their period of training at **CSIR-CMERI** shall be provided by BCREC and CMERI shall extend the canteen facilities to the students on self –payment basis.

4.0 VALIDITY

This MoU shall be in full force and effect from the date of signature hereof for a **period of 3 (three) years**. Either organization may terminate this MoU at any time by giving six months notice in writing to the other. In the event of termination, programmes under way shall be allowed to be completed according to the terms that have been agreed upon.

5.0 ARBITRATION AND JURISDICTION

1. In the event of any question/dispute/difference arising under the agreement or in connection herewith (except as to matters the decision of which is specially provided under this agreement) the same shall be referred to the Delhi International Arbitration Centre for appointment of Arbitration to adjudicate the dispute.
2. The award for the Arbitrators shall be final and biding on the parties. The Arbitrators may give interim award(s) and / or directions, as may be required.
3. Subject to the aforesaid provision, the arbitration and conciliation act, 1996 and the rules made hereunder and any modification thereof from time to time being in force shall be deemed to apply to the Arbitration proceeding under this clause.

C.M.E.R.I. BUSINESS DEVELOPMENT GROUP DURGAPUR-9

IN WITNESS WHEREOF the parties have caused this MoU to be executed by their duly authorized officers on the respective dates and at the respective places hereinafter set forth.

Signed for and on behalf of CSIR (CSIR-Central Mechanical Engineering Research Institute)	**Signed for and on behalf of Dr. B. C. Roy Engineering College**
18/12/21	
Seal: प्रो. (डॉ) हरीश हिरानी / Prof. (Dr.) Harish Hirani निदेशक / Director सी एस आई आर-केन्द्रीय यांत्रिक अभियांत्रिकी अनुसंधान संस्थान CSIR-Central Mechanical Engineering Research Institute दुर्गापुर-७१३२०९ / Durgapur-713209, भारत / India	Seal: Dr. SANJAY S. PAWAR Principal Dr. B. C. Roy Engineering College DURGAPUR
Date: 18/12/2021	Date: 18/12/2021
Signed at: DURGAPUR	Signed at: DURGAPUR
1. Witness (Name & Address) डॉ अंजली चैटर्जी / DR. ANJALI CHATTERJEE मुख्य वैज्ञानिक व प्रमुख / Chief Scientist & Head व्यवसाय नवाचार एवं कौशल विभाग/Business Innovation and Skills सी एस आइ आर केन्द्रीय यांत्रिक अभियांत्रिकी अनुसंधान संस्थान CSIR-Central Mechanical Engineering Research Institute दुर्गापुर-९ / Durgapur-9, पश्चिम बंगाल / West Bengal	1. Witness (Name & Address) Dr. K. M. HOSSAIN Vice-Principal Dr. C. ROY ENGINEERING COLLEGE DURGAPUR
2. Witness (Name & Address) Biplab Choudhury (Dr. BIPLAB CHOUDHURY) Scientist Central Mechanical Engineering Research Institute Durgapur - 713209	2. Witness (Name & Address) Dr. A. KAHALI Head Administration Dr. B. C. Roy Engg. College Durgapur

MEMORANDUM OF UNDERSTANDING

Between

DR. B.C ROY ENGINEERING COLLEGE-DURGAPUR

And

VITTI RESEARCH FOUNDATION

(A Non-Profit Section-8 Company)

Regd. under U/S Section 12A & 80G Income Tax Act

Accelerating AI Research & Implementation

AGREEMENT

FOR

JOINT COLLABORATION IN ESTABLISHING

Dr. B.C Roy Engineering College Innovation Hub (BRAIN)

FOR

RESEARCH & DEVELOPMENT, PROJECTS, CONSULTANCY, TRAINING & EDUCATION

30/03/2022

30/03/22

MEMORANDUM OF UNDERSTANDING

BETWEEN

DR. B.C ROY ENGINEERING COLLEGE

AND

VITTI RESEARCH FOUNDATION

Whereas, **Vitti Research Foundation,** a non-profit Section-8 company, has a focus to promote Artificial Intelligence & Robotics through Research, Training & Education, Consultancy, Projects & Products as well as Incubating & Mentoring Start-ups, having its registered office at 8/3 2nd floor, Abdul Aziz Road, W.E.A., Karol Bagh, Delhi-110005 and hereinafter unless the context otherwise requires be referred to as **Vitti .**

Whereas, **Dr. B.C Roy Engineering College** has been a pioneer in introducing academic and research programs in Management and also has been the hub of interdisciplinary and transactional research with a potential for technology transfer and commercialization of the innovative research products and hereinafter unless the context otherwise requires be referred to as **BCREC.**

WHEREAS, both BCREC and Vitti,
now

- § Recognizing the importance of growing need of Artificial Intelligence, Robotics & Emerging and Foundational Technologies in every aspect of life, have teamed up for undertaking Industry & Govt. projects, Consultancy, Training & Education, Research and Development in the areas of AI/ Machine Learning, Data Analytics, IOT, Blockchain, AR/VR/MR etc.
- § Appreciating the need for creation of large reservoir of highly qualified manpower in AI, Emerging & Foundational Technology space especially in areas such as Fintech, Media & Communication, Management, and Education etc.
- § Desiring to club their efforts by pooling their expertise and resources.

BCREC Intend to form an Special Purpose Vehicle (SPV), a Section-8 Company with Vitti having 30% stake to be named as BRAIN (BCREC AIEFT Innovation Hub) and working as nucleus for furthering Consultancy, Trainings & Education, Culture of promoting Research & Innovation, Technology Development, Delivery of Products & Projects along-with Incubating & Mentoring Start-ups.

NOW, THEREFORE, in consideration of the mutual promises made herein and of good and valuable consideration, the receipt and sufficiency of which both BCREC and Vitti hereby acknowledge and agree to sign a Memorandum of Understanding (MOU).

1/3/2022

ARTICLE-I: SCOPE OF THE MOU

The AI Innovation Hub is being set up with both short term and long-term objectives. This Innovation Hub will be named as **BRAIN** (BCREC AIEFT Innovation Hub).

- Set up a platform for research in Artificial Intelligence, AR, VR, MR, IOT, Blockchain etc.
- To create innovative application platform & domain capabilities across verticals for Digital India needs such as Fintech, Management, Media & Communication, Education, Environment, Smart City, Health & Life Science, and Agriculture among others.
- To provide an ecosystem for innovation to thrive and embrace entrepreneurship.
- Build Industry capable talent, startup community and entrepreneurial ecosystem for AI /ML and other associated cutting-edge technologies.
- Set up collaboration of Academia with Industry & Government to rework the technology back-ends to ensure smooth transition to next Industry Revolution (4.0).
- Provide support for all aspects of data analytics including support for analysis of large datasets and applications of artificial intelligence (machine learning) to all areas of research.
- In the long term, the education system, industry and policy makers adopt Artificial Intelligence and Emerging Technologies as a practice for betterment of society.
- Start-up support, Incubation specifically for AI technologies & industry event organization
- IPR Life Cycle Management including its commercialization supports
- The areas of cooperation can be extended through mutual consent.

ARTICLE-II: SCOPE AND TERMS OF INTERACTIONS

VITTI RESEARCH FOUNDATION:

- Help design a premier systems laboratory for R&D in Artificial Intelligence and align with immersive AR, VR, and MR research. For establishing the BRAIN (BCREC AIEFT Innovation Hub), a Detailed Project Report (DPR) will be required which will cover the following:
    - Structure of the AIEFT Innovation Hub (SAIN)
    - Hardware & Software requirements
    - Administrative and Technical staff requirements
    - Industry Connects
    - Revenue streams
- Take up Industry event organization. Vitti will take up effort to not only market AIEFT focused Industry event at BCREC will also support proper & detailed planning in terms of creating the awareness about the event using digital marketing, contacting Industry for arranging the speakers, to inviting the industry leaders for presentations, discussions etc. but also arranging seminar, talks, workshop, hackathon etc..
- Bring Industry problems and solve using AI research & implementation- domain focus (Production, Management practices, Education, Fintech, Environment, and Health & Life Science etc.)
- Support & Mentor start-ups and provide them Industry alignment
- Support IP evaluation, protection, market insight, prototype, negotiation till product development and license exploitation
- Amalgamate associated technology set e.g. 5G, Neurosciences, BCI, Mixed Reality to AI world and endeavor to help industry solve some of the real-world problems and deliver horizontal/vertical POCs & enterprise applications

VITTI FOUNDATION

30/03/2022

- Align with government, industry, premier academic institutions & research foundations globally to develop & deliver research-oriented Autonomous vehicle, AI & robotics implementations.
- Leverage Vitti's other COEs being established with premier institutions, universities and industry for project delivery, mentoring, training etc.
- Create a research hub focused on the fundamental AI problem sets and will endeavor to publish papers and generate Intellectual Property (IPs) in partnership with academia.
- Will be responsible of front ending through its AI Innovation Hub, operationalizing the Hub, conducting the daily operations, and ensuring the success of the AIEFT Innovation Hub.
- Provide world-class AI research base for master's & PhDs initiatives in conjunction with top Global Universities & Scholars.
- Work with University to create publication to promote safe AI with contributions from global best practices and works.
- Every internship program would be paid and the cost shall be decided by Vitti & BCREC jointly.
- Support design, delivery, and certification of courses on AI & Emerging Technologies

Dr. B.C Roy Engineering College:

- Provide human resources and physical resources on sharing basis to supports the activities of Hub, for project development, delivery, and content design, writing & retooling/reskilling of professionals, launch new courses on AI & Emerging Technologies.
- BCREC and Vitti will work together for obtaining International & Govt. grants, CSR funding, Industry projects, Research & Development, Proof of Concepts etc.
- BCREC will support for project consultancy, development & delivery.
- The Hub will work towards fostering research and education along with Government and Industry to bring in the following gains in this domain
- Build Artificial Intelligence & Data Analytics practice from the BCREC campus and bring research to the Hub.
- Bring Government funded projects to add to the Digital India and related projects and going forward deliver and monetize these projects.
- Build technology platform and create IPR for monetizing as well as putting to open cloud for more research and growth.
- Get Industry funding for immersive AR, VR, MR research and build assets.
- Establish AIEFT Innovation Hub to contribute in project delivery, R&D and creating 2D, 3D content

ARTICLE-III: EFFECTIVE DATE AND DURATION OF MOU

- This MOU shall be effective from the date of its approval by competent authorities at both ends. The duration of the MOU shall be for a period of 5 years from the effective date.
- During its tenancy, the MOU may be extended or terminated by a prior notice of not less than 3 months by either party. However, termination of the MOU will not in any manner affect the on-going projects or trainings being undertaken at that point of time under the MOU.
- Any clause or article of the MOU may be modified or amended by mutual agreement of Vitti and BCREC.

ARTICLE-IV: IPR

- Rights regarding publications, patents, royalty, ownership of product, design, process, code-base etc. under the scope of this MOU, shall be decided by the two parties by mutual consent.

VITTI FOUNDATION

30/03/2022

ARTICLE-V: CONFIDENTIALITY

- During the tenure of the MOU both BCREC and Vitti will maintain strict confidentiality and prevent disclosure of all the information and data exchanged under the scope of this MOU for any purpose other than in accordance with this MOU.
- Both BCREC and Vitti shall bind their respective personnel who come into possession or knowledge of any confidential information not to disclose the same to third parties without written approval of the disclosing party or use such confidential information for any use other than intended under this agreement or projects.
- Further both BCREC and Vitti shall put in place adequate and reasonable measures to keep and store confidential information secure so as to prevent any unauthorized use.
- CONFIDENTIAL INFORMATION shall mean any proprietary information, data or facts belonging to parties collectively or severally, disclosed by the disclosing party under this agreement or any subsequent agreement, whether in writing, verbal or electronically, irrespective of the medium in which such information is stored, which is marked confidential or with any other words having similar meaning by the disclosing party, or specifically agreed to be kept confidential by the parties, or declared or identified so by the disclosing party before such disclosure or during the discussions.
- However confidential information shall not include any data or information which:
  - Is or become publicly available through no fault of the receiving party
  - Is already in the rightful possession of the receiving party prior to its receipt of such data or information.
  - Is independently developed by the receiving party without reference to the confidential information of the disclosing party
  - Is rightfully obtained by the receiving party from a third party or is in the public domain.
  - Is disclosed with the written consent of the party whose information it is, or
  - Is disclosed pursuant to court order or other legal compulsion, after providing prior notice to The disclosing party

ARTICLE-VI: AMENDMENTS

Any amendment add /or addenda to the AGREEMENT shall be in writing and signed by the PARTIES Here to and shall only after such execution be deemed to form part of the AGREEMENT and have the effect of modifying the AGREEMENT to the extent required by such amendment or addenda.

ARTICLE-VII: RESOLUTION OF DISPUTES

- This agreement shall take effect and be construed in accordance with the Laws of India and be subject to the jurisdiction of the courts at Delhi/Kolkata.

- The dispute or difference whatsoever arises between PARTIES in relation to or in connection with this AGREEMENT both the parties shall first try to resolve the dispute/difference amicably between themselves, failing which the matter shall be referred to and settled through arbitration. The arbitration proceedings shall be held in accordance with the provision of THE ARBITRATION AND CONCILIATION (AMENDMENT) ACT, 2015. The venue of arbitration shall be Delhi/Kolkata and Language of arbitration shall be English

VITTI FOUNDATION

30/03/2022

ARTICLE-IX: MISCELLANEOUS

- The headings and subheadings are inserted for convenience only and shall not affect the construction of this Agreement.
- Both BCREC and Vitti shall not, during the term of this Agreement directly or indirectly, solicit or offer employment or engagement to any of the personnel of other party without the prior consent in writing of that other party.
- No failure to exercise and no delay in exercising, on the part of a Party, and right, remedy, power or privilege hereunder shall operate as a waiver thereof, nor shall any single or partial exercise of any right, remedy, power, or privilege hereunder preclude any other or further exercise thereof or the exercise of any other right, remedy, power, or privilege. The rights, remedies, power and remedies, powers and privileges provided by law.
- After this Agreement has been signed, all preceding understandings/negotiations and correspondence pertaining to it shall become null and void.

ARTICLE-X: COORDINATORSHIP(s)

- The following members from BCREC and Vitti will coordinate the activities of BRAIN (BCREC AIEFT Innovation Hub).

ARTICLE – XI: COMMERCIAL TERMS

- For every training, project work, consultancy, research work, lab establishment, initiative etc. a detailed statement of work (SOW) will be developed highlighting roles and responsibilities along with Commercials and schedule.
- All the efforts (e.g. preparing the Detailed Project Report, Bill of Material, Conducting the Industry Event and operating the AI Innovation Hub) and resources provided for operationalization of BRAIN or projects will be charged. In addition any other expenses in terms of personnel travel & stay will also be charged on actuals by Vitti.

Dr. B.C Roy Engineering College

30/03/2022

Dr. Sanjay S. Pawar
Principal

Vitti Research Foundation

30/03/2022

Kundana Kumar Lal
President

Witness:

1. Name K. M. Hossain 30/3/2022

2. Name Alok Kahali 30/3/22

Witness:

1. Name

2. Name

Dr. B. C. ROY ENGINEERING COLLEGE, DURGAPUR
(Approved by AICTE & Affiliated to MAKAUT, WB)

CAMPUS : JEMUA ROAD, FULJHORE, DURGAPUR-713206 (W.B), INDIA
☎ : (0343) 250-1353/4106/4121/2449. Fax : (0343) 250-4059 / 3424
E-mail : info@bcrec.ac.in ● Website : www.bcrec.ac.in

MEMORANDUM OF UNDERSTANDING(MOU)

BETWEEN

Dr. B. C. Roy Engineering College, Durgapur

&

ARDENT COMPUTECH PVT LTD, West Bengal

Dr. B. C. ROY ENGINEERING COLLEGE, DURGAPUR
(Approved by AICTE & Affiliated to MAKAUT, WB)
CAMPUS : JEMUA ROAD, FULJHORE, DURGAPUR-713206 (W.B.), INDIA
(0343) 250-1353/4106/4121/2449, Fax (0343) 250-4059 / 3424
E-mail : info@bcrec.ac.in ● Website : www.bcrec.ac.in

MEMORANDUM OF UNDERSTANDING

This **Memorandum of Understanding** (hereinafter called as the 'MOU') is entered into on this the 16 day of November, Two Thousand Nineteen **(**16/11/2019**)**,

BETWEEN

Dr. B. C. Roy Engineering College, Jemua Road, Fuljhore, Durgapur 713 206 in the District of West Burdwan, West Bengal, which is an affiliated Engineering and Technology College affiliated to The Maulana Abul Kalam Azad University of Technology (formerly West Bengal University of Technology) and Approved by The All India Council for Technical Education, New Delhi hereinafter referred as **'First Party'**, the institution which expression, unless excluded by or repugnant to the subject or context shall include its successors – in-office, administrators and assigns).

AND

Ardent Computech Pvt Ltd,Module No.132, Ground Floor, SDF Building, Sector V, Saltlake, Kolkata-700091; the Second Party, and represented herein by its **Director HR** (hereinafter referred to as "**Second Party**", company which expression, unless excluded by or repugnant to the subject or context shall include its successors – in-office, administrators andassigns).

(First Party and Second Party are hereinafter jointly referred to as 'Parties' and individually as 'Party')

Dr. B. C. ROY ENGINEERING COLLEGE, DURGAPUR
(Approved by AICTE & Affiliated to MAKAUT, WB)
CAMPUS : JEMUA ROAD, FULJHORE, DURGAPUR-713206 (W.B.), INDIA
(0343) 250-1353/4106/4121/2449, Fax : (0343) 250-4059 / 3424
E-mail : info@bcrec.ac.in ● Website : www.bcrec.ac.in

WHEREAS:

A) First Party is an Engineering College in the name and style of Dr. B. C. Roy Engineering College, Durgapur.

B) First Party & Second Party believe that collaboration and co-operation between themselves will promote more effective use of each of their resources, and provide each of them with enhanced opportunities.

C) The Parties intent to cooperate and focus their efforts on cooperation within area of Skill Based Training, Education and Research.

D) Both Parties, being legal entities in themselves desire to sign this MOU for advancing their mutual interest;.

E) **Ardent Computech Pvt Ltd**, the Second Party is engaged in Skill Development, Education and R&D Services in the fields of ***Training on high end technologies for engineers*** ,and other related fields.

F) **Ardent Computech Pvt Ltd,** the Second Party is promoted by Ardent Computech Pvt Ltd; Module No: 132, Ground Floor, SDF Building, Sector-V, Kolkata-700091. Under one umbrella ARDENT offers Project based learning in IT Engineering and Core Engineering. Internships are available in many tending technologies. Post Internship, the participants will get Training Certificate, Project Certificate from ARDENT. On successful completion the participants will get the opportunity to sit for Global Certification Exam for Microsoft Technology Associate, AutoDESK Certified User, Hewlett Packard Enterprise, etc.

G) Ardent Computech Pvt Ltd has been associated with different engineering colleges pan India basis since last 17 years. It's main objective is to impart skill trainings on upcoming trending technologies for the engineers. Ardent actually helps the engineering students to be ready for the industry. Ardent

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Computech Pvt Ltd and having its branches at Saltlake ,Sector V, Saltlake Sector I, Jadavpur—Kolkata, Durgapur and Noida.

(H) The Second Party Ardent Computech Pvt. Ltd. hereby agrees and affirms that the Mentors listed in their proposal shall be exclusively detailed for the training assignments of the students, and shall desist from deploying any faculty who, in the opinion of the First Party are not adequately qualified for teaching assignments / mentorships.

NOW THEREFORE, IN CONSIDERATION OF THE MUTUAL PROMISES SET FORTH IN THIS MOU, THE PARTIES HERETO AGREE AS FOLLOWS:

CLAUSE 1 CO-OPERATION

1.1 Both Parties are united by common interests and objectives, and they shall establish channels of communication and co-operation that will promote and advance their respective operations within the **Institution** and its related wings. The Parties shall keep each other informed of potential opportunities and shall share all information that may be relevant to secure additional opportunities for oneanother.

1.2 First Party and Second Party co-operation will facilitate effective utilization of the intellectual capabilities of the faculty of First Party providing significant inputs to them in developing suitable teaching / training systems, keeping in mind the needs of the industry, the Second Party shall also design effective training modules in keeping with contemporary trends.

1.3 The general terms of co-operation shall be governed by this MOU. The Parties shall cooperate with each other and shall, as promptly as is

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reasonably practical, enter into all relevant agreements, deeds and documents (the 'Definitive Documents') as may be required to give effect to the actions contemplated in terms of this MOU. The term of Definitive Documents shall be mutually decided between the Parties. Along with the

1.4 Definitive Documents, this MOU shall represent the entire understanding as to the subject matter hereof and shall supersede any prior understanding between the Parties on the subject matter hereof.

CLAUSE 2 SCOPE OF THE MoU

2.1 The budding **engineering /technology** students from this institution could play a key role in technological up-gradation, innovation and competitiveness of the industry. Both parties believe that close co-operation between the two would be of major benefit to the student community to enhance their skills and knowledge.

2.2 **Curriculum Design:** Second Party will give valuable inputs to the First Party in teaching / training methodology and suitably customize the curriculum so that the students fit into the industrial scenario meaningfully.

2.3 **Industrial Training & Visits:** Industry and Institution interaction will give an insight into the latest developments / requirements of the industries; the Second Party to permit the Faculty and Students of the First Party to visit its group companies and also involve in Industrial Training Programs for the First Party. The industrial training and exposure provided to students and faculty through this association will build confidence and prepare the students to have a smooth transition from academic to working

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career. The Second Party will provide its Labs / Workshops / Industrial Sites for the hands-on training of the learners enrolled with the First Party.

2.4 **Internships and Placement of Students:** Second Party will actively engage to help the delivery of the Internship and placement of students of the First Party into internships/jobs, as per AICTE internship Policy. The Second Party will also register itself on AICTE Internship Policy Portal for disseminating the Internship opportunities available with them.

2.5 **Research and Development:** Both Parties have agreed to carry out the joint research activities in the fields of **Training and Skill Development.**

2.6 **Skill Development Programs:** Second Party shall train the students of First Party on the emerging technologies in order to bridge the skill gap and make them industry ready.

2.7 **Guest Lectures:** Second Party shall extend the necessary support to deliver guest lecturers to the students of the First Party on the technology trends and in house requirements.

2.8 **Faculty Development Programs:** Second Party to train the Faculties of First Party for imparting industrial exposure/ training as per the industrial requirement considering the National Occupational Standards in concerned sector, ifavailable.

2.9 Both Parties to obtain all internal approvals, consents, permissions, and licenses of whatsoever nature required for offering the Programs on the terms specified herein.

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2.10 There is no financial commitment on the part of Dr. B. C. Roy Engineering College, Durgapur - the First Party to take up any program mentioned in the MoU. If there is any financial consideration, it will be dealt separately.

CLAUSE 3 INTELLECTUAL PROPERTY

3.1 Nothing contained in this MOU shall, by express grant, implication, Estoppels or otherwise, create in either Party any right, title, interest, or license in or to the intellectual property (including but not limited to know-how, inventions, patents, copy rights and designs) of the other Party.

CLAUSE 4 VALIDITY

4.1 This Agreement will be valid until it is expressly terminated by either Party on mutually agreed terms, during which period **Ardent Computech Pvt Ltd**, the Second Party, as the case may be, will take effective steps for implementation of this MOU. Any act on the part of **Ardent Computech Pvt Ltd**, the Second Party after termination of this Agreement by way of communication, correspondence etc., shall not be construed as an extension of this MOU.

4.2 Both Parties may terminate this MOU upon 30 calendar days' notice in writing. In the event of Termination, both parties have to discharge their obligations.

CLAUSE 5 RELATIONSHIP BETWEEN THE PARTIES

5.1 It is expressly agreed that **Dr. B. C. Roy Engineering College, Durgapur** and **Ardent Computech Pvt Ltd** are acting under this MOU as independent contractors, and the relationship established under this MOU shall not be construed as a partnership. Neither Party is authorized to use the other

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Party's name in any way, to make any representations or create any obligation or liability, expressed or implied, on behalf of the other Party, without the prior written consent of the other Party. Neither Party shall have, nor represent itself as having, any authority under the terms of this MOU to make agreements of any kind in the name of or binding upon the other Party, to pledge the other Party's credit, or to extend credit on behalf of the other Party.

5.2 **NON- BINDING CLAUSE**

Each Party shall be free to enter into any Agreements/Understanding with any other Party/Parties for their own gains/ functions that do not directly contravene with any of the Clauses of this MOU.

Dr. B. C. Roy Engineering College, Durgapur – The First Party shall be represented by The Director.

Ardent Computech Pvt Ltd – The Second Party – Shall be represented by the Director - HR

Any divergence or difference derived from the interpretation or application of the MoU shall be resolved by arbitration between the parties as per the Arbitration Act, 1996. The place of the arbitration shall be at District Head Quarters of the First Party. This undertaking is to be construed in accordance with Indian Law with exclusive jurisdiction in the Courts of **Sub- Divisional Magistrate, Durgapur or the District Court at Asansol.**

Dr. B. C. ROY ENGINEERING COLLEGE, DURGAPUR
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AGREED by Either Parties:

For **Dr. B. C. Roy Engineering College**, Durgapur

Pijush Pal Roy
DIRECTOR
Dr. B. C. Roy Engineering College
DURGAPUR

For **Ardent Computech Pvt Ltd** Indranil De Sarkar

Pijush Pal Roy
DIRECTOR
Dr. B. C. Roy Engineering College
DURGAPUR

AuthorizedSignatory

ARDENT COMPUTECH PVT. LTD.
Indranil De Sarkar
Director

AuthorizedSignatory

Dr. B. C. Roy Engineering College, Durgapur.	**Ardent Computech Pvt Ltd**
Address: Jemua Road, Fuljhore, Durgapur – 713 206	Module No-132, Ground Floor, SDF Building, Sector-V, Saltlake, Kolkata-700091
Contact No. (0343) 250 4121	9674489000 / (033)40073507
Reg Email Id director@bcrec.ac.in	indranil@ardentcollaborations.com
www.bcrec.ac.in	www.ardentcollaborations.com

Witness1: CKore

Head
Dept. Computer Science & Engg.
Dr. B. C. Roy Engineering College
Durgapur

Witness 2: Pralay Majumder

ARDENT COMPUTECH PVT. LTD. KOLKATA

Witness3:

A. KAHALI
Head Administration
Dr. B. C. Roy Engg. College
Durgapur

Witness 4:

ARDENT COMPUTECH PVT. LTD. KOLKATA

DR. B.C. ROY ENGINEERING COLLEGE, DURGAPUR

Office : JEMUA ROAD, FULJHORE, DURGAPUR - 713206 (W.B.) INDIA
Phone : (0343) 2501353 / 2504106 / 2503985

PAYMENT VOUCHER

Voucher No. BUREC/2nd/2018/8/93 96 Date 16.07.2018

	Rs.	P.	Rs.	P.
Dr. Cocubes Technologies Pvt. Ltd. A/C			329217	00
CC-1819-000669 dt. 6/7/18 Rs	3,59,700	~~00~~		
less ITDS Rs	30,483	~~00~~		
Cr.				
Net Amount Payable : Rs.			329217	~~00~~

Amount in words : Rupees Three lac twenty nine thousand two hundred Seventeen only

Paid to Sri / ~~Smt.~~ M/s. COCUBES TECHNOLOGIES PVT. LTD.

~~Cash~~ / Cheque / DD on account of Subscription for 2019 batch (Service end date 05.03.2018) 7 DCT + 2 pre addmn. vide cheque No. 570388

Received Payment in full NEFT NO.

P. Kumar

Signature | Prepared by | Passed by

Original for Recipient

CoCubes
An Aon Company

Empower Results®

TAX INVOICE

Invoice from:
CoCubes Technologies Pvt. Ltd.
1205-1206, 12th Floor, Welldone Tech Park
Sohna Road, Gurgaon-122002
State: Haryana
GSTIN: 06AACCV5537E1ZF
PAN: AACCV5537E

Invoice No.	:	CC-1819-000669
Date	:	06-07-2018
CRM ID	:	731
PO #	:	xx----xx

Invoice To:
Dr. B. C. Roy College of Engineering
Management House, Fuljhor, Burdwan - 713206
State: West Bengal
Place of Supply: West Bengal
GSTIN: NA, **State Code:** NA
PAN: AAABD0204F

Ship To:
Dr. B. C. Roy College of Engineering
Management House, Fuljhor, Burdwan - 713206
State: West Bengal
Place of Supply: West Bengal
GSTIN: NA, **State Code:** NA
PAN: AAABD0204F

CoCubes Contact
Avisek Chakraborty

Client Contact
Mr. Tarun Bhattacharya
9434011952

Due Date
05-08-2018

Description of Services	Qty/ Units	Rate/Unit Price	Amount
Subscription for 2019 Batch (Service End Date 05/07/2019) 7 DCT + 2 PRE-ASSESS®	300	1016.10	304830.51

Pan No: AACCV5537E **GSTIN:** 06AACCV5537E1ZF **Category:** Management consulting and management services including financial, strategic, human resources, marketing, operations and supply chain management. **(HSN Code for services: 9983)**	**Sub Total**	₹ 304830.51
	CGST @ 9%	₹ 0.00
	SGST @ 9 %	₹ 0.00
	IGST @ 18%	₹ 54869.49
	Grand Total	₹ 359700.00

Bank Name: HDFC Bank Limited
Current A/c No.: 05728640000229
Beneficiary Name: CoCubes Technologies Pvt. Ltd.
IFSC Code: HDFC0000572, Swift Code: HDFCINBB

CoCubes Technologies Pvt. Ltd. Accounts Department

For CoCubes Technologies Pvt. Ltd.

AAAP

TPO Durgapur <tpo.dgp@bcrec.ac.in>

CoCubes.com || Agreement for Dr. B. C. Roy Engineering College || 2019 Batch || Requesting Confirmation

TPO Durgapur <tpo.dgp@bcrec.ac.in> Thu, Jul 5, 2018 at 2:54 PM
To: Avishek Chakraborty <avisek.chakraborty@cocubes.com>
Cc: "Dr. B. C. Roy Engineering College - Placement Cell" <tpo.kol@bcrec.ac.in>, Rajesh Chatterjee <rajesh@bcrec.ac.in>, Director BCREC <director@bcrec.ac.in>, tarun bhattacharjee <tarun.bhattacharjee@bcrec.ac.in>, ALOK KAHALI <alok.kahali@bcrec.ac.in>, Avirup Das <avirup.das@cocubes.com>

Dear Avisek,

Please Refer your mail as above
As directed by our General Secretary, we here by approved your MOU.

The necessary payment for the MOU is being paid shortly.

Regards,

Lt. Col D.K. Chowdhury
Head, Training & Placement
BCREC
[Quoted text hidden]

Approval
Bhaya Chakraborty
5/7/17

CoCubes.com || Agreement for Dr. B. C. Roy Engineering College || 2019 Batch || Requesting Confirmation

Avishek Chakraborty <avisek.chakraborty@cocubes.com> Thu, Jul 5, 2018 at 2:49 PM
To: TPO Durgapur <tpo.dgp@bcrec.ac.in>
Cc: "Dr. B. C. Roy Engineering College - Placement Cell" <tpo.kol@bcrec.ac.in>, Rajesh Chatterjee <rajesh@bcrec.ac.in>, Director BCREC <director@bcrec.ac.in>, tarun bhattacharjee <tarun.bhattacharjee@bcrec.ac.in>, ALOK KAHALI <alok.kahali@bcrec.ac.in>, Avirup Das <avirup.das@cocubes.com>

Dear Sir,

This has reference to our discussions with you regarding the engagement by Dr. B. C. Roy Engineering College, the client of CoCubes Technologies Pvt. Ltd., an Aon Hewitt company ("**CoCubes**"), for availing the Services defined hereinafter. We are bringing on record the following terms of our engagement. **Please send us an email confirmation on the below Commercial and Legal terms:-**

COMMERCIAL TERMS FOR AGREEMENT

Scope of Services and Project Plan – 7 Diagnostic Career tests + 2 PRE-ASSESS®

Timelines – As mentioned in the invoice

Fees – Described below

Offering	Degree	Batch	Count of Students	Price/student
7 DCT + 2 PRE-ASSESS	B.Tech	2019	300	INR 1199 (Inclusive GST)

300 x 1199 = 359700/-

LEGAL TERMS FOR AGREEMENT

(a) This Agreement shall be on a "principal to principal" basis.

(b) This Agreement shall, from **5th July, 2018** (the "**Effective Date**") continue for a period of One (1) year ("**Term**"), unless terminated earlier.

(c) The Services of CoCubes, an Aon Hewitt company, shall be provided on a non-exclusive basis to the Institute.

I. CoCubes shall provide access to its Platform to the Institute and the Students, provided that the use of the Platform shall be subject to its Terms and Conditions at https://static.CoCubes.com/document/reg_tc.html, which shall prevail in all matters related to access and use of the Platform.

II. All data related to Students shall be authenticated and provided by the Institute in a predefined format. CoCubes does not conduct any background checks on the Students or verify the contents of their resume/curriculum vitae and hence does not warrant the authenticity of any Student data on the Platform.

III. CoCubes shall not be responsible for any loss of opportunity for those Students whose data is incomplete or inaccurate. CoCubes will not be held liable for any deviation, non-delivery or delay in provision of Services under this Agreement nor will CoCubes be deemed to be in breach of its obligations hereunder due to external factors beyond CoCubes's control.

(d) CoCubes reserves the right to suspend performance of the Services, if the Institute fails to pay any due fees.

(e) The Institute shall promptly notify in writing its acceptance to CoCubes, within one week of completion of Services by CoCubes. In case no such notification is received within one week, it shall be presumed that the Services rendered are accepted by the Institute.

(f) Either party may terminate the Agreement by prior written notice of 30 days to the other Party. Termination of this Agreement shall not affect the rights and obligations of the Parties accrued prior to the effective date of termination including payment of undisputed fees. Upon termination of this Agreement, each party shall return or destroy all Confidential Information as directed by the other party. Upon termination:

I. CoCubes will stop providing its Services and access to its Platform to the Institute and its Students forthwith.

II. In the event of termination of this Agreement after a period of one (1) month by the Institute for any reason whatsoever, CoCubes shall not be liable to refund the Fees back to the Institute.

(g) **Payment terms**

I. All payments are to be made 100% in advance

II. Payments become due immediately from the date of invoice and shall be made to CoCubes within 7 days from date of receipt of invoice without any deduction or set-off.

III. The prices are inclusive of all taxes and duties which would be payable, as applicable.

(i) Each Party agrees to indemnify the other Party for such claims, suits, losses and damages, including settlement costs (collectively Liabilities) being suffered by the aggrieved Party as a direct consequence of breach of its confidentiality and intellectual property related obligations under this Agreement. The Institute agrees to indemnify CoCubes from and against any Liability arising out of (i) misuse of the Platform by the Students or the Institute (ii) any Student related information provided to CoCubes being incorrect, false or misleading.

(i) Neither Party will be liable for any indirect, incidental, special or consequential damages, including the loss of profits, revenue, data, incurred by either Party, whether in an action in contract, tort, based on a warranty or otherwise, even if the other Party has been advised of the possibility of such damages. CoCubes's liability for damages under this Agreement will not exceed the amounts actually paid by the Institute to CoCubes or actual damage, whichever is less.

(j) Neither Party is restricted from assigning this Agreement or its rights or obligations to its affiliate/subsidiary or CoCubes subcontracting the whole / part of the Services to any contractor of its choice, provided that such subcontracting shall not relieve CoCubes from its obligations to the Institute under this Agreement. The assignment to CoCubes' Affiliates to perform the Services shall not be regarded as subcontracting.

(k) **Confidentiality**

I. For the purposes of this Agreement, "Confidential Information" includes: (i) terms of this Agreement; (ii) Institute Information; (iii) CoCubes Information. Each Party's respective Confidential Information will remain its sole and exclusive property.

II. The Receiving party shall (i) not use the Confidential Information for any purpose except as expressly contemplated under this Agreement, except that CoCubes may use the Institute's Information in combination with other data for statistical or analytical purposes provided that no such Institute Information is identifiable by the Institute (ii) not disclose the Disclosing Party's Confidential Information to a third party without prior written consent and may only disclose the Confidential Information to those of its employees on a need to know basis (and in case of CoCubes , any affiliate or third party service provider providing back office/IT support) ("**Personnel**" collectively), however, either Party may disclose the other Party's Confidential Information to its legal counsel and auditors. CoCubes may also disclose the Institute's Information to any subcontractor as reasonably necessary for such subcontractor to perform its services in connection with this Agreement, provided that such subcontractor is subject to a confidentiality agreement (iii) immediately notify the Disclosing Party of any suspected or actual unauthorized use, copying or disclosure of the Confidential Information. For the avoidance of doubt, CoCubes shall not be required to destroy electronic records which are automatically backed up to a backup or recovery system in the ordinary course of business for disaster recovery purposes. CoCubes will retain an archival copy of the Confidential Information for the purpose of determining the scope of obligations incurred under this Agreement.

III. The obligations under clause k (II) shall not apply to confidential information which (i) is or becomes generally available or known to the public through no fault of the Receiving Party; (ii) was already known by or available to the Receiving Party prior to disclosure by the Disclosing Party; (iii) is subsequently disclosed to the Receiving Party by a third party who is not under any obligation of confidentiality to the Disclosing Party; (iv) is required by law to be disclosed as part of a judicial process, government investigation, legal proceeding, or other similar process; or (v) has already been or is hereafter independently acquired or developed by the Receiving Party without violating any confidentiality agreement with or other obligation to the Disclosing Party.

IV. The parties shall comply at all times with all applicable laws including those relating to personal data protection. The Institute agrees that CoCubes may transfer Institute data, physically or electronically, to its personnel and affiliates in India or overseas in connection with the performance of this Agreement.

V. The Institute acknowledges that CoCubes may be required to mention its indicative list of Institutes in its proposals, marketing materials, brochures and/ or similar documents and agrees that it has no objection to making a reference to the Institute's name in the aforesaid documents

(l) **Intellectual Property**

I. "Institute Information" is defined as all non-public information data (in whatever form or media) provided to CoCubes under this Agreement by or on behalf of the Institute. The Institute represents that use of Institute Information contemplated herein will not infringe the privacy and/ or intellectual property rights of any third party. Institute Information will remain the property of the Institute.

II. CoCubes retains all proprietary rights, title and interest in " CoCubes Information", which includes, but is not limited to: websites or web based applications through which it may perform the Services and make related information and/or content available to the Institute including software and software systems used in the operation of the CoCubes website, the CoCubes Online Platform (www.CoCubes.com), user interfaces and screen designs; general purpose consulting and software tools; presentations including CoCubes' templates, standard proposals and materials and derivatives thereof; all algorithms, apparatus, components, circuit designs and assemblies, concepts, trade secrets, data (including clinical data), databases, designs, diagrams, documentation, drawings, flow charts, formulae, ideas, inventions (whether or not patentable or reduced to practice), marks (including brand and product names, logos, slogans, domain names), know-how, marketing and development plans, methods, models, procedures, processes, protocols, schematics, software codes (in any form including source code and executable or object code), specifications, subroutines, techniques, tools, works of authorship and other forms of technology, generalized practices, techniques, business information, regardless of whether developed in connection with the Services or engagements with other CoCubes Institutes.

III. To the extent that CoCubes utilizes any CoCubes Information, in connection with the performance of Services, such CoCubes Information shall remain the property of CoCubes. Nothing in this Agreement shall be construed to grant the Institute any rights in CoCubes Information, other than the limited license to use the Platform for access to the Services as specified here under.

IV. CoCubes grants to the Institute a non-exclusive, non-sub-licensable, non-transferable license to use the CoCubes Information solely for the Institute's internal use. To the extent such license covers CoCubes Software, such license shall terminate and expire upon the termination or expiration of the applicable SOW or, if no SOW applies, upon the termination of CoCubes's provision of Services related to such CoCubes Software.

V. Student data is the nonexclusive property of the Institute and CoCubes. The analysis generated from such Student data so accumulated belongs to CoCubes. CoCubes shall have the right to permit its Institutes to use the processed Student data as part of the CoCubes service offerings to its Institutes. CoCubes shall use the Student data for displaying it on the Platform for online career development activities, which are a part of the Services provided by CoCubes to the Institute. "Students" shall mean students studying at the Institute, who have consented to their enrollment to avail the Services and who will be provided access to the Platform.

VI. The Institute shall not, with respect to CoCubes Information (i) create derivative works or translations (ii) transfer, distribute, lease, market, sublicense or otherwise grant rights in whole or in part to any third party; (iii) obfuscate, remove or alter any of the internet links or copyright or other proprietary legends (iv) reverse engineer, decompile or disassemble CoCubes Software or any part thereof or otherwise obtain or attempt to obtain the source code for CoCubes Software.

(m) Force Majeure - Neither Party will be liable to the other for its failure to perform any obligations under this Agreement where such performance is rendered impossible due to circumstances beyond its reasonable control, including acts of God, floods, acts of terrorism, riots or other hostilities, pandemics, government or legislative actions, technological outages and similar occurrences, provided that the Party experiencing the delay

promptly notifies the other party and takes reasonably necessary steps to resume full performance as soon as possible. If the Force Majeure Event/s continue(s) to subsist for a continuous period of 30 days, the other Party may terminate the Agreement by giving notice in writing.

(n) This Agreement will be governed by the laws of India. Each Party agrees to submit itself to the exclusive jurisdiction of the courts of New Delhi. Disputes arising under this Agreement shall be governed by the Indian Arbitration and Conciliation Act 1996. The Tribunal shall consist of a sole arbitrator appointed by mutual consent of both the Parties. The language of the arbitration shall be English. The seat of arbitration shall be New Delhi. The fees of arbitration will be borne by the Party as directed in the arbitration award.

(o) No person employed by either party for the performance of its obligations under this Agreement shall be deemed to be an employee of the other party.

(p) During the Term and for a period of twelve (12) months thereafter, neither party shall, directly or indirectly, solicit for employment or employ, or accept services provided by, any employee, officer or independent contractor of the other party who performed any work in connection with or related to the Services.

(q) This Agreement (i) embodies the final understanding between the Parties with respect to its subject matter; (ii) supersedes all previous oral or written agreements or arrangements between the Parties; (iii) may be signed in counterparts, each of which will be deemed an original; (iv) may only be amended in writing signed by an authorized officer of each Party. The Parties agree that any pre-printed terms on any transactional or other document used in connection herewith are per se null and void. Should any provision of this Agreement be held invalid or unenforceable, such invalidity will not invalidate the whole of this Agreement, but rather the remainder of this Agreement will remain in full force. Waiver by either Party of a breach of any provision of this Agreement by the other Party will not operate or be construed as a waiver of any subsequent, similar breaches by the breaching Party.

(r) All notices under this Agreement will be in writing and deemed effectively delivered upon receipt by personal delivery, reputed courier service or registered mail at the address provided by the Parties and as confirmed by delivery receipt.

Additional points

1. **Payment Terms**

a.) CoCubes will also charge 35 paise per SMS (if the number of SMSes exceed the limit provided upon sign up)

b.) If the Institute fails to make the payment, assuming the log-ins of the student and/or Institute are active, the Platform will auto lock all the log-ins provided to (all across batches) the Students and the Institute. This may lead to loss of opportunities for Students for which CoCubes will not be responsible.

2. **Disclaimers**

a.) It has to be noted that the fees charged by CoCubes is towards the annual subscription of the technology for career development offerings; the fee is not towards creating employment opportunity of any specific company. As a principle and business model, CoCubes does not charge fee in the name of any specific company.

b.) This price is applicable for 2019 batch only

c.) Updates in count of Students, Services, prices and Terms for further batches need to be mutually agreed upon in writing

Warm Regards,

Avisek Chakraborty
Manager – Institutions

CoCubes.com
+91 9903 970 940

WHOM SO EVER CONCERN

This Memorandum of Understanding/Agreement (hereinafter referred to as MoU for convenience) is entered into on of 23/12/2016.

Between

DR.BC ROY ENGINEERING COLLEGE, DURGAPUR

And

CoreEL Technologies India Pvt. Ltd., having registered office at 21, 7th Main, 1st Block, Koramangala, Bangalore-560034 and herein after unless the context otherwise requires be referred to as ("CoreEL")

1. Introductory: Partnership Objective

1.1. CoreEL is a Synergistic Value Added Technology Products and Solutions Provider in India. CoreEL develops standard and custom system level products to Industry, provides Solutions to Industry & provides Learning Solutions to Educational Institutions. CoreEL serves five vertical markets with its products and solutions. These markets are Defense & Space, Broadcasting & Professional Video, Education, Telecom & Networking and Security and Surveillance. All CoreEL Solutions will have High Technology content and uniqueness, with its ability to provide diversity of products and solutions around these products.

2. DR.BC ROY ENGINEERING COLLEGE, is a Leading College of Repute in DURGAPUR, West Bengal, India and offers advanced teaching & research programs in the field of Engineering & Technology.

2.1. The Parties wish to cooperate with each other for mutual benefit.

3. Benefits

3.1. The Parties contemplate that they will benefit from this alliance as follows:

3.2. Benefits to DR.BC ROY ENGINEERING COLLEGE, DURGAPUR

3.2.1. Opportunity to engage with the Industry on a regular basis to understand the needs of the industry and accordingly update the syllabus.

3.2.2. Opportunity to upgrade the infrastructure in information technology-related topics.

3.2.3. Opportunity to collaborate with the industry for research programs, projects and student internships in the above fields.

3.2.4. Opportunity to procure various industry standard hardware and software tools pertaining from a single reputed organization on a need basis and save time consumed in commercial negotiations, leading to greater availability of time for teaching or student development programs.

3.2.5. Faculty development programs for teaching staff, advanced training to students.

3.2.6. Strengthening of the brand equity of the institution.

3.2.7. Improved marketability of students.

3.3. **Benefits to CoreEL**

3.3.1. Sets a framework for the procurement of the industry standard hardware and software tools marketed by CoreEL by the institution.

3.3.2. Makes available a pool of trained engineers for hiring by CoreEL or CoreEL' s customers who use similar software and hardware.

4. Activities

4.1. In order to implement the objectives of this MOU, the Parties contemplate the following activities to be undertaken by them.

4.1.1. DR.BC ROY ENGINEERING COLLEGE, DURGAPUR, shall, from time to time, place orders for and purchase one or more of CoreEL's hardware and/or software products. A current list of such products will be sent on demand for setting related Labs.Subject to CoreEL's terms of supply and any third party terms of service, license agreements or other contracts, CoreEL shall supply such products to Bannariamman Institute of Technology,Sathyand its affiliated colleges at discounted rates. Bannariamman Institute of Technology,Sathy shall communicate this to all its affiliated colleges. The duration of such agreement can be extended on mutually agreed basis. Any change of pricing from Principal Company of the software/Hardware will be updated by CoreEL to Bannariamman Institute of Technology, Sathy.

4.1.2. CoreEL will set up Centre of Excellence or Nodal Centre for Labs with mutual agreement and this Lab would be named-for **CoreEL Center of Excellence.** CoreEL will help Bannariamman Institute of Technology,Sathyto impart certified training programs for students in weekends, summer holidays; evening classes etc.The students will

benefit from this as they will have a course completion certificate, project completion certificate and this will help them in getting a job in the industry

4.1.3. CoreEL will impart faculty development programs on Technologies and methodologies and other topics of interest to faculties/staffs of Bannariamman Institute of Technology, Sathyat regular intervals on request of Bannariamman Institute of Technology, Sathy. This will be at discounted rates.

4.1.4. CoreEL will offer advanced training programs to students of DR.BC ROY ENGINEERING COLLEGE, DURGAPUR on emerging technologies and design flows/methodologies to get them acquainted with the skills required by the industry. Such training programs shall be provided by CoreEL at reduced rates compared to its standard prices.

4.1.5. CoreEL will offer valuable Industry Perspective inputs to DR.BC ROY ENGINEERING COLLEGE, DURGAPUR in the area of curriculum upgrade and enhancement

4.1.6. CoreEL may consider offering internships to DR.BC ROY ENGINEERING COLLEGE, students within CoreEL and may provide assistance in getting internships to students with some of its large customers.

4.1.7. The Parties shall conduct joint Technical Seminars, Workshops and Conferences for increasing the awareness of technology in colleges affiliated to DR.BC ROY ENGINEERING COLLEGE, DURGAPUR on regular basis.

4.1.8. CoreEL shall provide training opportunities to DR.BC ROY ENGINEERING COLLEGE, DURGAPUR teaching staff at Sandeepani, training division of CoreEL at discounted rates.

4.1.9. DR.BC ROY ENGINEERING COLLEGE, DURGAPUR Faculties trained by CoreEL University Program can independently conduct training programs in "CoreEL Center of Excellence, Completion Certificate for all trainings will be issued by DR.BC ROY ENGINEERING COLLEGE, DURGAPUR Wherever necessary basic boards will be procured from CoreEL by DR.BC ROY ENGINEERING COLLEGE, DURGAPUR /concerned Trainee on recommendation of DR.BC ROY ENGINEERING COLLEGE, DURGAPUR during the training imparted by DR.BC ROY ENGINEERING COLLEGE, DURGAPUR .

4.2. A co-ordination committee consisting of two faculty members of DR.BC ROY ENGINEERING COLLEGE, DURGAPUR and two officers nominated by CoreEL shall be constituted to implement and give effect to the objectives of this MOU.

5. Process

Every time an activity is initiated under this MOU which requires any rendering of services, or supply or products, or both, from one Party to another, the Parties shall, depending on the nature of the transaction, the consideration reserved, liabilities assumed and such other factors, execute a binding purchase order (PO), work order (WO), license agreement or other definitive contract.

6. General

6.1. During their interaction under this MOU, the Parties may not disclose information of non-public nature which is valuable to each Party's business ("Confidential Information"). Use of Confidential Information shall be regulated by a non-disclosure agreement to be executed by the Parties. In the absence of such an NDA, the Party who is the recipient of Confidential Information shall keep confidential and not disclose to third parties such Confidential Information. Confidential Information shall be returned or destroyed upon written request by the party disclosing Confidential Information. All Confidential Information shall remain the exclusive property of the disclosing party or its licensors.

6.2. All rights, licenses and permissions to use any products supplied by CoreEL shall be regulated by the terms of such supply, including any applicable product license agreements.

6.3. Notwithstanding anything to the contrary, CoreEL's liability shall be limited to direct damages not exceeding the price of any products supplied or services rendered to DR.BC ROY ENGINEERING COLLEGE,

DURGAPUR and shall not extend to any indirect damages of any nature whatsoever, including but not limited to, special, incidental, consequential, or punitive damages or loss of profits.

6.4. This MOU may be terminated by either party without assigning reasons by prior written notice of 90 days.

6.5. Each Party shall take specific permission to use the name, logo and other trademarks of the other Party on its website, marketing collateral and other publications. Depiction of such trademarks shall be in accordance with trademark usage guidelines.

6.6. Each Party shall be an independent contractor to the other and shall not be an agent, joint venture, or partner of the other.

6.7. Disputes under this MOU shall be resolved by discussion between such senior management functionaries as the Parties may nominate for that purpose. If they fail to resolve a dispute amicably within 15 days of its commencement, the Parties shall refer the dispute to binding arbitration to a sole arbitrator at a place mutually agreed upon by both parties.

6.8. **The MoU will be valid for a period of 5(five) years from the date of signing the MoU and can be renewed with mutual consent.**

Signatures

	CoreEL	DR.B.C.ROY ENGINEERING COLLEGE, DURGAPUR
Signature	Sadiya	Sinha.
Name	Sadiya Arshad	Prof. AMITABHA SINHA
Title	National Manager	Principal Dr. B. C. Roy Engineering College DURGAPUR
Date		21/12/2016

D.C.ROY ENGINEERING COLLEGE Durgapur

CoreEL Technologies (I) Pvt. Ltd. Bangalore 560 034

ANNEXURE – A

[Current Product List of CoreEL]

1. XILINX/DIGILENT Range of Software and Boards(KITS)(ECE, EEE, CSE, TE, IT)
2. Mentor Graphics HEP 1, HEP2 and HEP 3 category of EDA software(ECE, EEE, CSE, IT)
3. Wind River's VX-works RTOS(ECE, EEE, CSE, IT)
4. Analog Devices(ECE, EEE, CSE, IT)
5. MATHWORKS–MATLAB (ECE,EEE,EIE,MECH,MECHATRONICS,AUTO,AERO)
6. Ansys(ECE,EEE,EIE,MECH,MECHATRONICS,AUTO,AERO,CIVIL)
7. Speed Goat(Real Time Control Simulation)(EEE, Power System)

The entire above list has generic training programs and also training programs which can be customized according to requirements.

Quotations for the same can be demanded according to requirements.

The salient feature of our university program :

We ar in University Segment for past 18 years catering to 2900 colleges all India.

We would like to bring across to you some of critical salient features of Our University Program to you

CoreEL Technologies is the AUTHORISED UNIVERSITY PARTNER FOR the following Organizations and products:

- ***Xilinx***
- ***Digilent***
- ***Mentor Graphics***
- ***MATLAB***
- ***Speed goat***
- ***Wind River VxWorks***
- ***Analog Devises***
- ***Ansys***

We have been Associated With SMDP (Special Manpower Development Program) a government of India Program wherein all IIT's, NIT's, IISC and top tier colleges are our esteem customers. We have been involved in SMDP 1, SMDP 2 and now also for SMDP 3. Till date 33 top TIER 1 colleges / Universities are associated with us and this will go up to 60 colleges for SMDP 3. We are also associated with TEQIP, MODROB, AICTE, UGC, FIST, DST etc. in regards of various funding.

For your awareness as an authorized company we makes sure of 24/7 support, free workshops, trainings, seminars etc. These programs are delivered by authorised and certified product trainers and their credibility is of very high stake.

We try to ensure that the funds are utilized in the best possible way for these highly expensive technical products whose main challenge will be support and enabling the faculties and students.

We request you to kindly note that the following are the points which will cover you under university program.

1. *Supply of authentic products*
2. *Free upgrades*
3. *Free Workshops*
4. *Free Seminars*
5. *Life time support in upt@coreel.com for your students and faculties*
6. *Direct support and telecall support lifetime.*
7. *All above is done by authorized trainers and technical experts*

We look forward to a great relationship with you. You can contact the below mentioned at any time for further discussion in regards to any products.

For any clarification feel free to call us.

MEMORANDUM OF UNDERSTANDING

THIS MEMORANDUM OF UNDERSTANDING is entered into on 1st February, 2019 at Durgapur by and between.

1). The Mission Hospital-Durgapur (A unit of Durgapur Medical Centre Pvt. Ltd.) having its registered office at Plot No.219(P), Sector-IIC, Immon Kalyan Sarani, Bidhannagar, Durgapur, *hereinafter named TMH in acronym* and **represented by Mr. Ramesh Lall, Senior General Manaager-HRD**, and hereinafter designated as **the First Party** which expression, *unless repugnant to the context*, shall mean and include its successors and assignees)

AND

2). Dr B C Roy Engineering College, Durgapur represented by Dr. Pijush Pal Roy, Director hereinafter *named BCREC in acronym* and called **the Second Party** (which expression shall mean and include its **Successors** and Assignees)

WHERE AS the Second Party is desirous to avail medical treatment from the first party for its members (*that includes bonafide Students, Staff and Faculty/Officials)* and the First Party has agreed to provide medical treatment to the members of the Second Party ***at the College premises and during agreed College Hours.***"

WHERE AS it is deemed necessary to reduce the terms and conditions mutually agreed upon in writing to avoid any misunderstanding in the future , the following points were discussed and were agreed upon.:-

DEFINITIONS:

For the purposes of these terms and conditions:

a. "Hospital/TMH" shall mean The Mission Hospital, Durgapur, including its successors and permitted assigns.
b. "BCREC" shall mean Dr B C Roy Engineering College, Durgapur including its successors and permitted assigns.

THE MISSION HOSPITAL DURGAPUR | FUTURISTIC TECHNOLOGY. BRILLIANT MINDS.

TERMS AND CONDITIONS:

A. TMH will send one Doctor every day (Monday to Saturday) for general health check up of Staffs and Students of BCREC. *The timing shall be mutually agreed upon.*

B. TMH and BCREC will provide one – way conveyance respectively for transportation of the deputed Doctor from TMH (outbound) to BCREC and the return trip shall be provided by BCREC.

C. BCREC will pay a sum of Rupees 50000/ (Fifty thousand only) every month to TMH as the service charge.

D. *During end – Semester break/ College Holidays for longer duration, this arrangement shall remain suspended, and recommence when the College re – opens after Holidays/ end – Semester break.*

E. *For transportation of patients (ailing students/staff/Faculty/Officers) requiring Hospital attention, TMH shall provide Ambulances on call.*

WITNESS

1. DEBANJAN ACHARYA
   Debanjan Acharya.
2. Swapan Kumar Mula
   Swapan

Ramesh Lall
Sr.GM-HRD
The Mission Hospital

Ramesh Lall
Sr. General Manager-HR
The Mission Hospital
Durgapur, West Bengal

Director
Dr B C Roy Engineering College, Durgapur

Pijush Pal Roy
Director
Dr. B. C. Roy Engineering College
Durgapur

WITNESS

1. (KOUSHIK SENAPATI)
2. (ALOKE KAHALI)

The Mission Hospital, Durgapur | 219(P) Immon Kalyan Sarani, Sector-2C, Bidhan Nagar, Durgapur - 713212
P: 0343 2535555 | M: 9233355555 | F: 0343 2532550 | Email: hospital@themissionhospital.in | www.themissionhospital.com
Call: 9800881600 for free Ambulance within City Limits of Durgapur
A Unit of Durgapur Medical Centre Pvt. Ltd. CIN: U85110WB1987PTC042580

Dr. B. C. ROY ENGINEERING COLLEGE, DURGAPUR
(Approved by AICTE & Affiliated to MAKAUT, WB)

CAMPUS : JEMUA ROAD, FULJHORE, DURGAPUR-713206 (W.B.), INDIA
(0343) 250-1353/4106/4121/2449, Fax : (0343) 250-4059 / 3424
E-mail : info@bcrec.ac.in ● Website : www.bcrec.ac.in

MEMORANDUM OF UNDERSTANDING(MOU)

BETWEEN

Dr. B. C. Roy Engineering College, Durgapur

&

ARDENT COMPUTECH PVT LTD, West Bengal

Dr. B. C. ROY ENGINEERING COLLEGE, DURGAPUR
(Approved by AICTE & Affiliated to MAKAUT, WB)
CAMPUS : JEMUA ROAD, FULJHORE, DURGAPUR-713206 (W.B.), INDIA
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MEMORANDUM OF UNDERSTANDING

This **Memorandum of Understanding** (hereinafter called as the 'MOU') is entered into on this the 16 day of November, Two Thousand Nineteen **(**16/11/2019**)**,

BETWEEN

Dr. B. C. Roy Engineering College, Jemua Road, Fuljhore, Durgapur 713 206 in the District of West Burdwan, West Bengal, which is an affiliated Engineering and Technology College affiliated to The Maulana Abul Kalam Azad University of Technology (formerly West Bengal University of Technology) and Approved by The All India Council for Technical Education, New Delhi hereinafter referred as **'First Party'**, the institution which expression, unless excluded by or repugnant to the subject or context shall include its successors – in-office, administrators and assigns).

AND

Ardent Computech Pvt Ltd,Module No.132, Ground Floor, SDF Building, Sector V, Saltlake, Kolkata-700091; the Second Party, and represented herein by its **Director HR** (hereinafter referred to as "**Second Party**", company which expression, unless excluded by or repugnant to the subject or context shall include its successors – in-office, administrators andassigns).

(First Party and Second Party are hereinafter jointly referred to as 'Parties' and individually as 'Party')

Dr. B. C. ROY ENGINEERING COLLEGE, DURGAPUR
(Approved by AICTE & Affiliated to MAKAUT, WB)

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E-mail : info@bcrec.ac.in ● Website : www.bcrec.ac.in

WHEREAS:

A) First Party is an Engineering College in the name and style of Dr. B. C. Roy Engineering College, Durgapur.

B) First Party & Second Party believe that collaboration and co-operation between themselves will promote more effective use of each of their resources, and provide each of them with enhanced opportunities.

C) The Parties intent to cooperate and focus their efforts on cooperation within area of Skill Based Training, Education and Research.

D) Both Parties, being legal entities in themselves desire to sign this MOU for advancing their mutual interest;.

E) **Ardent Computech Pvt Ltd**, the Second Party is engaged in Skill Development, Education and R&D Services in the fields of ***Training on high end technologies for engineers*** ,and other related fields.

F) **Ardent Computech Pvt Ltd,** the Second Party is promoted by Ardent Computech Pvt Ltd; Module No: 132, Ground Floor, SDF Building, Sector-V, Kolkata-700091. Under one umbrella ARDENT offers Project based learning in IT Engineering and Core Engineering. Internships are available in many tending technologies. Post Internship, the participants will get Training Certificate, Project Certificate from ARDENT. On successful completion the participants will get the opportunity to sit for Global Certification Exam for Microsoft Technology Associate, AutoDESK Certified User, Hewlett Packard Enterprise, etc.

G) Ardent Computech Pvt Ltd has been associated with different engineering colleges pan India basis since last 17 years. It's main objective is to impart skill trainings on upcoming trending technologies for the engineers. Ardent actually helps the engineering students to be ready for the industry. Ardent

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Computech Pvt Ltd and having its branches at Saltlake ,Sector V, Saltlake Sector I, Jadavpur—Kolkata, Durgapur and Noida.

(H) The Second Party Ardent Computech Pvt. Ltd. hereby agrees and affirms that the Mentors listed in their proposal shall be exclusively detailed for the training assignments of the students, and shall desist from deploying any faculty who, in the opinion of the First Party are not adequately qualified for teaching assignments / mentorships.

NOW THEREFORE, IN CONSIDERATION OF THE MUTUAL PROMISES SET FORTH IN THIS MOU, THE PARTIES HERETO AGREE AS FOLLOWS:

CLAUSE 1 CO-OPERATION

1.1 Both Parties are united by common interests and objectives, and they shall establish channels of communication and co-operation that will promote and advance their respective operations within the **Institution** and its related wings. The Parties shall keep each other informed of potential opportunities and shall share all information that may be relevant to secure additional opportunities for oneanother.

1.2 First Party and Second Party co-operation will facilitate effective utilization of the intellectual capabilities of the faculty of First Party providing significant inputs to them in developing suitable teaching / training systems, keeping in mind the needs of the industry, the Second Party shall also design effective training modules in keeping with contemporary trends.

1.3 The general terms of co-operation shall be governed by this MOU. The Parties shall cooperate with each other and shall, as promptly as is

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reasonably practical, enter into all relevant agreements, deeds and documents (the 'Definitive Documents') as may be required to give effect to the actions contemplated in terms of this MOU. The term of Definitive Documents shall be mutually decided between the Parties. Along with the

1.4 Definitive Documents, this MOU shall represent the entire understanding as to the subject matter hereof and shall supersede any prior understanding between the Parties on the subject matter hereof.

CLAUSE 2 SCOPE OF THE MoU

2.1 The budding **engineering /technology** students from this institution could play a key role in technological up-gradation, innovation and competitiveness of the industry. Both parties believe that close co-operation between the two would be of major benefit to the student community to enhance their skills and knowledge.

2.2 **Curriculum Design:** Second Party will give valuable inputs to the First Party in teaching / training methodology and suitably customize the curriculum so that the students fit into the industrial scenario meaningfully.

2.3 **Industrial Training & Visits:** Industry and Institution interaction will give an insight into the latest developments / requirements of the industries; the Second Party to permit the Faculty and Students of the First Party to visit its group companies and also involve in Industrial Training Programs for the First Party. The industrial training and exposure provided to students and faculty through this association will build confidence and prepare the students to have a smooth transition from academic to working

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career. The Second Party will provide its Labs / Workshops / Industrial Sites for the hands-on training of the learners enrolled with the First Party.

2.4 **Internships and Placement of Students:** Second Party will actively engage to help the delivery of the Internship and placement of students of the First Party into internships/jobs, as per AICTE internship Policy. The Second Party will also register itself on AICTE Internship Policy Portal for disseminating the Internship opportunities available with them.

2.5 Research and Development: Both Parties have agreed to carry out the joint research activities in the fields of **Training and Skill Development.**

2.6 **Skill Development Programs:** Second Party shall train the students of First Party on the emerging technologies in order to bridge the skill gap and make them industry ready.

2.7 **Guest Lectures:** Second Party shall extend the necessary support to deliver guest lecturers to the students of the First Party on the technology trends and in house requirements.

2.8 **Faculty Development Programs:** Second Party to train the Faculties of First Party for imparting industrial exposure/ training as per the industrial requirement considering the National Occupational Standards in concerned sector, ifavailable.

2.9 Both Parties to obtain all internal approvals, consents, permissions, and licenses of whatsoever nature required for offering the Programs on the terms specified herein.

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2.10 There is no financial commitment on the part of Dr. B. C. Roy Engineering College, Durgapur - the First Party to take up any program mentioned in the MoU. If there is any financial consideration, it will be dealt separately.

CLAUSE 3 INTELLECTUAL PROPERTY

3.1 Nothing contained in this MOU shall, by express grant, implication, Estoppels or otherwise, create in either Party any right, title, interest, or license in or to the intellectual property (including but not limited to know-how, inventions, patents, copy rights and designs) of the other Party.

CLAUSE 4 VALIDITY

4.1 This Agreement will be valid until it is expressly terminated by either Party on mutually agreed terms, during which period **Ardent Computech Pvt Ltd**, the Second Party, as the case may be, will take effective steps for implementation of this MOU. Any act on the part of **Ardent Computech Pvt Ltd**, the Second Party after termination of this Agreement by way of communication, correspondence etc., shall not be construed as an extension of this MOU.

4.2 Both Parties may terminate this MOU upon 30 calendar days' notice in writing. In the event of Termination, both parties have to discharge their obligations.

CLAUSE 5 RELATIONSHIP BETWEEN THE PARTIES

5.1 It is expressly agreed that **Dr. B. C. Roy Engineering College, Durgapur** and **Ardent Computech Pvt Ltd** are acting under this MOU as independent contractors, and the relationship established under this MOU shall not be construed as a partnership. Neither Party is authorized to use the other

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Party's name in any way, to make any representations or create any obligation or liability, expressed or implied, on behalf of the other Party, without the prior written consent of the other Party. Neither Party shall have, nor represent itself as having, any authority under the terms of this MOU to make agreements of any kind in the name of or binding upon the other Party, to pledge the other Party's credit, or to extend credit on behalf of the other Party.

5.2 **NON- BINDING CLAUSE**

Each Party shall be free to enter into any Agreements/Understanding with any other Party/Parties for their own gains/ functions that do not directly contravene with any of the Clauses of this MOU.

Dr. B. C. Roy Engineering College, Durgapur – The First Party shall be represented by The Director.

Ardent Computech Pvt Ltd – The Second Party – Shall be represented by the Director - HR

Any divergence or difference derived from the interpretation or application of the MoU shall be resolved by arbitration between the parties as per the Arbitration Act, 1996. The place of the arbitration shall be at District Head Quarters of the First Party. This undertaking is to be construed in accordance with Indian Law with exclusive jurisdiction in the Courts of **Sub- Divisional Magistrate, Durgapur or the District Court at Asansol.**

Dr. B. C. ROY ENGINEERING COLLEGE, DURGAPUR
(Approved by AICTE & Affiliated to MAKAUT, WB)
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E-mail : info@bcrec.ac.in ● Website : www.bcrec.ac.in

AGREED by Either Parties:

For **Dr. B. C. Roy Engineering College**, Durgapur

Pijush Pal Roy
DIRECTOR
Dr. B. C. Roy Engineering College
DURGAPUR

For **Ardent Computech Pvt Ltd** Indranil De Sarkar

AuthorizedSignatory

Pijush Pal Roy
DIRECTOR
Dr. B. C. Roy Engineering College
DURGAPUR

ARDENT COMPUTECH PVT. LTD.
Indranil De Sarkar
Director

AuthorizedSignatory

Dr. B. C. Roy Engineering College, Durgapur.	**Ardent Computech Pvt Ltd**
Address: Jemua Road, Fuljhore, Durgapur – 713 206	Module No-132, Ground Floor, SDF Building, Sector-V, Saltlake, Kolkata-700091
Contact No. (0343) 250 4121	9674489000 / (033)40073507
Reg Email Id director@bcrec.ac.in	indranil@ardentcollaborations.com
www.bcrec.ac.in	www.ardentcollaborations.com

Witness1:

Head
Dept. Computer Science & Engg.
Dr. B. C. Roy Engineering College
Durgapur

Witness 2:

ARDENT COMPUTECH PVT. LTD. KOLKATA

Witness3:

A. KAHALI
Head Administration
Dr. B. C. Roy Engg. College
Durgapur

Witness 4:

ARDENT COMPUTECH PVT. LTD. KOLKATA

Dr. B. C. ROY ENGINEERING COLLEGE, DURGAPUR
(Approved by AICTE & Affiliated to WBUT)
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E-mail : dgp_bcrec@sancharnet.in, Website : www.bcrec.org

Memorandum of Understanding

Analog Teaching Lab Setup at Department, Dr. B.C. Roy Engineering College, Durgapur

This memorandum of understanding is signed on the 22nd Sep Tuesday of, 2015, between the following institutions:

a. **M/s Ed Gate Technologies Pvt Limited** which is the University Program Partner of Texas Instruments ,India

b. **Dr. B.C. Roy Engineering College, Durgapur.**

This Memorandum of Understanding is proposed in order to establish a teaching lab facility using Analog Kits at **Dr. B.C. Roy Engineering College, Durgapur.**

Through this Memorandum of Agreement, the two parties agree to the following.

(a) A **steering committee** will be set up to monitor the activities of the MoU. The committee will consist of the **Gurpreet Singh Manager TI India University Program of** M/s **EdGate Technologies Pvt Limited** and the **Prof. (Dr.) Chandan Kumar Ghosh, Associate Professor of Electronics & Communication Engineering Department of Dr. B.C. Roy Engineering College, Durgapur**. With mutual consent, the steering committee can be expanded to include more members from the two institutions. The steering committee will be the supreme body as far the implementation of the activities of the MoU, the continuation of the MoU, and termination of the MoU are concerned.

(b) **Lab Setup**: The College will utilize there existing lab to setup "Texas Instruments Lab" **EdGate Technologies Pvt Limited** agrees to donate **ASLK PRO KIT- 6 Numbers** to college under TI University Program to setup Texas Instruments **ASLK PRO** Lab **EdGate Technologies Pvt Limited** working with TI India will also provide the branding ,Material to setup the lab ,e.g. posters and name plates .The college will be responsible for purchasing any other equipment's required to setting up the lab and for maintenance of the lab. **EdGate Technologies Pvt Limited** agrees to set up the lab and provide the necessary initial training and learning materials to begin with utilization of Lab.

Dr. B. C. ROY ENGINEERING COLLEGE, DURGAPUR
(Approved by AICTE & Affiliated to WBUT)
CAMPUS : JEMUA ROAD, FULJHORE, DURGAPUR-713206 (W.B.), INDIA
☎ : (0343) 250-1353/4106/4121/2449, Fax : (0343) 250-4059 / 3424
E-mail : dgp_bcrec@sancharnet.in, Website : www.bcrec.org

(c) **Curriculum**: The College will explore ways to introduce a lab based courses using Texas Instruments TI Platforms in their undergraduate /post graduate engineering curriculum.

(d) **Faculty Development Program**: Under University Program **EdGate Technologies and TI** will organize at least one faculty development program at the premises of the college **to help the faculty members in teaching Analog Kit using ASLK PRO kit .** The college will provide the infrastructure and other facilities to conduct event successfully.

(e) **Workshops/Events**: If the College wishes to organize a national event in the area of TI Platform, **EdGate Technologies Pvt. limited /TI** will provide speakers.

(f) **Publicity through Media** : The college does not publicize the event to other external communication about the MOU in electronic or print media without explicit permission from **EdGate Technologies Pvt Limited /Texas Instruments** .In case the college /University wants to do so ,a prior approval from **Texas Instruments and EdGate Technologies Pvt Limited** is required .

Authorized Signatories:

Authorized Signatory from the Institution:

Principal
Dr. B. C. Roy Engineering College
DURGAPUR

Authorized Signatory from your Company:

EdGate Technologies Private Limited
Bangalore

THE MISSION HOSPITAL DURGAPUR FUTURISTIC TECHNOLOGY BRILLIANT MINDS

MEMORANDUM OF UNDERSTANDING

THIS MEMORANDUM OF UNDERSTANDING is entered into on 1st February, 2019 at Durgapur by and between.

1). **The Mission Hospital-Durgapur (**A unit of Durgapur Medical Centre Pvt. Ltd.) having its registered office at Plot No.219(P), Sector-IIC, Immon Kalyan Sarani, Bidhannagar, Durgapur, *hereinafter named TMH in acronym* and **represented by Mr. Ramesh Lall, Senior General Manaager-HRD**, and hereinafter designated as **the First Party** which expression, *unless repugnant to the context*, shall mean and include its successors and assignees)

AND

2). **Dr B C Roy Engineering College, Durgapur represented by Dr. Pijush Pal Roy, Director** hereinafter *named BCREC in acronym* and called **the Second Party** (which expression shall mean and include its **Successors** and Assignees)

WHERE AS the Second Party is desirous to avail medical treatment from the first party for its members (*that includes bonafide Students, Staff and Faculty/Officials)* and the First Party has agreed to provide medical treatment to the members of the Second Party ***at the College premises and during agreed College Hours.***"

WHERE AS it is deemed necessary to reduce the terms and conditions mutually agreed upon in writing to avoid any misunderstanding in the future , the following points were discussed and were agreed upon.:-

DEFINITIONS:

For the purposes of these terms and conditions:

a. "Hospital/TMH" shall mean The Mission Hospital, Durgapur, including its successors and permitted assigns.
b. "BCREC" shall mean Dr B C Roy Engineering College, Durgapur including its successors and permitted assigns.

THE MISSION HOSPITAL DURGAPUR | FUTURISTIC TECHNOLOGY | BRILLIANT MINDS

TERMS AND CONDITIONS:

A. TMH will send one Doctor every day (Monday to Saturday) for general health check up of Staffs and Students of BCREC. *The timing shall be mutually agreed upon.*

B. TMH and BCREC will provide one – way conveyance respectively for transportation of the deputed Doctor from TMH (outbound) to BCREC and the return trip shall be provided by BCREC.

C. BCREC will pay a sum of Rupees 50000/ (Fifty thousand only) every month to TMH as the service charge.

D. *During end – Semester break/ College Holidays for longer duration, this arrangement shall remain suspended, and recommence when the College re – opens after Holidays/ end – Semester break.*

E. *For transportation of patients (ailing students/staff/Faculty/Officers) requiring Hospital attention, TMH shall provide Ambulances on call.*

WITNESS

1. DEBANJAN ACHARYA
Debanjan Acharya.

2. Swapan Kumar Mula
Swapan

Ramesh Lall
Sr.GM-HRD
The Mission Hospital
Ramesh Lall
Sr. General Manager-HR
The Mission Hospital
Durgapur, West Bengal

Director
Dr B C Roy Engineering College, Durgapur
Pijush Pal Roy
Director
Dr. B. C. Roy Engineering College
Durgapur

WITNESS

1. (KOUSHIK SENAPATI)

2. (ALOKE KAHALI)

TPSDI
TATA POWER
SKILL DEVELOPMENT INSTITUTE
Power Skills For Life

Understanding

between

Tata Power Skill Development Institute

(TPSDI)

and

Dr B C Roy Engineering College, Durgapur

(BCREC)

Date: 02.02.2019

1. Background

The Tata Power Skill Development Institute (TPSDI) is an endeavor from the Tata Power Company to empower youth and others with employable skills, especially in the Power and allied sectors, and to address the skill gap challenge faced by the Indian Power Sector.

The Institute provides modular training and certification across a wide range of employable skills.

The Institute has set up five training hubs in four locations in the country leveraging the facilities of Tata Power and its JV/Subsidiaries:

- Shahad - Mumbai, Maharashtra
- Trombay - Mumbai, Maharashtra
- Maithon - Dhanbad, Jharkhand
- Mundra - Kutch, Gujarat
- Jojobera - Jamshedpur, Jharkhand

The Institute's unique training approach is designed for delivering skills with **speed, scale, and standards.**

Given the needs of Engineering students - Skills for the Power Sector, Specialized Skills for specific domains of operations in the Power Sector and Allied fields, TPSDI and the College wish to collaborate to bring together the resources and expertise for the benefit of the students.

This Understanding describes the Joint and Individual obligations that TPSDI and College agree to fulfil, to realize the potential of their synergy.

Each is referred to as "Party" in this Understanding, or jointly as "Parties". College includes the Students enrolled with the College.

2. Understanding

College has requested TPSDI to offer courses of training at TPSDI for students undergoing their curriculums and/or desirous of taking the Industry Certification courses/facilities offered by TPSDI.

Course modules will be mutually agreed upon between TPSDI and the College.

The Fees structure for the course is as defined below, which will be remitted by DD, by College/student to The Tata Power Company Limited on or before the commencement of the course

Feb 2019- Dec 2019	*Fee per student
One-Day Course	Rs 500/-
One -Week (5 working days) Course	Rs 3000/-

*GST Inclusive

No. of students: **100 Students**

3. Obligations of Students and College

- All students enrolled in the course at TPSDI will follow the TPSDI Code of Conduct and Safety Norms for Students.

4. Obligations of TPSDI

- TPSDI will conduct the course and assessments with all classroom, practical, and site visit components as per the course curriculum laid down by TPSDI.
- The students will be awarded a Certificate by TPSDI after they undergo the course and assessments successfully.

5. Intellectual Property and Copyrights

Both parties recognize that the concepts, designs, plans, content, assessments, and processes that are developed by either party, will remain the Intellectual Property and Copyright of that party at all times.

Neither party will infringe upon the Copyright of the other party. If any use or re-use of the materials of the other party are required, it can be done only after consent in writing is provided.

6. The use of Logos

Both parties can use the Logo of the other party, for demonstrating the mutual understanding and partnership contained in this Understanding, on approval in writing or as confirmed over email correspondence, of the exact context of use, and as approved in each instance.

7. Effective Date, Term and Termination

a. This Understanding is valid with effect from the date of the last signature at the end of the document.

b. This Understanding is valid till 31.12.2019 unless terminated before that. The achievements and progress under the Understanding will be reviewed by both the parties.

c. This Understanding can be terminated by either party at any time, for any reason, with a communication to the Contact person of the other party. Any open transactions at that time will be taken forward to closure as may be mutually agreed. Any Commercial transactions open at that time will be settled and closed within 30 days.

8. No Licenses

This Understanding is only describing a Business Relationship, and should not be construed to mean any form of ownership or license to either party except as stated in this Understanding.

There are no other rights granted to either party by the other, except as stated in this Understanding.

9. Points of Contacts

For managing the activities under this Understanding, the Contact Persons responsible at either party are as follows, including their contact and location details:

For TPSDI	For College
Name: Mr. Alok Prasad	Name: Dr. Pijush Pal Roy
Desig.: Principal-TPSDI, Maithon	Desig: Director-BCREC
Address: Tata Power Skill Development Institute, The Tata Power Co Ltd., Adjacent to Maithon Power Ltd., Vill:Dombhui, P.O. Barbendia, Maithon District - Dhanbad 828205	Address: Dr. B. C. Roy Engineering College Jemua Road, Fuljhore Durgapur - 713206
Telephone:+91 7070090547 Mobile:+919204857098	Telephone: +91-9431506000 +91-6297128554
Email:alokprasad@tatapower.com	Email: director@bcrec.ac.in
Registered Office Address: The Tata Power Company Limited, Parel Receiving Station, Parel Tank Road, Mumbai 400 033, Maharashtra, India	Registered Office Address: Dr. B. C. Roy Engineering College "Management House" Jemua Road, Fuljhore Durgapur – 713206, W.B.

10. Signatures

For TPSDI	For College
	Pijush Pal Roy Director Dr. B. C. Roy Engineering College Durgapur
Name: Mr. ALOK PRASAD	**Name: DR. PIJUSH PAL ROY**
Designation: Principal-TPSDI, Maithon	**Designation: Director, BCREC Durgapur**
Date: 2nd February 2019	**Date: 2nd February 2019**

Mr.J.C. Mistry, Chief-TPSDI

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