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CONSTRUCTION DIRECTORY 2019

CONSTRUCTION DIRECTORY 2019

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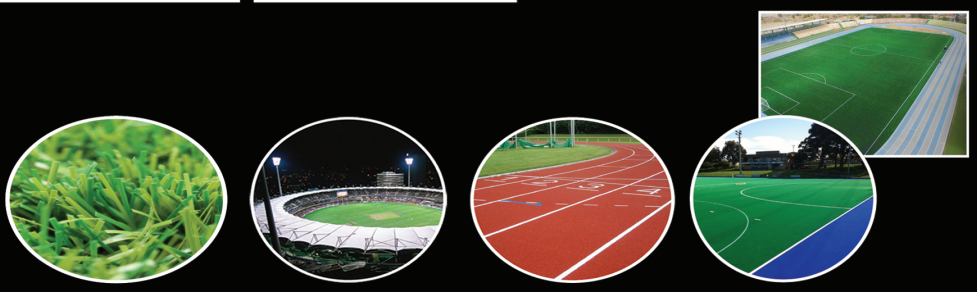

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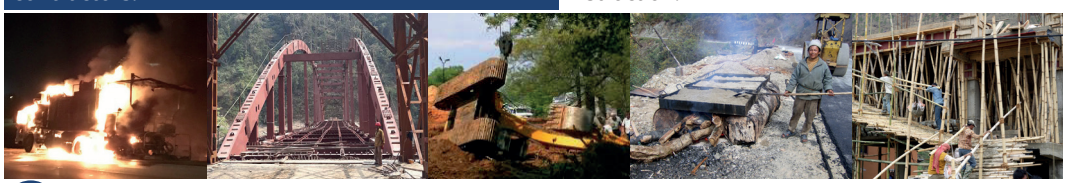
- Thefts and burglaries,
- Accidental damages during the course of construction.



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BB 1499	31,129.60 MB	46,080 MB	1 Month	Nu. 1499
BB 2499	53,043.20 MB	81,920 MB	1 Month	Nu. 2499

Additional Prepaid Broadband Plans

Packages	Data Quota (MB)	Validity	Price in Nu.
BB 599	15,360 MB	1 Month	Nu. 599
BB 1099	32,768 MB	1 Month	Nu. 1099
BB 1999	63,488 MB	1 Month	Nu. 1999

2. Postpaid Broadband Plans

Packages	Existing Data Quota (GB)	Revised Data (MB)	Additional Charge Per MB	Validity
BB 499	8,192 MB	9,216 MB	0.054	1 Month
BB 1599	26,624 MB	46,080 MB	0.035	1 Month
BB 2999	51,200 MB	102,400 MB	0.029	1 Month

Additional Postpaid Broadband Plans

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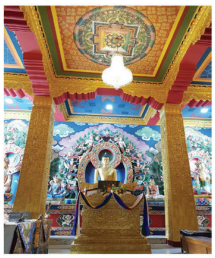




The Dynamic World of BHUTAN grc

Glassfibre Reinforced Concrete (GRC) is the new revolutionary product in construction material. Its popularity continues to rise as it is a composite building material that is a mixture of glassfibre and cement – combining the strength of cement with the flexibility of glassfibre. The combination is a versatile building material that has captured the imagination of architects, engineers and builders all over the world.

BHUTAN grc was founded in 2002. It remains the established firm in manufacturing GRC products in the kingdom and the region. **BHUTAN grc's** vision is to offer this magical material as an alternative to timber, the traditional go-to material that proves to be a burden to environmental preservation and conservation. In the last sixteen years, **BHUTAN grc** has proven its determination in providing an alternative material that is more suitable if not more adept than timber when it comes to traditional Bhutanese designs. **BHUTAN grc's** track record speaks for itself in the numerous high profile structures, ranging from the largest Guru Padmasambhava Statue in Takila in Eastern Bhutan to the contemporary Le Meridien, Thimphu's newest landmark and the Bhutan National Bank Limited in Thimphu.

Indeed, GRC continues to revolutionise the construction industry with its innovative potentiality; providing an alternative to the extensive wood-based sector in the kingdom. This sets perfectly with Bhutan's environmental policy of conserving a minimum of 60% forest cover for all times to come as enshrined in the Constitution of the Kingdom.

BHUTAN grc's aspirations are the same. And **BHUTAN grc** is of the well-founded belief that the promotion of such an environmental friendly construction sector is an achievable reality.

GRC - Salient Features

- It is an ideal substitute for stone carving due to its lightweight & resistance to weather.
- It is tailor made.
- It can be moulded into any shape, size, profile etc.
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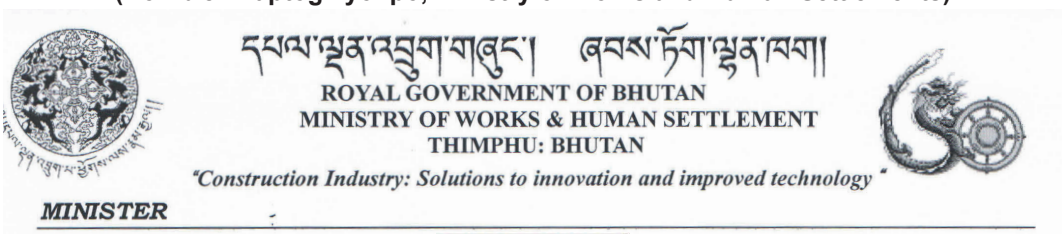
MESSAGE FROM THE CHAIRPERSON (CDB)

(Hon'ble Zhaptog Lyonpo, Ministry of Works and Human Settlements)



As the Construction Association of Bhutan celebrates its historical milestone of twenty years of service, I would like to commend the Construction Association of Bhutan (CAB) for its efforts in facilitating and bringing out its 4th edition of the Construction Directory 2019-2020. I am certain that this directory, with its sea of information, will be of immense help to everyone in the construction industry.

For an industry which has seen unprecedented growth over the years, contributing about 16.28% to our GDP and employing 4,125 contractors, the construc¬tion sector is today considered one of the backbones of our economy. I am certain that the Construction Directory will be a useful kit to all the contractors, engineers and all individuals in guiding them in their day-to-day field work. The at¬tempt to revise the edition every two years in itself demonstrates the maturity and development of the private construction sector.

The ministry would like to take this opportune moment to urge the Construction Associa-tion of Bhutan to continue to remain proactive and move forward, to tackle pressing issues that confront the industry, such as lack of professionalism in the private construction industry and altogether gear towards developing the capacity of the Bhutanese contractors.

The CDB, mandated as a regulator and promoter of the construction industry, commits to render any assistance to CAB and its members in enhancing their capacity, more so of small contractors, who have persistently limited capacity in respect to formulating bidding strategies and carrying out construction and contract management among others.

Lastly, I would like to express my sincere appreciation to all individuals of CAB and in particular the team for their time and effort in bringing out this 4th issue of Con¬struction Directory 2019-2020. Undoubtedly, the Construction Directory will be very useful for its users in the construction industry.

Tashi Delek!

Dorji Tshering

MESSAGE FROM THE PRESIDENT (CAB)

འབྲུག་བཟོ་བསྒྲུབ་ཚོགས་པ།།
Construction Association of Bhutan
Post Box 1075, Thimphu, Bhutan
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PRESIDENT

MESSAGE FROM THE PRESIDENT
Construction Association of Bhutan

As we venture into the association's 20th anniversary year, we are pleased to present the 4th Edition of the bi-annual Construction Directory. Evidently, the Construction Directory- the consummation of a vision that started long ago, stands out as one of our most significant achievements in the last two decades.

The Construction Directory in its core essence is intended to facilitate locating & sourcing of all products related to the construction industry and encompasses contact information of our member contractors. Alternatively, it serves as an information dissemination tool to impress valuable information on its users in the construction industry.

We have endeavored to incorporate all the feedbacks we have received from the users of the past publication, and we are confident that this edition of the Construction Directory will take precedence over all its predecessors both in content & presentation. Therefore, I welcome all the constituents of the construction industry to get a copy of the directory which is provided free of cost- available in print version from our office and electronic format uploaded on our website; the Construction Directory will serve its intended purpose only if it is in the hands of its intended users.

Lastly, we would like to thank everyone who has contributed in the publication of the 4th edition of the Construction Directory, as well as applaud those who have served on the publication committee for their vision and efforts in bringing this valuable tool to fruition.

I hope all of you will have an enjoyable time perusing through our publication.

Thank you & Tashi Delek!!!

THINLAY GYAMTSHO

ས།། དང་ལུགས་གནམ་ལོ་ ས་མོ་ཕག་ལོ། 2019 EARTH FEMALE PIG YEAR

January

འབྲུག་ཟླ་ ༡༡ དང་ ༡༢ པ།

ཟླ་ཁ SUN	MON	TUE	WED	THU	FRI	SAT
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༦ 6	༧ 7	༨ 8	༩ 9	༡༠ 10	༡༡ 11	༡༢ 12
༡༣ 13	༡༤ 14	༡༥ 15	༡༦ 16	༡༧ 17	༡༨ 18	༡༩ 19
༢༠ 20	༢༡ 21	༢༢ 22	༢༣ 23	༢༤ 24	༢༥ 25	༢༦ 26
༢༧ 27	༢༨ 28	༢༩ 29	༣༠ 30	༣༡ 31		

February

འབྲུག་ཟླ་ ༡༢ དང་ ༡ པ།

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༡༧ 17	༡༨ 18	༡༩ 19	༢༠ 20	༢༡ 21	༢༢ 22	༢༣ 23
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March

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༡༠ 10	༡༡ 11	༡༢ 12	༡༣ 13	༡༤ 14	༡༥ 15	༡༦ 16
༡༧ 17	༡༨ 18	༡༩ 19	༢༠ 20	༢༡ 21	༢༢ 22	༢༣ 23
༢༤ 24	༢༥ 25	༢༦ 26	༢༧ 27	༢༨ 28	༢༩ 29	༣༠ 30

April

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May

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June

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July

འབྲུག་ཟླ་ ༤ དང་ ༥ པ།

ཟླ་ཁ SUN	MON	TUE	WED	THU	FRI	SAT
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༧ 7	༨ 8	༩ 9	༡༠ 10	༡༡ 11	༡༢ 12	༡༣ 13
༡༤ 14	༡༥ 15	༡༦ 16	༡༧ 17	༡༨ 18	༡༩ 19	༢༠ 20
༢༡ 21	༢༢ 22	༢༣ 23	༢༤ 24	༢༥ 25	༢༦ 26	༢༧ 27
༢༨ 28	༢༩ 29	༣༠ 30	༣༡ 31			

August

འབྲུག་ཟླ་ ༥ དང་ ༦ པ།

ཟླ་ཁ SUN	MON	TUE	WED	THU	FRI	SAT
				༡ 1	༢ 2	༣ 3
༤ 4	༥ 5	༦ 6	༧ 7	༨ 8	༩ 9	༡༠ 10
༡༡ 11	༡༢ 12	༡༣ 13	༡༤ 14	༡༥ 15	༡༦ 16	༡༧ 17
༡༨ 18	༡༩ 19	༢༠ 20	༢༡ 21	༢༢ 22	༢༣ 23	༢༤ 24
༢༥ 25	༢༦ 26	༢༧ 27	༢༨ 28	༢༩ 29	༣༠ 30	༣༡ 31

September

འབྲུག་ཟླ་ ༧ དང་ ༨ པ།

ཟླ་ཁ SUN	MON	TUE	WED	THU	FRI	SAT
༡ 1	༢ 2	༣ 3	༤ 4	༥ 5	༦ 6	༧ 7
༨ 8	༩ 9	༡༠ 10	༡༡ 11	༡༢ 12	༡༣ 13	༡༤ 14
༡༥ 15	༡༦ 16	༡༧ 17	༡༨ 18	༡༩ 19	༢༠ 20	༢༡ 21
༢༢ 22	༢༣ 23	༢༤ 24	༢༥ 25	༢༦ 26	༢༧ 27	༢༨ 28
༢ 29	༣ 30					

October

འབྲུག་ཟླ་ ༨ དང་ ༩ པ།

ཟླ་ཁ SUN	MON	TUE	WED	THU	FRI	SAT
		༡ 1	༢ 2	༣ 3	༤ 4	༥ 5
༦ 6	༧ 7	༨ 8	༩ 9	༡༠ 10	༡༡ 11	༡༢ 12
༡༣ 13	༡༤ 14	༡༥ 15	༡༦ 16	༡༧ 17	༡༨ 18	༡༩ 19
༢༠ 20	༢༡ 21	༢༢ 22	༢༣ 23	༢༤ 24	༢༥ 25	༢༦ 26
༢༧ 27	༢༨ 28	༢༩ 29	༣༠ 30	༣༡ 31		

November

འབྲུག་ཟླ་ ༩ དང་ ༡༠ པ།

ཟླ་ཁ SUN	MON	TUE	WED	THU	FRI	SAT
					༤ 1	༥ 2
༦ 3	༧ 4	༨ 5	༩ 6	༡༠ 7	༡༡ 8	༡༢ 9
༡༣ 10	༡༤ 11	༡༥ 12	༡༦ 13	༡༧ 14	༡༨ 15	༡༩ 16
༢༠ 17	༢༡ 18	༢༢ 19	༢༣ 20	༢༤ 21	༢༥ 22	༢༦ 23
༢༧ 24	༢༨ 25	༢༩ 26	༣ 27	༢ 28	༢ 29	༤ 30

December

འབྲུག་ཟླ་ ༡༠ དང་ ༡༡ པ།

ཟླ་ཁ SUN	MON	TUE	WED	THU	FRI	SAT
༤ 1	༥ 2	༦ 3	༧ 4	༨ 5	༩ 6	༡༡ 7
༡༢ 8	༡༣ 9	༡༤ 10	༡༥ 11	༡༦ 12	༡༧ 13	༡༨ 14
༡༩ 15	༢༠ 16	༢༡ 17	༢༢ 18	༢༣ 19	༢༤ 20	༢༥ 21
༢༦ 22	༢༧ 23	༢༨ 24	༢༩ 25	༣༠ 26	༡ 27	༢ 28
༣ 29	༤ 30	༥ 31				

Jan 02: Winter Solstice (Nyilo)
Jan 06: Traditional Day of Offering (Chunipa Losar)
Feb 05: Losar (New Year) (2 days)
Feb 21: Birth Anniversary of His Majesty the King (3 days)

Apr 14: Death Anniversary of Zhabdrung
May 02: Birth Anniversary of Third Druk Gyalpo
Jun 17: Lord Buddha's Parinirvana
Jul 11: Birth Anniversary of Guru Rimpoche
Aug 04: First Sermon of Lord Buddha

Nov 01: Coronation Day of His Majesty the King
Nov 11: Birth Anniversary of Forth Druk Gyalpo / Constitution Day
Nov 19: Decending Day of Lord Buddha
Dec 17: National Day of Bhutan

CONTENTS

I. BACKDROP

The Construction Association of Bhutan was institutionalised in January 25, 2000 under the auspicious Chair of the Hon'ble President of the Bhutan Chamber of Commerce & Industry. Dasho Ugen Tsechup Dorji took the rein of the Association as the first President elect, securing 149 votes out of the 189 votes cast under the secret ballot, amongst the seven (7) competing candidate nominees. By July 2002, the Association had a full-fledged Secretariat established in the capital, Thimphu.

II. HISTORY OF CAB'S INCEPTION

Under the aegis of SAARC Chamber of Commerce & Industry (SCCI), a regional forum for private sector development in the seven SAARC countries, SAARC Council for Construction Industry (SAARC-CCI) was established in 1999 as a regional forum for development & promotion of construction industry of the SAARC countries at national, regional & international level. The SAARC-CCI notified Bhutan Chamber of Commerce & Industry (BCCI), a member federation in the SCCI, in November 1999 for representation in the council's 1st meeting scheduled in December 1999 at Kathmandu, Nepal. In the absence of construction association in Bhutan, BCCI in its 54th Executive Committee Meeting on November 29, 1999 decided to call all Class-A contractors in Bhutan for a meeting within December 15, 1999 to discuss the issue. All Class-A contractors met on December 14, 1999 under the Chairmanship of BCCI's President and came up with unanimous decision to form "Contractors Association of Bhutan" as a forum to address specific problems and policies related to Bhutanese construction industry at national and regional level. Consequently, resolution was passed by the floor, to call general meeting of all Class A, B & C contractors in January 2000 to discuss "modalities for institution of Contractors Association of Bhutan" Subsequently, all Class A, B & C contractors met on January 25, 2000 in Thimphu in the conference hall of BCCI. In the meeting members were apprised of the need for forming an association for the benefit of construction industry. It was also highlighted that recently Royal Government felt the need of such association for effective representation. The floor reached a unanimous consensus for establishment of "Contractors Association of Bhutan" to address specific problems and policy issues related to Bhutanese construction industry at national, regional and international level, and endorsed the decision to establish the association.
On January 25, 2000 Contractors Association of Bhutan was established for the development & promotion of Bhutanese construction industry. Dasho Ugen Tsechup Dorji took the rein of the Association as the first President elect. In 2002 on October 10-11 in its 3rd Annual General Meeting, the General Body approved change of name from Contractors Association to Construction Association for meaningful representation and wider coverage of the related industrial entities under the construction sector.

Subsequently, on 30th April, 2012, the association was officially registered as Public Benefit Organization under the Civil Society Organizations Act of Bhutan, 2007.

Key Undertakings

- CAB is in continuous dialogue and interaction with various government agencies to streamline the procurement procedure in order to provide fair opportunity and level playing field for all Bidders.

- CAB has been instrumental in maintaining the status quo of Mobilization Advance at 10% which was contended to be reduced to 5%. Similarly, upon timely intervention from CAB, the defect liability period is being maintained at 12 months for normal projects against 36 months.
- CAB was instrumental for incorporation of Price Variation Clause in contract documents of various works authorities. Similarly, price adjustment provision has been made applicable to projects of at least 12 months duration against previous 18months. Small works has also been brought under the scope of deviation clause which will be reflected in the revised PRR.
- CAB is promulgating adoption of a 'unified standard equitable contract document', based on PRR by all procuring agencies.
- With constant correspondence & intervention from CAB, payment clause to ensure timely payment has been incorporated within the SBD. CAB is also regularly monitoring the compliance of the same by the Procuring Agencies.
- CAB initiated the annual Construction Fair, the largest of its kind in the country from the year 2017.
- Through its Construction Directory (bi-annual Publication), CAB provides consolidated list of contractors, consultants & suppliers in the construction industry. Useful statistical information, litigation in construction, technical information and latest technological developments in construction industry are disseminated via the publication.
- CAB is an affiliate member of the International Federation of Asia and Western Pacific Contractors' Association (IFAWPCA). IFAWPCA in turn is affiliated to Confederation of International Contractors' Associations (CICA), the world body of contractors and builders. While IFAWPCA has a consultative organisation status with Asian Development Bank, CICA has a similar status with the World Bank.
- CAB is also affiliated to many national organizations, directly or indirectly connected to the construction industry. This facilitates exchange of thoughts, ideas and views.
- CAB has been given representative status in many committees of Governments, which decide policies on economic development, procurement, taxation, labour laws, environment, etc. CAB has representative as board members to the board of the IFAWPCA, CDB & BCCI. CAB has representative in the oversight committee such as the Independent Review Body, Debarment Committee etc.
- CAB was part of the working committee for drafting the Economic Development Policy (EDP) 2016
- CAB had representative as taskforce member in the drafting committee of the Bhutan Alternative Dispute Resolution Rules and Regulations 2018.
- Similarly, CAB is included in the drafting committee of the National Construction Industry Policy
- With the formulation of the MoU with the RICBL, the commission levied on performance guarantee by RICBL has been reduced with the introduction of new slab system for amount between 50million-100million and amount beyond 100 million @ 1.5% pa and 0.75% pa respectively.
- CAB facilitates Bhutanese Contractors to attend the IFAWPCA Convention in various member country (currently on self-financed basis) by providing visa process support, arrangement of accommodation and logistics. As of 2018 Bhutanese contractors have attended the Convention in Korea & Malaysia. In November, 2018, 33 team delegates from Bhutan attended the

Convention in Kuala Lumpur, Malaysia.

- CAB is collectively pursuing the CSR in Construction Industry and constantly advocating the same to the various stakeholders in construction sector.
- CAB is also in constant dialogue with the Govt. and other stakeholders to tackle issues and find solutions to problems related to realistic project duration, realistic cost estimate, unreasonable HR/Equipment requirements and other pertinent issues related to construction industry.
- CAB is making a difference for the construction business through advocacy with a collective voice.

III. OBJECTIVES

The board policy objectives of the Association for development and promotion of Construction Industry are stated as:
a. "Development" through identifying, facilitating and assisting construction industry in business, information and technology development: and
b. "Promotion" through assessing, monitoring and assisting the needs, performance and problems of the construction industry.

MISSION

"To develop and promote the Bhutanese construction industry and to represent the Bhutanese construction industry at national, regional and international level"

VISION

"To foster the growth of the member contractors to achieve excellence and become world class providers of all services in the construction sector"

IV. ROLES & RESPONSIBILITIES OF CAB

- Develop & Promote the Bhutanese Construction Industry
- Advocate & represent the construction sector to the government and other stakeholders
- Stimulating, mobilising and co-ordinating the Construction Sector
- Pursue Corporate Social Responsibility (CSR) in the Construction Industry
- Lobbying for private construction sector issues
- Acting as the conduit for programmes for and towards the development of the PCS, and
- Providing services to members

V. SERVICES

- Assist & facilitate members in documentation during registration, renewal and upgradation of their contract license & CDB certificate

- Recommendation of Non-national engineers for recruitment
- Sensitization & Awareness on government policies & procurement norms
- Technical and legal consultation/advise related to procurement process (Arbitration, tender filling etc.)
- Advocacy & Awareness on Occupational Health & Safety and Quality Assurance
- General & Technical Trainings and Workshops
- Local, Regional & International linkages & Exposure through platforms such as Construction Fair, IFAWPCA Conventions, Study Tours & Trainings, etc.
- Access to information or advertisement opportunities through Construction Directory
- Member Savings: on Bank Guarantees; Machineries/Equipment purchase or hire; purchase of Construction materials such as Cement, Steels & Bricks;
- Engineer services for measurement of works, preparation of BoQ & final bills, bidding through e-GP, rate analysis etc.
- Sensitization & Information dissemination on contemporary and upcoming programs, events, policy changes, new policies etc. via sms, phone, email, social media, print media, BBS, etc.
- Members capacitation and awareness workshops
- Organize meetings, conferences, workshops, seminars to provide members with fora for exchange of views and experiences.
- Opportunity for multiple business forums and social activities such as annual Construction Fair, intermittent meetings, receptions for specific events to broaden networking opportunities and CAB annual picnic for members.

VI. UPCOMING:

- **Unit rate schedule software:**

- An automated unit rate software to derive prevailing rate to produce realistic cost at site for specific works. The user will only have to enter the cost of the particular items at the work location to get the estimated built-up rates.

- **Member Savings:**

- Reduced Commissions on Performance Guarantee
- Nominal Discounts on essential construction materials such as Cement, Steel, Bricks, etc.
- Nominal Discounts on Purchase & Hire of Machineries & Equipment.

- **Publications:**

- Monthly Construction Newsletter / Journals
- Digital annual report published on CAB website
- Construction Forecast Report
- Miscellaneous Construction related Literatures.

- **Construction Career Expo**

- One-of-a-kind interactive expo to address the industry's looming labour shortage by marketing the career paths available in construction with unique opportunities to get students hands on the tools.

- **Labour Resource Bank**

- Consolidated labour pool of TVET construction workers under CAB. The workers will be supplied to the contractors as and when required.

CIVIL SOCIETY ORGANIZATIONS AUTHORITY

Certificate of Registration

This is to certify that **Construction Association of Bhutan** is hereby registered as a **Public Benefit Organization** under the Civil Society Organizations Act of Bhutan, 2007 with effect from **30th April 2012** corresponding to the **9th day of the 3rd Bhutanese month of the Water Male Dragon Year.**

The Organization is hereby allotted Registration number: **CSOA/PBO-21.**

The Organization seeks to fulfill the objectives as defined in its Articles of Association and Memorandum of Association and shall operate in **the whole of Bhutan.**

The aforementioned organization is subject to the provisions of the Civil Society Organizations Act of Bhutan 2007 and other laws in force in the country.

Validity of this certificate is subject to annual renewal. Please see overleaf for registration status.

Seal

CHAIRPERSON
Civil Society Organizations Authority
THIMPHU; BHUTAN

CSO Authority, Thimphu, Bhutan
PABX: +975-2-324954 or Tel. +975-2-324873 Fax:. 339217. Website: www.csoa.org.bt

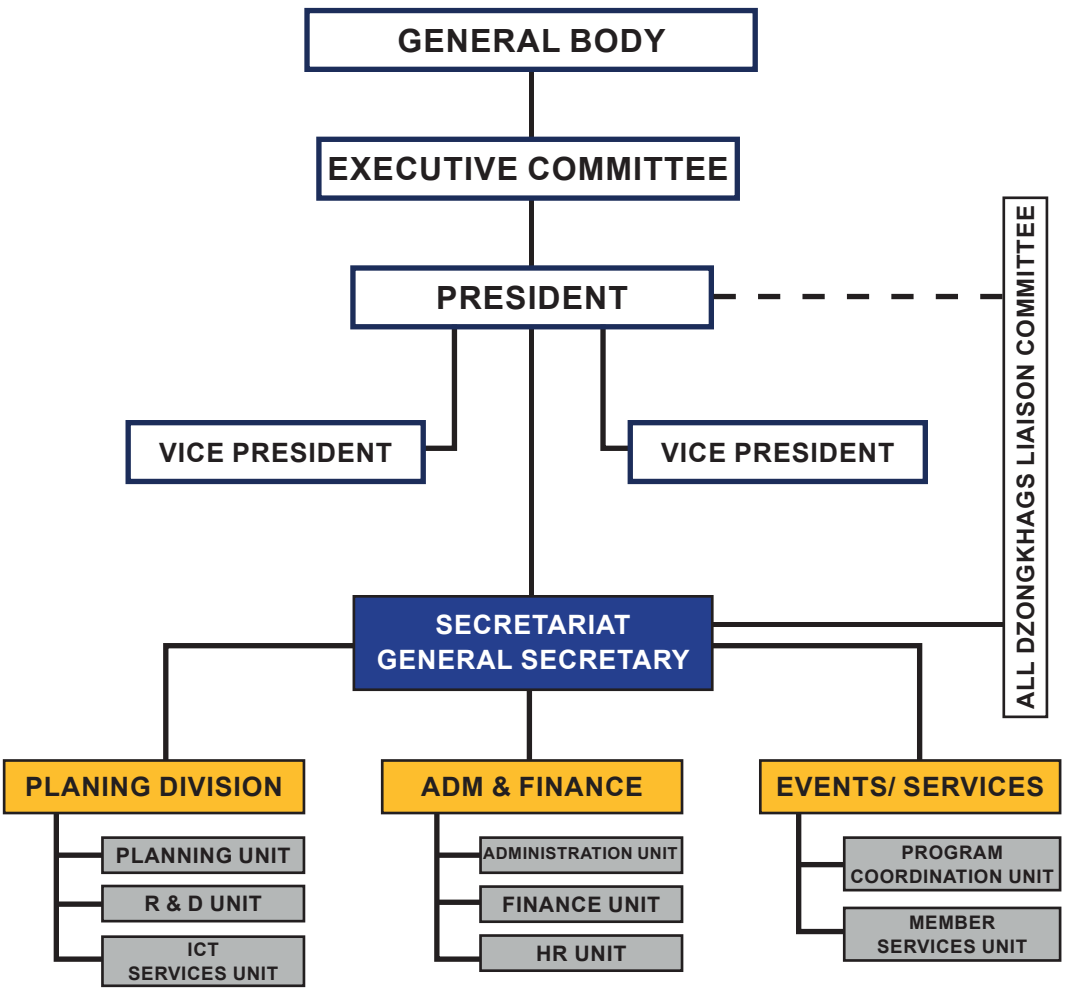
ORGANIZATIONAL STRUCTURE 2019

GENERAL BODY

The General Body is the governing body of the association. General Body comprises of elected members from all the Dzongkhags represented through respective Dzongkhag Liaison Committee (DLC), and the Executive Committee Members under the chairmanship of the President as the elect Head of the association. All registered members of the Association are treated as other members of the general body in the same status as the general member of the body. The general body meets once in a year.

EXECUTIVE COMMITTEE

The Executive Committee is the executing body for the Association. It comprises 15 members under chairmanship of President supported by 2 Vice Presidents. As the executing body of the association, the executive committee exercises full administrative and financial powers. Additionally, financial matters are entrusted to the Finance Committee Members.



SECRETARIAT OFFICE

The Secretariat Office is the implementing body of the association. The Secretariat office is headed by the General Secretary. The secretariat office is responsible for day-to-day implementation of the plans and programs of the association.

BOARD MEMBERS

PRESIDENT

Mr. Thinlay Gyamtsho
M/s T&K Construction Private Limited

VICE PRESIDENTS

VICE PRESIDENT

Mr. Tshering Yoenten
M/s Chogyel Construction

VICE PRESIDENT

Mr. Ugyen Penjor
M/s Kabab Construction

EXECUTIVE MEMBERS

Mr. Kezang Choejoe
M/s K.C Construction
Private Limited
(Large Member)

Mr. Karma Wangchuk
M/s K.W Construction
Private Limited
(Large Member)

Mr. Karma G. Wangchuk
M/s K.Gangri Construction
Private Limited
(Large Member)

Mr. Neten Wangdi
M/s Neten Construction
Private Limited
(Large Member)

Mr. Dawa Norbu
M/s Druk Wangyel Construction
(Medium Member)

Mr. Rinchen Daba
M/s R.D Construction
(Medium Member)

Mr. Pema Tenzin
M/s Druk Phuensum Construction
(Medium Member)

Mr. Dorji
M/s Druk Yusel Construction
(Medium Member)

Mr. Tshering Drukpa
M/s Karma Construction
(Small Member)

Mr. Passang Dorji
M/s Sangzam Construction
(Small Member)

Mr. Ugyen Samdrup
M/s Dzamlha Construction
(Small Member)

GENERAL SECRETARY

Mr. Wangdi Gyeltshen

FORMER PRESIDENTS

FOUNDER OF CAB

Dasho Ugyen Tsechup Dorji
M/s Singye Construction Private Limited
(2000-2012)

Aum Phub Zam
M/s Yarkey Construction Private Limited
(2013-2016)

DZONGKHAG LIAISON COMMITTEE MEMBER

UNIT 1

EXECUTIVE COMMITTEE MEMBER

Sl	Name	Company	Class	Designation	Dzongkhag	Mobile No.	Email
1	Mr. Thinlay Gyamtsho	T& K Const. Pvt Ltd	L	President	Thimphu	17601580	tnk_construction46@yahoo.com
2	Mr. Ugyen Penjor	Kabab Construction	M	V/President	Thimphu	77110660	kabcons23@gmail.com
3	Mr. Tshering Yonten	Chogyel Construction	M	V/President	Thimphu	17670311	tsheringy2009@gmail.com
4	Mr. Kezang Choejoe	K.C Const Pvt Ltd	L	ECM	Thimphu	17110537	kezangchoejoe@gmail.com
5	Mr. Karma Wang-chuk	K.W Const Pvt Ltd	L	ECM	Thimphu	17110764	kwcpl02@gmail.com
6	Mr. Karma G. Wangchuk	K. Gangri Const	L	ECM	Paro	17110673	karmagwang5@druknet.bt
7	Mr. Neten Wangdi	Neten Const. Pvt Ltd	L	ECM	Thimphu	17119380	netencons@gmail.com
8	Mr. Dawa Norbu	Druk Wangyel Const	M	ECM	Trongsa	17600352	agaydawa@gmail.com
9	Mr . Rinchen Daba	R.D Construction	M	ECM	Punakha	77101444	rdconstruction@gmail.com
10	Mr. Pema Tenzin	Druk Phunsum Const	M	ECM	Wangdue	17607506	drukpconst@gmail.com
11	Mr. Dorji	Druk Yusel Const	M	ECM	Paro	17622122	dtshokay@yahoo.com
12	Mr. Tshering Drukpa	Karma Construction	S	ECM	Tsirang	17551881	yeshidema2011@gmail.com
13	Mr. Passang Dorji	Sangzam Construc-tion	S	ECM	Wangdue	17649322	passangdorji743@gmail.com
14	Mr. Ugyen Sam-drup	Dzamlha Construc-tion	S	ECM	Punakha	17611004	ugyensamdrup88@gmail.com

DZONGKHAG LIAISON COMMITTEE MEMBER OF BUMTHANG DZONGKHA

Sl	Name	Company	Class	Designation	Dzongkhag	Mobile No.	Email
1	Mr. Ugyen Dorji	M/s. Uee Dee Construction	M	Chairman	Bumthang	77119611	udeebumthang@gmail.com
2	Mr. Rinchen Dorji	M/s. Banga Construction	M	Member	Bumthang	17554799	chamkhar0245@gmail.com
3	Mr. Wangda	M/s. Norzang Construction	M	Member	Bumthang	17120055	wangdadrukpa03@gmail.com
4	Mr. Dorji	M/s. Saram Construction	M	Member	Bumthang	17120051	dorjisaram@yahoo.com
5	Mr. Tshering Tenzin	M/s. Tshering Namdruk Construction	M	Member	Bumthang	17820035	ttenzin72@gmail.com
6	Mr. Karma Thinley	M/s. Choeing Construction	S	Member	Bumthang	77223382	
7	Mr. Karma	M/s. Yearang Construction	S	Member	Bumthang	17114541	karmakurjy13@gmail.com

DZONGKHAG LIAISON COMMITTEE MEMBER OF CHHUKHA DZONGKHA

Sl	Name	Company	Class	Designation	Dzongkhag	Mobile No.	Email
1	Mr. Damchoe	M/s. Tshering Construction	L	Chairman	Chhukha	17110199	tsheringconstruction14@gmail.com
2	Mr. Tashi Dorji	M/s. Dawa Tshering Const. Pvt. Ltd	L	Member	Chhukha	77105760	dawatsheringcpl@gmail.com
3	Mr. Rinchen Khandu	M/s. Goodwill Construction	M	Member	Chhukha	17604310	rinchenkhandu62@yahoo.com
4	Mr. Kinley Penjor	M/s. Yangtam Construction	S	Member	Chhukha	17779354	kin_pin42@yahoo.com
5	Mr. Tshencho	M/s. Dawa Dendup Construction	S	Member	Chhukha	17977100	dawa17977100@gmail.com
6	Mr. Namgay Dorji	M/s. Namgay Dorji Construction	S	Member	Chhukha	17602865	namgayt673@gmail.com
7	Mr. Penjor Dorji	M/s. Penjor Dorji Construction	S	Member	Chhukha	17510750	pemcdb3@gmail.com

DZONGKHAG LIAISON COMMITTEE MEMBER OF DAGANA DZONGKHA

Sl	Name	Company	Class	Designation	Dzongkhag	Mobile No.	Email
1	Mr. Krishna Bdr. Katwal	M/s. Divya Construction	S	Chairman	Dagana	17692036	krishnabdr647@yahoo.com
2	Mr. Kinzang Tobgay	M/s. Samphel Lhendup Construction	S	Member	Dagana	17683356	
3	Mr. Dagap Gyeltshen	M/s. Dagap Gyeltshen Construction	S	Member	Dagana	17693711	Gy@gmail.com

DZONGKHAG LIAISON COMMITTEE MEMBER OF HAA DZONGKHAG

Sl	Name	Company	Class	Designation	Dzongkhag	Mobile No.	Email
1	Mr. Sangay	M/s. Sangay Const. Pvt Ltd	L	Chairman	Haa	17117787	klhayul7@yahoo.com
2	Mrs. Passang Wangmo	M/s. Jigme P Thinley Construction	L	Member	Haa	77105760	
3	Mr. Kipchu	M/s. Kipchu Construction	M	Member	Haa	17111324	Kipchuconstruction@gmail.com
4	Mr. Tshewang Namgyel	M/s. Daysang Construction	M	Member	Haa	17110772	somgyel77@gmail.com
5	Mr. Tshering	M/s. Gha Construction	S	Member	Haa	77241785	tsheringtshering1967@gmail.com
6	Mr. Thinley Tenzin	M/s. Iekey Construction	S	Member	Haa	17111801	
7	Mr. Samba	M/s. Samba Construction	S	Member	Haa	17119707	sonamchodey87@gmail.com

DZONGKHAG LIAISON COMMITTEE MEMBER OF LHUNTSE DZONGKHAG

Sl	Name	Company	Class	Designation	Dzongkhag	Mobile No.	Email
1	Mr. Karma Chophel	M/s. Jigme Dorji Construction	M	Chairman	Lhuntse	17116184	karmachophel555@yahoo.com
2	Mr. Karma Penden	M/s. KD Samdrup Construction	L	Member	Lhuntse	17113180	k.penden@gmail.com
3	Mr. Karma Tenzin	M/s. KTP Construction	M	Member	Lhuntse	17610013	wangx12@yahoo.com
4	Mrs. Karma Choki	M/s. Samphel Dendup Construction	M	Member	Lhuntse	17130850	tsheringy1979@gmail.com
5	Mr. Tsheringla	M/s. Sengling Phuensum Construction	S	Member	Lhuntse	17131893	dorjeecring1973@gmail.com
6	Mr. Karma Chophel	M/s. Tshering Peldar Construction	S	Member	Lhuntse	17546828	namgyelyeshi@gmail.com
7	Mr. Sonam Gyeltshen	M/s. S Gyeltshen Construction	S	Member	Lhuntse	77166666	samdenlhuendrup@gmail.com

DZONGKHAG LIAISON COMMITTEE MEMBER OF MONGAR DZONGKHAG

Sl	Name	Company	Class	Designation	Dzongkhag	Mobile No.	Email
1	Mr. Wangchukla	M/s. Chethun Construction	M	Chairman	Mongar	17968070	chukwang666@gmail.com
2	Mr. Pema Namgyel	M/s. Sonam Yeshi Construction	M	Member	Mongar	77117292	tdendup24@yahoo.com
3	Mr. Chophel	M/s. Yongphel Builders	M	Member	Mongar	17777999	yongphel777@gmail.com
4	Mr. Sangay Wangchuk	M/s. Lhayuel Lhamtoen Construction	S	Member	Mongar	17820995	sangayw@ymail.com
5	Mr. Penjor	M/s. Jaibab Penjor Construction	S	Member	Mongar	17661862	ppenjor2016@gmail.com
6	Mr. Kezang Dawa	M/s. Drami Khorlo Construction	S	Member	Mongar	17650214	kelzang098@gmail.com

DZONGKHAG LIAISON COMMITTEE MEMBER OF PARO DZONGKHAG

Sl	Name	Company	Class	Designation	Dzongkhag	Mobile No.	Email
1	Mr. Karma G.Wangchuk	M/s. K.Gangri Construction	L	Chariman	Paro	17110673	karmagwangchuk5@druknet.bt
2	Mr. Penden Dorji	M/s. Druk Penden Construction	L	Member	Paro	17634567	
3	Mr. Tsengay	M/s. Gongphel Construction	M	Member	Paro	17170028	dechenongmo@gmail.com
4	Mr. Gem Tshering	M/s. Damchu Choley Construction	S	Member	Paro	17606765	
5	Mr. Chimi Dorji	M/s. K.F Construction	S	Member	Paro	17622525	cd1711@druknet.bt
6	Mr. Dorji	M/s. Parop Construction	S	Member	Paro	17622122	dtshokay@yahoo.com

DZONGKHAG LIAISON COMMITTEE MEMBER OF PUNAKHA DZONGKHAG

Sl	Name	Company	Class	Designation	Dzongkhag	Mobile No.	Email
1	Mr. Rinchen Daba	M/s. R.D Construction	M	Chairman	Punakha	17111105	rdconstruction@gmail.com
2	Tshewang Norbu	M/s. HI-Tech Const Pvt.Ltd	L	Member	Punakha	17118090	htcbhutan@gmail.com
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6	Mr. Namgyel	M/s. Kinga Wangdi Construction	S	Member	Punakha	77291933	
7	Mr. Ugyen Samdrup	M/s. Dzamlha Construction	S	Member	Punakha	17611004	ugyensamdrup88@gmail.com

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4	Mr. S.K Pradhan	M/s. Kismat Construction	S	Member	Samtse	77256493	nor_wang@hotmail.com
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4	Mr. Rai Bdr Das	M/s. RP3 Builders	M	Member	Sarpang	17611070	rp3builder@gmail.com
5	Mr. Rajan Pradhan	M/s. Alpha Beta Construction	M	Member	Sarpang	17636520	alphabetaconst@gmail.com
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DZONGKHAG LIAISON COMMITTEE MEMBER OF S/JONGHAR DZONGKHAG

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3	Mr. Choba Dendup	M/s. Dunglagang Construction	S	Member	Tsirang	17697587	
4	Mrs. Tshering Lham	M/s. Tshering L Construction	S	Member	Tsirang	17895726	gyemdorjo@gmail.com
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DZONGKHAG LIAISON COMMITTEE MEMBER OF TRASHIGANG DZONGKHAG

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6	Mr. Jigme Dorji	M/s. Saden Construction	S	Member	Trashigang	17121270	
7	Mr. Dorji Gyelt-shen	M/s. Dorji Gyeltshen Construction	S	Member	Trashigang	17734533	dorjigyeltshen378@gmail.com

DZONGKHAG LIAISON COMMITTEE MEMBER OF WANGDUE DZONGKHAG

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3	Mrs. Tshering Pem	M/s. Tshering Karma Construction	M	Member	Wangdue	17618081	
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DZONGKHAG LIAISON COMMITTEE MEMBER OF ZHEMGANG DZONGKHAG

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5	Mr. Kinga Dorji	M/s. Phuntsho Gongphel Construction	S	Member	Zhemgang	17515809	
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UNITS CONVERSION TABLE

UNIT 2

COMMONLY USED UNITS CONVERTION TABLE			
LENGTH	**WEIGHT**	**AREA**	**VOLUME**
1 inch = 2.54 cm	1 kg = 2.205 pounds	1 sq.m = 10,000 sq.cm	1 litre = 0.22 gallon
1 cm = 0.394 inch	1 pound = 0.453 kg	1 hectare = 10,000 sq.m	1 gallon = 4.546 litres
1 km = 0.621 mile	1 pound = 16 ounces	1 sq.km = 100 hectares	1 cum = 35.315 cu.ft
1 mile = 1.609 km	1 ounce = 0.063 pound	1 sq.km = 0.386 sq.mile	1 cu.ft = 0.028 cu.m
1 mile = 1.76 yard	1 ounce = 28.35 gms	1 sq.yard = 9 sq.feet	1 cu.ft = 28.329 litres
1 yard = 0.914 m	1 ton = 1000 kgs	1 sq.yard = 0.836 sq.m	
1 m = 1.094 yard	1 kg = 1000 gms	1 acre = 4840 sq.yard	
1 m = 3.281 feet		1 acre = 4047 sq.m	
1 feet = 30.48 cm			

Common Engineering Design Conversion Factors					
Given	**Multiply by**	**To Find**	**Given**	**Multiply by**	**To Find**
Length [L]			**Energy, Work or Heat [M] $[L]^2$ $[t]^{-2}$**		
Foot (ft)	0.304800	Meter (m)	Btu	1.05435	kJ
Inch (in)	25.4000	Millimeter (mm)	Btu	0.251996	kcal
Mile (mi)	1.609344	Kilometer (km)	Calories (cal)	4.184*	Joules (J)
Area $[L]^2$			ft-lbf	1.355818	J
ft^2	ft-lbf	0.138255	ft-lbf	0.138255	kgf-m
in^2	645.16	mm^2	hp-hr	2.6845	MJ
in^2	6.45160	cm^2	KWH	3.600	MJ
Volume $[L]^3$ & Capacity			m-kgf	9.80665*	J
in^3	N-m	1.	N-m	1.	J
ft^3	0.028317	m^3	**Flow Rate $[L]^3$ $[t]^{-1}$**		
ft^3	7.4805	Gallon	ft^3/min	7.4805	gal/min
ft^3	28.3168	Liter (l)	ft^3/min	0.471934	l/s
Gallon	3.785412	Liter	gal/min	0.063090	l/s
Force or Weight [M] [L] $[t]^{-2}$			**Heat Content**		
kgf	9.80665*	Newton (N)	Btu/lbm	0.555556	cal/g
lbf	4.44822	N	Btu/lbm	2.324444	J/g
lbf	0.453592	Kgf	Btu/ft^3	0.037234	MJ/m^3

Fracture Toughness			**Power [M] [L]^2 [t]$^{-3}$**		
ksi sqr(in)	1.098800	MPa sqr(m)	Btu/hr	0.292875	Watt (W)
Heat Flux			ft-lbf/s	1.355818	W
Btu/hr-ft^2	7.5346 E-5	cal/s-cm^2	Horsepower (hp)	745.6999	W
Btu/hr-ft^2	3.1525	W/m^2	Horsepower	550.*	ft-lbf/s
cal/s-cm^2	4.184*	W/cm^2			
Mass Density [M] [L]$^{-3}$			**Stress [M] [L]$^{-1}$ [t]$^{-2}$**		
lbm/in^3	27.68	g/cm^3	kgf/cm^2	9.80665 E-2*	MPa
lbm/ft^3	16.0184	kg/m^3	ksi	6.89476	MPa
Pressure (fluid) [M] [L]$^{-1}$ [t]$^{-2}$			N/mm^2	1.	MPa
Atmosphere (atm)	14.696	lbf/in^2	kgf/mm^2	1.42231	ksi
atm	1.01325 E5*	Pascal (Pa)	**Temperature***		
lbf/ft^2	47.88026	Pa	Fahrenheit	(°F-32) /1.8	Celsius
lbf/in^2	27.6807	in. H_20 at 39.2°F	Fahrenheit	°F+459.67	Rankine
Specific Heat			Celsius	°C+273.16	Kelvin
Btu/lbm-°F	1.	cal/g-°C	Rankine	R/1.8	Kelvin
Temperature*			**Thermal Conductivity**		
Fahrenheit	(°F-32) /1.8	Celsius	Btu-ft/hr-ft^2-°F	14.8816	cal-cm/hr-cm^2-°C
Fahrenheit	°F+459.67	Rankine			
Celsius	°C+273.16	Kelvin			
Rankine	R/1.8	Kelvin			

**** Indicates exact conversion(s)***

UNIT WEIGHTS OF COMMON CONSTRUCTION MATERIALS

S.No	Material	Theoretical Weight in(KG/M^3)	Approx Weight at Site in		Remarks
			Kg	Per	
1	Cement	1440	50	Bag	
2	Steel	7850	d^2/162		d -dia in mm
3	Sand-				

	Dry	1600	50 to 55	farma	1 farma=1.25cft
	River	1840	57 to 63	farma	1 farma=1.25cft
4	Stone(basalt)	2850 to 2960	48 to 52	farma	metal 12mm to 20mm
5	Water	1000	1	liter	
6	PCC	2240	8.24 to 8.5	Cube mould	cube mould size=15x15x15cm
7	RCC 2% Steel	2420			
8	Bricks	1600 to 1920	1.9 to 2	no	9x4x2 3/4"
			4.8 to 4.9	no	9x6x3 3/4"
9	Brick Masonry	1920			
10	Soil(damp)	1760	50 to 55	cft	Black cotton
11	Cement concrete block(solid)	1800	18 to 20	cft	30x15x20 cm
			10 to 11	no	30x10x20 cm
12	Cement Mortar	2080	57 to 62	cft	
13	Lime Mortar	1760	48 to 52	cft	
14	Lime	640	30	bag	
15	Glass	2530	0.9 to 0.95	sft	4mm tk plain
16	Teak Wood	670 to 830	18 to 20	cft	
17	Sal Wood	990	22 to 24	cft	
18	Marble mosaic tile		2.8 to 3.2	no	25x25x22mm
			4.8 to 5.2	no	30x30x25mm
19	Chequered tile		2.5 to 2.8	no	25x25x22mm
20	Glazed tile15x15cm		0.20 to 0.25	no	5mm tk
21	Marble Stone	2620	5.1	sft	3/4"tk
22	Granite Stone	2460-2800	5.35	sft	3/4"tk
23	Coddappa	2720	6.4	sft	1 1/4"tk
24	A.C.sheet corrugated	16	1.2	sft	
25	Bitumen	1040	220	Drum	200liter drum
26	Window frame (simple design)		1.9 to2.1	sft	
27	Door Frame				
	a)3'00×7'0		25 to 27	no	section 4"x2 1/2"
	b)2'6"x7'0		24 to 26	no	section 4"x2 1/2"

FORMULAS

UNIT 3

Area of a Circle

To calculate the area of a *circle*, the *radius* must be known.

$\pi = 3.14$
r = radius
A = area

$A = \pi r^2$

Ellipses

Minor Axis (b)

Major Axis (a)

To calculate the area of an *ellipse*, the lengths of the *major* and *minor axis* must be known.

a = major axis
b = minor axis
$\pi = 3.14$
A = area

$A = \pi(.5a)(.5b)$

Area of a Triangle

To calculate the area of any *triangle*, the *base* and *height* must be known.

b = base
h = height
A = area

$A = .5(bh)$

Parallelograms

To calculate the area of a *parallelogram*, the *base* and *height* must be known.

b = base
h = height
A = area

$A = bh$

Multisided Polygons

Area calculation of a *multisided polygon*:

s = side length
f = distance between flats or diameter of inscribed circle
n = number of sides
A = area

$A = n\frac{s(.5f)}{2}$

Multisided Polygons

Area calculation of a *multisided regular polygon*:

$A = \frac{ns^2}{4\tan\left(\frac{180}{n}\right)}$

A = area
s = side length
n = number of sides

Multisided Regular Polygons

A *regular polygon* can be inscribed in a circle

- An inscribed polygon is a polygon placed inside a circle so that all the vertices of the polygon lie on the circumference of the circle

Multisided Regular Polygons

A *regular polygon* can also circumscribe around a circle.

- A circumscribed polygon is a polygon placed outside a circle so that all of sides of the polygon are tangent to the circle

Mass Properties

In this lesson, you will investigate the following mass properties:

- Volume
- Surface Area
- Density
- Mass

Volume

- Volume is the amount of three-dimensional space contained within an object.
- Design engineers use volume to determine the amount of material needed to produce a part.
- Different formulas for different shapes

Rectangular Prism

V = H x W x L
V = 4" x 4" x 8"
V = 128 in³

Volume Formulas for Prisms, Cylinders, Pyramids, or Cones

If B is the area of the base of a prism, cylinder, pyramid, or cone and H is the height of the solid, then the formula for the volume is

$V = BH$

Note: You will need to calculate the area of the shape for the base of the prism. For example: If the solid is a triangular prism, then you will need to calculate the area of the triangle for the base and then calculate the volume.

Volume: Measurement

- *Volume* is the amount of three dimensional space enclosed by an object
  - Two methods to determine volume
    - Calculate using geometry of object
    - Measure indirectly using water displacement (or 3D scanner)

Density

- *Density* is a measure of the amount of matter per unit of volume

High Density | Low Density

- Objects more dense than water sink
- Objects less dense than water float

Density

- Density can be indicated in multiple ways
  - Mass Density = mass per unit volume
  - Weight Density = weight per unit volume

Formula Sheet

Mass and Weight

$m = VD_m$ (9.1)
$W = mg$ (9.2)
$W = VD_w$ (9.3)

V = volume
D_m = mass density
m = mass
D_w = weight density
W = weight
g = acceleration due to gravity

$m = VD_m$
$D_m = \frac{m}{V}$
$W = VD_w$
$D_w = \frac{W}{V}$

Matter: Mass vs. Weight

- *Mass* is the amount of matter in an object or the quantity of the inertia of the object
- *Weight* is the force of gravity on mass

$W = mg$

W = weight
m = mass
g = acceleration of gravity

- Many materials are purchased by weight

Mass vs. Weight

Contrary to popular practice, the terms *mass* and *weight* are not interchangeable and do not represent the same concept.

$$W = mg$$

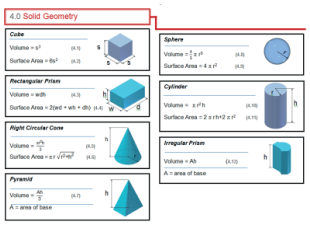
weight = *mass* x *acceleration due to gravity*
(lbs) (slugs) (ft/sec^2)

$g = 32.16\ ft/sec^2$

Properties of Solids

Volume, *mass*, *weight*, *density*, and *surface area* are properties that all solids possess. These properties are used by engineers and manufacturers to determine material type, cost, and other factors associated with the design of objects.

Formula Sheet



Density

Mass Density (D_m) is an object's *mass* per unit *volume*.

SI System
grams per cubic centimeter
($lb/in.^3$)

Weight density (D_w) is an object's *weight* per unit *volume*.

U S Customary System
pounds per cubic inch
($lb/in.^3$)

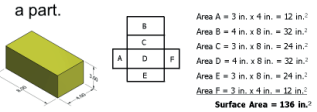
Area vs. Surface Area

There is a distinction between *area* (A) and *surface area* (SA).

- *Area* describes the measure of the two-dimensional space enclosed by a *shape*.
- *Surface area* is the sum of all the areas of the faces of a three-dimensional *solid*.

Surface Area

- Surface area is the area of the exterior surface of an object.
- Surface area is important when determining coatings and heat transfer of a part.



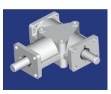
Physical Properties

A physical property is a property that can be observed or measured without changing the identity of the matter.

Examples of Physical Properties:

Volume	Density	Color
Surface Area	Centroid	Moment of Inertia
Mass	Odor	Temperature
Weight	Viscosity	Electric Charge
Boiling Point	Melting Point	Attraction to magnets

Centroid



- A 3D point defining the geometric center of a solid.
- Do not confuse centroid with the center of gravity.
  - The two only exist at the same 3D point when the part has uniform geometry and density.

Principal Axes

- The lines of intersection created from three mutually perpendicular planes, with the three planes' point of intersection at the centroid of the part.

The X, Y, and Z axes show the principal axes of the ellipsoid.

Work Points

A ***work point*** is an independent entity whose location is defined in space. Work points may be placed or projected onto part faces, linear edges, or onto an arc or circle. Work points can be constrained to the center points of arcs, circles, and ellipses.

Work Axes

A ***work axis*** is a line that extends forever in two directions. Work axes are useful for locating the center of a hole or cylinder, are used in the creation of revolved features, and may be constrained to in assembly models.

Work Planes

Work planes are continuous two-dimensional planes that can be used to establish sketch planes. Assembly constraints can also be applied to work planes.

What are Working Drawings?

- Working drawings are a complete set of documents that specify how an object will be manufactured and assembled. Each set should include:
- Part Drawings
- Assembly Drawings
- Parts List
- Any Special Specifications or Instructions.

Working Drawings

- Elements of Working Drawings
- Drawing Layout
- Drawing Views
- Dimensioning
- Annotations
- Multiple Features

STEEL TABLE

UNIT 4

EQUAL ANGLES

Size (mm)	Section Weight (Kg/Mtr)	Wt.per pc (6mtr)	No.of Pcs per MT
35 x 35 x 5	2.60	15.60	64
35 x 35 x 6	3.00	18.00	56
38 x 38 x 3	1.71	10.26	97
40 x 40 x 5	3.00	18.00	56
40 x 40 x 6	3.50	21.00	48
45 x 45 x 5	3.40	20.40	49
45 x 45 x 6	4.00	24.00	42
50 x 50 x 5	3.80	22.80	44
50 x 50 x 6	4.50	27.00	37
60 x 60 x 5	4.50	27.00	37
65 x 65 x 5	4.90	29.40	34
65 x 65 x 6	5.80	34.80	29
65 x 65 x 8	7.70	46.20	22
65 x 65 x 10	9.40	56.40	18
75 x 75 x 6	6.80	40.80	25
75 x 75 x 8	8.90	53.40	19
75 x 75 x 10	11.00	66.00	15
80 x 80 x 6	7.30	43.80	23
80 x 80 x 8	9.60	57.60	17
80 x 80 x 10	11.80	70.80	14
90 x 90 x 6	8.20	49.20	20
90 x 90 x 8	10.80	64.80	15
90 x 90 x 10	13.40	80.40	12
90 x 90 x 12	15.80	94.80	11
100 x 100 x 6	9.20	55.20	18
100 x 100 x 8	12.10	72.60	14
100 x 100 x 10	14.90	89.40	11
100 x 100 x 12	17.70	106.20	9
110 x 110 x 8	13.40	80.40	12
110 x 110 x 10	16.60	99.60	10
110 x 110 x 12	19.70	118.20	8
130 x 130 x 10	19.70	118.20	8
130 x 130 x 12	23.40	140.40	7
150 x 150 x 12	27.40	164.40	6
150 x 150 x 16	35.80	214.80	5

UNEQUAL ANGLES

Size (mm)	Section Weight (Kg/Mtr)	Wt.per pc (6mtr)	No.of Pcs per MT
45 x 30 x 5	2.80	16.80	60
45 x 30 x 6	3.30	19.80	51
75 x 50 x 6	5.60	33.60	30
75 x 50 x 8	7.40	44.40	23
100 x 75 x 8	10.50	63.00	16
100 x 75 x 10	13.00	78.00	13
125 x 75 x 8	12.10	72.60	14
125 x 75 x 10	14.90	89.40	11
150 x 75 x 10	17.00	102.00	10
150 x 115 x 10	20.10	120.60	8
150 x 115 x 12	24.00	144.00	7
150 x 115 x 16	31.40	188.40	5

ROUND BAR

Size (mm)	Section Weight (Kg/Mtr)	Wt.per pc (6mtr)	No.of Pcs per MT
10 mm	0.60	3.60	278
12 mm	0.90	5.40	185
14 mm	1.20	7.20	139
16 mm	1.60	9.60	104
18 mm	2.00	12.00	83
20 mm	2.50	15.00	67
22 mm	3.00	18.00	56
25 mm	3.85	23.10	43
28 mm	4.83	28.98	35
32 mm	6.30	37.80	26
36 mm	8.00	48.00	21
40 mm	9.90	59.40	17
50 mm	15.41	92.46	11
53 mm	17.32	103.92	10
56 mm	19.34	116.04	9
63 mm	24.50	147.00	7
71 mm	31.08	186.48	5
80 mm	39.50	237.00	4
90 mm	49.94	299.64	3
100 mm	61.66	369.96	3

RIBBED BAR / TMT

Size (mm)	Section Weight (Kg/Mtr)	Wt.per pc (6mtr)	No.of Pcs per MT
8 mm	0.50	3.00	333
10 mm	0.60	3.60	278
12 mm	0.90	5.40	185
14 mm	1.21	7.26	138
16 mm	1.60	9.60	104
18 mm	2.00	12.00	83
20 mm	2.50	15.00	67
22 mm	3.00	18.00	56
25 mm	3.85	23.10	43
28 mm	4.86	29.16	34
32 mm	6.30	37.80	26
36 mm	8.00	48.00	21
40 mm	9.86	59.16	17

SQUARE BAR

Size (mm)	Section Weight (Kg/Mtr)	Wt.per pc (6mtr)	No.of Pcs per MT
8 mm	0.50	3.00	333
10 mm	0.80	4.80	208
12 mm	1.10	6.60	152
16 mm	2.00	12.00	83
20 mm	3.14	18.84	53
22 mm	3.80	22.80	44
25 mm	4.90	29.40	34
28 mm	6.15	36.90	27
32 mm	8.00	48.00	21
40 mm	12.60	75.60	13
45 mm	15.90	95.40	10
50 mm	19.60	117.60	9
56 mm	24.61	147.66	7
63 mm	31.20	187.20	5

CHANNEL

Size (mm)	Section Weight (Kg/Mtr)	Wt.per pc (6mtr)	No.of Pcs per MT
75 x 40 (L)	5.10	30.60	33
75 x 40 (M)	6.00	36.00	28
75 x 40 (H)	7.14	42.84	23
100 x 50 (L)	8.00	48.00	21
100 x 50 (H)	9.56	57.36	17
125 x 65	13.10	78.60	13
150 x 75	16.80	100.80	10
175 x 75	19.60	117.60	9
200 x 75	22.80	136.80	7
250 x 80	30.20	181.20	6
250 x 82	34.20	205.20	5
300 x 90	41.50	249.00	4
400 x 100	49.50	297.00	3

TEE BARS

Size (mm)	Section Weight (Kg/Mtr)	Wt.per pc (6mtr)	No.of Pcs per MT
20 x 20 x 3	0.90	5.40	185
30 x 30 x 3	1.40	8.40	119
40 x 40 x 6	3.50	21.00	48
50 x 50 x 6	4.50	27.00	37
75 x 75 x 10	10.95	65.70	15

H-BEAM / JOIST

Size (mm)	Section Weight (Kg/Mtr)	Wt.per pc (6mtr)	No.of Pcs per MT
150 x 75	15.00	90.00	11
175 x 85	19.50	117.00	9
200 x 100	25.40	152.40	7
250 x 125	38.10	228.60	4
300 x 140	46.10	276.60	4
350 x 140	52.40	314.40	3
400 x 140	61.60	369.60	3

FLAT BARS

Size (mm)	Section Weight (Kg/Mtr)	Wt.per pc (6mtr)	No.of Pcs per MT
25 x 3	0.59	3.54	282
25 x 6	1.20	7.20	139
25 x 10	2.00	12.00	83
32 x 6	1.50	9.00	111
32 x 10	2.50	15.00	67
35 x 6	1.60	9.60	104
35 x 10	2.80	16.80	60
40 x 6	1.90	11.40	88
40 x 8	2.50	15.00	67
40 x 10	3.10	18.60	54
40 x 12	3.80	22.80	44
45 x 6	2.10	12.60	79
45 x 10	3.50	21.00	48
45 x 12	4.20	25.20	40
45 x 16	5.60	33.60	30
50 x 6	2.40	14.40	69
50 x 8	3.10	18.60	54
50 x 10	3.90	23.40	43
50 x 12	4.70	28.20	35
50 x 16	6.30	37.80	26
50 x 20	7.80	46.80	21
53 x 16	6.60	39.60	25
56 x 16	7.00	42.00	24
65 x 8	4.10	24.60	41
65 x 10	5.10	30.60	33
65 x 12	6.10	36.60	27
65 x 20	10.20	61.20	16
65 x 25	12.80	76.80	13
75 x 8	4.70	28.20	35
75 x 10	5.90	35.40	28
75 x 12	7.10	42.60	23
75 x 20	11.80	70.80	14
75 x 25	14.70	88.20	11
75 x 32	18.80	112.80	9
100 x 10	7.80	46.80	21
100 x 12	9.40	56.40	18
100 x 16	12.60	75.60	13
100 x 20	15.70	94.20	11
100 x 25	19.60	117.60	9
110 x 20	17.30	103.80	10
150 x 12	14.10	84.60	12
150 x 16	18.80	112.80	9
150 x 20	23.60	141.60	7
150 x 25	29.40	176.40	6
150 x 32	37.7	226.20	4
150 x 45	53.00	318.00	3
180 x 12	17.00	102.00	10
180 x 16	22.60	135.60	7
180 x 18	25.40	152.40	7
180 x 20	28.30	169.80	6
200 x 10	15.70	94.20	11
200 x 12	18.80	112.80	9
200 x 16	25.10	150.60	7
200 x 20	31.40	188.40	5
200 x 25	39.20	235.20	4
220 x 20	34.50	207.00	5
250 x 12	23.60	141.60	7
250 x 20	39.20	235.20	4
250 x 25	49.10	294.60	3
300 x 12	28.30	169.80	6
300 x 16	37.70	226.20	4
300 x 20	47.10	282.60	4
300 x 25	58.90	353.40	3

NOTE:

- WEIGHT PER PIECE CONSIDERED FOR STANDARD 6-METER LENGTH
- NO. OF PCS PER METRIC TONNE CONSIDERED FOR 6-METER LENGTH
- WT PER PC AND NO OF PCS PER MT ARE APPROX. ESTIMATES
- ALL DATA IS FOR BLACK UNTREATED MILD STEEL BARS ONLY
- TOLERANCE AS PER BIS – ISI GUIDELINES APPLICABLE FOR EACH ITEM CORRELATED TO ITS RESPECTIVE QA GUIDELINE.

USEFUL INFORMATION

UNIT 5

1. Reinforced Cement Concrete (R.C.C.)

1.1 Steel:

(a) Steel reinforcing bars shall be of mild steel or deformed steel or standard specifications and shall be free from corrosion, loose rust, scales, oil, grease, paint, etc.

(b) The steel bar shall be round and capable of being bent (doubled over) without fracture.

(c) Bars shall be hooked or bent accurately and placed in position as per design and drawing and bound together tight with 20 S.W.G. annealed steel wire at their point of intersection.

(d) Bars shall be bent cold by applying gradual and even motion, bars of 40 mm diameter and above may be bent by heating to dull red and allowing to cool slowly without immersing in water or quenching.

(e) Joints in the bar should be avoided as far as possible. When joints have to be made, an overlap of 40 times diameter of the bar shall be given with proper hooks at end and joints should be staggered. Bigger diameter bars should be joined by welding and tested before placing in position.

(f) While concreting, steel bars shall be given side and bottom covers of concrete by placing pre-cast cover blocks underneath of 1:2 cement mortar of 2.5 cm x 2.5 cm in section and thickness of specified cover, 4 cm to 5 cm for beam and 1 cm to 2 cm for slab.

(g) During laying and compacting of concrete, the reinforcing bars should not move from their positions and bars of the laid portions should not be disturbed.

(h) The values of usual percentage of steel assumed for various items will be as shown below:

Sr. No.	Item	Percentage of steel (By volume of concrete)
1	Slab	0.9 to 1.5%
2	Foundation	0.5 to 1%
3	Wall	1 to 2%
4	Column	1 to 3%
5	Lintel, Beam	1.5 to 3%

(i) As the steel weighs 7850 kg per cubic metre, the 1% steel reinforcement means there will be 78 kg of steel per cubic metre of volume of concrete.

(j)The quantity of binding wire for reinforced steel is usually assumed as 1 to 1.3 kg per quintal of steel reinforcement.

(k) Due allowance is to be made for wastage of steel which is usually between 5% to 10%.

(l) The following minimum clear cover shall be maintained:

i. Footings.....50 mm
ii. Raft Foundation top.....50 mm
iii. Raft Foundation bottom.....75 mm
iv. Strap Beam.....50 mm
v. Grade Slab.....20 mm
vi. Columns.....40 mm
vii. Shear Wall.....25 mm
viii. Beams.....25 mm
ix. Slabs.....15 mm
x. Flat Slab.....20 mm
xi. Stair case.....15 mm
xii. Retaining Wall.....20/25 mm on earth
xiii. Water Retaining Structures.....20/30 mm

1.2 Centering and shuttering:

(a) Centering and shuttering shall be made of timber or steel plate close and tight to prevent leakage of mortar, with necessary props, bracing and wedges sufficiently strong and stable and should not yield on laying concrete and made in such a way that they can be slackened and removed gradually without disturbing the concrete.

(b) No plastering shall be made on the concrete surface.

(c) A coat of oil washing should be applied over the shuttering or paper should be spread to have a smooth and finished surface and to prevent adherence to concrete.

(d) For slab and beam, small camber should be given in centering, 1 cm per 2.5 m with a maximum of 4 cm.

(e) The centering and shuttering shall be removed slowly and carefully so that no part is disturbed or damaged.

(f) In normal circumstances where the ambient temperature does not fall below 15°C and where ordinary Portland cement is used and adequate curing is done, following striking period may be adopted:

Type of Formwork	Minimum period before striking formwork
a) Vertical formwork to columns	16 – 24 hrs
b) Soffit formworks to slab (Props to be re-fixed immediately after removing the formworks)	3 days
c) Soffit formworks to beams (Props to be re-fixed immediately after removing the formworks)	7 days
d) Props to slabs: i. Spanning up to 4.5m ii. Spanning over 4.5m	7 days 14 days
e) Props to beams and arches: i. Spanning up to 6 m ii. Spanning over 6 m	14 days 21 days

For other cements and lower temperature, the stripping time recommended above may be suitably modified.

1.3 Proportion of cement concrete:

(a) Cement concrete shall be of 1:1.5:3 proportion by volume for slabs, beams and lintels, and columns unless otherwise specified.

1.4 Materials:

(a) Cement, sand and coarse aggregate shall be same as for cement concrete.

(b) The stone aggregate shall usually be 20 mm to 6 mm gauge unless otherwise specified.

(c) For heavily reinforced concrete members as in case of ribs of main beams, the maximum size of aggregate should usually be restricted to 5 mm less than the minimum clear distance between the main bars or 5 mm less than the minimum cover to the reinforcement, whichever is smaller.

Where the reinforcement is widely spaced, limitations of the size of the aggregate may not be so important.

1.5 Laying:

(a) Before the laying of the concrete, the shuttering shall be clean, free from dust, dirt, and other foreign matters.

(b) The concrete shall be deposited (not dropped) in its final position. Maximum Free fall of concrete allowed is 1.50 m.

(c) In case of columns and walls it is desirable to place concrete in full height if practicable, so as to avoid construction joints, but the progress of concreting in the vertical direction shall be restricted to one metre per hour.

(d) Care should be taken that the time between mixing and placing of concrete shall not exceed 20 minutes so that the initial setting process is not interfered with.

(e) During winters, concreting shall not be done if the temperature falls before -ve 4°C.

(f) Concrete shall be protected from frost and concrete affected by frost shall be removed and work redone.

(g) Concrete shall be compacted by mechanical vibrating machine until a dense concrete is obtained.

(h) The vibration shall continue during the entire period of placing concrete.

(i) Compaction shall be completed before the initial setting time starts, i.e., within 30 minutes of addition of water to the dry mixture.

(j) Over vibration which will separate coarse aggregate from concrete shall be avoided.

(k) After removal of the form work in due time, the concrete surface shall be free from honey combing, air holes or any other defect.

(l) Concreting shall be laid continuously, if laying is suspended for the rest of the following day, the end shall be sloped at an angle of 30° and made rough for future jointing.
(m) When the work is resumed, the previously sloped position shall be roughened, cleaned and watered and a coat of neat cement shall be applied and the fresh concrete shall be laid.

(n) For successive layer the upper layer shall be laid before the lower layer has set.

(o) Structures exceeding 45 meter in length shall be divided by one or more expansion joints.

(p) Structures in which plan dimension changes abruptly shall be provided with expansion joints at the section where such changes occur.

(q) Reinforcement shall not extend across an expansion joint at the break between the sections shall be complete.

1.6 Finishing:

(a) If specified, the exposed surface shall be plastered with 1:3 cement sand mortar not exceeding 6 mm thickness and the plastering shall be applied immediately after removal of the centering while the concrete is green.

(b) Immediately before applying plaster, the surface of concrete shall be kept wet and neat cement wash shall be given.

1.7 Measurement:

(a) Measurement shall be taken in cum for the finished work and no deduction shall be made for the volume of steel.

(b) Steel reinforcement shall be measured under a separate item in kilogram or tonne.

(c) Plastering, if any, shall not be included in the measurement.

(d) The rate for R.C.C. work shall be for the complete work excluding steel but including centering and shuttering and all tools and plants.

2. Plain Cement Concrete (P.C.C)

2.1 Aggregate

Aggregate shall be inert materials and shall be clean, dense, hard, sound, durable, non-absorbent and capable of developing good bond with mortar.

2.1.1 Coarse aggregate:

(a) Coarse aggregate shall be of hard broken stone of granite or similar stone, free from dust, dirt and other foreign matters.

(b) The stone ballast shall be of 20 mm size and down and all should be retained in a 5 mm square mesh and well graded such that the voids do not exceed 42%.

(c) The gauge of stone ballast shall be specified depending on the thickness of concrete and nature of work. For building work 20 mm gauge and for road work and mass work 40 to 60 mm gauge may be used.

2.1.2 Fine aggregate:

(a) Fine aggregate shall be of coarse sand consisting of hard, sharp and angular grains and shall pass through screen of 5 mm square mesh.

(b) Sand shall be of standard specifications, clean and free from dust, dirt and organic matters.

(c) Sea sand shall not be used. Fine aggregate may also be of crushed stone if specified.

Simple Test for Sand Quality

Good quality sand as an aggregate in your cement mix is vital to achieving the finest quality building material that will guarantee that your project stands the test of time. To ensure you add only the finest quality sand to your cement mix, conduct the following simple sand quality test:

• Weigh out 5 kg of dry sand and 1 kg of cement. Measure out 1-litre of water and two further separate volumes of water, one of 200ml and one of 300ml
• Mix the sand, cement and 1 litre of water. If the mix is plastic and workable, the sand is good quality. If not:
• Mix in 200ml water. If the mix is plastic and workable the sand is average quality. If the mix is still not workable, mix 300ml of water. If the mix is now workable, the sand quality is poor and it should only be used for unimportant work
• If the mix is still not workable the sand is unsuitable for mortar and plaster

2.1.3 Cement

(a) Cement shall be fresh Portland cement of standard ISI specifications, and shall have the required tensile and compressive stresses and fineness.

(b) Cement shall be stored in dry places on a raised platform about 200mm above floor level and 300mm away from walls. Bags to be stacked not more than 10 bags high in such a manner that it is adequately protected from moisture and contamination.

(c) Cement should be stored in a weather proof shed or container and fully protected. It should be stored so as to ensure “first in - first out” use.

(d) Cement shall be tested for its setting:
1. The initial setting time shall not be less than 30 minutes.
2. The final setting time shall not be more than 10 hours.

2.1.4 Water

Water shall be clean and free from alkaline and acid matters and suitable for drinking purposes.

2.2 Batching and Mixing Materials

Correct batching and uniform mixing are essential to producing concrete of consistent quality. Generally speaking, in the retail cement market, materials are batched by volume and mixed by hand or in relatively small mechanical mixers.

The following building tips are therefore relevant:
• One bag of cement has volume of 33 litres (0.033m3).
• One builder's wheelbarrow, filled level to the top, has volume of 65 litres (0.065m3). One wheelbarrow is therefore equivalent to two bags of cement by volume.
• Size of standard measurement box at site may be 30 cm x 30 cm x 40 cm or 1.23 cft equivalent to one bag of cement.
• Sand bulks in volume when damp. If your sand is dry, reduce the amount of sand batched by 20 to 25%. For example, batch 200 litres of dry sand for the low strength concrete mix rather than 260 litres of damp sand. The mix yield will be the same but you will need to add more water to the mix to compensate for the lack of water in the sand.
• Stones do not bulk in volume and no correction for stone volume or water content is necessary.
• Do not split bags when batching except for small or unimportant work.
• Use a concrete mixer or hand mix on a dry, clean, non-absorbent surface.
• When mixing concrete by hand, first mix the cement, sand and water thoroughly and mix in the stone last - this saves a lot of effort.
• Mix until the colour and workability of the mix are uniform.
• Add enough water to make the mix plastic and workable. Too little water will make the mix difficult to compact and too much water will weaken the mix.
• The ratio of free water to cement when using saturated surface dry aggregate shall be as low as possible and not exceed 0.60 by weight for all concrete.
• Slump requirement as per IS 456: Lightly reinforced 25 – 75 mm; heavily reinforced 75 – 100 mm & Trench fill (in-situ & Tremie) 100 – 150 mm (For Tremie no need of vibrator)

2.3 Laying:

(a) Concrete shall be laid gently (not thrown) in layers not exceeding 15cm and compacted by pinning with rods and tamping with wooden tampers or with mechanical vibrating machine until a dense concrete is obtained. (For important work mechanical vibrating should be used, for thick or mass concrete immersion type vibrators and for thin concrete surface vibrators should be used for compacting concrete)

(b) Over-vibration which will separate coarse aggregate from concrete should be avoided.

(c) After removal of the form-work in due time, the concrete surface shall be free from honey combing, air holes or other defects.

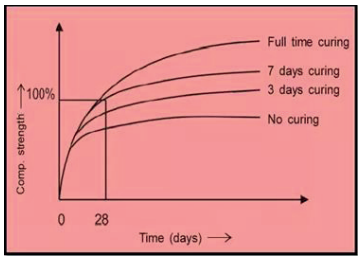
(d) Concrete shall be laid continuously, if laying is suspended for rest or for the following day, the end shall be sloped at an angle of 30º and made rough for future jointing.

(e) When the work is resumed, the previous sloped portion shall be roughened, cleaned and watered and grout of neat cement shall be applied and the fresh concrete shall be laid.

(f) For successive layer, the upper layer shall be laid before the lower has set.

2.4 Curing:

Curing is a procedure of promoting the hydration of cement for development of concrete strength and controlling the temperature. As a result of curing, we can achieve higher strength and reduced permeability which is very vital for long term strength or durability. The effect of curing has been shown in the following figure:



CURING:

Super sulphate cement: 7 days

Ordinary Portland Cement: 10 days

Minerals & Admixture added cement: 14 days

The curing is required for full development of strength. Initially the entire concrete has sufficient quantity of water for hydration. But over the passage of time, the water is lost due to evaporation or it is consumed due to reaction of hydration. The relative humidity, thus, falls below 80% level and the hydration process eventually stops.

IMPORTANT NOTES TO REMEMBER ON CURING

• Curing should be started as earliest as possible
• For the portion of concrete which is covered with formwork, the curing should be started as soon as formwork is removed.
• On exposed surface, it should be started when concrete has sufficiently hardened such that it doesn't get disturbed by curing.
• Ensure uninterrupted curing. If it is discontinued for any reason, the reaction of hydration will be stopped permanently. The partial hydration makes the capillary pores discontinuous and water can't enter the concrete even if the curing is started again.
• High strength concrete should be cured at an early age.
• There is a widespread belief that humid climate is sufficient and curing is not required in rainy season.
• The person generally entrusted for curing is the most unskilled person who doesn't appreciate the importance of curing and assumes that curing is a process of wastage of water, time and money.
• It can't be made a measurable item in the contract.

2.5 Minimum Cement Content, Maximum Water-Cement Ratio and Minimum Grade of Concrete for Different Exposures with Normal Weight Aggregates of 20mm Nominal Maximum Size

Sl No.	Exposure	Plain Concrete			Reinforced Cement Concrete		
		Minimum cement content kg/ m3	Maximum Free Water Cement Ratio	Minimum Grade of Concrete	Minimum cement content kg/m3	Maximum Free Water Cement Ratio	Minimum Grade of Concrete
i)	Mild	220	0.6	--	300	0.55	M 20
ii)	Moderate	240	0.6	M 15	300	0.5	M 25
iii)	Severe	250	0.5	M 20	320	0.45	M 30
iv)	Very Se-vere	260	0.45	M 20	340	0.45	M 35
v)	Extreme	280	0.4	M 25	360	0.4	M 40

2.6 Estimation of Material quantities

1) The materials required for preparation of cement concrete are cement, sand (i.e. fine aggregates) and ballast (i.e. coarse aggregates) which are to be mixed in the predetermined proportion.

2) The voids in the coarse aggregates are filled by fine aggregates and that in the fine aggregates are filled with by cement paste (i.e. cement and water).

3) Thus, the wet volume of the cement concrete (i.e. when water is added to the dry cement concrete mix) will always be less than its corresponding dry volume (i.e. sum of total volume of each ingredient added together).
4) It has been observed that in order to prepare 1 cum. of wet cement concrete, the corresponding dry volume required is about 1.52 cum.

5) Knowing the mix of the cement concrete (i.e. 1:1:2 or 1:1.5:3 or 1:2:4 etc.) the ingredient materials required can be determined as follows:

To determine the materials required for 1 cum. of (wet) concrete of 1:1.5:3 proportion, the dry volume of concrete required will be 1.52 cum. (which shrinks to 1 cum. after adding of water to it)

Therefore, the total quantity of cement required $= \frac{1.52}{(1+1.5+3)} = \frac{1.52}{5.5} = 0.276\ cum$

As 50 kg cement bag is equivalent to 0.0347 cum of cement

The quantity of cement required = 0.276/0.0347 = 7.9 bags

Similarly, Quantity of sand required: 0.276 x 1.5 = 0.414 cum

And, Quantity of Coarse aggregate required: 0.276 x 3 = 0.828 cum

The following table gives the indicative quantities of materials required for cement concrete of various proportion (i.e. mix) by volume.

NOMINAL MIX			WATER CEMENT RATIO	WATER PER 50KG BAG OF CEMENT	CEMENT		SAND (CUM)	CRUSHED STONES (CUM)
CEMENT	F.A.	C.A.			BY WEIGHT (KG)	BY NUMBER OF BAGS		
1	1	-	0.25	12.5	1015	20.3	0.710	-
1	1.5		0.28	14	815	16.3	0.855	-
1	2	-	0.3	15	687	13.74	0.963	-
1	2.5	-	0.35	17.5	585	11.7	1.023	
1	3	-	0.4	20	505	10.1	1.06	-
1	4	-	0.53	26.5	395	7.9	1.106	-
1	6	-	0.7	35	285	5.7	1.197	-
1	8	-	0.9	45	220	4.4	1.232	-
1	1	2	0.3	15	560	11.2	0.392	0.784
1	2	2	0.42	21	430	8.6	0.602	0.602
1	1.5	3	0.42	21	395'	7.9	0.414	0.828

1	1.66	3.33	0.48	24	363	7.26	0.419	0.838
1	2	3	0.5	25	385	7.7	0.539	0.808
1	2	3.5	0.53	26.5	330	6.6	0.462	0.808
1	2	4	0.55	27.5	310	6.2	0.434	0.868
1	2.5	3.5	0.57	28.5	305	6.1	0.534	0.748
1	2.5	4	0.6	30	285	5.7	0.499	0.798
1	3	4	0.65	32.5	265	5.3	0.556	0.742
1	2.5	5	0.65	32.5	255	5.1	0.446	0.892
1	3	5	0.69	34.5	240	4.8	0.504	0.84
1	3	6	0.75	37.5	215	4.3	0.452	0.904
1	4	8	0.95	47.5	165	3.3	0.462	0.924

Notes:
1. F.A. = Fine Aggregates, C.A. = Coarse Aggregates
2. The table is based on assumption that the voids in sand and crushed stone are 40 and 45 percent respectively.
3. Air content of 1 percent has been assumed.
4. For gravel aggregates decrease cement by 5 percent, increase sand by 2 percent and coarse aggregate in proportion to fine aggregate in mix.
5. No allowance has been made in the table for bulking of sand and wastage.

2.7 Tips for Using Concrete in an Environmentally Responsible Manner:

- Use the recommended mix design proportions on the bag to mix the concrete
- Use the correct strength mix to minimise waste
- Do not add too much water – this will reduce the concrete strength
- Mix just enough concrete (mortar or plaster) for your project
- If you are building a house, make sure you design for optimal energy efficiency
- Use good quality aggregates and potable water
- Cure the concrete properly to get maximum durability
- Do not waste water when cleaning
- Dispose of your paper bags in a responsible manner
- Use local raw materials - this reduces the carbon footprint of the transport component
- Recycle building rubble where possible

1. Earthwork

3.1 General information

(a) Earthwork shall be taken in cum and the length, breadth and height or depth shall be measured to get the cubic content.

(b) Earthwork of different nature as in excavation in foundation, in trenches, etc., and in filling in plinth, in banking, etc., shall be measured under separate items.

(c) Earthwork in different kinds of soil as ordinary soil, hard soil, ordinary rock, hard rock, etc., shall be classified separately and measured under separate item.

(d) Excavation shall include throwing of the excavated earth at least one meter clear of the edge

of excavation.

(e) Dressing or trimming and levelling or grading, ramming and consolidation thickness of each layer, etc., shall be described and included in the item of earthwork.

(f) Measurement of excavation or trenches or borrow pits shall be taken for average dimensions.

(g) When the ground is fairly uniform 'Deadman" or "Tell-Tales" which shall be left at suitable intervals to determine the average depth of excavation.
(h) For uneven or sloping ground, diagonal 'Tell-Tales' shall be left.

(i) No deduction shall be made for Deadman, Tell-Tales which shall be removed after the measurements have been taken and checking has been completed.

(j) When the ground is very uneven, levels shall be taken before the start and after the completion of the earthwork by levelling instrument and the average depth of excavation or filling shall be determined from these levels.

(k) Whenever it is not possible or convenient to make measurements from cutting, the filling or banking shall be measured and deduction for shrinkage or voids (settlement allowances) shall be made from actual measured cubic contents depending on the nature of the soil and methods of consolidation.

(l) Generally, 10% deduction shall be made in caser of ordinary consolidated fills and in case of consolidation done by heavy machinery, a deduction of 5% shall be made.

(m) Lead and lift:
i. The measurement shall be taken separately for every 30 m lead or distance and every 1.5 m lift or height or depth.
ii. The lead shall be measured from the centre of the area of excavation to the centre of the area of spoil heap.
iii. Similarly, lift shall be measured from the centre of excavation to the centre of spoil heap.
iv. The normal rate is for each unit of 30 m lead and 1.5 m lift. For grater lead or lift, the rate shall be different for every unit of 30 m lead, and for every unit of 1.5 m lift.

3.2 Foundation trench:

(a) Unless otherwise specified, the foundation trench shall be measured in cum for rectangular section, bottom width being width of concrete and the depth shall be measured as vertical depth even though the contractor might have excavated with sloping sides for convenience.

3.3 Return, fill and ram:

(a) Returning, filling and ramming excavated earth shall be taken in cum under a separate item and shall include spreading in layers of 20 cm in depth, watering, ramming and levelling.

3.4 Puddling:

(a) Clay puddle work shall be taken in cum and shall be described including supply of clay, its preparation, placing in layer of 15 cm, ramming, etc.

3.5 Surface dressing:

(a) Trimming and dressing of natural ground to remove vegetation and small irregularities not

exceeding 15 cm deep shall be taken in sqm under a separate item 'Surface Dressing'.

(b) Cutting down of trees exceeding 30 cm girth shall be accounted separately and enumerated i.e., taken in numbers, stating the girth at 1 m above ground and paid separately.

3.6 Surface excavation:

(a) Excavation exceeding 1.5 m in width as well as 10 sqm in plan but not exceeding 30 cm in depth shall be described as Surface excavation and measured in sqm

3.7 Pumping:

(a) When spring water requires pumping, the work of pumping and dewatering shall be taken under separate item.

3.8 Timbering:

(a) Timbering or 'Planking and Strutting' for protecting the sides of trench or loose earth, shall be measured in sqm of face supported, and shall be classified under separate items as: –

(b) Depth not exceeding 1.5 m,

(c) Depth exceeding 1.5 m but not exceeding 5 m,

(d) Depth exceeding 5 m.

(e) Timbering shall include all necessary timber work including walls, struts, poling boards, etc.

(f) Both sides of trench shall be taken as one side area and shall be equal to length x depth of timbering.

3.9 Measurement of Earthworks

As per I.S. 1200 of 1974, the measurement of the item of earth work shall be carried out as follows:

(a) Earth work in excavation and earthwork in filling or embankment are to be considered separately under different items and shall be measured in cubic metres by multiplying the length of excavation (or filling) by its width (or breadth) and the depth (or height). i.e., Quantity of earth work = L x B x D (or H) cubic metres subject to the dimensions of L, B and D (or H) as shown on the drawings.

(b) It is necessary to record the measurement of excavation item separately for every additional 1.5m lift and also for additional different leads (i.e., disposing off the excavated material beyond the boundary of the proposed work) as the rates of excavation will vary according to different lifts and leads.

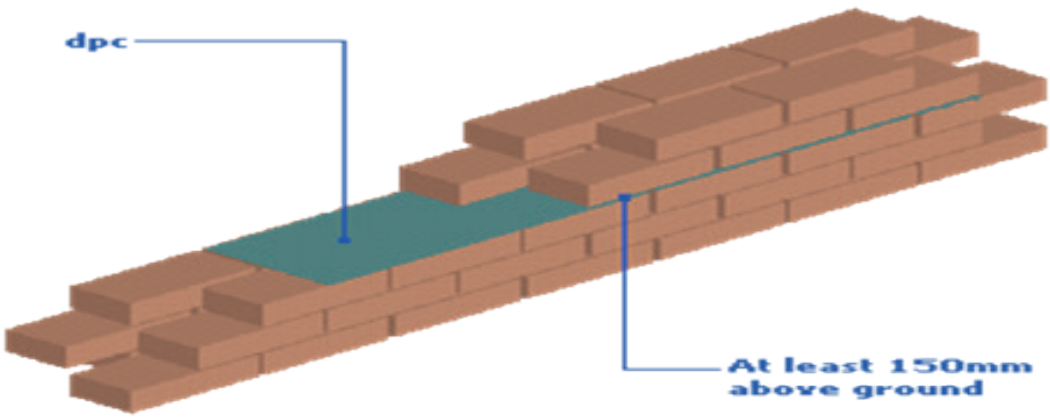
(c) As the same excavated material is usually used for 'back filling' (i.e., return fill and ramming the portion of the gap between the original portion of the excavated ground and the completed masonry in foundations) no separate provision is necessary for this work.

(d) In case of sand filling in plinth, this item is to be taken separately and measured in cubic metres.

(e) The Excavation in different soil strata is usually classified as follows:
i. Ordinary loose soft soil
ii. Hard soil
iii. Soft moorum
iv. Hard moorum
v. Soft rock
vi. Hard rock requiring blasting
vii. Hard rock requiring chiselling

(f) Usually shoring, strutting, preparing the foundation bed and dewatering, if necessary, is also included under this item.

4. Damp Proof Course



4.1 Materials

(a) Damp proof course shall consist of cement, coarse sand and stone aggregate of 1:1 ½:3 proportion with 2% of impermo or cem-seal, or Acco proof by weight of cement or other standard water proofing compound (1 kg per bag of cement).

(b) The damp proof course shall be applied at the plinth level in a horizontal layer of 2.5 cm thickness.

(c) The cement shall be fresh Portland cement of standard specifications.

(d) The sand shall be clean, coarse of 5 mm size and down, and the stone aggregate shall be hard and tough of 20 mm size well graded and free from dust and dirt.

4.2 Mixing

(a) Mixing shall be done in a masonry platform or in a sheet iron tray in the proportion of 1:1 ½:3 by measuring with measuring boxes.

(b) The cement is first mixed thoroughly with the water proofing compound to the required quantity, and then mixed dry with sand in the proportion of 1:1 ½.

(c) The mix of cement and sand shall than be mixed dry with stone aggregate to have the proportion 1:1 ½:3.

(d) Clean water shall then be added slowly and gradually while being mixed, to the required quantity to give a plastic mix of the required workable consistency.

(e) The mixing shall be done by turning at least three times to give a uniform and homogeneous concrete.

4.3 Laying

(a) The level of the surface of the plinth shall be checked longitudinally and transversely.

(b) The top of walls at damp proof course should be laid with frogs of the brick downward.
(c) Side forms or shuttering of strong wooden batten of 2.5 cm thickness shall be fixed properly and firmly on both sides to confine the concrete so that the shuttering does not get disturbed during compaction and mortar does not leak through.

(d) The inner edges of the shuttering shall be oiled to prevent concrete adhering to it.

(e) The surface of the wall shall be cleaned and the masonry shall be wetted by watering before concrete is laid.

(f) The concrete shall be laid within half an hour of mixing and compacted thoroughly by tamping to make dense concrete and levelled both longitudinally and transversely.

(g) After two hours of laying the surface of the concrete shall be made rough and chequered so as to form a key with the wall above.

(h) The damp proof course shall be laid in continuation in one day without any joints.

(i) Joints or breaks if unavoidable shall be given at the sills of the doors or the openings.

(j) If joints cannot be avoided the joint shall be sloped and the sloped surface shall be applied with neat cement wash just before starting concreting on the following day.

(k) Shuttering may be removed after three days.

(l) On removal of shuttering the edges should become smooth without any honey combing.

4.4 Curing

(a) The damp proof course shall be cured by watering and kept wet for 7 days and the construction of wall above may be started.

(b) The surface shall be cleaned and wetted before masonry is started.

4.5 Painting with Asphalt

(a) Two coats of asphalt painting may be applied on the upper surface of damp proof course, if specified.

(b) The first coat of hot asphalt at 1.5 kg per sqm shall be applied uniformly on the surface when the concrete is dry and the painted surface is blinded immediately with coarse sand and the surface is tamped lightly.

(c) The second coat of hot asphalt at 1 kg per sqm should then be applied uniformly and the surface is immediately blinded with coarse sand and tamped lightly.

4.6 2cm Damp proof course

(a) The damp proof course may be of 2 cm thick layer of 1:2 cement and coarse sand mortar with standard water proofing compound at the rate of 1 kg per bag of cement.

(b) The mixing, laying, curing, etc. shall be done in the same manner as above.
The form or shuttering shall be 2 cm thick.

5. Brickwork Ist Class

5.1 Bricks

(a) All bricks shall be of first class of standard specifications made of good brick earth thoroughly burnt, and shall be of deep cherry red of copper colour.

(b) Bricks shall be regular in shape and their edges should be sharp and square and shall emit clear ringing sound on being struck, and shall be free from cracks, chips, flaws and lumps of any kind.

(c) Bricks shall not absorb water more than one-sixth of their weight after one hour of soaking by immersing in water.

(d) Bricks shall have a minimum crushing strength of 105 kg per sq.cm

5.2 Mortar

(a) Mortar shall be specified and materials of mortar shall be of standard specifications.

(b) For cement mortar, cement shall be fresh Portland cement of standard specifications.

(c) Sand shall be sharp, clean and free from organic and foreign matters.

(d) For rich mortar, coarse or medium sand should be used and for weak mortar, local fine sand may be used.

(e) Proportion of cement sand mortar may be 1:3 or 1:6 as specified.

(f) Materials of mortar shall be measured to have the required proportion with measuring box and first mixed dry to have a uniform colour in a clean masonry platform and then mixed by adding clear water slowly and gradually to have workable consistency and mixed thoroughly by turning at least three times.

(g) Fresh mixed mortar shall be used, old and stale mortar shall not be used, and mortar for one hour's work only shall be mixed with water so that the mortar may be used before setting starts.

(h) Lime surkhi (or sand or cinder) mortar if specified shall be mixed in the specified proportion

by grinding in mortar mill for at least three hours on the same day of use.

(i) Lime shall be fresh and slaked and screened at site of work.

(j) Fresh mixed mortar within 24 hours shall be used. Old and stale mortar shall not be used.

(k) For small work, hand mixing may be allowed in the same manner as for cement mortar described above.

(l) Proportion of lime surkhi (or sand or cinder) mortar may be 1:2 to 1:3 as specified.

5.3 Soaking of bricks

(a) Bricks shall be fully soaked in clean water by submerging in tank for a period of 12 hours immediately before use.

(b) Soaking shall be continued till air bubbling is ceased.

5.4 Laying

(a) Bricks shall be well bounded and laid in English bond unless otherwise specified.

(b) Every course shall be truly horizontal and wall shall be truly in plumb.

(c) Vertical joints of consecutive course shall not come directly over one another, vertical joints in alternate course shall come directly over one another.

(d) No damaged or broken bricks shall be used.

(e) Closers shall be of clean-cut bricks and shall be placed near the ends of the walls but not at the other edge.

(f) Selected best shaped bricks shall be used for face work.

(g) Mortar joint shall not exceed 6 mm in thickness and joints shall be fully filled with mortar.

(h) Bricks shall be laid with frogs upward except in the top course where frogs shall be placed downward.

(i) Brickwork shall be carried out not more than 1 m height at a time.

(j) When one part of the wall is to be delayed, stepping shall be left at an angle of 45º.

(k) Corbelling or projections which were made should not be more than ¼ brick projection in one course.

(l) All joints should be raked and faces of wall cleaned at the end of each day's work.

5.5 Curing

(a) The brickwork shall be kept wet for a period of at least 10 days after laying.

(b) At the end of each day's work the tops of walls shall be flooded with water by making small weak mortar edging to contain at least 2.5 cm deep water.

5.6 Protection

(a) The brickwork shall be protected from the effect of sun, rain, frost, etc., during the construction and up till such time it is green and likely to be damaged.

5.7 Scaffolding

(a) Necessary and suitable scaffolding shall be provided to facilitate the construction of brick wall.

(b) Scaffolding shall be sound and strong and supports and members sufficiently strong so as to withstand all loads likely to come upon them.

5.8 Measurements

(a) Brickwork shall be measured in cum

(b) Different kinds of brickwork with different mortar shall be taken under separate items.

(c) The thickness of wall shall be taken as multiple of half bricks as half brick 10 cm, 1 brick 20 cm, 1½ brick 30 cm and so on.

(d) The rate shall be for the complete work including scaffolding and all tools and plants.

5.9 Approximation of quantity of bricks

Normally, 500 no. of bricks (brick size: 20cmx10cmx10cm (0.002cum), considering 10mm for mortar) are required for 1 cum of brick masonry.

suppose, ratio of mortar= 1:6, then sum: 1+6 = 7

We use 30% mortar in brick work, So, 1 cum of brickwork has 0.3 cum of mortar.

Therefore, following dry material is required:

Cement = 1x 0.30/7 = .043 cum

Density of cement=1440 Kg/cum; So, volume for 1 bag of Cement = 50/(1440) = 0.0347 cum

Cement = 0.043/0.0347 = 1.2 bags

Sand = 0.043 x 6 = 0.26 cum or 0.26 x 35.3 = 9.18 cft

6. Plastering Cement Mortar or Lime Mortar

(a) The joints of the brickwork shall be raked out to a depth of 18 mm and the surface of the wall shall be washed and kept wet for two days before plastering.

(b) The materials of mortar, cement and sand or lime and surkhi or sand, or kankar lime, as specified should be of standard specifications.

(c) The materials or mortar shall be first dry mixed, by measuring with boxes to have the required proportion (as specified), and then water added slowly and gradually and mixed thoroughly.

(d) The thickness of plaster shall be as specified usually 12 mm applied in two or three coats.

(e) To ensure uniform thickness of plaster, patches of 15 cm x 15 cm strips 1 m apart or 10 cm wide plaster shall be applied first at about 2 m apart to act as a guide.

(f) First mortar shall be dashed and pressed over the surface and then brought to a true smooth and uniform surface by means of float and trowel.

(g) External plastering shall be started from top and worked down towards floor.

(h) Internal plastering shall be started wherever the building frame is ready and centering of the roof slabs have been removed.

(i) Ceiling plastering shall be completed before starting of wall plaster.

(j) All corners and edges shall be rounded.

(k) The plastered surface shall be kept wet for 10 days.

(l) The surface should be protected from rain, sun, frost, etc.

(m) For ideal work, the plastering should be applied in three coats – the rendering or first coat of 10 mm, the floating or second coat of 10 mm to 6 mm and finishing coat of 5 to 6 mm, having a total minimum thickness of 20 mm.

(n) The first coat shall be applied on the prepared raked, cleaned and wetted surface by dashing the mortar and floated roughly with wooden float.

(o) It shall be kept damp for two days.

(p) When the first coat has sufficiently set, the surface shall be wetted and a second coat of plaster shall be applied and brought to true even surface and then lightly roughened with a wooden float to provide bond for the finishing coat.

(q) The second coat shall be kept damp for at least two days and then allowed to dry.

(r) The finishing coat shall be applied on the wetted surface of the second coat and finished smooth to true even surface by float and trowel.

(s) The work shall be tested frequently with a straight edge and plumb bob.

(t) At the end of the day, the plaster shall be left, cut clean to line.

(u) When the next day plastering is started, the edge of the old work shall be scrapped, cleaned and wetted with cement slurry.

(v) At the end of the day, the plastering shall be closed on the body of the wall and not nearer than 15cm to any corner.

(w) Curing shall be started as soon as the plaster has hardened sufficiently not to be damaged

when watered.

(x) The plaster shall be kept wet for at least 10 days.

(y) Any defective plaster shall be cut in rectangular shape and replaced.

(z) If specified, the final surface shall be given special finishing textures, as Scraped textures, Canvas textures, Cork-float finish, Wavy combed finish, Concentric arc finish, etc., with the required tools by engaging an expert worker in the profession.

(aa) Different proportions of mortar which may be used for plastering:

i. Cement, sand mortar – 1:3, 1:4, 1:5, 1:6
ii. Cement, lime, sand mortar – 1:1:6; C:L:S
iii. Lime, surkhi or sand mortar – 1:1, 1:2; Kankar lime mortar, Kankar lime alone.
iv. For ceiling plastering 1:3 cement mortar with coarse sand is generally used.
v. Cement, lime sand mortar is slow setting and has better workability than cement, sand mortar.

6.1. Pointing (Cement Mortar or Lime Mortar)

(a)The joints of the brickwork shall be raked out to a depth of 20 mm and the surface of the wall washed and cleaned and kept wet for two days before pointing.

(b) The materials of mortar, cement and sand, or lime and surkhi or sand, or kankar lime, as specified, shall be of standard specifications.

(c)The materials of mortar shall be first dry mixed by measuring with boxes to have the required proportions as specified (1:2 or 1:3 for cement sand mortar, 1:1 for lime surkhi mortar, or kankar lime mortar), and then mixed by adding water slowly and gradually and thoroughly mixed.

(d) Mortar then shall be applied in the joints slightly in excess and pressed by a proper tool of the required shape.

(e) Extra mortar if any is removed and surface finished.

(f) Mortar shall not be spread over the face of bricks, and the edges of bricks shall be clearly defined to give a neat appearance.

(g) After pointing the surface shall be kept wet for seven days.

6.2. Flush Pointing

(a) The mortar shall be pressed into the raked, cleaned and wet joints and shall be finished off flush and level with edges of brick to give a smooth appearance.

(b) The edges shall be neatly trimmed with a trowel and straight edge.

6.3. Ruled Pointing

(a) The mortar shall be pressed into the raked, cleaned and wet joints and a groove of shape and size of 5 to 6 mm deep shall be formed running a forming tool of steel along the centre line of the joint.

(b) The vertical joints also shall be finished in a similar way at right angles to the horizontal lines.

(c) The finished work shall give a neat and clean appearance with straight edges.

6.4. Weather or Struck Pointing

(a) The mortar shall be applied on the raked, cleaned and wet joints, and horizontal joints shall be pressed and finished with a pointing tool so that the joint is sloping from top to bottom.

(b) The vertical joint shall be finished as ruled pointing.

6.5. Raised or Tucked Pointing

(a) The mortar shall be applied in raked, cleaned and wet joints in excess to form raised bands.

(b) The mortar shall be pressed and run with proper tool to form bands of 6 mm raised and 10 mm width as directed

6.6. Quantity estimation for Plastering

To determine the quantities of cement and sand for 12 mm thick plaster in cement mortar (1:6), the procedure would be as follows:

Considering the area to be plastered as 100 sqm, with a thickness of 12 mm, the quantity of wet mortar required = 100 (sqm) x 0.012 = 1.20 cum.

(This is wet volume that means we need this much volume of cement mortar after mixing water, So for dry volume, we have to add 30-35% as bulkage of sand, we are using 35% and wastage as 20%)

Consider 35% Sand Bulkage = 1.2 m3 x (1+0.2+0.35) (Many of us would use 1.54 as constant)

= 1.86 m3

Cement : Sand (Ratio) = 1 : 6 (Total = 1+6 = 7 Parts)

Cement required (1 Part) = 1.86 x 1/7

= 0.265 m3 /0.0347

= 7.66 bags (Approx – 8 Bags)

Sand required (5 Part) = 1.86 x 6/7

= 1.59 m3

6.6.1. Approximate method

The approximate method of determining the volume of dry mortar required is to multiply the quantity of wet mortar required by a factor 1.8

i.e. Volume of wet mortar required = 0.12 cum.
Therefore, Volume of dry mortar required = 0.12 x 1.8 = 0.216 cum.

Therefore, Quantity of cement required = 0.216 / (1+4) = 0.043 cum.

= 0.043/0.0347 = 1.24 bags = 1.2 bags (1 bag of 50kg cement = 0.0347 cum)

and, Quantity of sand required = [0.216 / (1+4)] x 4 = 0.0173 cum. which is same as determined above.

7. Painting

(a) The brand of the paint shall be specified and ready-made paint of the required color should be used.

(b) If thinning is required, pure turpentine may be added to the required extent.
(c) The surface shall be made perfectly smooth by rubbing with sand paper of different grades, first with coarse one and successively with fine sand papers.

(d) All holes and open joints shall be filled with strong putty or with a mixture of glue and plaster of Paris and smoothed by rubbing with sand paper.

(e) In steel work, all rusts and scales shall be perfectly removed by scraping and brushing.

(f) The number of coats shall be specified, in new work one priming coat and then two coats of paints shall be applied.

(g) The paint shall be applied with brushes evenly and smoothly by crossing and laying off in the direction of grains of wood-work and no brush marks should be visible.

(h) Each coat shall be perfectly dry before the next is applied.

(i) Before the next coat is applied, the surface shall be rubbed with No. 0 sand paper, to give a smooth and glazed surface.

(j) The paint should be stirred in the container immediately before use.

(k) Brushes should be cleaned and washed with turpentine at the end of the day's work and kept dry.

(l) If stiff paint is used, it should be first prepared by mixing with double boiled linseed oil and turpentine to a thin cream.

(m) If old paint is to be removed, it may be removed by washing with soda water, or with caustic soda or blowing with blow lamp and scraping or by using any patent paint remover.

(n) After removing the paint, the surface should be dried and rubbed with sand paper and smoothed before paint is applied.

(o) In old painted surface, if paint is not required to be removed but requires repainting, the surface should be washed with soap water and then paint shall be applied.

(p) In steel work exposed to weather, the painting should be done either with red oxide paint or with aluminium paint.

8.5. Distempering

(a) The distemper shall be of best quality and the colour shall be as specified.

(b) The distemper shall be mixed and prepared and water added, as laid down in the instructions of the manufacturer.

(c) First a paste is made by adding little hot water to the distemper powder and stirred thoroughly, and the paste is allowed to stand for a few minutes.

(d) The paste is then thinned with water to have a thin cream to the consistency of oil paint and stirred thoroughly all the time while applying.

(e) If the surface is rough, it should be smoothened with sand paper.

(f) The surface must be perfectly dry before distempering is commenced.

(g) In new cement plaster the surface shall be washed over with a solution of zinc sulphate, 1kg zinc sulphate in 10 litres of water and then allowed to dry.

(h) In old surface, the surface shall be repaired with plaster of Paris where required and then whole surface should be sand papered and washed and allowed to dry.

(i) The number of coats shall be two or as specified.

(j) The distemper shall be kept well stirred in containers and shall be applied with broad brushes first horizontally and immediately crossed vertically.

(k) Brushing shall not be continued too long to avoid brush marks.

(l) The second coat shall be applied after the first coat is dried up.

(m) After each day's work, the brushes shall be washed and kept dry.

(n) Distempering should be done during dry weather but not during too hot weather, not wet weather.

(o) Oil distemper:

i. Oil distemper is similar to ordinary dry distemper in powder form.
ii. In the oil distemper compound (dry powder), oil is mixed by the manufacturer while manufacturing.
iii. For application of oil distemper, it is mixed with the required quantity of water and then applied on the surface.
iv. The methods of preparation and application are similar as described above

8.6 Color Washing

(a) Color wash shall be prepared with fresh slaked white lime mixed with water to make thin cream adding the colored pigment to the required quantity to give the required tint.

(b) Gum (glue) in the proportion of 100 grams of gum to 16 litres of wash shall be added.

(c) The color wash may be applied in one or two coats as specified.

(d) The method of application shall be same as for white washing.

8.7. White Washing

(a) Fresh white lime slaked at site of work should be mixed with sufficient water to make a thin cream.

(b) The approximate quantity of water required in making the cream is 5 litres of water to 1 kg of lime.

(c) It shall then be screened through a coarse cloth and gum (glue) in the proportion of 100 grams of gum to 16 litres of wash shall be added.

(d) The surface should be dry and thoroughly cleaned from dust and dirt.

(e) The wash shall be applied with jute brush, vertically and horizontally alternatively and the wash kept stirred in the container while using.

(f) Two or three coats shall be applied as specified and each coat shall be perfectly dry before the succeeding coat is applied over it.

(g) After finishing, the surface shall be of uniform colour.

(h) The white wash should not splash on the floor and other surfaces.

(i) In old surface, the surface should be cleaned and repaired with cement mortar where necessary and allowed to dry before white wash is applied.

(j) For final coat, blue pigment powder should be mixed to the required quantity with the lime water to give a bright white surface.

8.8. Measurements:

The length and breadth shall be measured correct to 10 mm. The area shall be calculated in sqm correct to two places decimal, except when otherwise stated. Small articles not exceeding 0.1 sqm of painted surfaces where not in conjunction with similar painted work shall be enumerated. Painting up to 15 cm in width or in girth and not in conjunction with similar painted work shall be given in running metres. Components of trusses, compound girders, stanchions, lattices and similar work shall, however be given in sq. metres irrespective of the size or girth of members. In measuring painting, varnishing oiling etc., of joinery, and steel work etc. the coefficients as in following tables shall be used to obtain the area payable. The following coefficients shall be applied to the areas measured flat and not girth.

Sl. No.	Description of Work	How to Measure	Multiplying co-efficient
I	**WOOD WORK – DOORS, WINDOWS, etc..**		
1	Panelled or framed and braced Doors, windows etc.	Measured flat (not Girthed) including frame	1.30 (for each side)
2	Ledged and battened or ledged, Battened and braced, doors, windows etc.	Edges, blocks, cleat, etc. Shall be deemed to be Included in the item.	1.30 (for each side)
3	Flush doors etc	-do-	1.20 (for each side)
4	Part panelled and part glazed or gauzed Doors, Windows, etc..	-do-	1.00 (for each side)
5	Fully glazed or gauzed doors, windows, Etc.	-do-	0.80 (for each side)
6	Fully venetianed or louvered doors, Windows etc.	-do-	1.80 (for each side)
7	Trellis (or Jaffri) work one way or two way	Measured flat over all, no Deduction shall be made for open spaces, supporting members shall not be measured separately.	2 (for painting all over)
8	Carved or enriched work	Measured flat	2.00 (for each side)
9	Weather boarding	Measured flat not girth, Supporting frame work shall not be measured separately	1.20 (for each side)
10	Wood shingle roofing Measured flat (not girthed)	1.10 (for each side)	
11	Boarding with cover fillets and match boarding	Measured flat (not girthed)	1.05 (for each side)
12	Tile and slate battening	Measured flat over all, no deduction shall be made for open spaces	0.80 (for painting all over)
II	**STEEL: WORK-DOORS, WINDOWS ETC.**		
13	Plain sheeted steek doors or windows	Measured flat (not girthed) including frame edges etc.	1.10 (for painting all over)
14	Fully glazed or gauzed steel doors and windows	-do-	0.50 (for each side)

15	Partly panelled and partly glazed or gauzed doors and windows.	-do-	0.80 (for each side)
16	Corrugated sheeted steel doors or windows	-do-	1.25 (for each side)
17	Collapsible gates	Measured flat	1.50 (for each side)
18	Rolling shutters of interlocked laths	Measured flat (size of opening) all over jamb, guides, bottom rails and locking arrangement etc shall be included in the item (top cover shall be measured separately)	1.10 (for each side)
III	**GENERAL**		
19	Expanded metal, hard drawn steel Wire fabric of approved quality Grill works and gratings in guard bars, balustrades, railings, partitions and m.s. bars in window frames	Measured flat over all, no deduction shall be made for open spaces, supporting members shall not be measured separately	1.0 (for painting all over)
20	Open palisade fence and gates including standards, braces, rail stays etc. in the timber or steel	-do-(see Note No.12)	1.00 (for painting over)
21	Corrugated iron sheeting in roofs, Side cladding etc.	Measured flat (not Girthed)	1.14 (for each side)
22	AC corrugated sheeting in roofs, side cladding etc.	-do-	1.20 (for each side)
23	AC semi corrugated sheeting in roofs, side cladding etc. or Nainital Pattern using plain sheets	-do-	1.10 (for each side)
24	Wire gauze shutters including painting of wire gauze	-do-	1.0 (for each side)

EXPLANATORY NOTE FOR THE TABLE

1. Measurements for doors windows etc., shall be taken flat (and not girth) overall including frames, where provided. Where frames are not provided, the shutter measurements shall be taken.

2. Where doors, windows etc., are of composite types other than those included in Table-1 the different portion shall be measured separately with their appropriate coefficients, the centre line of the common rail being taken as the dividing line between the two portions.

3. The coefficients for doors and windows shall apply irrespective of the size of the frames and shutters members.

4. In case steel frames are used the area of doors, windows shutters shall be measured flat excluding frames.

5. When two faces of a door, window etc. are to be treated with different specified finishes, measurable under separate items, the edges of frames and shutters shall be treated with the one or the other type of finish as ordered by the Engineer, and measurement of this will be deemed to be included in the measurement of the face treated with that finish.

6. In the case where shutters are fixed on both faces of the frames, the measurement for the doorframe and shutter on one face shall be taken in the manner already described. While the additional shutter on the other face will be measured for the shutter area only excluding the frame.

7. Where shutters are provided with clearance at top or/ and bottom each exceeding 15 cm height, such openings shall be deducted from the over-all measurements and relevant co- efficient shall be applied to obtain the area payable.

8. Collapsible gates shall be measured for width from outside to outside of gate in its expanded position and for height from bottom to top of channel verticals. No separate measurements shall be taken for the top and bottom guide rails rollers, fittings etc.

9. Co-efficient for sliding doors shall be the same as for normal types of doors in the table. Measurements shall be taken outside to outside of shutters, and no separate measurements shall be taken for painting guides, rollers, fittings etc.

10. Measurements of painting as above shall be deemed to include painting all iron fittings in the same or different shades for which no extra will be paid.

11. The measurements of guard bars expanded metal, hard drawn steel wire fabric of approved quality grill work and gratings, when fixed in frame work, painting of which is once measured elsewhere shall be taken exclusive of the frames. In other cases, the measurements shall be taken inclusive of the frames.

12. For painting open palisade fencing and gates etc., the height shall be measured from the bottom of the lowest rail, if the palisades do not go below it, (or from the lower end of the palisades, if they project below the lowest rail), up to the top of rails or palisades which-ever is higher, but not up to the top of standards when the latter are higher than the top rails or the palisades. Width of moulded work of all other kinds, as in band rails, cornices, architrave shall be measured by girth. For trusses, compound girders, stanchions, lattice girders, and similar work, actual areas will be measured in sqm and no extra shall be paid for painting on bolts heads, nuts, washers etc. even when they are picked out in a different tint to the adjacent work. Painting of rain water, soil, waste, vent and water pipes etc. shall be measured in running metres of the particular diameter of the pipe concerned. Painting of specials such as bends, heads, branches, junctions, shoes etc. shall be included in the length and no separate measurements shall be taken for these or for painting brackets, clamps etc. Measurements of wall surfaces and wood and other work not referred to already shall be recorded as actual. Flag staffs, steel chimneys, aerial masts, spires and other such objects requiring special scaffolding shall be measured separately. Precautions: All furniture, fixtures, glazing, floor etc. shall be protected by covering and stairs, smears, splashing, in any shall be removed and any damage done shall be made good by the contractor at his cost.

9. Road Works

Bitumen road construction consists of various steps such as preparation of base course, application of bituminous coats, placement of bituminous mix, rolling and check for quality etc. which are discussed

9.1. Steps in Bituminous Road Construction

1. Preparation of the existing base course layer

The existing surface is prepared by removing the pot holes or rust if any. The irregularities are filled in with premix chippings at least a week before laying surface course. If the existing pavement is extremely way, a bituminous levelling course of adequate thickness is provided to lay a bituminous concrete surface course on a binder course instead of directly laying it on a WBM.

2. Application of Tuck Coat

It is desirable to lay AC layer over a bituminous base or binder course. A tack coat of bitumen is applied at 6.0 to 7.5 kg per 10 sqm area, this quantity may be increased to 7.5 to 10 kg for non-bituminous base.

3. Preparation and placing of Premix

The premix is prepared in a hot mix plant of a required capacity with the desired quality control. The bitumen may be heated up to 150 – 177 deg C and the aggregate temperature should not differ by over 14 deg C from the binder temperature.

The hot mixed material is collected from the mixture by the transporters, carried to the location is spread by a mechanical paver at a temperature of 121 to 163 deg C. the camber and the thickness of the layer are accurately verified.

The control of the temperatures during the mixing and the compaction are of great significance in the strength of the resulting pavement structure.

4. Rolling

A mix after it is placed on the base course is thoroughly compacted by rolling at a speed not more than 5km per hour.

The initial or break down rolling is done by 8 to 12 tonnes roller and the intermediate rolling is done with a fixed wheel pneumatic roller of 15 to 30 tonnes having a tyre pressure of 7kg per sq.cm. the wheels of the roller are kept damp with water.

The number of passes required depends on the thickness of the layer. In warm weather rolling on the next day, helps to increase the density if the initial rolling was not adequate. The final rolling or finishing is done by 8 to 10 tonne tandem roller.

5. Quality control of bituminous concrete construction

The routine checks are carried out at site to ensure the quality of the resulting pavement mixture and the pavement surface.

Periodical checks are made for

a) Aggregate grading

b) Grade of bitumen

c) Temperature of aggregate

d) Temperature of paving mix during mixing and compaction.

At least one sample for every 100 tonnes of the mix discharged by the hot mix plant is collected and tested for above requirements. Marshall tests are also conducted.

For every 100 sq.m of the compacted surface, one test of the field density is conducted to check whether it is at least 95% of the density obtained in the laboratory. The variation in the thickness allowed is 6mm per 4.5m length of construction.

6. Finished surface
Road Construction - Finishing

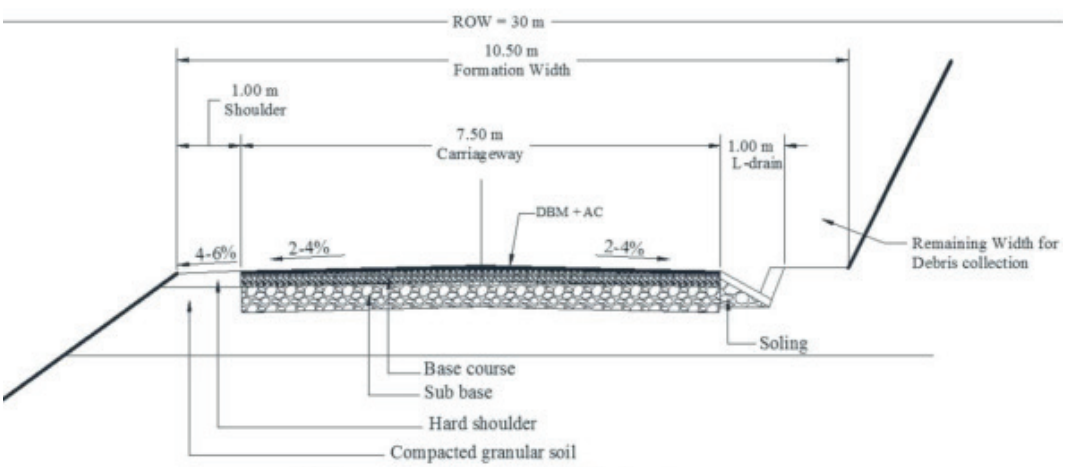
The AC surface should be checked by a 3.0 m straight edge. The longitudinal undulations should not exceed 8.0 mm and the number of undulations higher than 6.0 mm should not exceed 10 in a length of 300 m. The cross-traffic profile should not have undulations exceeding 4.0mm.

9.2. Road Classification

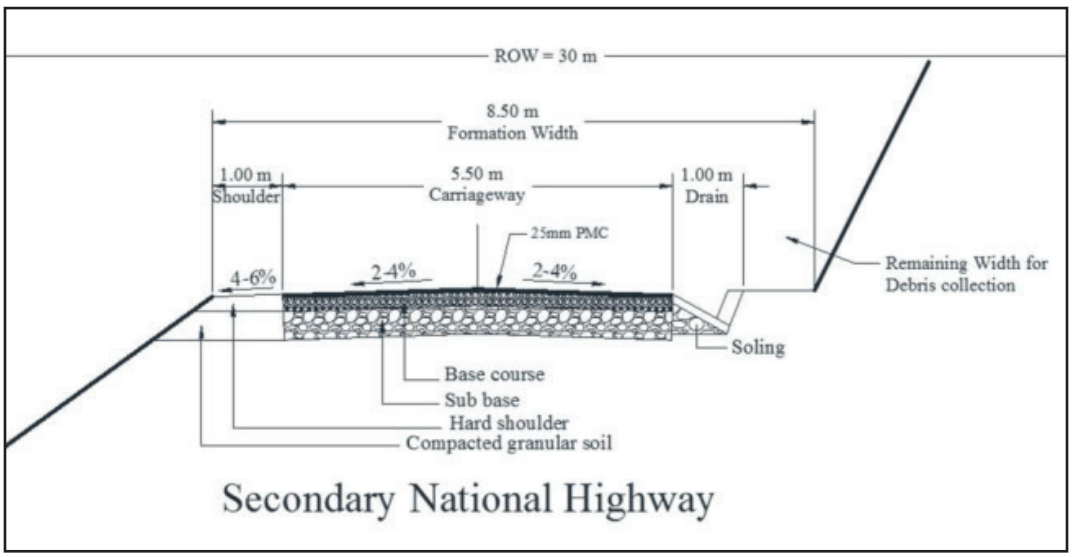
1. Asian Highway (AH)
2. Primary National Highway (PNH)
3. Secondary National Highway (SNH)
4. Dzongkhag/GC Roads (DR)
5. Urban Roads (UR)
6. Farm Roads (FR)
7. Access Roads (AR)

9.3. Right of Way (ROW)

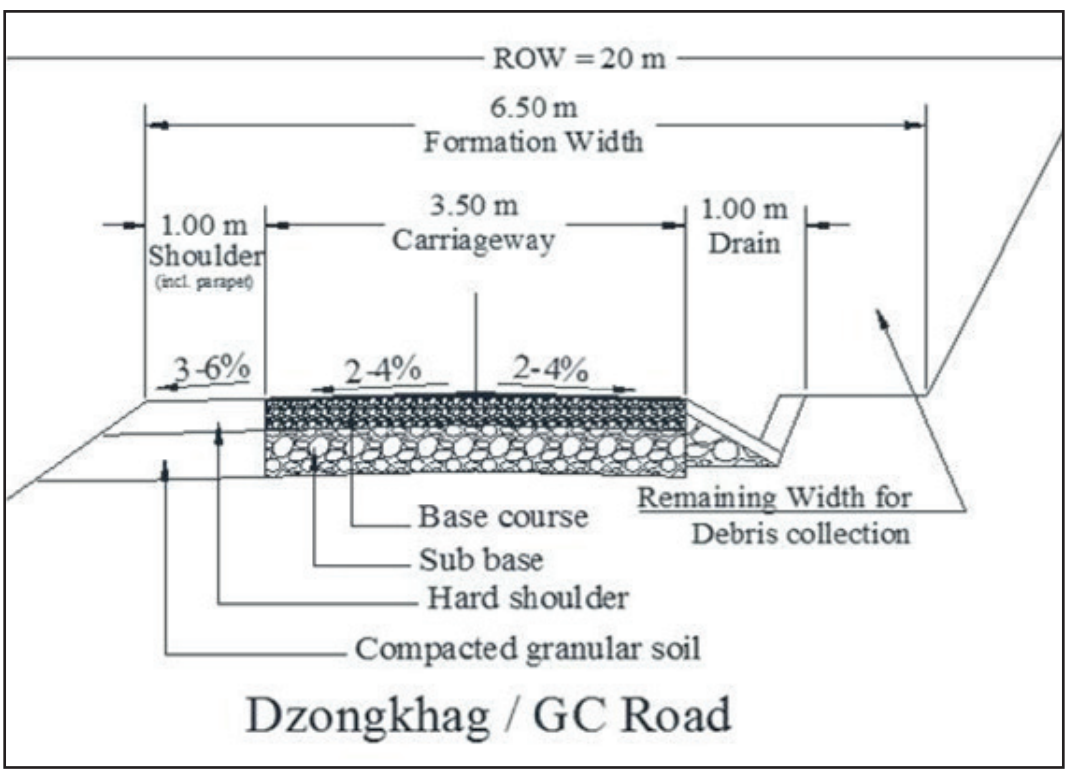
1. All Highway = 100
2. Dzongkhag/GC Roads = 60
3. Farm Roads = 40



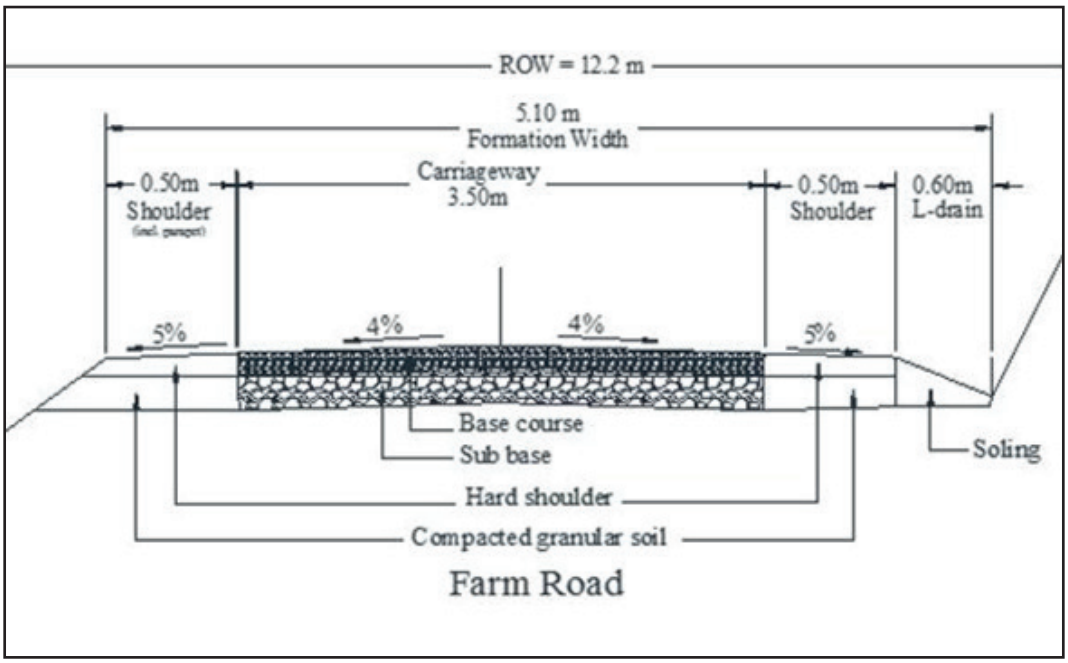
Primary National Highway



Secondary National Highway



Dzongkhag / GC Road



10. FREQUENCY OF TEST OF CONSTRUCTION MATERIALS

Sl. No	Material	Name of Test	Frequency
1	Cement	a) Fineness b) Initial Setting time c) Final Setting time d) Compressive strength e) Soundness	For each consignment of 50 tonnes or part thereof
2	Cement concrete	Compressive strength(kg/sq.cm)	Quantity of 3 cubes up to Section 5 cum - 1 set 6-15 cum - 3 sets 16-30 cum - 3 sets 31-50 cum - 4 sets 51 cum & above - 4 sets +1 additional set for each additional 50 cum or part thereof. (per day work)
3	Mortar	Compressive strength(kg/sq.cm)	Up to 100 cum work/day = one per mixer
4	Sand	a) Silt content b) Fineness modulus	One test for each source
5	Brick Burnt 2nd Class	a) Water absorption b) Crushing Strength	A set of 15 bricks for each 50,000 consignment or part thereof

6	80/60/40 metal and crush metal 25/20/12/10/6	a) specific gravity b) Crushing value c) Abrasion value d) Impact value e) Water absorption f) Flakiness g) Gradation	One test for 200 cum for road work and for change of source for concrete work
7	Soil	a) Proctor density test b) CBR test	a) One test per 8000 cum soil b) One test per 3000 sqm or as required
8	Granular sub-base (Murum)	Plasticity index (PI)	One test per 25 cum of material
9	Hard murum	a) Gradation test b) Plasticity index	One test per 200 cum of quantity
10	Soft murum	Plasticity index (PI)	One test per 25 cum of quantity
11	Stone/Rubble	a) Specific gravity b) Water absorption c) Compressive strength	One test for each source
12	Concrete	Compressive strength	One test of (15cm) 6 cubes per day for first 3 days thereafter for every 60 cum of concrete or three days' work whichever is less
13	Inter locking concrete paving block	a) Compressive strength b) Water absorption	1 set of 8 blocks for every 10,000 blocks
14	Flooring tiles (Mangalore and glazed)	a) Water absorption b) Flexural strength	16 tiles for each 2000 nos
15	Mangalore tile	a) Breaking load b) water absorption	A set of 16 tiles for each 2000 nos
16	Mild/TMT steel	Tensile strength, % Elongation, weight per metre, Yield stress, Bend/Re-bend test	Per 10 MT or per lot of steel consignment

ASPECTS OF TENDERING FOR CONTRACTORS

UNIT 6

1. GENERAL

1.1 Purchasing and Reading the Bidding Documents

The first step in tendering process is purchasing the Bidding Document. Purchase the Bidding Document immediately after the Invitation of Bids is announced. After purchasing the Bidding Document, the reading process should begin. Read the bidding document carefully giving special emphasis to the Bidding Data Sheet (Section II) and the Special Condition of Contracts.
While reading the bidding document, the important information may be entered and recorded separately which basically would guide a bidder to meet with all the requirements of the bidding document in submitting a responsive bid. A sample format is being developed for use by the contractors as given in DATA-TABLE form.

1.2 Drawing a Time Schedule

Once the bidding document is read and after completion of the information on DATA-TABLE, the next important step is to draw a time schedule for completing the whole process of bid preparation & submission. The preparation of such a work plan would to a larger extent help the bidder in ensuring that adequate and proper time frame is allocated to every important activity in preparing the bid within given time. A sample time schedule format is given in the Table below:

Sl. No	Activity	No of Days	Start Date	End Date	Remarks
1	Site Visit				
2	Ascertaining of current Market Rates				
3	Rate Analysis of items				
4	Completing the Priced Bill of Quantities (BoQ)				
5	Preparing and completing the Documentations				
6	Preparation of Bid Security				
7	Finalization and submission of Bid				

2. THE BIDDING PROCESS

2.1 Site Visit:

Many bidders tend to bid for a project without making a visit to the project site. This is a very important aspect of the biding process. In order to submit a bid, it is very important to ascertain the local conditions of the project site such as the following:

- Weather/climatic Condition
- Accessibility of site
- Availability of local construction materials such as sand, stones and aggregates.
- Communication & other facilities such as telephone and internet connections, electricity etc.

- Availability of local labour.
- Social environment of the project site etc.

2.2 Ascertaining of current Market Rates

First a list of materials required for the project must be prepared in the form of a table as given below:

Sl. No	Material (A)	Unit (B)	Place of Availability/ Purchase (C)	Rate of Purchase –(Nu) (D)	Rate at Project Site.(Nu) (E)
1	Sand	Cum	Wangdi	100	110
2	Timber	Cu.ft	Thimphu	200	205
3	Steel	kg	Phuntsholing	35	36
4	Bamboo	m	Phuntsholing	4	5

To prepare and complete the above table, the first thing is to identify and make comprehensive list of all materials required for the project. Once the materials required are identified, the next step is to check the availability of materials and decide on where it is best to purchase them. A material can be locally available and available at other locations, but in anyway the rates must be calculated to derive the rates at Project Site. The rate at project site should be calculated by adding the transportation cost, loading and un-loading cost and any other associated cost involved in such operations to place the materials at project site.

2.3 Rate Analysis

Rate analysis must be carried out for each item in the BoQ. Bidders often tend to submit arbitrary rates either based on experience or playing with the BSR rates by applying certain percentages which expose bidders to greater risks of un-certainties. Therefore, bidders are advised not to use the BSR rates. BSR may only be used as reference document/guideline in analysing your rates.

2.4 Completing the BoQ Table.

Once the rate analysis is completed, the next step is completing the BoQ Table. The tender documents offer ready format for filling in the rates and completing the table. It is always advised to carry out the task in excel sheet first to minimize arithmetic errors. The results can then be copied in to the BoQ Table. (Do not forget to sign or put initial on each page of the BoQ)

2.5 Preparing and completing the Documentation.

(a) Form of Bid

This is one of the most important documents a bidder must submit. In completing the Form of Bid, always remember the following:

- Insert the Bid Amount both in Figures and Words. Here the bid amount should be exactly the same as the total sum derived at the end of BoQ Table.
- The Bid Form should be always signed and Power of Attorney should be enclosed if the Signatory is other than license holder.
- Legal Stamp should always be affixed.
- The format for bid form provided in the bid document has to be used.

(b) Qualification Documents- Technical

In general, bidders are required to furnish documents to assess the technical capability as indicated below:

(1) Experience as Prime Contractor (Similar Work Experience): Provide the list of works (the required number as specified in the Bid Data Sheet) in the format specified in the Bidding document. (Always attach work completion certificate for each work in submitted list).

(2) Equipment List: The list of equipment as required in the Bid Data Sheet must be provided in the same format as specified in the Bidding Document. (Always attach ownership certificates for owned equipment and leasing agreements for leased equipment).

(3) List of Key Personnel: The list of key personnel must be submitted in the same format as specified in the Bidding Document. (Do not forget to submit the CV of each personnel. CVs must be signed and in original. Claimed qualifications must be supported by certificates of education).

(4) Bid Capacity Assessment: For assessing the Bid Capacity, the highest Annual Turnover (A) of the last 3-5 years is required and also the value of existing commitments. Therefore, the bidder is required to submit 2 kinds of information i.e the Turnover for the last 3-5 years and the total value of existing commitments. Turnover for a particular year is the total value of works done in that year.

The Bidder must submit Turnover information in the form of a Table. The Turn Over figure of each year may be supported by the Audited Balance Sheet. If Audited Balance sheet is not available in case of smaller contractors, the turn over for each year must be calculated separately to derive the total value of works done in that particular year. For works that has project duration of more than 12 months, the whole contract amount may be distributed on a pro-rata basis.
To furnish the value B which is the existing commitments, on-going works must be listed in a Table. The Table must show total value of works and value of remaining works for each work. Each value of remaining work must be certified by the respective employer (engineer). Here, care must be taken such that for ongoing works whose contract duration extends beyond the present contract duration, necessary adjustments must be made to exclude portions of the on-going works extending beyond the present contract period.

(C) Qualification Document – Financial
Usually bidder is required to submit evidence of access to financial resources such as lines of credit, loans and overdraft facilities from financial institutions. The amount of liquid assets should be equal to or more than what is specified in the Bidding Data Sheet.

2.6 Preparation of Bid Security

Bid Security must be valid for the duration specified in the Bid Data Sheet. The validity period should normally start from the Date of Bid Submission. In fixing the last date of bid validity, the actual number of calendar days in a particular month must be considered and it must never be taken for granted that a month has 30 days. (It is suggested that the preparation of Bid Security may be done at least one week in advance to the date of bid submission).

2.7 Finalizing and Submission of Bid

Once the above steps are completed, the final step is to compile all the documents together and finalize the bid. Bidders often submit documents which are actually not required. Bidders are NOT REQUIRED to submit the following:

- Instruction to Bidders

- Bidding Data Sheet
- General Conditions of Contract
- Special Conditions of Contract
- Specifications and drawing

Bidders are only REQUIRED to submit the documents comprising the Bid. The documents comprising the Bid are given below:

- The Bid Form or the Form of Bid
- Bid Security
- Priced Bill of Quantities
- All qualifications forms & documents -both technical and financial
- Integrity Pact Statement (once finalized by the Government)
- Any other requirements specified in the Bid Data Sheet.

The last step in the finalization of Bid is the marking and sealing of Bids. Bidders often make numerous mistakes in marking and sealing of bids. The accepted practice of submitting the bid is that original and copies are sealed in separate envelopes marked “ORIGINAL” in case of original and “COPY” in case of copies. Finally, both the original and copies are placed in an outer envelope.

Always remember the following:

For outer envelope:

- Write “CONFIDENTIAL” and address of the client
- Never write the address of your firm
- Include a warning not to open the bid before the time and date specified in the BDS
- Write the name and identification number of the contract
- Use gum or cello tape to properly seal (close) the envelope
- Use of Stapler to close the envelope is not advised

For the Inner Envelopes:

- Do not forget to mark as “ORIGINAL” and “COPY” respectively
- Seal (close) the envelope and sign across it
- Write the name and address of your firm
- Use gum or cello tape to properly seal (close) the envelope
- Use of Stapler to close the envelope is not advised.

3. SUMMARY OF THINGS TO BE REMEMBERED

- Always buy the tender document well before the tender submission date
- Ascertain the correct rate of materials and labour for the project site
- Always complete the preparation of tender documents well in advance of the tender submission date leaving enough time to cross check
- Conduct rate analysis for every item while projecting and deciding on the rates.
- Check the validity of the bid security in relation to what required is by the tender document.
- Submit the tender document leaving adequate time cushion between the actual submission of tender and the deadline of tender submission should there be any unforeseen obstacles.

TYPICAL DATA-TABLE

ITB Cause	Details		Data Required to be filled
1.2	The Intended Date & Contract Duration (days or months)		
4.3 (j)	Ceiling for Sub-Contractors Participation (Indicate %)		
4.5 (a)	Required Highest Annual value of construction works (Nu)		
4.5 (b)	No of similar works experience		
	Minimum value of works of similar experience (Nu)		
4.5 (c)	Are there any requirement of equipment (indicate YES or NO) (If YES List them on a separate sheet)		
4.5 (e)	The minimum liquid asset/credit facilities (Nu)		
9.2	Prebid Meeting (If not Required Leave Blank)	Date:	
		Time:	
12.1	Any additional Materials to be completed and submitted? (Indicate YES or NO; List them separately in case of Yes).		
14.4	Rate Analysis required to be submitted? (Indicate YES or NO).		
15.1	Bid Validity Period (No of Days).		
16.1 & 16.2	The amount of Bid Security (in % or figure)		
18.1	The number of copies of Bid to be submitted		
19	Can the Bid be submitted electronically? (Indicate YES or NO)		
20.1	The Deadline for submission of Bid	Date:	
		Time:	
23.1	Bid Opening	Date:	
		Time:	
30.1	Margin of Preference (Indicate YES or NO)		

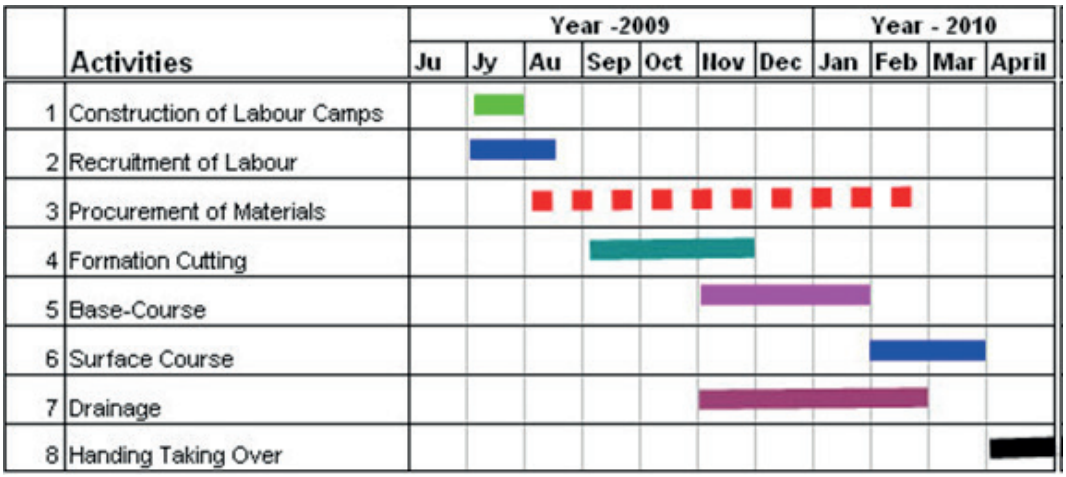
ASPECTS OF CONTRACTING – FOR CONTRACTORS

A. Prior to commencement of works.

Once the letter of work award is received, planning process should begin right-away after the signing of the contract. Before the actual implementation of the work, there are two important aspects to be accomplished as mentioned below:

(1) Preparation of overall implementation schedule

The implementation schedule (IS) should include major activities or operations of the contract implementation and would remain more or less same throughout the contract implementation



While preparing the implementation schedule, the most important thing is to identify the working seasons within the project period. While concreting and cement works cannot be carried out during winter months (especially in higher altitudes), most of the works cannot be carried out in rainy season.

Since the implementation schedule is only going to give an overall picture of the contract implementation, contractors must come up with detailed WORKPLAN for a shorter duration, which may change from time to time depending on the actual progress in the field. Workplans generally are more descriptive, capturing and outlining all the activities intended to be carried out during a particular period. It is mostly desirable to make monthly workplans and execute the works. Additionally, workplans could also be developed on a weekly basis in order to ensure execution of works in a planned manner.

Contractors must also come up with a material's plan, so that the required quantities are available at all times. Purchasing the materials in bulk during the early phase of the contract period is always advantageous to the contractors as materials undergo substantial price fluctuations and very often materials are not available in short notice. Even though bulk purchase of materials in the early phase of the contract is desirable, most of the contractors are not able to do so because of the cash constraints. In any case, the material's plan could help the constant availability of materials to implement the contract as per the devised workplan.

(2) Review of the Scope of the works

Before the start of the actual execution of the works, the scope of the works within the contract must be reviewed properly. Technical specifications and drawings must be read very carefully. The main reason for reviewing the scope of the work is to "identify any missing items and also to identify any substantial changes to the scope of works". The inclusion of new items and those changes require considerable amount of time in obtaining additional technical and financial sanctions. This is how delays and inconveniences during contract implementation could be minimized or avoided.

B. During the implementation phase

The project must be implemented by strictly following the work plan. Un-foreseen events may occur during the implementation phase and contractors must be always ready to cope up with such events so that the work progress is not affected adversely. Contractors are strongly advised to remember the following during the implementation phase:

1. All communications with the employer must be in writing. Any changes to drawings and scope of work must be received in writing.

2. Any conflicts must be revolved as soon as possible. If the conflict is a major one which cannot be solved by mutual agreement, then it must be immediately referred to the Adjudicator appointed under the contract. If there is no adjudicator appointed for the contract or in case it cannot be resolved by the Adjudicator, formal arbitration may be initiated under the existing Arbitration System.

3. At all times, the executed quantities must be checked against the quantities specified in the Contract under the Bill of Quantities (BoQ). In case of likely substantial positive deviations in quantities, the employer must be informed in advance in writing so that administrative and financial sanction for the deviations could be processed well in time.

4. It is extremely important to carry out the works as per the specifications and drawings. It is advised to refer the drawings and specifications from time to time on a constant basis to avoid mistakes.

5. Running Bills must be prepared based on the joint measurements taken with the client's engineer. Contractors are not advised to submit bills by taking measurements independently.

6. While submitting the bills, contractors are advised to keep proper record to substantiate the receipt of the bills for future reference in case of late payment of bills.

7. In case of any compensation events, the client must be informed in writing as early as possible. Remember that the notification of the events later than 30 days will result in relieving the client of all responsibilities of the claims (Refer to Clause 32: Early Warning of the General Conditions of Contract of SBD). To substantiate any claims, always maintain the contemporary records.

C. Post-Implementation phase.

During the defects liability period (DLP), if there is any notification by the client to carry out rectification works, contractors must respond positively in writing. The scope of rectifications must be determined jointly. The scope of works identified for rectification works would include only those of construction defects. Therefore, contractors are advised to be careful while making the joint assessment of the scope of rectification works. Upon completion of the rectification works, the same must be handed over officially to the client with proper Handing/Taking Over record.

D. Summary of things to be remembered

- Always prepare a workplan and execute the works as per the work plan.
- Commence the works as early as possible.
- Any hindrance or delays occurred, which are either due to circumstances out of the control of the contractor or due to the result of the actions or decisions of the implementing agency must be noted and informed in writing. Such delays should be dully verified and certified by the implementing agency which will help in securing time extension later on.
- All discussions held with the implementing agency should be recorded and minutes should be accordingly prepared in writing.
- Always review the progress of the works as often as possible by referring the deadline of project completion.

- Never receive any instructions verbally.
- Make timely supply of materials to the project site.
- Always aim to finish the project well ahead of deadline for project completion to avoid payment of liquidated damages.
- Make effort to conduct monthly or quarterly meetings with the client agency to report on overall performance of the project. This is also the time to raise concerns to the client. Properly maintain record the minutes of the meetings.

ASPECTS OF CONTRACTING – FOR IMPLEMENTING AGENCIES

A. FIXATION OF PROJECT DURATIONS

Implementing agencies tend to prescribe the duration of a project mostly on an arbitrary basis without application of the required rationale. Although, there cannot be any definite formula to calculate project durations, rationalization of project duration can be done by taking into consideration various factors as outlined below:

(1) Climatic conditions

Climatic conditions play a vital role in the implementation of projects. Adverse climatic conditions usually offer lot of hindrances during the project execution. Higher rainfall areas would confront more hindrances due to the rainfalls while most places in the higher altitudes would encounter considerable hindrances due to snowfall or extreme cold weather in the winter months. Therefore, it is extremely necessary to consider climatic or weather conditions of the project site and estimate the workable months in a year. This would help in estimating a realistic project duration.

(2) Remoteness of Project Location

While estimating the project durations, the factor of remoteness of a project location must also be considered. Some projects may be located in very remote areas where there are no road connections, electricity connections, etc, which makes project execution very difficult. In the absence of road facility, materials will have to be transported manually which may consume a lot of time especially when the project is located in extremely remote area. Further, in the remote areas where there are no electricity connections, concreting works would consume more time as machines cannot be deployed for mixing of concrete. Such factors must be considered while allocating project durations.

(3) Availability of construction materials

If materials are locally available, the procurement and supply of materials would be of considerable advantage in the execution of the project. When materials for the project have to be transported from elsewhere, there is cost and time involved and the same have to be provisioned for in determining the contract duration. In some projects, materials are required to be procured from third countries in which case the procurement formalities such as custom inspection & clearance, freight insurance, loading and unloading etc. consume considerable time.

(4) Complexity of project

Some consideration must also be given for complex projects whereby the scope of works would entail execution of work items of complex in nature such as installation of heating system, installation of complex building components, etc. Such complex items of works would require more time than other simple work activities.

Inconsideration of the aforementioned factors, the implementing agencies must rationalize the

project duration and come up with a reasonable project duration. It must also be remembered that constricting the project duration should be the last option and initiated only in case of extremely rare occasions as required by the situation when there is considerable advantage to the client in early completion of the project.

B. FIXATION OF QUALIFICATION CRITERIA

Very often, implementing agencies tend to specify un-necessary or extra qualification criteria in the tender documents leading to inconsistency and inconveniences to the bidders. For example, when it is not practically possible to deploy more than 3 excavators at the worksite, some implementing agencies unnecessarily specify requirement of 5 or more excavators.

For the small category of contractors, technical evaluation is not required. Some implementing agencies tend to specify technical requirements such as trucks and other technical manpower.

C. RATIONALIZING THE BIDS SUBMITTED BY THE CONTRACTORS

It has become a customary practice for implementing agencies to rationalize the bids of the contractor by comparing them to the departmental estimate. Before a bid is rejected supposedly huge cost variation from the department estimate, the bidder has to be given the opportunity to justify its quote and one way of doing it is by asking the bidder to submit its analysis of rates. The departmental estimates, which are at times prepared by inexperienced engineers without proper site verifications are also prone to errors.

D. REJECTION/DISQUALIFICATION OF BIDS

Bids are often rejected by implementing agencies for petty issues such as:

(1) Mistakes in marking and sealing of Bids

Bids should not be rejected for mistakes in the marking and sealing of bids as per footnote 23 on ITB 19.

(2) Non-representation of bidder or bidder's representative in the bid opening.

The absence of a bidder or a bidder's representative in the opening of the bids cannot result in the rejection of a bid.

(3) Non-submission of documents historical in nature

Historical documents are document whose contents and intents don't change at all or change substantially over a reasonable period of time such as tax clearance certificate, license, etc. Although the tender documents may require a bidder to submit those documents, non-submission of those documents should not necessary require the disqualification of a bidder. In case of missing historical documents, procuring agencies can ask the bidder during the evaluation process to submit the missing historical documents giving a reasonable time. In case the bidder doesn't submit the missing documents within the given time limit, then disqualification of the bidder may take It has been experienced that some implementing agencies initiate disqualification of a bidder based on some evidence of ongoing litigation of a bidder. On the strength of the fact that our laws say that a person can presume to be innocent until proven guilty by the court of law, it is in-correct to disqualify a bidder for an ongoing litigation case. It must also be remembered that most of the litigation cases are ones that are initiated by the bidders in the pursuit of mohoose not to open the bid of a single bidder submitting the bid. As the Clause 3.3.2.5 of the Procurement Rules & regulations clearly states that the bidding process should be considered as valid if the bid was satisfactory advertised and prices are reasonable in comparison to the market prices.

(4) On-going litigation of a bidder
It has been experienced that some implementing agencies initiate disqualification of a bidder based on some evidence of ongoing litigation of a bidder. On the strength of the fact that our laws say that a person can presume to be innocent until proven guilty by the court of law, it is in-correct to disqualify a bidder for an ongoing litigation case. It must also be remembered that most of the litigation cases are ones that are initiated by the bidders in the pursuit of monetary claims from the clients.

(5) Single bidder submitting the Bid
Most of the implementing agencies choose not to open the bid of a single bidder submitting the bid. As the Clause 3.3.2.5 of the Procurement Rules & regulations clearly states that the bidding process should be considered as valid if the bid was satisfactory advertised and prices are reasonable in comparison to the market prices.

(6) Rejection of bid due to mismatch of copy and original bid.
Implementing agencies very often tend to misinterpret the concept of identical copy of the bid whereby bidders are rejected for non-inclusion of documents in the copy which are included in the original but not necessarily required to be submitted (which does not form part of the bid) in the bid. Therefore, in the copy of the bid, the check should be made only in relation to what is actually required to be submitted as part of the bid.

E. IMPORTANT POINTS TO REMEMBER DURING CONTRACT IMPLEMENTATION

- Always ensure that the project site is handed over to the contractors in time.
- The mobilization advance should be made in a timely manner to facilitate the timely mobilization of resources for early commencement of the works.
- Review thoroughly the workplan submitted by the contractor and suggest corrections, if any.
- The work progress of the contractor must be reviewed from time to time. In case of poor progress, remedial measures must be sought immediately by sensitizing the contractor.
- Constant monitoring and supervision of works is key to successful implementation of a contract. Lapses by contractors in terms of deviation from the scope of works or quality must be notified to the contractor as early as possible. This would ensure in cutting down the rectification costs to the contractors thereby avoiding the hostile environment which would otherwise be created between the client and the contractor.
- Every communication relating to the contract should be made in writing.
- In conveying any decisions to the contractor, always ensure such decisions are within one's jurisdiction of authority.
- The project engineer must be very sensitive to any positive deviations and should be in a position to process the deviations in a timely manner to avoid any complications.
- Verification of bills and approval must be done as early as possible. Delaying the verification of bills and payment would adversely affect the progress of works by limiting the cashflow of the contractor. Unnecessarily delaying the bills of a contractor beyond 30 days would result in making compensatory claims by the contractor.

- Deduction of any advances taken by the contractor must be deducted in each running bill to ensure that all advances are recovered by the time the contract has assumed 80% of the progress of work.

GRIEVANCE REDRESSAL MECHANISM IN TENDERING AND CONTRACT

INDEPENDENT REVIEW BODY (Before the Conclusion of Contract)

The Independent Review Body serves to provide a mechanism to ensure independent decisions in respect of Applications for review brought by bidders for alleged breaches of the provisions of the PRR/SBDs/SRFP. The scope of the review shall be limited to procurement decisions up to the award stage of procurement process and/or where the contract has not been concluded.

The Government Procurement & Property Management Division shall serve as the Secretariat to the IRB. Any supplier, contractor or service provider who has or likely to suffer, loss or injury resulting due to violation of the procurement rules may initiate a review procedure in accordance with the provisions in the relevant standard bidding documents issued by the Ministry of Finance.

The Independent Review Body shall be composed of seven members from following agencies besides the independent experts appointed by the Body who shall become the ad-hoc member for that particular sitting:

i. An officer of position of Director and above from the Ministry of Works and Human Settlement;
ii. An officer of position of Director and above from the Ministry of Economic Affairs;
iii. An officer of Position of Director and above from the Ministry of Finance;
iv. Director of the Construction Development Board;
v. General Secretary or an equivalent senior officer of the Construction Association of Bhutan;
vi. Secretary General or an equivalent senior officer of the Bhutan Chamber of Commerce and Industry; and
vii. Attorney General or an equivalent senior officer of the Office of Attorney General.

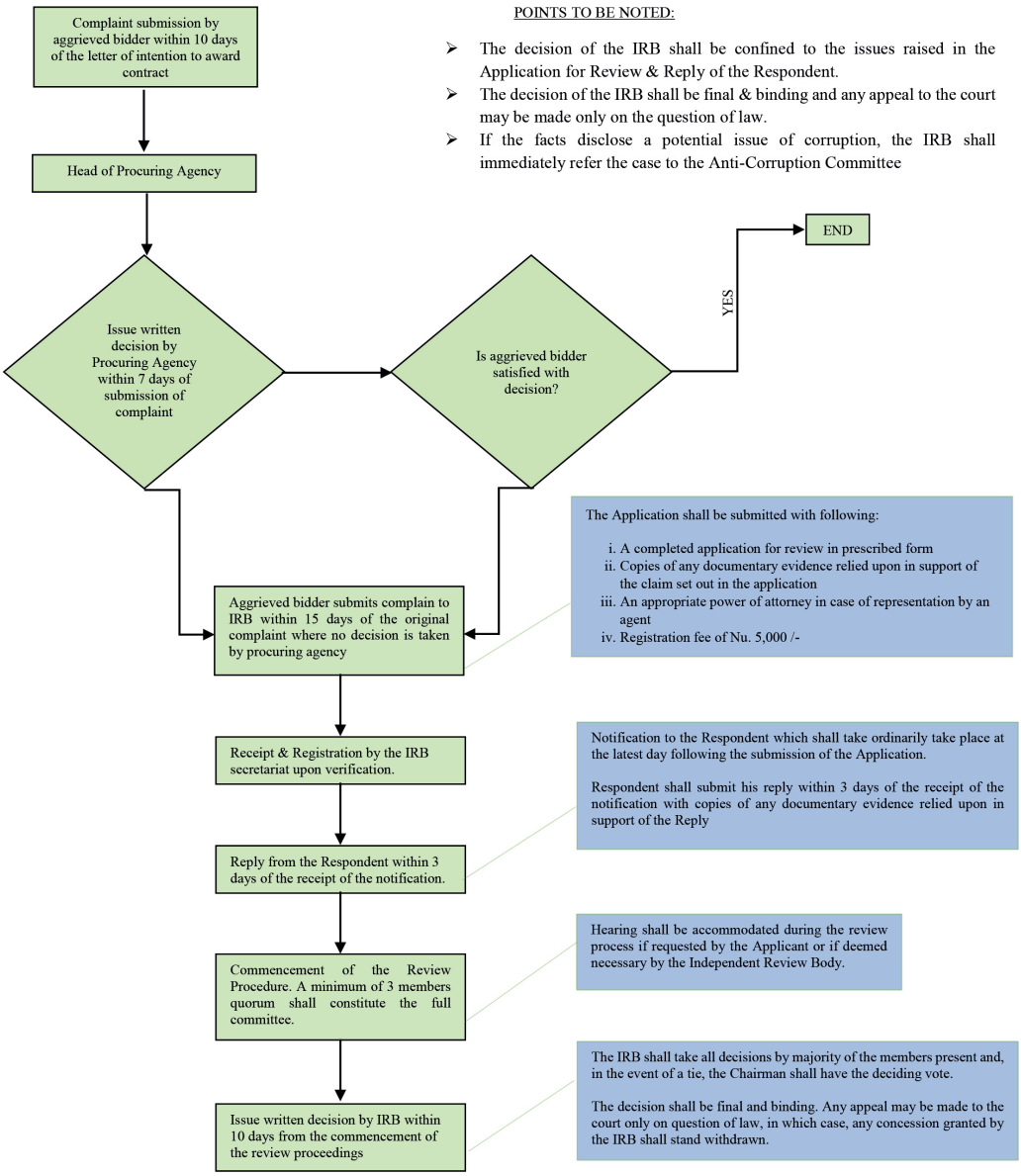
Unless the Independent Review Body dismisses the complaint as being frivolous in the disposal of appeal may take either any or in combination thereof of the following decisions, as deemed appropriate:

i. make a declaration with regard to the legal rules or principles which apply to the subject matter of the proceedings;
ii. annul in whole or in part any unlawful act or decision of the procuring agency, which may involve removal of any unlawful technical or other specifications;
iii. prohibit the procuring agency from acting unlawfully, from making an unlawful decision or from following an unlawful procedure;
iv. order the termination of the procurement procedure;

Until a ruling is issued concerning the complaint, the Independent Review Body may also order the suspension of the procurement procedure on the merits of the claim where:

i. the complainant demonstrates a prima facie case, such that it is more likely than not that he will succeed in his claim; and
ii. the complainant is likely to suffer irreparable harm in the absence of a suspension; and
iii. the grant of the suspension would not cause disproportionate harm to the public interest, the procuring agency or to other suppliers and contractors.

COMPLAINT PROCESS FLOW CHART



Note:

The Secretariat shall immediately notify about the decision to the Respondent, the Applicant and such other public agency or persons as the committee chair may determine.

The summary of the decision shall be published on the website of the Government Procurement & Property Management Division.

ARBITRATION (Post contract)

Arbitration is a form of Alternative Dispute Resolution mechanism which seeks to resolve disputes outside of the court by an independent and impartial third party known as Arbitrator/s.
Arbitration in Bhutan is guided by the extant legislation viz. Bhutan Alternative Dispute Resolution Act 2013, which came into effect on 14th March, 2013. Bhutan is member to the Convention on the Recognition and Enforcement of Foreign Arbitral Awards, also known as the New York Convention, which was adopted by a United Nations diplomatic conference on 10 June 1958 and entered into force on 7 June 1959.
To facilitate Arbitration in Bhutan, Bhutan Alternative Dispute Resolution Centre has been established as provided for by the Bhutan ADR Act on June, 2018, the centre is an alternative to court and envisages to resolve disputes faster with fewer formalities as compared to the court. The Centre is an independent body, having a distinct legal personality, and capable of doing all such things and entering into all transactions as are incidental or conducive to the exercise or performance of its functions as per the ADR Act 2013.

Advantages of Arbitration over Litigation:

Arbitration is largely becoming an effective medium of dispute resolution and much sought after for its advantages over litigation which includes among other things:

- **Speed**
  Arbitration is faster than litigation.

- **Flexibility**
  Arbitration is based on party autonomy. Parties may choose their arbitral tribunal. Further, they are free to tailor the arbitral proceedings to best suit their individual needs.

- **Cost Control & Savings**
  Although arbitration require more upfront fees than litigation, resolving a case through arbitration is usually far less costly than proceeding through litigation because the process is quicker and generally less complicated than a court proceeding.

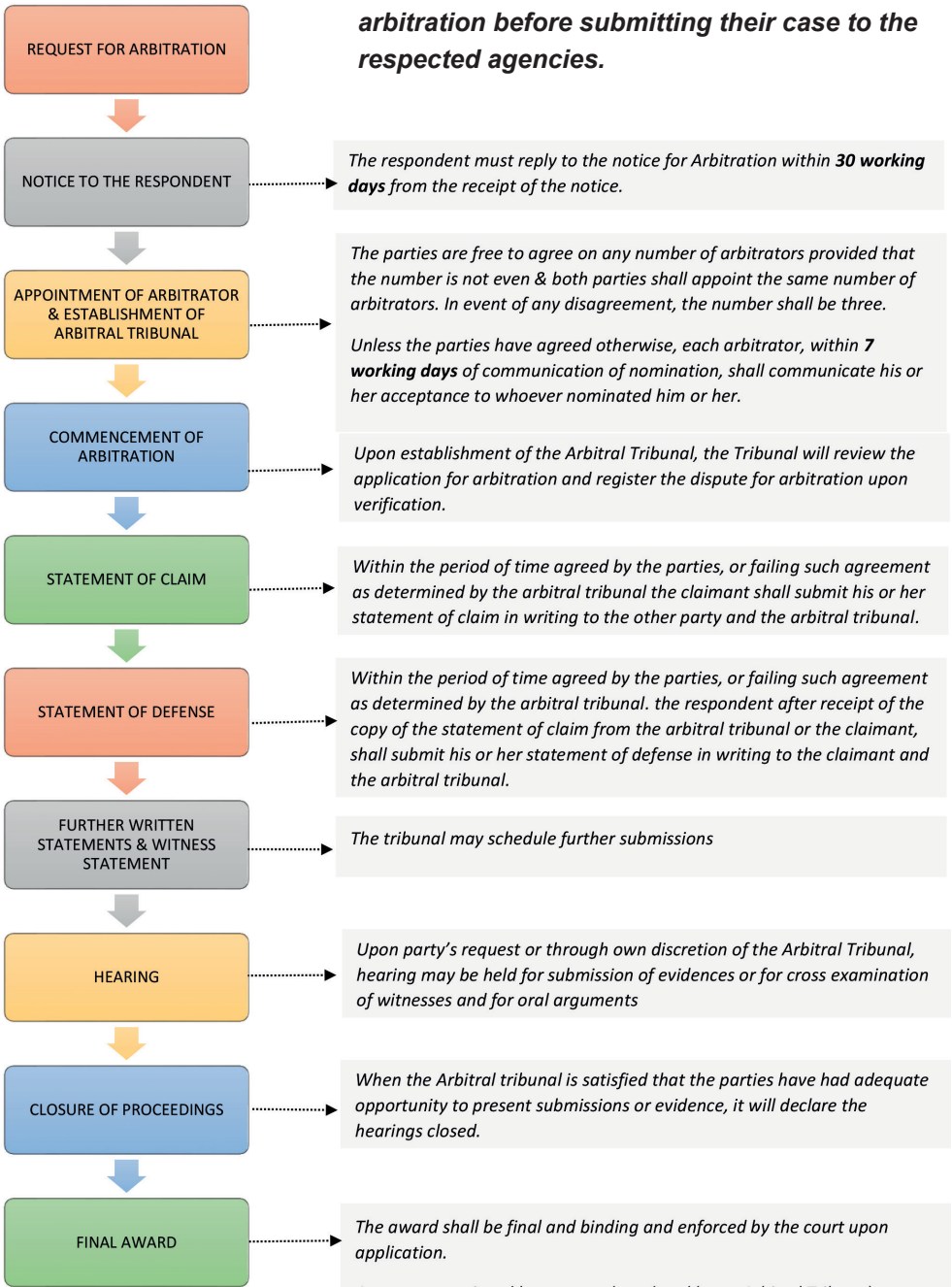
- **Expertise**
  Parties and FAI may select arbitrators with optimal expertise, experience and other qualifications to resolve a specific dispute.

- **Confidentiality**
  Contrary to court litigation, arbitration is a confidential method of settling business disputes.

- **Finality and enforceability of the award**
  An arbitral award constitutes a legally enforceable decision. It is binding on the parties to the arbitration, and cannot be appealed on its merits. Pursuant to the New York Convention of 1958, arbitral awards are recognized and enforced in most countries in the world.

ARBITRATION PROCESS FLOW CHART

All CAB members can avail advice on IRB and arbitration before submitting their case to the respected agencies.



COMMON TECHINICAL TERMINOLOGIES WITH NOTES

UNIT 7

ADMIXTURES
Materials added to mortar or concrete to achieve particular modifications to the normal properties of the basic materials.

AGGREGATE
Strictly speaking this means all particles of sand, broken stone or gravel etc., used in making concrete. The term is often loosely used to denote all particles larger than 4.75mm in which case “coarse aggregate” is more correct term.

AGITATION
The process of providing gentle motion in mixed concrete just sufficient to prevent segregation or loss of plasticity.

AIRLOCK
A bubble of air in pipe that stops liquid or gas flowing in the pipe.

ALUMINUM PAINT
Base of this paint is aluminium powder. Very finely ground aluminium is suspended in either quick drying spirit varnish or slow drying oil varnish as per requirement. The spirit or oil evaporates and a thin metallic film of aluminium is formed on the surface. This paint is shiny and silvery looking and visible in darkness and reflects heat to a considerable degree. It is thinner than enamel paint and covering capacity is quite high.

ANGLE OF REPOSE
The maximum value of natural slope at which a material can stand is called its angle of repose. It is the angle of the slope from horizontal and is indicated as Φ. It is normally taken equal to angle of internal friction or angle of shearing resistance. Φ is more for dry, coarse grained, well graded and compacted/dense soil. The more the Φ, the more the shear strength of soil.

ANTIFREEZE COMPOUNDS
Antifreeze compounds are those compounds which when mixed in water, lower its freezing point so that water doesn’t become ice at 0° C but it will do so below 0 ° C. Salt (NaCl) is one such compound. This is why when salt is mixed in ice, it starts melting because freezing point is lowered.

ASBESTOS
A fibrous silicate mineral material that is inert, strong and incombustible.

ASPHALTIC CEMENT
Asphaltic bitumen or the product resulting from a mixture of asphalt and flux oils or Asphaltic bitumen and flux oils producing a binder having cementing qualities suitable for the manufacture of asphalt pavement. It is refined asphalt.

ASPHALTIC CONCRETE
A premix of bitumen (with or without filler), sand and not less than 30 percent by weight of mineral aggregate of a size larger than sand.

ASPHALTIC MACADAM
A mixture of bitumen (with or without filler) and a mineral aggregate of a size larger than sand. It can be made be made by the grouting or pre-mixed methods.

BACKFILLING
That portion of the material retained by the wall (including special filter material), which has been placed behind it after construction to fill in the space between the wall and the natural ground.

BAND
A reinforced concrete or brick runner provided over the walls to tie them together and to impart horizontal bending strength in the walls for earthquake protection. Plinth band, lintel band, roof band, Gable band, Eaves level band are some of the names of the bands depending on the level of building where the band is provided.

BASE COURSE
That part of the construction resting upon the subgrade, and through which the load is transmitted to the subgrade or the supporting soil. A base course is the layer immediately under the wearing surface.

BEARING CAPACITY OF SOIL
Is the allowable pressure or stress which the soil can bear without shear failure or excessive settlement.

BLACK TOP SURFACE
A general term applied to wearing coats or surfaces of roads in which tar or bitumen is used as a binder.

BLAST FURNACE SLAG
Pozzolanic material, obtained as waste from steel plants.

BLOWN BITUMEN
It is also known as oxidized bitumen. It is produced by blowing air through molten, steam refined asphaltic bitumen. This process produces bitumen with comparatively high melting point and lower ductility. Blown bitumen has better weathering properties than steam refined type.

BOND STRENGTH
Resistance to separation of mortar and concrete from reinforcing steel and other materials with which it is in contact; a collective expression for all forces such as adhesion, friction due to shrinkage, and longitudinal shear in the concrete engaged by the bar deformations that resist separation.

BOND STONE
(Or through stone)- In stonework, some stones are placed at regular intervals right across the wall which are known as bond stones or through stones. If wall is considerably thick, two through stones with an overlap are provided.

BRACING
Horizontal or inclined members which hold together and strengthen the main steel structure against buckling and lateral loads.

CALCINATION
Heating in limited supply of air. For example, lime is obtained by calcining limestone.

CAMBER
Transverse slope of the road.

CARBONATION
When concrete hardens due to hydration of cement, some calcium hydroxide is liberated which sets up a protective alkaline medium inhibiting galvanic cell action and preventing corrosion of steel. In course of time, free hydroxide in concrete reacts with atmospheric carbon dioxide, forming calcium carbonate, resulting in shrinkage cracks. This reaction known as 'Carbonation' also lowers alkalinity of concrete and reduces its effectiveness as a protective medium.

CEMENT-AGGREGATE RATIO
The ratio, by weight or volume, of cement to aggregate.

CEMENT PAINT
This paint consists of white cement, pigment, accelerator and other additives. It is available in dry powder form. It is water proof and durable. It proves to be useful for surfaces which are damp at the time of painting or are likely to become damp after painting. It is desirable to provide cement paint on rough surface rather than on smooth surface because its adhesion power is poor on smoothly finished surface.

CHIPS
Are small angular fragments of stone containing no dust.

CHIPPING
Treatment of a hardened concrete surface by chiselling away a portion of material.

CLASSIFICATION OF ROCKS
• Igneous Rock: eg. Granite, dolerite and basalt, etc.These rocks are excellent for use as aggregates for concrete.
• Sedimentary Rocks: eg. Chalk, sandstone, and shale.
• Metamorphic Rocks: eg. Slate, schist, gneiss quartzite and marble.

CLINKER
A stage in the manufacture of cement in which the ingredients are fused into small pieces by heat.

COAL TAR
Coal tar is a thick black liquid which is obtained during the destructive distillation of coal. Coal tar is not a single compound. It is a mixture of more than 200 different carbon compounds. Coal tar can be separated into many chemical substances by the process of fractional distillation which are used to make drugs, dyes, explosives, paints, varnishes, plastics, synthetic fibres and pesticides etc.

COFFER DAM
Is a temporary enclosure built to exclude water from the working area and to permit free access to the area within, during the construction of a foundation or other structure that must be undertaken below water level. Coffer dams are usually made of earth, timber or sheet piling. It is a sort of “bund”.

COLD DRAWING
Methods of producing a bar or wire by drawing or stretching mechanically the metal through a die without heating the material, thus reducing its cross section. This improves physical properties of the metal, increasing tensile strength, yield point, hardness, and resistance of fatigue; gives superior qualities to hot rolled process.

CONCRETE
It is a mixture of cement, aggregates, water and air. Aggregates make 60-75% of the concrete volume. Concrete is strong in compression and weak in tension. The tensile strength of concrete varies from 8-14% of its compressive strength.

CONSISTENCY
Is a general and not a very definite term relating to the state of fluidity of a concrete mix obtained according to the proportion of water in the mix and is usually measured by the slump test.

CONSOLIDATION (OF SOIL)
Is the gradual compression of a saturated soil layer by expulsion of water from the pores under a steady load? It should be clearly distinguished from compaction where compression of soil is obtained by expulsion of air.

CURING COMPOUND
A liquid that can be applied as a coating to the surface of newly placed concrete to retard the loss of water or, in the case of pigmented compounds, also to reflect heat so as to provide an opportunity for the concrete to develop its properties in a favourable temperature and moisture environment.

CURING OF CONCRETE

The prevention of the loss of water from the concrete during its early life is known as curing. Such prevention is necessary because water is critical to the chemical reactions taking place in the concrete (hydration of cement) which results in the setting and hardening of cement. The strength of concrete is only 50% if it is not damp cured, of the strength it is damp cured for 14 days. Ordinary Portland cement achieves 100% strength after 28 days and after a year would achieve strength of 130%.

CUTBACK BITUMEN AND BITUMEN EMULSION

Cutbacks are softened bitumen whereby solid bitumen is thinned with a volatile distillate such as petrol, kerosene, diesel oil or tar oil. They can be used without heating or require only light heating. Cutbacks are classified into three categories: (1) Rapid Curing (RC) – light type for use as primer; (2) Medium Curing (MC)- medium type for surface dressing; (3) Slow Curing (SC) – Heavy type for pre-mixing.

Bitumen emulsions are bitumen emulsified in water. Emulsions can be applied cold and can be also used on damp surfaces. There are three grades of bitumen emulsions: (1) Rapid-setting; (2) Medium -Setting; and (3) Slow -setting. Rapid-setting emulsions are generally used for surface-painting, tack coats, seal coats, and grouting. On the other hand, slow-setting emulsions are used for pre-mixing and patch repairs during wet weather.

DAMP PROOF COURSE (D.P.C)

Purpose of D.P.C. is to prevent ground moisture rising up the wall and causing dampness on ground floor walls of building. Most brick, blocks and stones are porous and will absorb moisture by capillary action. D.P.C is provided at plinth level over walls using a waterproofing material.

DEAD LOAD

The fixed static load represented solely by the weight of walls, partitions, roofs, floors, and other permanent constructions including finishing.

DEFORMED BAR

A reinforcing bar with manufactured surface deformations which provide a locking anchorage with surrounding concrete.

DEPOSIT WORKS

The works whose cost is to be met from the non-government funds are known as deposit works. The amount of the fund is deposited in cash or otherwise placed at the disposal of divisional officer.

DIFFERENCE BETWEEN PUMPS AND TURBINES

Pumps Convert mechanical energy into fluid energy increasing the energy possessed by the fluid. Turbines convert fluid energy into mechanical energy.

DISPERSING AGENT

Admixtures capable of increasing the fluidity of pastes, mortar or concretes by reduction of inter-particle attraction.

DYNAMIC LOAD

A variable load; i.e., not static, such as a moving live load, earthquake, or wind.

EARTHWORK OVER EXISTING ROAD SURFACE

When construction embankment over existing road surface, the surface shall be permitted to stay only if it is more than 1 m from the new formation level. If the existing road surface is of cement concrete and within 1 m from the new formation level, the existing surface must be completely removed. IN case of granular or bituminous surface, the existing surface must be scarified to a depth of 50 mm or more to provide ample bond between the old surface and new material ensuring that at-least 500 mm portion below the top new sub-grade level is compacted to the desired density.

EARTH PRESSURE

The lateral pressure exerted by a soil mass on the retaining wall which supports the soil.

EARLY STRENGTH

Strength of concrete developed soon after placement, usually during the first 72 hours.

ECONOMIC EVALUATION OF PROJECTS

Economic evaluation of projects in simple terms is the process of carrying out cost-benefit analysis of a project to basically guide the decision maker to decide upon the feasibility or priority of a project. Some very important terms which are very synonymous to economic evaluation is outlined below:

1. Net Present Value (NPV)

It is defined as the net worth of project today. This is the difference between the total present worth of benefits and total present worth of costs. The present worth of costs and benefits are calculated by discounting future costs and benefits respectively. A positive value of NPV would indicate a feasible project. Discounting is the method of adjusting the future sums of money to a common base of present values. Higher the NPV, greater the feasibility of project.

2. Cost – Benefit Ratio (CBR)

It is the ration of total present worth of costs to the total present worth of benefits. If the value of CBR is less than unity, the project is acceptable.

3. Internal Rate of Return (IRR)

It is a measure of the rate of return of a project. It is the rate at which the net benefits are discounted so as to arrive at the cost of the project meaning that cost equates the benefits.

ENAMEL PAINTING

When the base of paint is ground in varnish or in viscous bodied oil instead of linseed oil, the resultant product has a harder and a glossier film and is known as enamel. Enamel painted surfaces are washable and aren't affected by acids, alkalis, gases or steam. They are equally good for use both on external and internal works. Enamels made from synthetic resins are known as synthetic enamels. They are available ready-made in many shades.

FERRO CEMENT OR FERRO CONCRETE

It is a term commonly used to describe a steel and mortar composite materials. Essentially a form of reinforced concrete, it exhibits behaviour so different from conventional reinforced concrete in performance, strength and potential application that it must be classed as a completely

separate material. It differs from conventional reinforced concrete in that its reinforcement consists of closely spaced, multiple layers of steel small diameter wire mesh completely impregnated with cement mortar. Ferro cement can be formed in sections less than one inch thick, with only a fraction of an inch of cover over the outermost mesh layer.

FIBRE REINFORCED CONCRETE (FRC)

Is made from hydraulic cements with or without aggregates of various sizes and incorporated in the main discrete fibre reinforcements. Fibres suitable for reinforcing concrete are produced from steel, glass, ceramics and organic polymers. Fibre are available in various sizes and shapes.

FINE AGGREGATE

Fine aggregates refer to sand having particle sizes less than 4.75 mm.

FLUXING

Is softening hard bitumen or asphalt (which are too hard for use) to the desired consistency by incorporation of certain oil.

FORM WORK

A temporary structure or mould for the support of concrete while it is setting and gaining sufficient strength to be self-supporting.

FORM OIL

Oil applied to interior surface of formwork to promote easy release from the concrete when forms are removed.

GALVANIZING

In this method, ferrous metal is thoroughly cleaned and it is dipped in a bath of molten zinc. The layer of zinc protects iron from rusting.

GLASS-FIBRE REINFORCED CONCRETE (GRC)

GRC is a versatile mouldable, lightweight finishing material for simple or decorative elevations. It consists of white cement, quartz sand, alkali resistant glass fibres and additives. Synthetic oxide colors can be added to get the desired shades to make it resemble any natural stone or exposed brick or wood etc. It combines the established compressive properties of cement mortars with valuable flexural and tensile strength properties contributed by the special glass fibres. The slender, slicker, sharper and light weight GRC elements can enhance the internal or external looks of existing or proposed buildings.

GRADER

A machine provided with an adjustable blade or scraper within the wheel base for shaping the road, subgrade or subsoil by loosening or moving the superficial materials laterally. It is either self-propelled or is toed by a tractor.

GRADING/TRIMMING

The operation of excavating and shaping the surface of earthworks.

GREEN BUILDING
A green building is a structure that is designed, built, renovated, operated or reused in an ecological and resource efficient manner. Green buildings are environment friendly and energy efficient. They use energy, water and other resources more efficiently. They use non-toxic, recycled materials, and provide clean air and natural light as far as possible.

GREEN CONCRETE
Concrete that has set but not appreciably hardened.

GROUTING
The action by which a binder in liquid form (cement, tar, bitumen, etc.) is made to penetrate into joints, fissures or cracks in concrete work under the action of gravity or by applied pressure.

HEAVY WEIGHT
Concrete in which heavy aggregate is used to increase the density of the concrete; unit weights in the range of 165 to 330 pounds per cubic foot are attained.

HONEYCOMB
Concrete that, due to lack of the proper amount of fines or vibration, contains abundant interconnected large voids or cavities.

HYDROMETER AND SEIVE TEST
Hydrometer test determines the particle size distribution of the finer particles in a soil whereas sieve test determines the particle size distribution for a coarse soil.

LEAN CONCRETE
Concrete of low cement content.

LIGHTWEIGHT CONCRETE
Concretes weighting less than 1600 kg/cum are generally termed as lightweight concrete. Such concretes are usually produced by using lightweight aggregates such as breeze or clinker, foamed slag, pumice. These concretes have good insulating qualities but are porous and absorptive and corrosive to steel, and are not used for reinforced works. Blocks made with this concrete are used for non-load bearing partition walls and panels, flooring and for fixing bricks for joinery.

MUSTER ROLL
Record of labour employed at site by a department purely on temporary and daily basis for a specific work or project.

ORGANIC CONTENT IN SOIL
It characterized by the darker colour in soil. Organic content usually has negative affect on the mechanical properties of soil.

PIG IRON
It is the raw iron obtained after heating iron ores in blast furnaces, and which is further refined to obtain useful irons.

PNEUMATIC
Moved or worked by air pressure.

PROPORTIONING OF MIX
Is the selection of proportions of ingredients for mortar or concrete to make the most economical use of available materials to produce mortar or concrete of the required properties.

PUG-MILL
Is a stationary mechanical mixer for blending cement and aggregate.

PUMPED CONCRETE
Is concrete which is transported through hose or pipe by means of a pump.

QUALITY ASSURANCE
A system of proceeding that ensures that the intended levels of quality on a project are obtained.

QUALITY CONTROL
Actions taken by an engineer or contractor to provide control over what is being done and what is being provided so that the applicable standards of good practice for the work are followed.

QUENCHING
It is the rapid cooling of heated metals by immersion either in liquids (water, oil, solutions), gases, solids or in air.

RAFT FOUNDATION
A continuous slab of concrete, generally reinforced, laid over or under the ground as a foundation for a structure. It is as large as, or slightly larger than the area of the building which it carries.

ROAD SAFETY AUDIT (RSA)
A Road Safety Audit is a formal examination of a future road or traffic project or an existing road in which an independent team qualified team (Road Safety Auditors) reports on the project's crash potential and safety performance. The audits may be taken at the feasibility phase, preliminary design phase, detailed designed phase and pre-opening phase.

ROLLING IN ROAD WORKS
Rolling should commence at the edges and progress towards the centre except in super-elevated portions where it should proceed from the inner edge to the outer edge. Each pass of the roller should uniformly overlap not less than one-third of the track made in the preceding pass. The roller should be operated at a minimum speed. For base courses, the speed should be about 3 km/hr for smooth-wheeled roller and 5 -6 km/hr for pneumatic-tyred and sheep-foot rollers.

SAND BLASTING
Sand blasting refers to driving of sand against an object or surface by air pressure. It is used for removing rust, scales and dirt.

SAND VERSES CLAY

• Sand is a good foundation material as it is usually stronger.
• Sand behaves poorly in excavation as it lacks cohesion
• When sand is loose and saturated, it becomes “quick” (i.e liquefy) and a major loss in supporting strength occurs.
• Clay is poor in foundation and good in excavation.
• Settlements in sand occur for a short time but in clays settlements may occur beyond the end of construction.

SCAFFOLDING

Is a temporary structure for gaining access to higher levels of the permanent structure during construction.

SEASONING OF TIMBER

The process of drying timber under more or less controlled conditions is called seasoning. It is the first step in the efficient utilization of timber. Freshly felled timber contains a large quantity of moisture; in many cases as much as 100%, while well-seasoned timber contains only about 10-12 %. Timber shrinks during drying and the main objective of seasoning is to eliminate this shrinkage before using the timber. A timber is considered fit for a carpenter’s work when it has lost 1/5th of its original weight and fit for joiner’s work when 1/3rd of its weight has been lost.

SERVICE ROAD

(i) A subsidiary road constructed between a road and buildings or properties facing thereon and connected only at selected points with the principal road.
(ii) A way at the back of buildings for “servicing” and providing other means of access.

SETTLEMENT AND BEARING CAPACITY IN SOILS

Bearing capacity is the ability of the soil to support the foundation loads without shear failure. Bearing capacity failures have the potential to cause major damage or collapse. Settlement is the tendency of soil to deform under applied loads. The most damaging settlements are differential settlements- those that are not uniform across the supported area.

SHORING

It refers to stout posts (generally timber posts or M.S. pipes) propped against a wall as a temporary support.

SHOTCRETE

The process of application of concrete or mortar on a surface by spraying under pneumatic pressure. It is also called ‘Guniting’.

SHORT AND SLENDER COLUMN

A compression member may be considered as short when both slenderness ratio and are less than 12, otherwise is considered as slender column.
Where
lx and D = effective length and depth respectively in respect of major axis.
ly and b = effective length and depth respectively in respect of minor axis.

SIMPLE VISUAL INDENTIFICATION TEST TO DIFFERENTIATE SILT AND CLAY IN THE FEILD

(1) Dry Strength Test

A small brick of soil is moulded with water and allowed to air dry. The brick is broken and a small 3 mm fragment is taken between thumb and finger. A silt fragment will break easily and whereas clay will not.

(2) Dilatancy Test

A small sample is mixed with water to form thick slurry. When the sample is squeezed, water will flow back into a silty sample quickly. The return rate will be much lower for clay.

(3) Plasticity Test

A moist soil sample is rolled into a 3 mm thread. As the thread dries, silt will be weak and friable but clay will be tough.

(4) Dispersion Test

A sample of soil is dispersed in water. The time for the particle to settle is measured. Silt settles in 15-60 minutes and clay remains in suspension for a very long time.

SIMPLE TEST TO DIFFERENTIATE SAND FROM SILT

Sand and Silt can be differentiated by the dispersion test. This test consists of pouring a spoonful of sample in a jar of water. If the material is sand, it will settle down in a minute or two but if it is silt, it may take 15 minutes to one hour.

SKIRTING

It is a finishing member along perimeter of a wall or other vertical surface where it meets the floor.

SOIL

Soil is an aggregate of loose mineral and organic particles. The primary mineral components of any soil are gravel, sand, silt and clay.

STONE MASONRY TIPS

• Stones should be sufficiently wetted before laying to prevent absorption of water from mortar.
• The hearting or interior filling of the wall face should consist of rubble stones not less than 150 mm in any direction, carefully laid, hammered down with a wooden mallet into position and solidly bedded in mortar.
• Through bond stones should be provided in masonry up to 600 mm thickness and in case, of masonry above 600 mm thickness, a set of two or more bond stones overlapping each other by at least 150 mm should be provided from face to back.
• Quoin stone i.e stone especially selected and neatly dressed for forming an external angle in masonry work should not be less than 0.03 cum in volume.
• Plum stones are selected long stones embedded vertically in the interior of the masonry to form a bond between successive courses and should be provided at about 900 mm intervals.
• Face joints should not be more than 20 mm thick, but should be sufficiently thick to prevent stone to stone contact and should be completely filled with mortar.

STORAGE OF MATERIALS

• Storage of Cement: Cement should be stored above ground level in perfectly dry and water tight sheds. The height of the stacks should not be more than 8 bags.
• Storage of Reinforcement Steel: The reinforcement bars when delivered on job should be stored above the surface of the ground upon platforms, skids, or other supports, and should be protected from mechanical injury and from deterioration by exposure.
• Storage of aggregates: Aggregate stockpiles may be made on ground that is free of vegetation, hard and well drained. If necessary, the ground should be covered with 50 mm planks.
• Storage of Bricks: Bricks should not be dumped at site. Bricks should be stacked in regular tiers as they are un-loaded to minimize breakage and defacement.
• Storage of Water: Water should be stored in containers /tanks covered at top in order to prevent intrusion by foreign matter or growth of organic matter. Water from shallow, muddy or marshy surface should not be permitted. The intake pipe should be enclosed to exclude silt, mud, grass, and other solid materials and there should be a minimum depth of 0.6 m of water below the intake at all times.

STRAIGHT RUN BITUMEN

Bitumen obtained from distillation of crude petroleum is known as straight run bitumen.

STUD OR STUDDING

The small timbers used in partitions and outside wooden walls, to which the laths and boards are nailed.

SUBSTRUCTURE

The part of a building or a structure below the level of the plinth or adjoining ground.

SUBWAY

Subway is an underground passage or tunnel to permit the movement of persons, traffic or to accommodate service pipes, cables, sewers, etc.

TECHNICAL SANCTION

After receipt of administrative approval and expenditure sanction, detailed estimates are required to be prepared for technical sanction. As its name indicates, it amounts to no more than a guarantee that the proposals are structurally sound and that the estimates are accurately calculated and based on adequate data.

THERMO MECHANICALLY TREATED (TMT) BAR

TMT bar is a recent technological advancement for production of deformed steel. Higher strength is obtained by intensive cooling of bar immediately after rolling. This process improves the properties of strength and ductility of steel.

THERMOPLASTIC

Plastics which can be softened by heating and moulded into different shapes again and again. E.g. Bakelite, Melamine, Urea formaldehyde resin.

TIME OF HAUL

In production of ready-mixed concrete, the period from first contact between mixing water and cement until completion of discharge of the freshly mixed concrete.

TIME OF SET

Time required after addition of water to cement for cement paste, mortars or concrete to attain a certain arbitrary degree of hardness or strength.

TINTED GLASS

Normal float glass to which colorants are added during manufacturing process to achieve tinting and solar radiation absorption properties. Tinted glass is heat absorbing glass which can reduce the heat load in a building resulting in energy saving. They also reduce glare and contribute aesthetically to the appearance of the building.

USE OF SAND

Sand should be clean, sharp, angular (gritty to touch), hard and durable; free from clay, mica and soft flaky pieces. A well graded sand should be used for cement work as it adds density to the mortars and concretes. Sand required for brick work needs to be finer than that of stone work. For ordinary masonry work, for concrete and first coat of plaster, the sand should pass through a sieve of 2mm * 2 mm mesh. For fine works, pointing or second coat of plastering, sand should pass through No.14 or 16 BS-1 mm sieve but should not have too much of finer sand. Crushed stone is not so satisfactory as natural sand since crushed stones contains a lot of fine particles like dust.

USE OF STONES FOR ROADWORKS

Stones used in road works should be tough and hard enough to resist to abrasion and crushing due to the stresses brought on by traffic. Aggregates of angular shapes, square and sharp with rough surfaces achieve the best mechanical interlock and offer greatest resistance to displacement under the repeated shocks of the traffic. Stones with round edges have lesser interlocking properties. Flaky aggregates should be avoided. Stones with high water absorption ration should be used. A piece of stone should not absorb more than one percent of its weight of water.

VOLUME COMPUTATION IN EARTHWORKS

Volume computation in earthworks is done usually by the average end area method. In this method, the two end areas are averaged and multiplied by the length between the two areas. When one of the areas is too small or zero, the volume is calculated by multiplying the larger area by the length and then taking one third of the value.

WATER CEMENT RATIO

It is the ratio of the amount of water to the amount of cement in a mixture. Typical values are approximately 0.45 to 0.60 by weight.

WHITE CEMENT

It is just a variety of ordinary cement which is practically free from coloring oxides of iron, manganese or chromium. For burning of this cement, oil fuel is used instead of coal. It is white in color and costlier than O.P.C.

DOWN MEMORY LANE

Inauguration of Fair & AGM 2018

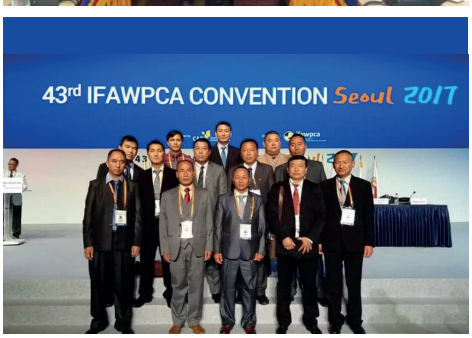
AGM & Seminar

Social Activities (Offered of Ku Sung Thug Mendrel to His Holiness

DOWN MEMORY LANE

Linkages with International Construction Fairs

Meeting with the National Council



CAB delegation to IFAWPCA Convention at Malaysia, 2018 & Korea, 2017

FINANCIAL INSTITUTION

BANK OF BHUTAN

Location: Samdrup Lam(Post Box: 75)
Tel: 05-252225,252127,252402,252645
website: www.bob.bt

BANK OF BHUTAN (BAZAR BRANCH)

Location: Near Central Hotel)
Tel: 05-252311, 252400,
Fax: 05-254458
Email: bazar_br@bobltd.com.bt
Website: http://www.bob.bt

ROYAL INSURANCE CORPORATION OF BHUTAN

Location: Samdrup Lam(Post box 77)
Tel: 05-252065
Fax: 05-252640, 252441, 253141
Email: ricbho@drunet.bt
www: http:/www.ricb.com.bt/

THIMPHU

HARDWARE & SUPPLIERS

T.D ENTERPRISE

Location: HongKong Market (P.O Box:1162)
Telephone: 02-323463
Mobile: 77777530, 17607606
Email: td_enterprise@hotmail.com
Deals in: Hardware, Electrical, Paints,
Sanitary & Entire Building Construction Materials Supplier.

J.D ENTERPRISES

Tel: 02-321344
Fax: 02-326870
Mobile: 17118887
Deals In: Hardware, Electrical, Paints,
Sanitaryware & General Order Suppliers.

THIMPHU

SERUB ENTERPRISES
Location: Nemeyzampa, Paro
Mobile: 17111873
Tel: 08-271393
Branch office: Changlam, Thimphu
Mobile: 17111873 Tel: 02-334037
Deals: Bosch Power Tools, Husqvarna, Lucas Mill STIHl,Tata Agrico.

THIMPHU

CHA REE TILES
Location: Babesa
Contact Person: Pema Thinley
Tel: 02-350650
Mobile:77660099/77660088/77560099
Deals: varities of Tiles & Marbles

CONSTRUCTION & MACHINERY HIRING

NETEN HIRING UNIT
Location: Changzamtog
Contact person: Neten Wangdi
Mobile: 17119380
Tel: 02-339907
Fax: 02-339907
Email:netencons@gmail.com
Deals: Construction Equipments.

THIMPHU

T & K CONSTRUCTION
Location : Thimphu
Contact person: Thinlay Gyamtsho
Mobile: 17601580
Email: tnk_construction46@yahoo.com
Deals: Equipment Hiring & Batching Plant.

KABAB CONSTRUCTION
Location: Above Swiss Bakery,
Mobile: 77110660
Email: kabcons23@gmail.com
Deals: Equipment Hiring

KW CONSTRUCTION PVT. LTD & HIRING
Location: Hongkong Market
Tel: 327921
Fax: 336039
Email: kwc@druknet.bt
Deals: Equipment Hiring.

TOOLS/ MACHINERIES EARTHMOVERS & EQUIPMENTS DEALERS

UGYEN EARTH MOVERS
Location: Babesa Express Way
Phone:02-350575, 350574,350573
Fax: 350135
Email: uembhutan@gmail.com
Deals: Heavy Equipments hiring

STATE TRADING CORPORATION LTD.
Location: Below Babesa Express way
Phone Toll Free No. 1980
Phone: 02-322953
Email: hras_unit@stcb.bt

ZIMDRA AUTOMOBILES EICHER DIVISION
Sales Office, Thimphu
Phone:337051/1704068/
17616327/17508735

SAMDEN VEHICLES PVT LTD.

Location: Babesa Express Way
Contact person: Managing Director
Mobile: 17111042
Tel: 02-351664/ 02-351664
Email:md@samdenvehicles.com
Deal: Distributors of Tata Vehicles.

YOEBAR TRADING

Location: Thimphu
Contact Person: Jigme Thinley
Mobile: 17114243
Tel: 02-328049
Email: yoebartrading@gmail.com

CONTINENTAL BHUTAN ENTERPRISES

Location: Lower Motithang
Telephone: 02-326924,325789,
Fax: 02-323463
Mobile: 17603573, 17632824
Email: komatsu@druknet.bt Website: http://www.cbebhutan.com
Deals in: Authorized dealer of KOMATSU, ELGI & SANDVIK machineries.

MAHINDRA (SINGYE AGENCIES)

Location: Above Zimdra Showroom
Tel: 02-338673/ 338674
Fax: 02-338672
Mobile: 17608507
Email: singyebhutan@gmail.com
Deals: Bolero, Trucks & Construction Equipments

THIMPHU

DRUK TRADING EQUIPMENTS

Location: Babesa
Contact Person: Tandin Wangyal
Mobile: 17116111/17141470
Tel: 02-333848 Fax: 02- 321479
Email: druktrading@yahoo.com
Deals: KOBELCO Mechinaries.

MANUFACTURING INDUSTRY

BHUTAN GRC
Telephone: 02-321084
Fax: 02-325699
Email: Karma.singay@gmail.com
Deals in : Glassfibre reinforced concrete

PERFECT TMX TMT
Post Box.252,1st Floor,
RICBL Building,
Phuntsholing, Bhutan.
perfectthermextmt@gmail.com

KARMA GROUP OF COMPANIES
Location:Above Dhejung Honda Showroom, Babesa
Tel:975-02-324163/325831
Fax: 975-02-322229
Email: info@karma.bt

THIMPHU

OTHERS

GRED PVT. LTD
(GYELSA TEWA REAL ESTATE DEVELOPER)
Location: Chang Jalu, Shearee Square, Thimphu
Mobile: 17110809
Tel: 02-333969 Fax: 02-333964
Email: gred@realtorbhutan.com
website: realtorbhuta.com

FOREIGN WORKERS RECRUITMENT AGENCY

RABGAY FOREIGN WORKERS RECRUITMENT AGENCY
Location: Opposite to Lhaki Building
Mobile: 16171819/77969698
Tel: 05-251258
Fax: 05-251258
Email: ragbayfwra2014@gmail.com

PHUNTSHOLING

RABGAY FOREIGN WORKERS RECRUITMENT AGENCY

Location: Twin Building, Flat no.6, Fisher Area (Gelephu)
Mobile: 16171819/77969698
Tel: 06-252001

TOOLS & MACHINERY SUPPLIER

CONTINENTAL BHUTAN ENTERPRISES

Location: Behind Norgay Cinema Hall.
Tel: 02-254268/05-253569
Fax: 05-253847
Email: Komatsu@druknet.bt
Deals: Komatsu, ELGI & Sandvik Machineries,
Spare Parts & Services.

SAMDEN VEHICLES

Location: Gaki Lam,
Mobile: 16907080
Tel : 05-251347
Email: chimi_lhamo@yahoo.com
Deals: Authorized distributor of TATA vehicles.

MAHINDRA (SINGYE AGENCIES BHUTAN)

Location: Phuentsholing
Tel: +975-5-254270 / 252546
Fax: +975-5-263092
Email: singyebhutan@gmail.com

STATE TRADING CORPORATION OF BHUTAN (STCBL)

Location: P.box: 76 Phuntsholing. Tel: 05-251164 , 252619
Eicher division (253752) Tata Division: 253590
Free Toll no. 1940 Fax: 05-252619
Email: Stcbl@druknet.bt Website: www.stcb.bt
Deals: Toyota, Eicher, TATA vehicles & Spare parts, CGI Sheet & Telecommunication Equipments & Tools.

UGEN EARTHMOVERS
Tel: 05-251658,252260,251045
Mobile: 17115175
Deals: Authorised dealer of JCB.

DRUK TRADING EQUIPMENTS
Tel: 05-251650
Fax: 05-251650
Mobile: 17778003
Deals: KOBELCO machineries & Spare parts, Servces.

HARDWARE & SUPPLIERS

AGARWAL TRADING
Location: Jordan Lam (Near Main liquor Shop)
Mobile: 17114080/17672082
Tel: 05-252408 Fax: 05-252408
Email: manishbtn@gmail.com
Deals: Hardware, Electricals, Paints, Sanitary ware & General order

BHUTAN ENTERPRISE
Location: Tharpai Lam(Near Zangto Pleri)
Mobile: 77221211
Tel: 05-252187 Fax: 05-252187
Email: bhutanenterprise@yahoo.com
Deals: Hardware, Electricals, Paints, Sanitary ware & General Order suppliers.

BHUTAN SALES
Tharpai Lam (Karma Steel)
Mobile: 17603666
Tel: 05-252383 (252385) Fax: 05-253666
Deals: Hardware, Electricals, Paints Sanitary ware & General Order suppliers.

L.D ENTERPRISES

Location : Opposite to Truck parking
Tel: 05-253881
Fax: 05-253881
Mobile: 17743133/7724391
Email: lhatu@druknet.bt
Deals: Hardware, Electricals, paints, sanitaryware & General Order supplier.

PAWAN HARDWARE ENTERPRISES

Location: Phuensum Lam,(Lhaki Building)
Tel: 05-252752 Fax: 05-25360
Mobile: 17116157/17601488
Email: pawanhe@yahoo.com
Deals: Hardware, Electricals, Paints, Sanitaryware & General order suppliers.

MANUFACTURING INDUSTRY

KARMA STEEL & WOOD INDUSTRY

Location: Near Dothi Bridge
Mobile: 17110193
Deals: integrated wood
website: http://www.karmatmt.com

YARAB PRIVATE LTD.

Location: Industrial Area
P.box: 308
Tel: 05-251607/252135/252003
Fax: 05-253104
Email: tandincable@druknet.bt
website: http:/yplbhuan.net
Deals: House wiring cables & wires (Royal cables).

DRUK MOSAIC TILES

Location: Deki Lam
Tel: 05-252797
Fax: 05-253953
Mobile: 17114141
Deals: Tiles, Interlocking Paver Block, Mosaic Tiles.

BHUTAN PLY INDUSTRY

Location: Industrial Area
Mobile: 77111333
Tel: 05-253651
Fax: 05-251828

PENDEN CEMENT AUTHORITY.

(Regional Office)
Location: Industrial Area
Tel:975-05-252885/83
Fax: 975-05-252885

EAST BHUTAN PVT. LTD.

Location: Samdrup Jongkhar
Contact Person: Kuenzang Leki
Tel: 07-251778
Mobile: 17114530
Email: eastbhutan@gmail.com
Website: www.eastbhutan.com
Deals: Authorized dealer of AAC Block-Brikolite, Export Coal, Export Gypsum Powder & Authorized dealers Appolo tyres,tyres retreading, Transport & Logistics

CDB-CONTRACTOR & CONSULTANT REGISTRATION

UNIT 8

CONTRACTORS REGISTRATION

Background

In accordance with Chapter II, clause 2.3.1 of Procurement Rules and Regulations 2009, the Construction Development Board (CDB) shall be the competent authority of the Government to establish and maintain the List of Registered Contractors and Consultants for Works as specified under clause 2.1.2.1. of Procurement Rules and Regulations 2009.

Accordingly, the Construction Development Board (CDB) has developed a online registration system called e-Zotin, wherein all Contractors/Consultants who wish to participate in the contracting/consultancy job of construction sector in Bhutan must first be registered through online with the CDB.

The classification, categorization and registration of Contractors/Consultants by the Construction Development Board through the use of uniform procedures and criteria, provides a quick access to updated records of Contractors/Consultants and avoid possible irregularities attributed to ad-hoc/multiple/inconsistent registration.

The procuring agencies could specify the additional requirement (depending on specific jobs) to that provided in the evaluation of potential Contractors/Consultants. The requirements will vary greatly with the nature of the projects. The specific requirements will be established and assessed in the tender documents during the bidding stage of those projects.

The Contractors will be Classified into Three Class, namely Class Large, Class Medium, and Class Small. The scope of their activities will be categorized into W1, W2, and W3 & W4 (for detail refer “Categorization of Infrastructure Projects”)

The Consultants are categorized into (a) Civil Engineering Services, (b) Architectural Services & (c) Electrical Engineering Services (for details refer “Consultants registration)

The registration system is a process of formal pre-qualification and is not limited to a particular contract or project. Proof of enrolment on the CDB Registration System will constitute a presumption of overall suitability and will qualify Contractors/Consultants to participate in the bidding of government or other public work projects. The system prevents the need for formal pre-qualification process of Contractors/Consultants, and therefore allows the government contracts to be awarded and executed faster.

REGISTRATION SYSTEM

The Construction Development Board (CDB) has developed a Contractors/Consultants Registration System based upon a classification of Contractors/Consultants and Categorization of Works. The registration of Contractors/Consultants, re-registration, up-gradation, and any matters related to Contractors/Consultants registration shall be carried out strictly in accordance with the specified principles and procedures.

CDB Registration requirement henceforth shall apply to JVs (amongst National Contractors/ Consultants or with Foreign Contractors/Consultants) & also to independent Foreign Construction or Consultancy Firms if they wish to participate in contract/consultancy works in Bhutan.

All Ministries/Departments/Agencies (government corporate agencies) concerned in the public sector shall use these Registered Contractors/Consultants according to their classifications and categories in the execution of infrastructure projects. The private sectors & the NGOs are also encouraged to use the same.

ELIGIBILITY FOR REGISTRATION:

All Bhutanese citizens having attained the age of 18 years shall be eligible to register All Bhutanese are permitted to undertake business in any Dzongkhag of their choice. Census registration or ownership of landed property in a particular Dzongkhag shall not be a condition for eligibility to registration.

An applicant shall be entitled to only one Registration Certificate within the Kingdom.

The fees for registration shall be levied as per the "Schedule of fees".

Scope of Registration

Contractors shall be classified and registered under one of three classifications namely: Small, Medium and Large for each category of Projects.

Validity of Certificate of Registration

Contractors who have been duly registered with the Construction Development Board will be issued a Certificate of Registration valid for a period of two years.

At any time during the validity period of the Certificate of Registration, the Contractors may submit a request in the approved application form for upgrading of his category and/or for additional classification Headings/Sub-headings.

A late fee of Nu. 100 per day shall be levied for each day of delay (with 1 month of grace period after the expiry of the validity period) subjected to maximum of Nu. 3000.00 for Small. The renewal of the certificate of registration MUST be applied within thirty (30) days of its expiration date.

Categorization of Infrastructure Projects

Infrastructure projects will be categorized into 4 separate Headings itemized under reference W1 to W4. Each heading generally covers the types of works that are executed under the Government's infrastructure program. A brief description of each Heading is given below:

Infrastructure Projects Categories		
Categories	**Headings**	**Description**
W1	Roads & Bridges	Construction of roads (laterite, prime and seal Flexible or rigid pavement); timber or concrete or steel bridges, culverts, surface drainage, kerbs, footways, pedestrian overhead crossings, airport runways and aprons
		Rehabilitation, reinstatement, improvement to embankment, slope stabilization, provision of adequate drainage system, re-gravelling or resealing existing pavement, repair, improvement or reconstruction of road sections or repair or reconstruction of damaged or destroyed bridges.
		Construction of all types of bridges, aqueducts and flyovers
W2	Bhutanese Paintings	Internal and external finishing and decorations of all structures in traditional Bhutanese paintings
W3	Buildings, Irrigation, Drainage, Flood Control, Water Supply & Sewerage	Construction of all kinds of buildings including that of timber, masonry, concrete or steel. Services such as storms and sanitary drainage system.

		Rehabilitation and restoration of all physical facilities in damaged or destroyed buildings.
		Construction of drainage systems, terminal buildings, hangers, warehouses Depots, any appurtenant structures.
		The construction includes all the internal electrification (new and renovation, repair), plumbing, painting and finishing work other than Internal and external finishing and decorations of structures in traditional Bhutanese paintings
W4	Power & Telecom Works	Construction, rehabilitation and improvement of civil works in hydropower facilities, such as dam tunnels and power generating plant buildings. Installation of underground cables, overhead transmission and distribution lines, compound lighting, construction of substations including the installation of switchgear, transformers and low voltage distribution board.
		Construction of Substations & Transmission Lines
		Laying ducts and construction of junction boxes and of manholes for telephone cable networks.

Permissible work volumes & values of Contractors

The Contractors will be classified according to his/her capabilities for each category of work. There are three classifications ranging from Large to Small. Contractors' classification will determine the size of construction works that he/she is eligible to undertake, as well as the maximum number of contracts that can be awarded at a time.

Details	(Large)	(Medium)	(Small)
Eligible bid amount (million Nu)	> 15 million	4 – 15 million	≤ 4 million
Maximum number of contracts at a time	5 Nos.	4 Nos.	2 (provided the total amounts is < 4mn)
Maximum value of contracts at a time (million Nu)	No ceiling	No ceiling	4 million

Note: The above values are based on the agencies estimate and not the quoted value.

Classification is based upon the Contractors' human resources & equipment and facilities. For upgrading of classification and/or to request other categories of work, the Contractors may apply for an additional category through online (e-zotin).

Because a Contractors classification is partly determined by their experience in a sector, it is anticipated that Contractors will maintain different classifications for different categories of work. For example, a Contractor may be eligible as a "Medium" Contractors for category W1 (Roads and Bridges), yet only be eligible as a "Medium" Contractors for category W3 (Buildings). In this case, the Contractors will maintain 2 classifications.

W2 will not have any Class such as Small, Medium and Large.

Registration Requirements (How to Register)

Contractors should register with the CDB prior to obtaining Trade License from the Ministry of Economic Affair. MoEA will grant licenses to only those Contractors that are recognised with the CDB.

- The first step towards registering with CDB is to apply the application online (e-Zotin - www.cdb.gov.bt).
- Also needs to submit Citizenship ID Card copy and Induction course certificate copy (for new registration only).
- A registration certificate is awarded to the applicant after the receipt of fees. Please note that registration fees are calculated per category. The more categories that are awarded, the higher the total registration fees will be. Applicant must insist on proper receipt every time a payment is made.
- If an applicant does not agree with the CDB's assessment, or desires an exemption from a particular requirement, he/she is eligible to request an appeal to the Board of CDB. Appeals will be decided by the Board during the next scheduled board meeting. For more information regarding the appeal process an applicant shall contact CDB.
- Issuance of CDB Registration does not constitute the fulfilment of all the requirements to obtain Trade License. Requirements for Trade License will be stipulated by the concerned agencies.

Criteria for New Registration/Up-gradation of Contractors

Technical Capability (Personnel and Equipment Resources)

Applicants should satisfy the Construction Development Board that they have necessary full-time personnel stationed in Bhutan to undertake the work corresponding to the Classification/ Category Heading applied for.

Personnel qualifications such as technical/professional qualifications (academic certificates), undertaking letter and appointment order shall be submitted with the application.

Personnel Resources

Permanent Key Employees:	Large		Medium		Small
	W1 & W3 W4		W1 & W3 W4		W1, W3 & W4
1. Manager	1		1		1
2. Graduate Engineer	1 (Civil)	1 (Elec)	-	-	-
3. Diploma Engineer	2 (Civil)	1 (Elec)	1 (Civil)	-	-
4. Accountant	1	1	-	-	-
5. Site supervisor	2 (Civil)	2 (Elec)	1 (Civil)	1 (Elec)	-

The following documents have to be submitted to authenticate information on key personnel's:
1. Academic transcripts and other relevant information;
2. Copy of CID or valid work permits issued by the Immigration for Non-Bhutanese,
3. Latest Undertaking letter;

NOTE:
- Manager: The qualification of Managers of a firm recruiting fresh managers other than the proprietor should be class XII and above;
- Site supervisor: The qualification of Site Supervisor of firms should be Class X and above

during the replacement or re-registration if they are not able to commit the existing Site Supervisor;

- Accountant: The qualification of Accountant/Accounts Officer for large firm should be Bachelor degree in the field of Commerce, Business Management, Business Administration and Accountancy during replacement or re-registration.

Applicants must also have owned construction equipment adequate to undertake the work corresponding to the Classification/Category applied for. The minimum requirements to be qualified for "Technical Capability" for different classifications are below:

Equipment Resources

Sl. No.	Criteria	Large			Medium			Small
		W1	W3	W4	W1	W3	W4	No requirement
1.	Excavator (or) Pay loader	1	1	-	-	-	-	
2.	Road Roller	1	-	-	-	-	-	
3.	Truck	1	1	1	1*	1*	1*	
4.	Air Compressor	1	1*	1*	-	-	-	
5.	Survey equipment	Total Station		1*	Levelling Machine		-	
6.	Concrete mixer	-	1	1	1	1	-	
7.	Vibrator	-	1	1	1*	1*	1*	
8.	Crane Truck	-	-	1	-	-	-	
9.	Steel Shuttering set (sft)	-	5000	-	-	2000	-	
10.	Water Pump /Multi-meter	-	-	1	-	1	1	
11.	Meggar	-	-	1	-	-	1	
12.	Max puller	-	-	1	-	-	-	

Schedule of Fees (New Registration & Re-registration & Upgradation Fee)

A Contractor, who is issued a new Certificate of Registration, shall pay the Registration Fee corresponding to the Classification. The Contractors shall apply for re-registration one month before the expiry of the registration validity.

Registration fees are based on the categories (W1-W4) that are applied for. The more categories the Contractors apply for, the higher their fees will be.

The following table provides the fee structures. Fees are paid after the CDB has assess a Contractors' application and has determine their eligible categories and classifications. All fees must be paid before a registration certificate will be issued.

Categorization	Fees (Nu) per Category Heading	
	New registration/Up-gradation	Re-registration
Small	5,000/-	2,500/-
Medium	10,000/-	5,000
Large	15,000/-	7,500/-
Registered (W2)	1,500/-	1,000/-

Mode of payment

All fees shall be payable by cash in accordance with the procedures specified in The Financial Manual, the Royal Government of Bhutan. Fees once paid are not refundable. The Construction Development Board will adjust the fees after giving prior notice.

Change in contractors' particulars

Registered contractors are required to inform the construction development board of any changes in its management status, address or any pertinent particulars within one month of such change.

Change in CDB Certificate

The following changes may become necessary as & when the cases arise:

Change in the Ownership

The change/transfer of ownership of CDB Certificate (only for Bhutanese firms/individuals) will be allowed under the following conditions:

1. The Transferee should be a direct inheritor of licensee/certificate holder proven by property inheritance documents duly endorsed by competent authorities.
2. He/she should have been associated in the same business for more than 5 years and continuously worked not less than 3 years prior to the request for transfer of CDB.
3. Transfer of CDB Registration maybe allowed to be effected within the validity period of the certificate.

A nominal lump-sum transfer fee to be charged for the change in ownership.

Change of ownership in the CDB Registration Certificate will not constitute/warrant an automatic/right for change of Trade License. It will be at the discretion of the MoEA to grant/not grant the change in the Business license as per their norms prevailing at that time.

Change in the Firm's Name

The change shall be announced with reasons in the news media after which one month observation period will be kept before processing the change.
Original CDB Certificate shall be surrendered to CDB

Change in the Location

The change shall be announced with reasons in the news media after which one month observation period will be kept before processing the change.
Original CDB Certificate shall be surrendered to CDB

Change due to down gradation

Submit complete registration forms.
Enclose the Original CDB Certificate or pay late fees.
CDB registration fees as applicable
Letter of consent for down gradation

Certificate of registration

The Certificate of Registration is the property of the Construction Development Board and it must be returned to the office where the Contractors/Consultants is registered whenever the Contractors/Consultants' registration has expired or is withdrawn for any reason.

Registered Office
Each Applicant (at least one partner in case of JV) must be a Bhutanese National and must establish a registered office with proper postal address.

Terms & conditions of certification

1. As provided in clause 2.1.1.2 and 2.3.1 of Procurement Rules and Regulations 2009, the holder of this Certificate is qualified to participate in public procurement procedure.

2. The issuance of CDB Registration Certificate will be based largely on the fulfilment of the minimum criteria set against classification of Contractor/Consultant and Categorization of Works and upon certification by competent authority for construction professionals.

3. All the registered contractors should comply with 'Code of ethics for Contractors'.

4. CDB will not be accountable for any false/fabricated submission that could have led to the fulfilment of the criteria and subsequent issue of CDB Registration Certificate.

5. CDB Registration Certificate once issued would not relieve the certificate holder of any relaxation on the minimum requirements for registration.

6. Notwithstanding the provisions of Companies Act of Bhutan, the certificate issued is non-transferable even if the promoters separate and establish similar companies.

7. CDB Certificate cannot be leased or subleased to any individual or another firm.

8. Certificate is valid during the period for which it was issued provided it has not been cancelled, suspended or revoked by CDB or any other competent authority.

9. Failing to renew within the expiry date will lead to penalty of Nu.100 per day.

10. Failing to pay the fees for approved online application within 30 days will lead to cancellation of the application.

11. All registered construction firm must attend the mandatory refresher course in order to apply for renewal.

12. No Contractors can submit bid, participate in bidding or be on the contention for award if the registration has expired.

13. No Contractors can undertake/implement works which is not within the scope of the registration.

14. CDB may verify the resources committed for the projects as and when desires.

15. The registration is subject to verification whenever the CDB so desires. CDB will inspect the minimum mandatory requirement of manpower and equipment of Large and Medium contractors and the during the time of monitoring, every firm must extend necessary support and cooperation to CDB Officials.

16. Large and Medium Contractors must have Office established with Signboard (requirements of office and signboard as determined by CDB)

17. Registered firms are required to inform the CDB of any changes in their address, contact details or any pertinent particulars within one month.

18. The CDB Registration Certificate can be revoked, downgraded, suspended or cancelled at any given time if the:

1. Holder undertakes unlawful participation in the procurement process;
2. Entity does not possess the minimum requirements during the physical verification process (at the discretion of CDB);
3. Entity has obtained the same due to false submissions;
4. Entity becomes bankrupt or winds up; or
5. Entity has been charged by the court for penal offence.

Cancellation & suspension of CDB Certificates

The CDB Registration Certificate can be revoked, suspended or cancelled at any given time if the:

1. Holder undertakes unlawful participation in the procurement process.
2. Entity does not possess the minimum requirements during the physical verification process (at the discretion of CDB).
3. Entity has obtained the same due to false submissions.
4. Entity becomes bankrupt/winds up.
5. Entity has been charged by the court.
6. Re-registration is not done within ONE year from the expiry of validity

Registration of Foreign Firms/JVs

Henceforth any JV between Foreign Firm(s) & Bhutanese Companies or Foreign Firms (independently) wishing to participate (whether on invitation by the prospective client or through advertisement) in the Construction works in Bhutan need to be registered with CDB.

Joint Ventures between Bhutanese Firm(s) & Foreign will be issued specific CDB Certificate and they can participate in the specified work.

The Applicant must submit the following information:

1. The Bhutanese Firm must already have a valid CDB Registration Certificate.
2. The Foreign Firm wishing to obtain the CDB Registration Certificate must first prove that they are a legal entity in their place of operation.
3. The application must specifically mention the job for which CDB registration is required.
4. The CDB Registration Certificate will be used only within Bhutan.
5. Brief Company Profile
6. Copy of License/incorporation from the country of establishment (attested by District Magistrate)
7. Copies of Relevant Past Experience (authenticated by client)
8. Financial information (balance sheet) of past 5 years
9. Power of Attorney of Authorized signatory (rank must at-least of second in command in the hierarchy)
10. Any other requirement that CDB may specify

Once all the required details are submitted in every respect CDB will review the submission and if acceptable issue the Certificate within 2 weeks from the date of application.

CONSULTANT REGISTRATION

Background

The CDB has the mandate to register Consultants. However, Governments & Corporations Employees are not eligible to obtain Consultants Certificate. It shall maintain a register of Consultants who wish to provide consultancy services in construction Industry and only those registered with CDB shall be permitted to practice consultancy service in Bhutan. As decided during the 38th Board Meeting & 3rd Annual Engineering Conference, the need to revive registration of Consultants related to the construction Industry is felt necessary.

General

To promote greater professionalism and accountability, a system for identifying and registering qualified Consultants has been introduced as one of the responsibilities of the Construction Development Board (CDB). All Consultants who wish to participate in the construction sector in Bhutan must first be registered with the CDB. The CDB shall maintain a register of Consultants who wish to provide Consultancy services in construction Industry.

To begin with a very simple registration system, which can provide basic information of Consultants such as their technical qualifications, past experience etc. will be established. It is not the intention of the CDB to use the registration system as classification system to assess a Consultant's capacity to perform specific assignment. It is left up to the procuring agencies to use the information provided in their evaluation of potential Consultants. The requirements will vary greatly with the nature of the projects. The specific requirements will be established and assessed in the tender documents during the bidding stage of those projects. All governmental agencies will be required to use the authorized tender documents for Consultant selection (Procurement Manual)

Types of Consultant

The Construction Industry employs a variety of different Consultants such as:

1. Civil Engineering Services
2. Electrical Engineering Services (which has seven different categories of Works for each services) and
3. Architectural Services (which has three different category of works).

Each service is a different professional specialization requiring its own registration criteria.
The following are the list of Consultancy Services related to construction Industry that needs to be registered with CDB:

1. Civil Engineering Services: This Service shall be registered under the following categories:
   - C1: Structural Design
   - C2: Geo-Tech Studies
   - C3: Social & Environment Studies
   - C4: Roads, Bridges, Building & Air Ports
   - C5: Irrigation, Hydraulics, Water Supply, Sanitation, Sewerage & Solid Waste
   - C6: Construction Management, Site Supervision & Surveying
   - C7: Water Resources & Hydro Power Projects

2. Architectural Services: This Services shall be registered under the following categories:
   - A1: Architectural & Interior Design
   - A2: Urban Planning
   - A3: Land Scaping & Site Development

3. Electrical Engineering Services: This Services shall be registered under the following cate-

gories:

E1: Investigation & Design of Hydro Project
E2: Operation & Maintenance of Hydro Power Plant
E3: Urban & Rural Electrification, Transmission Line, Communication & Scada
E4: Construction Management & Site Supervision
E5: Sub-Station
E6: Energy Efficiency Services
E7: House Wiring

How to Register

Registration

A Consultant, who wishes to be registered with CDB, shall apply online application to the CDB Secretariat, which can be done from CDB web site: www.cdb.gov.bt (e-Zotin).

Certificate of Registration

The CDB Secretariat shall process the application and if it meets the requirements for registration, the Certificate of Registration will be issued which is valid for a period of two years from the date of issuance. A Consultant shall apply for renewal of his Certificate of Registration within thirty days before its expiry date.

Privileges of Registration

A Consulting Firm or individual Consultant registered with the CDB shall be eligible to apply for a Trade License to practice in Bhutan. A Consulting Firm/individual who has both registered with CDB as well as obtained a Trade License shall only be permitted to practice in the construction Industry in Bhutan subject to the limits of their technical and Financial capacities, which shall be evaluated by the concerned procuring agency.

Requirements for Registration

Minimum requirements shall be applied to avoid deterioration of standards of the Construction Industry. The detail of requirements for each Service is as shown below:

Technical Capability

The minimum requirements for qualification of Technical Capability are determined by the following factor:

1. Human Resources (Key personnel)

2.1a. Minimum Requirements: Human Resources (Permanent Personnel) Assessment:

Criteria	Civil Engineering Services					
	C1 & C4	C2	C3	C5 & C6	C7	Total
Degree Engineer	1 (Civil)	1 (Geo-Tech)	1 (Social Science/ Environmental)	-	1 (Civil)	4
Diploma Engineer	-	-	-	1 (Civil)	-	1
Surveyor	-	-	-	1	-	1
Minimum Number of Employees	1	1	1	2	1	6

2.1b. Minimum Requirements: Human Resources (Permanent Personnel) Assessment:

Criteria	Architectural Services	Total
		A1, A2 & A3
Architect (Bhutanese) Masters/Degree	1	1
Minimum number of Employees	1	1

2.1c. Minimum Requirements: Human Resources (Permanent Personnel) Assessment:

Criteria	**Electrical Engineering Services**				**Total**
		E1 & E2	**E3 & E4**	**E5 & E6**	**E7**
Graduate Engineer	1(Electr) 1 (Civil) 1 (Mechanical) 1 (Hydrologist)	1 (Electrical)	1 (Electrical)	-	6
Diploma Engineer	-	1 (Civil)	1 (Civil)	1 (Electrical)	3
Minimum number of Employees	4	2	2	1	9

Following documents shall be submitted to authenticate information on all employees/ key personnel against table 2.1a, 2.1b and 2.1c above:

1. Latest undertaking letter with legal stamp
2. Academic Transcripts
3. Copy of CID Card
4. Valid permit issued from the Immigration & Census for non-national
5. Other relevant documents/information to demonstrate competence.

Fee Schedule:

1. A consultant who is issued a new Certificate of Registration shall pay the fee of Nu. 3000.00 per category.
2. A Consultant who is issued a re-validation Certificate of Registration shall pay the fee of Nu. 1500.00 per category.
3. A Consultant who wish to avail additional category shall pay the fee of Nu. 3000.00 per category.
4. A Consultant who does not renew their Certificate within the expiry date shall levy a penalty of Nu. 100.00 per day.
5. Validity of Certificate is two years from the issue date.
6. Grace period of one month (30 days) shall be permitted from the expiry date for re-validation of Certificate.
7. The CDB may revise the fees as and when necessary after endorsement from the Board Members and subsequent approval from the government after giving prior notice in the Media & newspaper.

Mode of Payment:

All fees shall be payable in cash in accordance with the procedures specified in the Financial manual, the Royal Government of Bhutan. Fees are non-refundable.

Monitoring of the Registered Consultant's Performance:

The CDB shall update the history of the Registered Consultants from time to time upon received of written information from the Firms. The Consultants are expected to maintain high

professional ethics and perform their services to the best of their ability with sound professional judgment. Those with poor performance history and having adverse records may be refused for re-validation.

(A). DEFINITION OF CIVIL ENGINEERING SERVICES CATEGORY:

Structural Design (C1): Includes design of all Civil Engineering infrastructures like buildings, bridges, workshops, airports, roads, sports, walls, stadiums, dams, tunnels, studios, towers, irrigation channels, etc.

Geo-Tech Studies (C2): Includes studies related to earth materials, sub-surface explorations assessments and design capabilities using an extensive sub-surface database. Geophysical surveys, Geology and soil mechanics, Geotechnical construction services to support new construction projects, i.e, value Engineering, review and sample testing, laboratory testing for soil modification, evaluation of foundation bearing conditions and Mine studies.

Social & Environmental Studies (C3): Includes preparation of Environment Impact assessment, Environment Management plan, Feasibility study and remedial design to help determine an effective approach to remediate a site, air quality assessment, climate studies, and wetland delineation reports.

Roads, Bridges, Buildings & Airports (C4): Includes all required studies of the roads, bridges, building and airports.

Irrigation, Hydraulics, Water supply, Sanitation, Sewerage & Solid Waste (C5): Includes studies and design works related to irrigation, Hydraulics, water supply, sanitation, fire hydrants, sewerage and solid waste. It also includes sanitary drainage system, sewer structures, infiltration gallery, raw water intake studies, raw water transmission piping design, water treatment facility design, water transport and storage, feasibility and financial reports, capacity analysis reports, ground well design etc.

Construction Management, Site Supervision & Surveying (C6): Includes the provision of professional expertise in Contract Management and supervision of the construction project site carrying out the responsibilities of project control systems, inspection & quality assurance, dispute avoidance & resolution, construction design reviews, cost estimating and evaluation, construction CPM scheduling etc. It also includes preparation of tender documents for procurement of goods & works, post contract management expertise in implementation of Contracts. Survey works includes surveying done in the required field at site, building and construction, communications, mapping, and the definition of legal boundaries for land ownership.

Water Resources & Hydro Power Projects (C7): Includes studies and design works on hydraulic structures, flood protection surveys, potential flood control measure identification, floodwall restoration design and hydro power plants. Design of hydro power structures like dam, tunnel, powerhouse, open channels, desilting chambers, fish ladders etc.

(B). DEFINITION OF ARCHITECTURAL SERVICES CATEGORY:

Architectural & Interior Design (A1): It deals with design of individual buildings, a group of buildings, its looks, aesthetics, designing its area program and utility. Interior design usually deals with the interiors of the building which includes interior space design, lighting, furniture, sitting arrangement, acoustic design etc.

Urban Planning (A2): It deals on a much larger scale. It covers more than acres of land and requires more of planners. It is on a city scale planning, like planning the urban spaces into residential, commercial, institutional, parking spaces, highway design etc.

Land Scaping & Site Development (A3): It deals usually with the developing of sites and making it beautiful. It can be on a small as well as on a larger scale. It usually plans the planting of trees, flowers, integrating water bodies, playground, children park etc.

(C). DEFINITION OF ELECTRICAL ENGINEERING SERVICES CATEGORY

Investigation & Design of Hydropower Project (E1): Includes identification & screening of potential sites. Alternative studies on topographical survey and mapping. Geological, Geo-technical & Environmental studies, power potential & optimization studies. Construction scheduling, methodology and equipment planning, cost estimation and financial analysis, tender engineering process. It also includes Engineering & design of civil, Electro Mechanical, and Hydro Mechanical equipment. Preparation of technical specifications, Engineering drawings, Environmental and Socio-Economic studies.

Operation & Maintenance of Hydro power plants (E2): Includes estimating & budgeting, start up and commissioning services. Operating procedures and long-term plant operation, safety and quality control programmes. Inventory control and procurement services, plant improvements and upgrade. Replacement of parts and field engineering services, performance testing and plant life assessment, equipment condition assessment, enterprise system management, annual reviews and audits.

Urban & Rural Electrifications, Transmission line, Communication & Scada (E3): Includes cost estimation, preparation of Bill of quantities (BoQ), design & Engineering for equipment, lines & accessories. It also includes detailed study of demand & supply, route survey & planning for layout, site preparation & project management.

Construction Management & Site Supervision (E4): Includes the provision of professional expertise in Contract Management and supervision of the construction project site carrying out the responsibilities of project control systems, inspection & quality assurance, dispute avoidance & resolution, construction design reviews, cost estimating and evaluation, construction CPM scheduling etc. It also includes preparation of tender documents for procurement of goods & works, post contract management expertise in implementation of Contracts.

Sub-Station (E5): Includes cost estimation, preparation of Bill of Quantities (BoQ), design & Engineering, site planning, site selection & equipment layouts. online diagrams & construction drawings, site supervision & project Management.

Energy Efficiency Services (E6): Includes solar energy, bio-mass energy etc. and efficiency studies to assess energy efficiency opportunities including financial evaluation. It also includes engineering for cost efficient design, building daylight modelling, energy performance modelling, lighting system design, analysis of day lighting, natural ventilation, end use assessments to identify energy savings opportunities & construction management of efficiency upgrades.

House wiring (E7): Includes Planning, design & cost estimation of electrical wiring & cabling including house plan.

BHUTAN STANDARD BUREAU

Sl.No.	Division	Contents to be incorporated in directory
1	SD	To avail standards related services from Bhutan Standards Bureau (BSB); call 325401/325104 Extension No. 107/109/128 or visit 1. http://www.bsb.gov.bt/standards/home/pageMenu/48 for list of Bhutan standards 2. http://www.bsb.gov.bt/standards/placingorder/placing_order for purchase of standards 3. http://www.bsb.gov.bt/standards/home/pageMenu/50 for information on price of standards
2	CD	Certification Division, Bhutan Standards Bureau, Rijug Lam, Thimphu, Tel: 325401/325104 Extension No. 115/117/120 (for availing Product and Management System Certification) For list of approved products visit our website www.bsb.gov.bt The procedures for product and management system certification can be downloaded from the website which also outlines redressal mechanisms.
3	MLSD	The Metrology and Laboratory Service Division (MLSD) was created to undertake the following two mandates: 1. Establish and operate metrological referral and calibration laboratories 2. Establish and operate product testing infrastructure The Product Testing Laboratory provides the following testing services: • Tests on cements • Tests on steel and steel components • Tests on concrete/building blocks • Tests on fine aggregates • Tests on coarse aggregates • Tests on soil • Tests on bitumen • Tests on road sub-grade For availing these services please call 325401/325104 Extension No. 111. For further information please visit our website at http://www.bsb.gov.bt/home/pageMenu/61

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BHUTAN ISUZU MOTORS

CONTRACTORS - LARGE CLASS

CDB	Firm/Name	Dzongkhag	Tel.No.
1032	TSHEWANG Construction Pvt Ltd	Sarpang	03 741150
1033	Chaggwong Construction Private Limited	Zhemgang	03-741335
1043	KENCHO DORJI Construction Private Limited	Thimphu	02-340646
1081	MINDU Construction Private Limited	Paro	08 271225
1146	TSHERING SAMDRUP Construction Pvt. Ltd.	Thimphu	02-324630
1149	JABAB Construction Private Limited	Thimphu	02-336637
1171	Druk Samdrup Construction Private Limited	Sarpang	6251068
1358	K.N Construction Private Limited	Sarpang	06-251249
1380	KUENGA Construction	Paro	8217313
1392	GAYJUR Construction Company Private Limited	Chukha	05-252259
1404	Z & K Construction Private Limited	Thimphu	77923204/77923204
1434	NAMGAY Construction	Thimphu	325036, 17600255
1435	LAMNEKHA Construction Private Limited	Thimphu	17164271, 17163570
1494	DOTILA Construction	Sarpang	06-252050,17614547, 7678870
1526	TASHI THUENDEL LERIG Private Limited	Thimphu	252,849
1571	DAWA TSHERING Construction Private Limited	Chukha	05-251452
1590	NIMA Construction Company Private Limited	Thimphu	322908/17110508/ 17110175
1593	K.W Construction Private Limited	Thimphu	02-324936/02-327921/ 17110764
1634	M.T.K Construction Private Limited	Wangdue Phodrang	481494, 17607291, 17113629
1653	GYALCON INFRASTRUCTURE Private Limited	Thimphu	02-337005
1656	BHUTAN Engineering Construction Private Limited	Thimphu	322091/324524/ 17110038/322543
1657	GASEB Construction Private Limited	Chukha	-251885
1664	DRUK LHAYUEL Construction Private Limited	Paro	nill
1677	KENCHO TSHERING Construction Pvt Ltd.	Sarpang	06- 252005
1708	NETEN Construction Private Limited	Thimphu	323,897

CONTRACTORS - LARGE CLASS

Mobile No.	W1	W2	W3	W4	Email
17680934	L	R	L	S	tshewangconstruction@gmail.com
17118578	L	R	L	S	rigwang510@gmail.com
17626509	L	R	L	M	lhamodorji4@gmail.com
17111034	L	R	L	M	minduconstruction@druknet.bt
17625703, 17358900	L	R	L	M	tsheringsamdrupconst.2012@gmail.com
17110340	L	R	L	S	jababconst@gmail.com
17614370	L	R	L	S	druksamconst@gmail.com
17115392, 77115390	L	R	L	S	kncpvtltd@gmail.com
17113849	L	R	L	M	kuengagroup@druknet.bt
17672291	L		L		tshewangnidup2304@gmail.com
77923204	L	R	L	M	zkcont5@gmail.com
77661277	L		L		namgayconstruction22@gmail.com
77200843/17110496	L	R	L	L	lamnekha@druknet.bt
17614547	L		L		dotila123@gmail.com
77200920	L	R	L	M	sangayttl@gmail.com
17715760	L		L		dawatsheringcpl@gmail.com
17113526	L	R	L		procurement.nima@gmail.com
17110764	L	R	L	M	kwcpl02@gmail.com
17113629	L	R	L	S	ugyen.lama@ymail.com
17170422/17116970	L	R	L		gyalconinfra@gmail.com
17856582	L	R	L		adm.becplth@gmail.com
97517110163	L	R	L	M	wnamgay77@gmail.com
17634567/77734567	L	R	L	S	druklhaconst@yahoo.com
17713777/77713777.	L	R	L	M	ktconstruction92@gmail.com
17119380	L	R	L	M	netencons@gmail.com

1728	DRUK CHAPCHAB Construction Pvt. Ltd.	Thimphu	323320
1748	TAGSINGCHUNGDRUK Construction Private Limited	Thimphu	17111994/17721173
1784	ETHO METHO Construction Private Limited	Thimphu	323684/325875
1785	TAMA Construction Private Limited	Thimphu	333072
1786	KARMA Construction Pvt. Ltd	Samdrup Jongkhar	07-251257/17608608, 17110636
1792	RABSEL Construction Private Limited	Trashigang	04 521190,17642749, 17117080
1811	K.D Builders Private Limited	Chukha	04-521140
1812	DHOENSUM Private Limited	Thimphu	324059
1827	DRUK PHUNSUM Construction & Company Pvt. Ltd.	Sarpang	06 251427
1828	RIRAB Construction Company Pvt. Ltd.	Thimphu	07-251269/77111893/ 17114366
1832	S.K.D Construction Pvt.Ltd	Samtse	05-365243, 365490, 365242
1836	PHUNTSHOK RABTEN Construction	Mongar	17130843
1849	JD Private Limited	Thimphu	323495, 326968,
1862	LHOJONG Construction Private Limited	Thimphu	02-325493
1957	NORBU Construction & Company Pvt. Ltd.	Sarpang	17600417/17511229/ 17130747
1958	PENJOR Construction Private Limited	Thimphu	325468
1965	RINSON Construction Company Private Limited	Thimphu	02-326650,326651
1988	R.L Construction	Thimphu	351247,
2000	TENZIN DORJI Construction	Samdrup Jongkhar	07-251469/17744038, 17114811
2055	KUENDHEN Builders Private Limited	Samdrup Jongkhar	17639109/17660322
2061	PASSANG Construction Private Limited	Thimphu	334150
2119	GONGPHEL Construction Private Limited	Samtse	
2146	K C Construction Private Limited	Thimphu	-
2148	SINGYE Construction Private Limited	Thimphu	324153, 327448, 327000
2151	BHUTAN Builders Private Limited	Thimphu	02-326924,02-323462
2173	ALPINE BUILDERS Private Limited	Thimphu	327369
2181	WANGTHANG Construction Private Limited	Thimphu	325782, 324594

77100771	L	R	L	M	drukchapchaub@gmail.com
17111994	L	R	L	S	tagsingchungdrukconst11@gmail.com
17400188	L	R	L	M	ethomethoconstruction@gmail.com
17113232	L	R	L	L	tama.pvt.ltd@gmail.com
17340679	L	R	L	M	kwangdi20542@yahoo.com
17986825	L	R	L	S	cholingrabsel7080@gmail.com
17110726	L	R	L	M	kdbpling@gmail.com
17110031	L	R	L	M	Dhoen@druknet.net.bt.
17115517	L	R	L	S	dpcl.info@gmail.com
77111893	L	R	L	M	rirabt@gmail.com
17604985	L	R	L	M	skdconstruction777@gmail.com
17130843	L		L		karmadupchu14@gmail.com
17600071, 17110060	L	R	L	M	jdpl@druknet.bt
17110604/77110604	L	R	L	M	lhojongpvt@gamil.com
17600417	L	R	L	M	nccpl1972@gmail.com
17111404	L	R	L	S	penjorconstruction@gmail.com
77103663	L	R	L	L	rinson@druknet.bt
17111529	L	R	L	S	rinchenrimdi62@yahoo.com
17114819	L	R	L	S	pgyeltshen1986@gmail.com
17639109, 17660320	L	R	L	S	sonam11bt@gmail.com
17111927	L	R	L	S	namgaytenzin851@gmail.com
17110625	L	R	L	M	ugay63@gmail.com
17110537	L	R	L	M	kezangchoejoe@gmail.com
17608696	L	R	L		singyeconstruction@gmail.com
77110258	L	R	L	S	songdi1958@gmail.com
17110039	L	R	L	M	alpinebuilders@gmail.com
17600209	L	R	L	L	ngawangjamtsho222@gmail.com

2182	YANGKHIL Construction Private Limited	Thimphu	327250
2206	The EMPIRE Construction Company Private Limited	Thimphu	584103, 584380
2233	TOB-DEN Construction Pvt. Ltd.	Sarpang	06-251800
2241	CHAPCHA Engineering Private Limited	Thimphu	321176, 17110146, 252539
2250	PELDEN Construction Private Limited	Thimphu	02-331461, 17305632
2263	KELWANG Private Limited	Thimphu	322565, 17111999
2266	SAMPHEL DHENDUP Construction Company Private Limited	Punakha	02-584338
2294	WELFARE Construction Private Limited	Thimphu	334125
2304	DIAMOND Construction Private Limited	Thimphu	02-339549/17160950
2309	DEYJUNG Construction Private Limited	Trashigang	17115092, 17663360
2317	LHO-MON Builders Private Limited	Chukha	02-335467,325861, 17117066
2319	E.W. Construction Private Limited	Thimphu	321738(o) 323405(r)
2348	KHARSA Construction Private Limited	Trashiyangtse	04 781115, 17682265, 17115272
2356	RAVEN Builders & Company Private Limited	Sarpang	06-251738
2370	CHENEY Construction	Trashigang	04-571149, 17623824, 17115223
2374	NAWANG Builders Private Limited	Thimphu	02336804/06,17140282, 17643399
2377	ARJUN Construction Pvt. Ltd.	Sarpang	
2379	TSHERING Construction Private Limited	Chukha	03-631595
2435	RIGSAR Construction Private Limited	Trashigang	04-521280, 521132, 17116565
2469	TSHOKI Construction	Thimphu	02-327435,
2481	DRUK HIMALAYAN Construction Private Limited	Haa	02-339697/ 08-375157
2490	T & K Construction Private Limited	Chukha	05-254508
2516	KUNLAY Construction Private Limited	Thimphu	325029, 02-334981
2536	PKC Construction Private Limited	Thimphu	02-341767, 323767
2581	RIGSUM GONPA Construction	Trashiyangtse	04 781180, 781211, 17699275
2586	T.TOBGYEL Construction Pvt. Ltd.	Trashigang	04-521521,17110520/ 17131713
2631	YARKAY Construction	Thimphu	02-336611, 05-253901, 05-252573,

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17112211, 17114770	L	R	L	L	yarkay@gmail.com

2637	U. WANGCHUK Construction	Paro	326383
2686	YUENDRUNG Construction Private Limited	Thimphu	
2826	NORYANG Private Limited	Thimphu	17111940,
2978	UGYEN TSHENDEN Construction PVT. LTD	Trashiyangtse	04-785127,17813575, 17130244
3061	K-RANGRIK Construction Company Private Limited	Sarpang	17630829/17645755
3062	INDANELLA Construction Private Limited	Pemagatshel	17130096
3067	DUNGKAR Company Private Limited	Thimphu	351195, 17111484
3163	PELDANG Construction Private Limited	Chukha	77353156 gm, 17130077, ceo
3206	BHUTAN Construction Private Limited	Thimphu	321188, 327521 17110018
3237	DEE GEE Construction Pvt. Ltd.	Paro	08 271273/17600105, 77102333
3248	SONAM JAMTSHO & BROS Construction	Lhuentse	04-545179,17113953, 77166666
3267	TSHERING TOBGYEL Construction	Wangdue Phodrang	02-481510
3329	U.P Construction	Thimphu	02-341207
3397	VAJRA Builder Private Limited	Thimphu	02-334981
3411	O.S.T Construction Private Limited	Thimphu	02-337236
3481	YANGCHENMA Private Limited	Thimphu	02-350273/17116200/ 17119233
3512	C.N Construction	Thimphu	17801233
3588	RIWANG Construction	Thimphu	351108, 02-334499
3590	T-KUNZOM Private Limited	Thimphu	02-339391,337381, 337382
3640	T & C L Construction	Thimphu	02-338959
3794	YARDAK Construction	Thimphu	17670968/17115434/ 17113388
3850	SERNYEL ZEYKHEL Construction	Pemagatshel	07 471152
3966	S.L Construction Private Limited	Thimphu	17694192, 02-347218, 17113950
3971	EIGHT Builders Pvt Ltd.	Sarpang	06-251321/06-251594
3998	TSAMGAR Construction Private Limited	Thimphu	02-342667
4060	DRUK KUNZANG Construction Pvt.Ltd	Thimphu	02326115/17612377/ 17112377
4103	BHUTAN Engg. Power Company Pvt. Ltd.	Thimphu	324524, 328980, 322091

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4114	NTT Construction Company Pvt. Ltd	Thimphu	17166666/17115225/ 337617
4153	AP SHA Construction	Thimphu	17604242
4181	PST Construction	Thimphu	06-251419
4266	YESHEY T. DENKAR PRIVATE LIMITED	Chukha	251188/17117322
4271	BHUTAN ALLIANCE Private Limited	Thimphu	07-471308, 17111970, 17602076
4467	KABAB Construction Private Limited	Thimphu	02-328466
4636	SHERIMUNG Construction Private Limited	Thimphu	17728903, 17562400
4637	RINGDREL Construction Private Limited	Mongar	17728903, 17867707
4639	PALDHEN NAMGYAL Const Pvt Ltd	Thimphu	17603298, 339832
4698	ISSUP Construction Pvt Ltd	Punakha	02-584340
4840	HI-TECH Company Private Limited	Punakha	2584557
4946	P.T Construction Private Limited	Sarpang	6251282
5003	TOETSHO-KHENI Construction	Trashiyangtse	17131080
5083	THUENLAM (N) Construction Private Limited	Thimphu	02-322669,02-326474
5116	DHODTER RIGTSEL Company Private Limited	Thimphu	02-337049/17629112
5126	GALAXY Builders Private Limited.	Chukha	05-253930
5184	JIGME WANGCHUK Construction	Samdrup Jongkhar	17886006/17130460
5340	BIKY Construction pvt Ltd	Wangdue Phodrang	02-481653
5367	CONSTRUCTION DEVELOPMENT CORPORATION LTD.	Thimphu	02-234569,2323702
5455	CHIMMI RD Construction Private Limited	Paro	08-240511,332392
5460	Karma and Chimmi Builders Pvt.Ltd	Thimphu	17116183/17116183
5728	JOENSHING Construction	Paro	02-340191
5814	Lotus Private Limited	Wangdue Phodrang	77767777 77878888
5850	LODEN Construction Private Limited	Thimphu	02-334331
6133	SOENAM MEBAR Construction Private Limited	Thimphu	17426916
6158	PEMA JUNEY Construction Private Limited	Thimphu	17772222/02332136
6289	GREEN MOUNTAIN Construction	Thimphu	17114408, 77225533, 17699591
6414	TSANGLHA Construction	Thimphu	17629759/02-323999

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6712	PELJOR LHENDUP Construction Private Limited	Trashigang	7481000
7030	LHENDUP NORBU Construction	Thimphu	17777785
7093	UPC Construction	Thimphu	17744570/17619718/ 77619718
7183	DELEK Builders Private Limited	Samdrup Jong-khar	06-252279
7225	GYELDRON VENTURE Builders	Chukha	05-253785
7317	T. NORBU T. Construction Private Limited	Mongar	17705498/17610013
7494	J.M Builders Private Limited	Thimphu	17118198/17658857
7521	CONTINENTAL CONSTUCTION [BHUTAN] Pvt. Ltd.	Chukha	05-252808
7640	CHOGYAL Construction Company Private Limited	Thimphu	02-326159
7644	Zangchong KJZ Private Limited	Zhemgang	04-521890
7646	WANGS Private Limited.	Thimphu	02-339121/77291717/ 17638214
7680	DRUK LAM-SEL Construction Compa-ny Pvt.Ltd	Thimphu	975-333417
7809	JANGCHUP Builders Pvt Ltd	Thimphu	02321028/17117131
7812	SONS Builders	Thimphu	17162662
7827	SOMSON COMPANY PRIVATE LIM-ITED	Mongar	04-744364
7846	ZAMKAR Construction Private limited	Sarpang	17829693/77934433/ 17934433
7872	RATNAPUNG CONSTRUCTION	Thimphu	17325566/77282855
7891	Muensel Builders Private Limited	Sarpang	
7906	Nor-Zang Construction private limited	Thimphu	2328914
7990	Shambhala Infra Pvt. Ltd	Thimphu	9752330177
8006	Meewang Construction Pvt, Ltd.	Thimphu	2336275
8045	TSHOK SUM BUILDER	Mongar	
8056	Hiraka Ventures Pvt. Ltd.	Chukha	

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CONTRACTORS - MEDIUM CLASS

CDB	Firm/Name	Dzongkhag	Tel.No.
1071	TASHI WANGCHUK Construction	Lhuentse	17743403, 04-641190
1073	KUENZANG Construction	Pemagatshel	07-471131, 17691163, 17130160
1075	K.P. Construction	Thimphu	3610330
1078	UGYEN Construction	Pemagatshel	
1093	JIGME DORJI Construction	Thimphu	17116184, 77116180
1099	RINZIN DORJI Construction	Thimphu	
1102	JAMYANG Construction	Wangdue Phodrang	481403, 481676,
1103	WANGCHUK Construction	Chukha	282381,17602380, 17665481
1173	SONAM Construction	Trongsa	17601889
1176	DONDHEN Construction	Mongar	380146
1180	AKASHA Construction	Mongar	
1190	DORJI Construction	Pemagatshel	07-471165
1195	T.T Construction	Thimphu	17600315,325552,
1211	UGYEN TSHERING Construction	Pemagatshel	07 471263
1236	Y C Construction	Thimphu	321297
1296	GYELTSHEN Construction	Bumthang	03-631307/17685696/ 17772221
1310	CHENGALA Construction	Mongar	04-680450
1343	SONAM YESHEY Construction	Mongar	04 744237, 17626430, 17117292
1361	DRUK PHUENSUM Construction	Wangdue Phodrang	04 481268, 17607506, 17977943
1367	DORJI Construction	Bumthang	325442, 03 641123, 17666717
1402	SHA SAMPHEL CONSTRUCTION	Wangdue Phodrang	481425, 17622082, 17111603
1403	DAMCHE Construction	Chukha	08-478392
1427	UT & SONs Construction	Mongar	330140/330140/ 338651
1428	TSHERING Construction	Mongar	04 539140
1432	SANGAY THINLEY Construction	Bumthang	03-631226,17115437
1441	PHUNTSHO Construction	Trongsa	521,246
1467	TSHERING Construction	Haa	08-375235,333306,
1475	RINGDOL Construction	Thimphu	337149
1485	SONAM T Construction	Thimphu	328862

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1490	DORJI Construction	Thimphu	323743
1533	DESANG Construction	Samtse	05 365243, 365490, 365242,
1547	GOODWILL Construction	Chukha	08 460418, 17604310
1549	KIPCHU Construction	Haa	08-375132
1558	SHA Construction	Wangdue Phodrang	481447/77878753
1630	TASHI DEYJUNG Construction	Trashigang	04 365175, 04 563045, 17886949
1671	T.T Construction	Sarpang	06 251373
1673	TENZIN DORJI Construction	Samdrup Jongkhar	07-481263
1676	DRUK K.D Construction	Thimphu	17769903,328151, 16923246
1690	GONGPHEL Construction	Paro	08 271389
1698	LEKI Construction	Thimphu	325075, 17607492, 17614344
1706	CHOKI Construction	Sarpang	06-251696,
1719	YARPHARLA Construction	Samtse	17492303/05-365334
1721	MANGALAM Construction	Mongar	04 785803, 07 251570, 17602712
1727	YANGDEN Construction	Dagana	332169,17924186/ 17137777
1738	PHUEL Construction	Tsirang	
1753	K & K Construction	Trashigang	04-521305
1757	CHETHUN Construction	Mongar	04-641167
1777	NIMA DHENDUP Construction	Pemagatshel	77196666/07481117/ 77242180
1783	CHENCHO Construction	Paro	08 271295,17606730, 17536767
1787	PEL DRUK Construction	Samtse	05 365358
1799	PENJOR Construction	Trashigang	04-521330
1814	P.K Construction	Wangdue Phodrang	471357, 481691, 17118115
1816	CHOGYEL Construction	Thimphu	351481
1818	RINCHEN Construction	Zhemgang	03 790600, 17604745, 17115587
1846	PEMA Construction	Zhemgang	03-741289
1891	TEE TEE Construction	Samdrup Jongkhar	7251137
1902	RICKEY Construction	Haa	17985693
1903	N.T.C Construction	Haa	08-373142, 375152

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1915	RUBTHUEN Construction	Trashigang	17111639/02-335629
1959	DAYSANG Construction	Haa	375,235
1981	KESANG Construction	Thimphu	08-271724
1993	PURNA Construction	Dagana	17151502/17705093
1994	LAMA Industry	Dagana	17150311/17151502
2001	TACHO Construction Private Limited	Chukha	05 252403,17111370
2024	NIDUP Construction	Thimphu	17341799/ 17642312
2070	TERBUM Construction	Wangdue Pho-drang	17111159
2160	R.D. Construction	Punakha	584134 (r), 17111105, 327831
2202	GADO Construction	Haa	08-272670,17778943, 17111536
2214	U.S Construction	Chukha	+975 5 252945
2226	SAMTEN Construction	Haa	08 375159, 17642986, 333417
2248	GLT Builders	Thimphu	323874
2267	KHANDU Construction	Haa	08 375222, 375303, 375666
2283	DE-KEELING Builders Private Limited	Chukha	05-254577,02-327948
2307	NGAWANG Construction	Thimphu	03-631781, 17554734
2316	DRUK MEBAR Construction	Chukha	02-322563/17110832/ 17601055
2324	SHINGJOGTANG Construction	Samdrup Jong-khar	07-251028
2330	NAMSEL BUDDHA Construction	Lhuentse	17870985
2344	PHUNTSHO NORLAM Construction	Bumthang	17727443
2357	SHA RADAK PHUNSUM Construction	Wangdue Pho-drang	02 481287, 17110982
2381	PUENSUM Construction	Chukha	17602565, 17615557, 17622011
2403	UDEE Construction	Bumthang	03-631119, 03-631139
2418	KEZANG NORBU Construction	Zhemgang	03 741241, 17664165, 17686978
2452	C.D Construction	Thimphu	365298, 06 251759
2455	SANGDAG Construction Private Lim-ited	Trashiyangtse	521248
2507	GEM Construction	Sarpang	06-251585
2548	NATIONAL Builders	Bumthang	03-631119

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2578	TSE-PHUG Construction	Thimphu	326929
2625	SAMPHEL DRUKPA Construction Private Limited	Thimphu	02-332887
2652	TASHI Construction	Chukha	478299, 254571, 17621358
2734	K.S.D Ventures	Chukha	17110137, 05-254790, 253458
2750	K.D Construction	Chukha	08-478664,08-478662
2775	SONAM YANGDAK Construction	Thimphu	
2800	GAHSEL Builders	Thimphu	05-252930 / 17601165, 05-254999
2816	TSHULTRIM METO Construction	Trongsa	521166
2828	NAMKAR Construction	Paro	77213141
2869	DOMTSHAP Construction	Thimphu	17606692, 17603202, 17737098
2875	DRUK KUENPHEN Builders	Wangdue Phodrang	17944293
2920	WANGMO Construction	Thimphu	327838,
2953	YESHI Construction	Thimphu	17493077
3005	TANDIN PENJOR Construction	Paro	08-272048, 17601591, 17632812
3009	NEO Construction	Thimphu	334,066
3015	GANGRI Construction	Samdrup Jongkhar	251,270
3086	DHOENDRUP Construction	Thimphu	351070, 17111327, 77100073
3098	GAKI PELBAR Construction	Thimphu	07-481177
3116	THUBTEN Construction	Bumthang	17493493
3118	KARMA TSHERING Construction	Thimphu	77452003
3133	MENTSANG Construction	Trashigang	324200
3146	RINZIN LHAMO Construction	Pemagatshel	17768140
3151	TASHI DELEK Construction	Punakha	05-84181
3155	C.T Construction	Trashigang	521395
3222	GOENPO Construction	Wangdue Phodrang	02-442003, 17646930, 17650579
3226	D.KAN'S Construction	Wangdue Phodrang	02-481248,77101144, 17111124
3236	INDO Construction	Paro	
3238	YANKEY Construction	Thimphu	324202/05-252271, 332056
3241	APEX Construction	Thimphu	77400500

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3278	TSHEVAM Construction	Trashigang	16490409
3282	RINCHEN BUMPA Construction	Lhuentse	04 545130
3296	TENZIN WANGCHUK Construction	Trongsa	17642019, 17115260
3300	KURIZAM COMPANY PRIVATE LIMITED	Paro	17130500
3319	SANGAY LODAY Construction	Lhuentse	17232443/17643014/ 04545186
3325	LOTEY Construction	Paro	08-272744,17120353
3347	DOEJAY Construction	Pemagatshel	07-471235
3348	TENZIN WANGMO Construction	Trashigang	04 -571149
3363	DRUK THUBTEN SANGAG CHOELING Construction	Zhemgang	03-741335
3368	SARAM Construction	Bumthang	17670461, 631787, 03631916
3372	DHONDUP Construction	Pemagatshel	17506968,77219804, tele- fax-07 481161
3385	NORZANG Construction	Bumthang	17120055
3391	K W M Construction	Paro	08-271331, 272270, 17300319
3392	U.N.D Construction	Thimphu	02 361188
3396	S.W. Construction	Trongsa	351169, 03 527014, 17601554
3401	KEZANG CHOKI Construction	Tsirang	06-47130,17921489
3415	DRUK WANGYEL Construction	Trongsa	03 521413
3447	SANGAY D Construction	Thimphu	17640156/77777785
3469	TASHI PHUNTSHUM Construction	Samtse	05-382092
3478	MASANG MEJUD Construction	Mongar	04-683704/17703171
3531	YONGPHEL Builders	Mongar	17777999
3574	NINGTOP Construction	Trongsa	03 521336, 17645714, 17120061
3586	NGAWANG THUBTEN Construction	Sarpang	17111956
3600	CHHOGDHEN Construction	Samdrup Jongkhar	17660322
3636	KUN-SUM Construction	Wangdue Phodrang	02-481447
3652	TSHERING PEMO Construction	Wangdue Phodrang	17618081, 17717600
3660	ZHENDUP Construction	Sarpang	06-251249
3669	TSASUM YANGPHEL Construction	Trashigang	04 563011
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3710	TSHENTHANG Construction	Thimphu	17113290, 08-240806, 17116055
3737	DRUKSAM Builders	Chukha	05-251611/17666155/ 77215591
3751	L.G Construction	Trashigang	02-328553/04-521405/17855576
3759	NAGTSHANG Construction	Trashiyangtse	04 785127
3760	KUNZANG DHENDRUP Construction	Trashiyangtse	17621441,04-785127, 17813755
3762	KARMA BUILDERS	Thimphu	326382
3764	KHINEY Construction	Trashiyangtse	17826737
3816	D D Construction	Zhemgang	17774467
3839	NGALA RETSHEL Construction	Wangdue Phodrang	17674187,77100365, 17566587
3853	PHUENTSHOG RABGAYL Construction	Thimphu	17678080
3891	SERBU Construction	Trashiyangtse	17616973
3903	LOEB Construction	Thimphu	322565,02-376121
3908	DANGKHAR Construction	Zhemgang	03-741179
3912	GONGTHUNG Construction	Trashigang	17721234, 17115220
3921	TSHENTOP Construction	Paro	17899750/77107579/ 77262080
3948	JAM NYING GAR Construction	Trashigang	17733578, 17547120
4061	PELDEN DRUKPA Construction	Thimphu	327830/17638310, 17115969
4076	NORZANG Builders	Chukha	5251203
4102	D.K Construction	Thimphu	17738921
4130	SONAM TENZIN Builder	Thimphu	02322043/17600291
4132	GREEN Construction	Paro	02-326776
4151	DRUKTER Builders	Haa	77213337, 17805077
4155	PHUNRABGYAL Construction	Bumthang	03-631163
4184	NORDENMA Construction	Thimphu	326382/323338, 77203090
4193	KHUJU Construction	Sarpang	6251143
4197	SONAM T. Construction	Bumthang	17725095
4203	SAMTHUEN Construction	Dagana	17683969
4238	GELEP Construction	Wangdue Phodrang	2481250
4249	D & B Construction	Thimphu	17653502/17786991, 17786990

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4285	SONAM JORDHEN Construction	Trongsa	17544542
4293	DRUK GANGJONG Construction	Thimphu	17651569/77277701
4312	NIMA DAWA Construction	Sarpang	17345840
4352	JIGME NORBULING Construction	Trashigang	
4444	DAA Construction	Paro	17627936,77202937/ 08-271139
4446	BAJOP CHIMI Construction	Punakha	481158/77617962/ 17615135
4449	Bumzang Construction Pvt. Ltd.	Punakha	17619223, 17653730
4497	G.D. Construction	Paro	17110746/77266501/ 17400161
4528	JANGUP Builders	Samtse	77315159
4549	TSATRA RANAM Construction	Mongar	17657900
4558	IRON K. Builders	Sarpang	77214262
4560	DRUK DHOEDJUNG Construction	Thimphu	02-337602
4565	MASTER Construction	Trashiyangtse	04-781180/04781211, 17113505
4594	T. NAMGYAL Construction	Sarpang	17898947, 03-790645, 17938121
4601	BROTHER Construction	Mongar	4641642
4615	OGYEN Construction	Thimphu	17633433/02331133
4627	TLK Construction	Chukha	254790/17613086/ 17117162
4641	GORTAP Construction	Pemagatshel	17765983,07-471152, 17130434
4683	KHULAL Construction	Thimphu	3360702/17618253
4686	THUELBAB Construction	Samtse	05-365593,17885609
4693	TASHI NORPHEL Builders	Sarpang	06-251963/17621657
4703	LARJAB Construction	Mongar	17647988
4730	JANGKHURUNG Construction	Sarpang	17727665
4742	STS Builders	Punakha	77250001/584395, 17111601
4762	UGYEN CHAMKHAR Construction	Bumthang	17732810
4768	SONAM KUENPHEN Construction	Samdrup Jong-khar	17773900/77443696
4771	CHIMI WANGMO Construction	Thimphu	17610347, 332278
4793	LUNGKHAR Construction	Trashiyangtse	17131244
4799	MKR Construction	Sarpang	17754599, 17669390
4844	RP3 Builder	Tsirang	06-251131
4845	MAHABALHA Construction	Trongsa	17644773, 77117280

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4998	THINLEY RABTEN Construction	Bumthang	17853468, 17670820
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5021	TSHERING ZAMLING Construction	Chukha	17838371/77217804
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5044	TSHECHAB Construction	Thimphu	17645667
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5118	BARKO Construction	Paro	17605703/77605703
5166	GAKI PHUNTSHO Construction	Trashigang	17813509/17131005
5179	UGYEN NAMKHE DORJI Construction	Trashigang	17652085
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5259	LHATU Construction	Thimphu	17151777
5296	RADHING Construction	Thimphu	02-331480
5339	NIMA YARGAY Construction	Samtse	77106352
5361	CHODA Construction	Trashigang	17558431/17117080
5362	JIGDREL Construction	Trashigang	
5385	DS Construction	Samdrup Jong-khar	17470504/17470507, 07-251376
5400	SHEKHAR Construction	Chukha	17115443,05-253380
5410	SAMPHEL DENDRUP Construction	Lhuentse	17700969, 17130850, 17700933
5424	BANGA Construction	Bumthang	03-631343,7787979, 177554799
5441	UPHEL Construction	Thimphu	17625108/17679640
5465	KTP Construction	Mongar	17610013
5478	DEJUNG BUMZANG Construction	Samdrup Jong-khar	17997088/17121029
5492	DRUK BARTSERI Builders	Pemagatshel	17611516
5555	SELZANG Builders	Thimphu	02-337897/17602993
5621	PELDRUK Builders	Wangdue Pho-drang	77111103/17111103
5632	NORZEA Construction	Tsirang	17878211/17661014/ 17516612
5654	KHAMBU Construction	Tsirang	17795515/17809511
5655	LAYGOI Construction	Sarpang	17621955/17511229
5692	DHUGDRAL DEYACHEN Construction	Thimphu	17705669/17323191
5740	LHANAM PELMO Construction	Sarpang	17130066

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5890	TASHI YARTSEL Construction	Chukha	77635105/17635105
5958	GALING Builders	Sarpang	06-252008,17113678
5986	JABAB TSHEGYEN Construction	Paro	17658826
5993	TAK DONGCHEN Construction	Thimphu	17902626
6050	DRUKSEL Construction	Samtse	251706
6101	KEZANG D Construction	Mongar	17657849
6119	Palden Jamtsho Construction	Sarpang	17686978
6129	SORAY Builders	Dagana	17635298, 77286160
6147	LOBZANG PHUENSUM TSHOGPA Construction	Trashigang	16481149
6149	C T P Construction	Trashigang	17803002
6203	SONAM KD Construction	Trashigang	17855520
6216	H.R. Construction	Sarpang	17590373
6239	TY. TSHOGGYEL Construction	Thimphu	17407905
6256	JIGME PHUENTSHOK YOUESEL Construction	Sarpang	16901098
6280	NORJUN Construction	Chukha	05-251994
6312	GAWAI NYIMA Construction	Thimphu	351723/77223230
6375	S GYELTSHEN Construction	Lhuentse	04-545123
6409	RUBJIB PASSANG NORPHEL Construction	Wangdue Phodrang	17616813/77616813
6417	KHENG RIGNAM SUM Builders	Thimphu	17111077
6480	DANIYAL Construction	Sarpang	17260042, 06-252072
6494	SHAKSHING GOENPA Construction	Thimphu	17636431
6528	NEHEMIA Construction	Tsirang	17290328, 77402240
6530	TASHI YANGKHIL DENDUP Construction	Paro	17638594
6585	ADD BHUTAN Construction	Sarpang	17150999/06-252071
6610	DRUK PENJOR Construction	Haa	08-375234
6620	SONAM G. Construction	Wangdue Phodrang	77467666/77413651
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6695	SHOMOP Construction	Paro	17895346, 77392530
6825	YOEZERLING Construction	Thimphu	17114214
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7149	DRUK ELITE Builder	Thimphu	17568189
7169	SOMU Construction	Sarpang	06-365363/17632467/ 17519929
7184	DAWA ZANGPO Construction	Trashiyangtse	17682386
7222	SANGAY DORJI Construction	Samdrup Jong-khar	17863015/17729954
7245	PHUB Builders	Thimphu	17623750
7249	GAANA Builders	Thimphu	02 - 350515
7257	KARMALING Construction	Paro	08-272069
7276	DALA Construction	Thimphu	17114408/77225533
7287	DHUSEL Construction	Thimphu	17932179
7355	DRUK ZAMLING Builders	Punakha	17615150
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7366	BEE BEE Builder	Sarpang	06-252102
7370	APPLE BUILDERS	Wangdue Pho-drang	17663238
7399	CHADO T Construction	Punakha	77118464/17118464
7516	DUDU Construction	Trongsa	77111166
7531	NANGSEL DEMA Construction	Mongar	17703133
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7804	Druk Norzang Builders	Thimphu	17118181
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7823	DOEJUNG CONSTRUCTION	Thimphu	17110599
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Sl	Name	Telephone	Fax
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HIGH COURT			
1	PABX	322355/322517/333308	323310
DZONGKHAG COURT			
1	PABX	329197/334654	324255
ROYAL AUDIT AUTHORITY			
1	PABX	322111/322833/324961/328729 /328730	323491
MINISTRY OF AGRICULTURE & FORESTS			
1	Hon'ble Lyonpo	322482	323153
2	PA to Hon'ble Lyonpo	322129	
3	Secretary	326735	326834
4	PA to Secretary	322379	
Bhutan Agriculture & Food Regulatory Authority			
1	PABX	327031/325790/325993	327032
2	Executive Director	327030	
DEPARTMENT OF AGRICULTURE			
1	PABX	322228	323562
2	Director	322805	
DEPARTMENT OF FORESTRY SERVICES			
1	Director	323055	322395
2	PA to Director	321185	
Nature Conservation Division, NCD			
1	PABX	325042	325475
DEPARTMENT OF LIVE STOCKS			
1	PABX	322418/322795/322384	322094
2	Director	323146	
FORESTS RESOURCES DEVELOPMENT DIVISION			
1	Joint Director	325835	

MINISTRY OF ECONOMIC AFFAIRS			
1	Hon'ble Lyonpo	322211	323617
2	PA to Hon'ble Lyonpo	322211	
3	Secretary.	326800	333317
4	PA to Secretary	322665	
5	Joint Secretary	325862	
6	PA to Joint Secretary	321337	321335
DEPARTMENT OF ENERGY			
1	Director General	323555	
2	PA to Director General	322505	335122
Bhutan Energy Authority			
1	Head	327318	328757
DEPARTMENT OF GEOLOGY & MINES			
1	PABX	323096/323349/322879/324118 /324142/323409	
2	Director General	323013	
3	PA to Director General	323096	
DEPARTMENT OF INDUSTRY			
1	Director General	325323	323507
2	PA to Director General	323597	
Industrial Infrastructure Development Division			
1	PABX	323536/332081	
2	Head	332079	
DEPARTMENT OF TRADE			
1	PABX	322407/333052/325588	
2	Director		326827
3	PA to Director		333052
REGIONAL TRADE & INDUSTRY OFFICE			
1	Regional Director	323334	331901
TOURISM COUNCIL OF BHUTAN			
1	PABX	323251/323252	323695
2	Director General	325225	
3	PA to Director General	325504	
BASOCHU POWER PROJECT			
1	Liaison Officer	327021	
KURICHU PROJECT AUTHORITY			
1	General Manager	324427	324428
TALA HYDRO ELECTRIC PROJECT AUTHORITY			
1	Asst. Liaison Officer	324985/325479	324803

MINISTRY OF EDUCATION			
1	Hon'ble Lyonpo	325431	
2	PS to Lyonpo	323825	326424
3	PA to Hon'ble Lyonpo	325431	
4	Secretary	325230	
5	PA to Secretary	325146	
DEPARTMENT OF ADULT & HIGHER EDUCATION			
1	Director	336174	326706
2	PA to Director	325648	
DEPARTMENT OF YOUTH & SPORTS			
1	PABX	325177/325421/325084	3250199
2	Director	335446	
3	PA to Director	325084	
BHUTAN BOARD OF EXAMINATION, BBE			
1	Secretary	322724/326559	325086
DEPARTMENT OF SCHOOL EDUCATION			
1	Director	325325	
SCHOOL PLANNING & BUILDING DIVISION			
1	PABX	325085/325142	323550
2	Executive Engineer	332308	
MINISTRY OF FINANCE			
1	PABX	322271/322285/322223/322514/327763	323154
2	Hon'ble Lyonpo	324867	
3	PA to Hon'ble Lyonpo	324867	333976
4	Secretary	327362	
5	PA to Secretary	322717	
6	Director General	327762	
DEPARTMENT OF NATIONAL BUDGET			
1	PABX	326770/326771/327772	323034
2	Director	324992	
3	PA to Director	322186	
DEPARTMENT OF PUBLIC ACCOUNTS			
1	PABX	322951/322604/322641/337063	334994
2	Director	335720	
3	PA to Director	324346	
DEPARTMENT OF REVENUE & CUSTOMS			
1	PABX	322319/333509	323608
2	Director	323057	
3	PA to Director	322389	

REGIONAL REVENUE & CUSTOMS			
1	PABX	323076/323609	324783
2	Regional Director	328104	
DEPARTMENT OF NATIONAL PROPERTIES			
1	PABX	322582/324151	324129
2	Director General	324128	
3	PA to Director General	336963	
4	Head, PPPD	336962	
MINISTRY OF FOREIGN AFFAIRS			
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3	PA to Hon'ble Lyonpo	322359	
4	Secretary	333729	
5	PA to Secretary	321413	
DEPARTMENT OF BILATERAL AFFAIRS			
1	Director	322278	323240
2	PA to Director	322278	
DEPARTMENT OF MULTILATERAL AFFAIRS			
1	Director	323297	
DEPARTMENT OF PROTOCOL			
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DEPT. OF SAARC & REGIONAL ORGANIZATIONS			
1	Director	337980	
MINISTRY OF HEALTH			
1	PABX	322602/328091/328092/328093/321328/326794/321842/322681/322961/325564/322385/326747/321789/331786	323113
2	Hon'ble Lyonpo	328359	
3	PS to Hon'ble Lyonpo	323944	
4	PA to Hon'ble Lyonpo	323973	
5	Secretary	326626	
6	PA to Secretary	326627	
PUBLIC HEALTH ENGINEERING DIVISION			
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HEALTH INFRASTRUCTURE DEVELOPMENT PROJECT			
1	Project Director	325111	

HEALTH TRUST FUND			
1		324632	
GOI PROJECT			
1	PABX	324468	
2	Project Manager	325111	
MINISTRY OF HOME & CULTURAL AFFAIRS			
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4	PA to Hon'ble Lyonpo	322643	
5	Hon'ble Secretary	322704	325049
6	PA to Hon'ble Secretary	322502	
DEPARTMENT OF DISASTER MANAGEMENT			
1	Director	327098	
2	PA to Director	334944	334944
DEPARTMENT OF LOCAL GOVERNANCE			
1	Director General	326935	327864
2	Joint Director	331898	
DEPARTMENT OF CIVIL REGISTRATION & CENSUS			
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Civil Registration & Citizenship Services Division			
1	Joint Director	327006	
DEPARTMENT OF IMMIGRATION			
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4	Joint Director	333522	
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DEPARTMENT OF CULTURE			
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4	Dzongrab	323783	

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MINISTRY OF LABOUR & HUMAN RESOURCES			
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2	Dy. Secretary	328431	
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DEPARTMENT OF EMPLOYMENT			
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DEPARTMENT OF HUMAN RESOURCES			
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1	Principal	327163	327172
MINISTRY OF WORKS & HUMAN SETTLEMENT			
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2	PABX-Old Building	327451/326793/321571	

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6	PA to Secretary	322429	322270
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3	PA to Director General	321434	
Construction Development Board			
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3	Executive Director	333502	
INVESTIGATION & DEVELOPMENT DIVISION			
1	Joint Director	334947	
Roads Division			
1	Chief Engineer	328203	
2	Executive Engineer	323796	
3	Dy. Executive Engi-neer	325913	
BHUTAN STANDARDS BUREAU			
1	PABX	325104/328298/326905	328298
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AUTONOMOUS BODIES			
NATIONAL ENVIRONMENT COMMISSION			
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DRUK HOLDING & INVESTMENT LTD			
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3	Executive Director	335794	
4	Chief Executive Officer	336256	
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3	PA to Managing Director	323110	
4	Dy. Managing Director	321701	
BHUTAN BROADCASTING SERVICES			
1	PABX	323071/326863/322533	328030
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3	PA to Managing Director	332340	323073
CORPORATIONS			
BANK OF BHUTAN LTD			
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3	General Manager	322444	
4	Thimphu Main Branch	323852	
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3	General Manager	337473	
BHUTAN NATIONAL BANK LTD			
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2	Chief Executive Officer	325662	
3	Dy. Chief Executive Officer	324183	
4	Branch Office	327535	331778
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2	Chief Executive Officer	333456	
3	PA to Chief Executive Officer	323103	338056/336782
BHUTAN TELECOM LTD			
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3	PA to Chief Executive Officer	327797	
CITY CORPORATION			
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3	PA to Executive Secretary	323665	
DRUK PUNJAP NATIONAL BANK LTD.			
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3	Dy. Chief Executive Officer	331291	
4	Branch Head	334379	
NATURAL RESOURCES DEV. CORPORATION LTD			
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2	Managing Director	325584	
3	Dy. Managing Director	326749	
4	Wang Division	323469	
KUENSEL CORPORATION			
1	PABX	322483/324688/322134	322975
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ROYAL INSURANCE CORPORATION OF BHUTAN			
1	PABX	322426/321161/323487/328307 324282/336758/323993	
2	Chief Executive Officer	328619	
3	PA to Chief Executive Officer	321036	336085
4	Executive Director	322133	
5	Manager	328308	
BHUTAN DEVELOPMENT BANK LTD			
1	PABX	322579/323425/333865/324687	323428
2	Managing Director	323424	
3	PA to Managing Director	324162	
4	Dy. Managing Director	323423	

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2	Managing Director	331988	333578
DAGACHHU HYDRO POWER CORPORATION			
1	General Manager	336095	336093
DRUK GREEN POWER CORPORATION LTD			
1	PABX	336413/336414	336342
2	Managing Director	336341	
3	PA to MD	336341	
NATIONAL HOUSING DEV. CORPORATION			
1	PABX	323147/332734/332735	
2	Director General	332732	332733
3	PA to Director General	331357	
DUNGSAM CEMENT PROJECT			
1	Liaison Office	336214	
PUNATSANGCHHU-I HYDROELECTRIC PROJECT AUTHORITY			
1	PABX	336851/335828	
2	Managing Director	336868	336870
3	Personal Secretary	336868	
PUNATSANGCHHU-II HYDROELECTRIC PROJECT AUTHORITY			
1	Chief P&A	332231	
2	Sr. Personnel Officer	332182	332186
STATE TRADING CORPORATION OF BHUTAN			
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2	Dy. General Manager	324785	
MANGDECHHU HYDROELECTRIC POWER PROJECT AUTHORITY			
1	PABX	521407	
Kurichhu Hydropower Plant			
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Chhukha Hydropower Plant			
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Tala Hydropower Plant			
1	PABX	77182006	05 -272070
Basochhu Hydropower Plant			
1	PABX	471021/471026	471020
KHOLONGCHHU HYDRO ENERGY LIMITED			
1	PABX	08 -781139/781044	781144
2	PA	781208	

Tangsibji Hydro Energy Limited			
1	PABX	03-521653	
MEDIA			
BHUTAN OBSERVER			
1	PABX	334891/334892/334893	327981
2	Managing Director	336367	
RADIO VALLEY, 99.9 FM			
1	PABX	335733	335744
KUZOO FM			
1	PABX	335264	
2	Managing Director	335567	335263
THE JOURNALIST PVT. LTD			
1	PABX	327540	321680
CSOs/NGOs			
ARMY WELFARE PROJECT			
1	Liaison Office	336001	
ASSOCIATION OF BHUTANESE TOUR OPERATORS			
1	PABX	322862/334439	325286
2	General Secretary	327715	
BHUTAN CHAMBER OF COMMERCE & INDUSTRY			
1	PABX	322742/324254	323936
2	President	326446	
3	Secretary General	323140	
ABILITY BHUTAN SOCIETY			
1	PABX	340747	340747
BHUTAN NETWORK FOR EMPOWERING WOMEN (BNEW)			
1	PABX	328878	334078
Bhutan Toilet Org			
1	General Secretary	17605030	
BHUTAN ASSOCIATION OF WOMEN ENTREPRENEURS			
1	PABX	329125	
BHUTAN MEDIA FOUNDATION			
1	PABX	331705 / 331709	
BHUTAN CANCER SOCIETY			
1	PABX	339174	
BHUTAN ANIMAL RESCUE AND CARE			
1	BARC OFFICE	7710 3516	
BHUTAN TRANSPARENCY INITIATIVE			
1	General Secretary	340921	340923

BHUTAN KIDNEY FOUNDATION			
1	General Secretary	328654	328654
BHUTAN CENTRE FOR MEDIA AND DEMOCRACY			
1	General Secretary	327903/339725	327219
CHITHUEN PHENDHEY			
1	General Secretary	333111	340796
CLEAN BHUTAN			
1	General Secretary	333709	
DISABLED PERSONS' ASSOCIATION OF BHUTAN			
1	General Secretary	339996	
DRAKTSHO THIMPHU			
1	General Secretary	327650/328750	327650
GNH CENTRE BHUTAN			
1	General Secretary	321263/322354	332275
GYALYUM CHARITABLE TRUST			
1	General Secretary	334412	333079
JANGSA ANIMAL SAVING TRUST			
1	General Secretary	335482	
LODEN FOUNDATION			
1	Executive Director	77193322	
LHOMON SOCIETY			
1	General Secretary	322751/335613	
MUSIC OF BHUTAN RESEARCH CENTRE			
1	General Secretary	17639934	
MENJONG FOUNDATION			
1	General Secretary	77128816	
NAZHOEN LAMTOEN			
1	General Secretary	338589	
PEL DRUKDRALING FOUNDATION			
1	General Secretary	17618421	
ROYAL TEXTILE ACADEMY			
1	PABX	336460 / 337589	328128
2	Executive Director	335117	
ROYAL SOCIETY FOR PROTECTION AND CARE OF ANIMALS			
1	PABX	323268	
ROYAL SOCIETY FOR PROTECTION OF NATURE			
1	PABX	322 056 / 326 130	323189

SABAH BHUTAN			
1	PABX	336745	336749
TARAYANA FOUNDATION			
1	PABX	329333	331433
ASSOCIATION OF BHUTANESE INDUSTRIES			
1	PABX	05-251340	05-251341
GUIDE ASSOCIATION OF BHUTAN			
1	Executive Director		
HANDICRAFTS ASSOCIATION OF BHUTAN			
1	Executive Director	338089	
JOURNALISTS ASSOCIATION OF BHUTAN			
1	Executive Director	339154	327287
HOTEL AND RESTAURANT ASSOCIATION OF BHUTAN			
1	Executive Director	336714/336262	336263
PHUENTSHOLING SPORTS ASSOCIATION			
1	General Secretary	05-253963/05-253964	

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