



# **CONSTRUCTION, MAINTENANCE, OPERATION AND EMERGENCY SERVICE FOR PUBLIC LIGHTING NETWORK**

## **PUBLIC TENDER**

### **TENDER DOCUMENTS**

(Tender Ref.: PLD-CS001/24/88)

**COMPANHIA DE ELECTRICIDADE DE MACAU – CEM, S.A.**

**“CONSTRUCTION, MAINTENANCE, OPERATION  
AND EMERGENCY SERVICE FOR PUBLIC  
LIGHTING NETWORK”**

**TENDER DOCUMENTS**

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**“CONSTRUCTION, MAINTENANCE, OPERATION  
AND EMERGENCY SERVICE FOR PUBLIC  
LIGHTING NETWORK”**

**I - Tender Announcement**

**Announcement**  
**“Construction, Maintenance, Operation and Emergency Service for Public Lighting Network”**  
**Public Tender**  
**(Tender Ref. PLD-CS001/24/88)**

1. **Tendering entity:** Companhia de Electricidade de Macau – CEM, S.A.
2. **Tender type:** Public tender
3. **Location of service:** Whole territory under the jurisdiction of Macao SAR
4. **Purpose of service:** To provide construction, maintenance, operation and emergency services for the public lighting network of Macao SAR
5. **Contract period:** 3 years, starting from 1<sup>st</sup> of July 2024
6. **Validity of proposals:** 90 days, starting from the date of public tender opening, may be extended following the instructions set in Programme of Tender
7. **Type of award:** Remunerated according to the list of unit prices
8. **Tender security:** MOP3,300,000.00 (Patacas Three Million and Three Hundred Thousand), either in the form of cash deposit, a cheque or a bank guarantee in favour of Companhia de Electricidade de Macau - CEM, S.A.
9. **Performance security:** MOP6,600,000.00 (Patacas Six Million and Six Hundred Thousand), either in the form of cash deposit, a cheque or a bank guarantee in favour of Companhia de Electricidade de Macau - CEM, S.A.
10. **Base price:** No base price
11. **Admission prerequisite:** Interested entities must be registered in the Land and Urban Construction Bureau of Macao SAR (DSSCU) for execution of works or, those who have submitted application or renewal before the date of public tender opening and the acceptance of the latter will be subject to the approval of its application or renewal

**12. Date, location and price to check and obtain tender documents:**

Date: From date of publication of this announcement until 10<sup>th</sup> May 2024

Time: 09:00 – 13:00 and 15:00 – 17:00 on working days

Location: Procurement and Logistics Department (PLD)

Estrada D. Maria II, Edif. CEM, 11/F, Macao

Copy of the tender documents can be requested from CEM by paying a fee of MOP500.00 (Patacas Five Hundred) and the amount received is reserved in favour of CEM. The tender documents can also be downloaded free of charge at CEM website ([www.cem-macau.com](http://www.cem-macau.com)).

**13. Date, time and location of tender explanation:**

Date and time: 18<sup>th</sup> April 2024 (Thursday), from 10:30 to 12:00

Location: Estrada D. Maria II, Edif. CEM, CV4 Integration Workshop

**14. Date, time and location for proposal submission:**

Deadline: 10<sup>th</sup> May 2024 (Friday), at 17:00

Location: Companhia de Electricidade de Macau – CEM S.A.

Estrada D. Maria II, Edif. CEM (Reception of Ground Floor),  
Macao

15. **Language for proposals:** Proposals shall be written in official language of Macao SAR or in English language

16. **Date, time and location of public tender opening:**

Date and time: 13<sup>th</sup> May 2024 (Monday), at 10:00

Location: Estrada D. Maria II, Edif. CEM, 9th Floor Multifunction Room

Bidders or their representatives should be present at the public tender opening for the purposes specified in Article 27 of Decree-Law No. 63/85/M dd. 6<sup>th</sup> July, and to clarify any possible questions regarding the proposals submitted.

Bidders can be represented by authorised persons for the public tender opening. The said authorised persons shall present the notarised authorisation documents in order to attend the opening.

17. **Proposal Evaluation Criteria and Respective Weighting Factors:**

The evaluation is divided into two phases. The first phase has the nature of elimination. The Bidders can go to the second phase evaluation only if he can comply with the Technical Specification, all requirements in the Tender Specification, all terms and conditions in the Programme of Tender as well as meeting the compulsory items in the first phase evaluation criteria.

First Phase Evaluation Criteria	
- Human resources	
- Completeness of equipment	
- Experience of the excavation works in Public Road from 2018-2023	
- Experience of the LV electrical equipment installation from 2018-2023	
- Experience of the LV electrical equipment maintenance from 2018-2023	

Second Phase Evaluation Criteria	Weighting
- Price	90%
- Management and Quality Certifications	10%

The entity to host this tender shall evaluate the proposals in accordance with the information on the proposals, and the methodology and score weighting as described above.

18. **Supplementary Information:** Starting from 29<sup>th</sup> April 2024 until the deadline of proposal submission, bidders can visit the Procurement and Logistics Department (PLD), located at Estrada D. Maria II, Edif. CEM, 11/F or CEM website ([www.cem-macau.com](http://www.cem-macau.com)) for supplementary information, if any.

Companhia de Electricidade de Macau - CEM, S.A., on 10<sup>th</sup> April 2024.

Leong Wa Kun  
Chairman of the Executive Committee

Zhang Jian  
Executive Director

**“CONSTRUCTION, MAINTENANCE,  
OPERATION AND EMERGENCY SERVICE FOR  
PUBLIC LIGHTING NETWORK”**

**II - PROGRAMME OF TENDER**

## II.1. – Preface of Programme of Tender

The Contractor should consider the following points in his proposal:

1. During the execution of the Contract and after completion of the Contract, the Contractor is the only responsible entity for the final quality achieved in the Contract, for all completed works and installed equipment, as well as for the guarantee of the quality and safety, and efficient functioning and operation, to the awarding entity.
2. During the execution of the Contract, the Contractor is the sole responsible entity for all acts arising from activities on the site and surroundings, thus, it must insure all risks against persons, objects and existing infrastructure, which may be influenced by such activities directly or indirectly until the works being taken over by the awarding entity by insurance policy issued by the insurers as per list specified in clause 1.4.2 of the Specifications (General Conditions of Contract).
3. For the measures of supervision of the Contractor to the employees, please see the rules stipulated in related sections of the Tender Documents.



## **II.2. – Programme of Tender**

### **1. TITLE OF THE CONTRACT & CONSULTATION OF TENDER DOCUMENT**

- 1.1 Companhia de Electricidade de Macau - CEM, S.A. henceforth referred to as CEM, accepts proposals in accordance with this Tender Documents relating to the “CONSTRUCTION, MAINTENANCE, OPERATION AND EMERGENCY SERVICE FOR PUBLIC LIGHTING NETWORK”.
- 1.2 The tender documents of “CONSTRUCTION, MAINTENANCE, OPERATION AND EMERGENCY SERVICE FOR PUBLIC LIGHTING NETWORK” are now available for consultation at the Procurement and Logistics Department (PLD) on the 11<sup>th</sup> floor of Estrada D. Maria II, Edif. CEM, during the working days from 9:00 am to 1:00 pm and 3:00 pm to 5:00 pm, from date of publication of respective tender announcement till date prior to tender opening.
- 1.3 The constitution of tender documents is shown in the INDEX.
- 1.4 Interested parties may pay MOP500.00 (Patacas Five Hundred) to acquire a copy of the tender documents which will be available within 5 days after payment, or download free of charge from CEM website ([www.cem-macau.com](http://www.cem-macau.com)).
- 1.5 The said interested parties are responsible for verification and comparison of the copy and the original, and are also responsible for acquiring the latest information or the amendment posted on the website every day before tender closing time. CEM shall not accept any complaint due to missing information arising from the responsibility of the bidders.

### **2. COMPLAINT OR QUERY TO THE TENDER DOCUMENT**

- 2.1. The entity hosting this tender is CEM. In the event of any doubts on the explanation of the information of tender documents for consultation, any complaint and application for clarification could be sent to CEM in written according to the time schedule as specified in Clause 19 of this Programme of Tender.
- 2.2. The clarification mentioned in the above clause shall be replied in written based on the time schedule set in Clause 19 of this Programme of Tender. In case that no reply is made on the last day of the schedule, it could be a reasonable reason to postpone the tender submission date if the applicant of clarification requests so.
- 2.3. A copy of the clarification shall be bound to the tender documents, and shall inform all the bidders via CEM website ([www.cem-macau.com](http://www.cem-macau.com)) and in written.
- 2.4. The Bidder is responsible for acquiring the latest information posted on the website before submitting the proposal.
- 2.5. The tender documents are written in Chinese and English languages. However, the Chinese version shall prevail if there is discrepancy between the two language versions.

### **3. TENDER EXPLANATION**

A tender explanation session will be held at Estrada D. Maria II, Edif. CEM - CV4 Integration Workshop starting from 10:30 to 12:00 on 18<sup>th</sup> April, 2024 (Thursday). During the session, CEM will provide detailed explanation concerning the technical and contractual terms of the tender documents.

### **4. SUBMISSION OF PROPOSAL**

- 4.1 The proposal shall be delivered by the Bidder or his representative in person to Companhia de Electricidade de Macau – CEM S.A. at Estrada D. Maria II, Edif. CEM, Macao (Reception of Ground Floor) no later than 17:00 of 10<sup>th</sup> May 2024 (Friday), and a receipt will be given. Besides, the proposal can also be delivered by registered mail with acknowledgement of receipt to the below address:

Companhia de Electricidade de Macau - CEM, S.A.  
Procurement & Logistic Department  
Estrada D. Maria II, Edif. CEM  
Macao

- 4.2 The deadline of proposal submission specified above is based on CEM office hour.
- 4.3 If the proposal is submitted by mail, the Bidder shall be solely responsible for the event of not acceptance of the proposal due to late submission, and shall not make any complaint.
- 4.4 All items of the List of Unit Prices provided by the tendering entity shall be completed. Any item without price written will lead to rejection of the proposal. The value of prices shall only be expressed in Arabic numerals (0-9). Other type or form of writing is not allowed, or else the proposal shall not be accepted as well.

### **5. LOCATION, DATE AND TIME FOR TENDER OPENING**

- 5.1 All proposals and documents shall be opened at Estrada D. Maria II, Edif. CEM - 9th Floor Multifunction Room at 10:00 on 13<sup>th</sup> May 2024 (Monday).
- 5.2 In the case of force majeure, which results in CEM headquarter being temporarily closed, the proposal opening date and time listed above would thus be extended to the following working day at the same time.
- 5.3 Based on the foreseeable effect in accordance with article 27 of the Decree Law no. 63/85/M dated 6<sup>th</sup> July, the Bidders or their legal representative(s) shall attend the tender opening. The authorised representative(s) shall present a notarised power of attorney which shows he/she is authorised to attend the tender opening (Annex XIX).

## **6. ADMISSION PREREQUISITE OF BIDDERS**

Bidders must be registered in the Land and Urban Construction Bureau of Macao SAR (DSSCU) for execution of works or, those who have submitted application or renewal before the date of public tender opening and the acceptance of the latter will be subject to the approval of its application or renewal.

## **7. TYPE OF CONTRACT & FORMAT OF PROPOSAL**

- 7.1 Remunerated according to the List of Unit Prices.
- 7.2 The Price Proposal (Annex I) and List of Unit Prices (Annex II), in accordance with the sample attached, must be written in one of the official languages of Macao SAR or in English language. Any amendment, insertion between the lines or deletion of words are not allowed. The documents shall only be completed by either using printer or handwriting (except the signature). If printing is used, the printer must be always the same, or, if the documents are handwritten, the same calligraphy and ink must be used, and writing in pencil is not accepted.
- 7.3 The proposal documents shall be signed by the Bidder or his authorized representative. When the documents are signed by the representative, a power of attorney or its certified copy with legal effect should be provided (the certified copy shall be issued within three months before the date of Tender Opening).
- 7.4 Price Proposal must be accompanied by the List of Unit Prices on which it is based.
- 7.5 Any Price Proposal that contravenes the provisions of Clauses 7.2 to 7.4 will not be accepted.

## **8. CONDITIONAL PROPOSAL**

Any submitted proposal which has been modified, or contains omissions, or is incompliant with the terms and conditions of Specifications will not be accepted.

## **9. TENDER BASE PRICE & TENDER SECURITY**

- 9.1 Tender base price: No base price.
- 9.2 Amount of tender security: MOP3,300,000.00 (Patacas Three Million and Three Hundred Thousand)
- 9.3 Tender security should be presented as cash deposit, a cheque/bank draft payable to CEM and drawn on one of the approved banks in Macao SAR, or presented as a bank guarantee of equal value under conditions referred to in Annex VI.
- 9.4 For cash deposit, the Bidder has to come to CEM in person for application.
- 9.5 Bank securities shall be issued by one of the following banks, through their head-offices or representatives in Macao SAR:
  - Bank of China Limited, Macau Branch
  - Banco Nacional Ultramarino, S.A.
  - Luso International Banking Ltd.
  - China Guangfa Bank Co., Limited, Macau Branch

- Banco Comercial de Macau, S.A.
- The HongKong & Shanghai Banking Corporation Limited, Macau Branch
- Tai Fung Bank Limited
- Banco Well Link, S.A.
- Macau Development Bank Limited
- Industrial and Commercial Bank of China (Macau) Limited
- China Construction Bank Corporation, Macau Branch
- The Bank of East Asia Limited, Macau Branch

9.6 The Bidder is allowed to retrieve the cash deposit, the cheque/bank draft, or release the bank guarantee which serve as the tender security for this tender once the Contract is signed with any of the Bidder, or the expiry date of the Proposal has been reached, or that he does not submit the proposal or his proposal is not accepted by CEM.

## **10. PAYMENT SCHEDULE**

Invoices for the amounts of all completed works, together with the related reports, shall be submitted to CEM on/before 25<sup>th</sup> of each month for examination and approval; if accepted, CEM will pay until the end of the following month.

## **11. CONSTITUTION OF DOCUMENTS**

11.1 The proposal shall include the following documents:

- a) A declaration provided by the Bidder stating his name, marital status and residential address (Annex III-a). In the case that the Bidder is a company, the declaration shall indicate the company name, address, any affiliate related to the execution of the Contract, names of members of board of directors, names of other persons with power to bear the duty of the company, and the commercial registration related to company establishment and amendments to the constitution (Annex III-b).

In the event of a consortium, it is also required to submit a declaration of incorporation, together with indication of the names of the composition of the consortium and their representatives, the percentage of composition and the members of the directors of the consortium.

The signatures of the above said documents have to be notarised.

- b) A certificate issued by the Financial Services Bureau (DSF) to prove that the Bidder does not owe any tax and duties to the Macao SAR Government (Annex IV). This document has to be issued within three months before the date of tender opening.
- c) A certificate issued by the Social Security Fund (Fundo de Segurança Social, FSS) which proves that the contribution conditions of social security by the Bidder meet the standard (Annex V). This document has to be issued within three months before the date of tender opening.
- d) A certificate proving that the Bidder has paid the Business Registration Tax or has been exempted from such tax for the most recent year (it has to be certified for photocopy submission).

- e) A certificate of tender security presented as specified in clause 9.4, or in the form of a cheque/bank draft, or as a bank guarantee (Annex VI).
- f) A document confirming the registration of the company in the Land and Urban Construction Bureau (DSSCU) or the application or renewal that were submitted before the date of the public tender opening (it has to be certified for photocopy submission).
- g) A declaration by the Bidder stating his commitment to comply with the minimum wages valid in Macao SAR. Alternatively, a list of wages for his employees based on these minimum wages valid in Macao SAR in which the wages cannot be lower than the above said wages can be submitted (signature of the declaration/list has to be notarised)
- h) A declaration by the Bidder with signature notarised declaring that he is committed to the priority of hiring local (Macao SAR) workers once he is awarded the Contract.
- i) A declaration by the Bidder stating his commitment to not adopt materials of qualities not meeting or below the requirements specified in the plans of the Programme of Tender, materials and equipment specified in Specifications once he is awarded the Contract (Annex VII, signature of the declaration has to be notarised).
- j) Documents and information as required in the latest version of "CEM Safety, Health, Environment and Quality Requirements & Responsibilities for Services Suppliers".
- k) A declaration by the Bidder stating his commitment to accept and comply with the "Rules for Integrity and Honesty" set forth by the executive authority (Annex VIII, signature of the declaration has to be notarised). For any violation of the said rules, the awarding entity reserves the right to terminate the Contract, whereupon the Contractor has to be responsible for compensation for all losses resulted therefrom.
- l) A declaration by the Bidder with signature notarised indicating that the Bidder or the bidding company whose current/former partners and current/former members of board of directors have not been sentenced by the court for involvement in acts of active or passive corruption in the exercise of functions in the last five years, supported with relative documents (Annex IX, signature has to be notarised).
- m) A declaration by the Bidder with signature notarised stating that he has not been sentenced by the court or administrative authority to have employed illegal workers, hired workers to perform functions outside the contract or without authorisation in the last five years (Annex X, signature has to be notarised).
- n) A declaration by the Bidder indicating whether or not he has been given additional penalties as specified in item no. 1 (1) of article no. 82 of Law no. 16/2021 (i.e. to be deprived of right to participate in direct negotiation, restricted enquiries or public tenders) (Annex XI, signature has to be notarised)
- o) A declaration confirming responsibility issued by a technician, duly registered according to Administrative Regulation no. 12/2015 (Annex XII, signature has to be notarised).
- p) Organization Chart for the team (Annex XIV)
- q) List of Bidder's staff with individual curriculum and relevant experience.
- r) Equipment List (Annex XV)

- s) List and technical documents of Bidder equipment to be used for:
    - Detection and identification for the reason of PL cable faults
    - Detection and identification for the reason of potential risk and failure within the public lighting distribution boxes
    - Detection and identification for the weak points of the connected underground cables
    - Detection and identification for the material defects applied in the lamp poles.
    - Detection and identification for the weak points at anti-corrosion treatment on the pole surface
  - t) Lists and technical documents of Bidder consumables, materials, machinery, machine tools and portable tools.
  - u) Bidder's working Instructions for transportation, removal, lifting and installation of concrete and metallic poles and components.
  - v) A list of excavation works (2018 – 2023) completed by the Bidder in Macao SAR (Annex XVI), indicate the project owner, amount, date and location (name of road).
  - w) A list of low voltage electrical equipment installation works (2018 – 2023) completed by the Bidder in Macao SAR (Annex XVII), indicate the project owner, amount, date, location (name of road or building) and job description.
  - x) A list of low voltage electrical equipment maintenance works (2018 – 2023) completed by the Bidder in Macao SAR (Annex XVIII), indicate the project owner, amount, date, location (name of road or building) and job description.
  - y) Valid management and quality certifications including ISO9001, ISO14001 and ISO45001 (if any).
  - z) Other information considered relevant (if any).
- 11.2 The Bidder can submit documents specifying the special conditions of his manpower and documents of any additional obligations he will bear as long as they do not contravene with the terms and conditions set in Specifications in order to guarantee the progress of works and suitability of installation works.
- 11.3 The above documents shall be written in one of the official languages of Macao SAR or in English language.
- 11.4 In the event that the Bidder has submitted false declarations for clause 11.1 l), m) and n), CEM shall report thereon to the Public Prosecutions Office for initiating the criminal litigation procedure.

## **12. SUBMISSION REQUIREMENTS FOR PROPOSAL AND OTHER DOCUMENTS**

- 12.1 The documents as specified in Clause 11.1 a), b), c), d), e), f), g), h), i), j), k), l), m), n), o), p), q), r), s), t), u), v), w), x), y) and z) shall be wax-sealed (on the closing position) in a closed opaque envelope with the following information labelled on the outside:

“Documents”

Name of the Bidder

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FOR PUBLIC LIGHTING NETWORK”**

Companhia de Electricidade de Macau - CEM, S.A.

- 12.2 Proposal documents comprising Price Proposal (Annex I) and List of Unit Prices (Annex II), and documents as specified in clause 11.2 shall be inserted in an envelope with the same conditions as Clause 12.1. The envelope shall be labelled with the following information:

“Proposal”

Name of the Bidder

**“CONSTRUCTION, MAINTENANCE, OPERATION AND EMERGENCY SERVICE  
FOR PUBLIC LIGHTING NETWORK”**

Companhia de Electricidade de Macau - CEM, S.A.

- 12.3 All of the above envelopes referred to in clauses 12.1 and 12.2 shall be inserted in a third opaque envelope, which named as “Exterior Envelope”, shall also be wax-sealed on the closing position. The envelope shall be delivered by hand to Companhia de Electricidade de Macau – CEM S.A. at Estrada D. Maria II, Edif. CEM, Macao (Reception of Ground Floor) following which a receipt shall be given by CEM, or by registered mail with acknowledgement of receipt to the address mentioned in clause 4.1.
- 12.4 The Exterior Envelope must be labelled with the name of the Bidder and address. It is also required to mention <Proposal for the Public Tender of “Construction, Maintenance, Operation and Emergency Service for Public Lighting Network” on 13<sup>th</sup> May 2024 (Tender Ref. PLD-CS001/24/88)> under the address.
- 12.5 All documents as enclosed in the proposal shall be indicated with the name of the Bidder or company, so as to provide identification for the documents. In the case that the documents have no information for identification, the documents shall be considered to be not submitted.
- 12.6 The Bidder must submit only one proposal, which is considered to be the best proposal.
- 12.7 In the case of force majeure, which results in CEM headquarter being temporarily closed, the proposal submission date and time listed above would thus be extended to the following working day at the same time.

### **13. VALIDITY OF PROPOSALS**

- 13.1 The period of validity for the proposals will be 90 days, calculated from the date of tender opening. All bidders who have not received the award notification is entitled to retrieve or release the tender security.
- 13.2 If, after a period of validity, none of the Bidder requests for retrieving or releasing of the tender security, it is by tacit consent of the Bidders that the period is extended, until the date on which the first application is made to that effect, but never for more than 60 days.
- 13.3 The release of the tender security mentioned in the above clause shall not lead to the loss of position of the Bidder during tendering, all proposals shall remain in condition to be considered for award of the Contract.

## **14. CLARIFICATION OF THE BIDDER**

- 14.1 Bidders should provide any clarification which is deemed necessary for any document constituting the Proposal to CEM in order to let CEM evaluate guaranteeing the technical performance for the good technical executions of the awarded works, the conditions of price and delivery time or any other conditions which are of the general or partial particular public interest.
- 14.2 During the evaluation stage, if CEM has any doubts about the real economic and financial conditions or technical capacities of any Bidder, CEM can request for any documents or information of accounting nature, or that which is essential for clarifying the doubts, prior to the award of the Contract.

## **15. AWARD OF THE CONTRACT & PERFORMANCE GUARANTEE**

- 15.1 The selected Bidder must submit a performance guarantee within 8 days after receiving the award notification. If the selected Bidder fails to submit the performance guarantee on time and has not been prevented from doing so due to a fact irrespective of his will that is considered to be sufficiently justified, then the award will be considered void immediately and the tender security will be seized by the entity who host this tender.
- 15.2 Amount of performance guarantee: MOP6,600,000.00 (Patacas Six Million and Six Hundred Thousand), which should be presented as cash deposit, a cheque/bank draft payable to CEM and drawn on one of the approved banks in Macao SAR, or presented as a bank guarantee at banks as specified in clause 9.5 (Annex XIII).
- 15.3 As required by law, the charges of the guarantee will be the complete responsibility of the bidders.
- 15.4 In the event that the selected Bidder does not attend for the signature of the Contract at the scheduled date, time and location without reasonable reasons, the award will be considered void immediately and it will lead to loss of performance security.
- 15.5 The selected Bidder is liable for any loss to third parties from the award of Contract, and may transfer this responsibility to any liability insurance policy.
- 15.6 If the amount of compensation for accident exceeds the amount referred to in the above clause, the payment of this difference is the responsibility of the selected Bidder.

## **16. APPLICABLE LAW**

Any omissions in the hereby Programme of Tender shall be governed by applicable laws of the Macao SAR, especially Decree-Law no. 63/85/M dated 6<sup>th</sup> July and Decree-Law no. 122/84/M dated 15<sup>th</sup> December as amended and republished by Law no. 5/2021.

## **17. PROPOSAL EVALUATION**

- 17.1 All proposal documents will be evaluated by an Evaluation Committee. The Evaluation Committee shall perform the evaluation based on the methodology listed in Clause 18. For



evaluation purposes, the Committee may, during this juncture, request the bidders to provide additional information and/or clarification.

17.2 CEM reserves the right to decide not to award the Contract to any party under the following conditions:

- a) CEM suspects collusion between bidders;
- b) No proposal document meets the minimum evaluation requirements;
- c) The proposed price(s) of all or the best proposal greatly exceeds the budget estimate for this project.

## 18. PROPOSAL EVALUATION CRITERIA & RESPECTIVE WEIGHTING FACTORS

The evaluation is divided into two phases. The first phase has the nature of elimination. The Bidders can go to the second phase evaluation only if he can comply with all the terms and conditions in the listed in the Programme of Tender and Specifications as well as meeting the compulsory items in the first phase evaluation criteria.

A. First Phase Evaluation Criteria	
A1	Human Resources <sup>(1)</sup> - In Annex XIV (Organization Chart for the Team), Bidders must completely fill in the information of competent personnel into the tables except for optional items.
A2	Completeness of Equipment <sup>(2)</sup> - In Annex XV (Equipment List), Bidders must completely fill in the tables and confirm already obtained all equipment in the Critical Equipment List.
A3	Experience of the excavation works in Public Road (area) <sup>(3)</sup> - In Annex XVI, Bidders must have experience (at least one project) of excavation works in Public Road (area) from 2018-2023 and state in the table (Trench length of each project should be over 200 meters and total length should be at least 2000 meters).
A4	Experience of the LV electrical equipment installation <sup>(3)</sup> - In Annex XVII, Bidders must have experience (at least one project) of LV electrical equipment installation from 2018-2023 and state in the table (Amount of each project should be over MOP1,000,000 and the total amount should be at least MOP3,000,000).
A5	Experience of the LV electrical equipment maintenance <sup>(3)</sup> - In Annex XVIII, Bidders must have experience (at least one project) of LV electrical equipment maintenance from 2018-2023 and state in the table (Amount of each project is over MOP500,000 and the total amount should be at least MOP1,500,000).
Remarks:	
(1) Bidders must provide CV of each of the personnel that could prove their qualification and professionalism. In case the qualification of the respective personnel does not match with the requirements set in the Specification, that personnel will not be counted. For detailed requirements of the personnel, Bidders may refer to Section 8 of GTC.	
(2) If Bidders could not complete the Necessary Equipment List during tender submission, Bidders must complete it and submit related equipment information to CEM within 20 days after the award of contract.	
(3) Bidders must provide proofs for all project experiences listed in the table (such as certificates / letters / written document issued by employer that stated the project nature, amount, start date and completion date etc.). Proofs that could not justify the project nature, project duration and contract amount will not be accepted, and that project experience will not be counted.	

The second phase evaluation will be scored in accordance with the following weighting.

B. Second Phase Evaluation Criteria		Weighting
B1	Price <sup>(1)</sup>	90%
B2	Management and Quality Certifications (ISO9001, ISO14001 or ISO45001) <sup>(2)</sup>	10%
Total		100%
<p>Remarks:</p> <p>(1) Bidder who offers the lowest price will get the highest score; and vice versa.</p> <p>(2) The weighting for each valid certificate is as follows, Bidder who cannot provide any valid certificates will get zero score:</p> <p>a) ISO9001: 4%</p> <p>b) ISO14001: 3%</p> <p>c) ISO45001: 3%</p>		

The entity to host this tender shall evaluate the proposals in accordance with the information on the proposals, and the methodology and score weighting as described above.

## 19. ARRANGEMENT OF TENDER SCHEDULE

The tendering schedule is arranged as follow:

- Start Date of Tender: 10<sup>th</sup> April 2024
- Closing Date of Request for Tender Clarification: 22<sup>nd</sup> April 2024
- Last Date of Reply to Tender Clarification: 29<sup>th</sup> April 2024
- Deadline for Tender Submission: 10<sup>th</sup> May 2024 at 17:00
- Date of Tender Opening: 13<sup>th</sup> May 2024 at 10:00

## 20. TERMINATION OR CANCELLATION OF TENDER

The entity to host the tender reserves the right to terminate or cancel the Tender in any phase, or without any reason, without prior notice to any bidder.

## 21. COMPLAINTS

Any complaints regarding the omission or irregularity of procedures related to the invitation to tender must be submitted in writing and mailed, faxed, or hand delivered to CEM:

Companhia de Electricidade de Macau - CEM, S.A.  
Procurement & Logistic Department  
Estrada D. Maria II, Edif. CEM  
Macao  
Director of Procurement & Logistics Department  
Labelled with “Complaints regarding Tender Ref. PLD-CS001/24/88”

## **22. BRIBES**

- 22.1 If a bidder or any of his agents or servants offers to give or agrees to offer or give to any person, any bribe, gift, gratuity or commission as an inducement or reward for doing or forbearing to do any action in relation to his Tender, then CEM may disqualify the Tender.
- 22.2 Any attempt by a bidder to influence CEM in the process of examination, clarification, evaluation and comparison of Tenders or in the decision concerning the award of any contract or to disclose any information on his Tender or the evaluation process to any other bidder or person not officially involved with such process may result in the rejection of the Tender.

## **23. CONFIDENTIALITY**

All information relating to the examination, clarification, evaluation and comparison of Tenders and recommendations concerning the award of any contract will be held confidential by CEM.

## ANNEX I

### SAMPLE OF PRICE PROPOSAL

\_\_\_\_\_ [name, martial status, occupation and residential address, or company and address of bidder], has registered at the Land and Urban Construction Bureau of Macao SAR (DSSCU), upon taking note of the objective of the Tender of “Construction, Maintenance, Operation and Emergency Service for Public Lighting Network” that was announced on the Government Gazette on \_\_\_\_\_ [day, month, year] by Companhia de Electricidade de Macau - CEM, S.A., hereby declares that he will carry out the contract jobs that CEM requires of him, under the conditions set out in the Programme of Tender and Specifications, and prices quoted in the List of Unit Prices relating to this proposal, which are an integral part of it.

\*It is also declared for the execution of the Contract, the undersigned shall abide by Macau SAR laws and court, as well as to renounce any rights derived from other legal jurisdictions of any other country.

The undersigned also declared to provide the performance security in the amount of MOP6,600,000.00 (Patacas Six Million and Six Hundred Thousand Only) if the Contract is awarded.

Dated this (day/month/year).

Signature \_\_\_\_\_

(Signature(s) shall be officially recognised by a notary)

Note: this sample is used as a reference only; bidders shall produce their document based on their own suitable contents or it may be considered as missing submission.

\*Only applicable to the Bidder who is not a local citizen, or whose headquarter of the company is not set up in Macao SAR.

## ANNEX II

### List of Unit Prices

REF.	DESCRIPTION	UN	PRICE (MOP)
項目	內容	單位	價格 (澳門元)
<b>4000</b>	<b>LIFTING UP, REMOVAL AND REINSTATEMENT OF PAVEMENTS</b> <b>(Prices submitted include mechanical cutting of the pavements, removal of residues to refuse pit, painting of signalling/traffic signs on pavements)</b> 開掘, 移除和重鋪路面工程 (此價格包括使用機械開挖路面, 清除開挖產生之建築廢料, 回復路面上之交通符號及界線)		
4001	Pavements in concrete B180, B225, B300 or B400 混凝土路面: B180, B225, B300 or B400	m2	
4002	Pavements in Reinforced concrete 加固混凝土路面	m2	
4003	Pavements in Asphalt applied above macadame or above concrete 瀝青路面包括混凝土和碎石底料	m2	
4004	All and any type of tuff/grass/ garden 所有及任何類型 凝灰岩/草地/花園	m2	
4005	Different type of sidewalk finishing: original Portuguese stone, mosaic, floor tiles, granite, marble, concrete slabs, granite cube. Note: price include the supply of damaged pieces 不同類型之路面飾面: 葡國石/馬賽克/瓦片/花崗岩/大理石/混凝土板/花崗石粒 (注: 包括供應受損的飾面物料)	m2	
4006	Asphalt in accordance with spec for Grand Prix (racetrack) 賽車跑道上之瀝青路面	m2	
4007	Pavement in Asphalt (PG100 high viscosity and high elasticity polymer modified asphalt, non-resin modified), included macadme or concrete base 瀝青路面 (PG100 型高粘高彈聚合物改性瀝青, 非樹脂類改性) 包括混凝土或碎石底料	m2	
4008	Removal of any type of pavement 開挖所有類別之路面	m2	
4009	Repaving of any type of pavement 重鋪所有類別之路面	m2	
<b>4020</b>	<b>EXCAVATION, REMOVAL OF RESIDUES, CABLE SIGNALLINGS, BACKFILL AND COMPACTION (Include supply and/or transport from origin or warehouse to job location)</b> 開掘, 移除, 壓泥, 回填路面工程, 所有相關電纜示意物料 (此價格包括提供及/或由倉運送到工作現場)		
4021	Excavation in soft soil, disintegrated rocks or soft rocks and removal of debris/clean soil to refuse pit, installation of necessary cover plates, plastic net and plastic tapes according to project drawing, and backfill with borrowed clean sand or granite powder, with nominal particle size < 1/16" (Backfill volume is equal to excavated volume due to no uPVC conduits installed.) 開掘泥土, 清除開挖產生之建築廢料, 根據圖則要求鋪設必要之電纜危險指示, 回填潔淨之砂土及花崗石粉, 粒徑<1/16" (回填體積等於開挖體積基於沒有安裝 PVC 管)	m3	
4022	Excavation in soft soil, disintegrated rocks or soft rocks and removal of debris/clean soil to refuse pit, installation of necessary cover plates, plastic net and plastic tapes according to project drawing, and backfill with borrowed clean sand or granite powder, with nominal particle size	m3	

	< 1/16" ( Backfill volume is lower than excavated volume due to installation of uPVC conduits.) 開掘泥土,清除開挖產生之建築廢料,根據圖則要求鋪設必要之電纜危險指示,回填潔淨之砂土及花崗石粉,粒徑<1/16" (回填體積少於開挖體積基於安裝 PVC 管)		
4023	Excavation in hard rocks including removing them to refuse pit, installation of necessary cover plates, plastic net and plastic tapes according to project drawing, and backfill with borrowed clean sand or granite powder, with nominal particle size < 1/16" 開挖岩石,清除開挖產生之建築廢料,根據圖則要求鋪設必要之電纜危險指示,回填潔淨之砂土及花崗石粉,粒徑<1/16"	m3	
4025	Demolish and rebuilding of gullies 拆除及重建溝渠	un	
4026	Demolition and rebuilding of pipes up to Ø=0.20m 拆除及重建 PVC 管 (直徑至 Ø=0.20m)	m	
4027	Demolition and rebuilding of pipes above Ø=0.20m 拆除及重建 PVC 管 (直徑 Ø=0.20m 以上)	m	
<b>4040</b>	<b>CABLE CONDUITS, ROAD CROSSINGS</b> <b>電纜管道, 過街管道</b>		
4041	Supply and installation of uPVC pipes (Ø≤50mm) which comply with BS 3506 Class B 提供及安裝符合 BS 3506 B 級標準之 uPVC 管道 (Ø≤50mm)	m	
4042	Supply and installation of uPVC pipes (50mm<Ø≤100mm) comply with BS 3506 Class B 提供及安裝符合 BS 3506 B 級標準 uPVC 管道(50mm<Ø≤100mm)	m	
4043	Supply and installation of uPVC pipes (100mm<Ø≤150mm) comply with BS 3506 Class B 提供及安裝符合 BS 3506 B 級標準 uPVC 管道 (100mm<Ø≤150mm)	m	
4044	Supply and installation of uPVC pipes (Ø≤100mm) which comply with BS 3506 Class B, included plastic spacers placed at 2 meters interval, supply and cast of blinding concrete grade C15/20 in 75mm thick, and surround with Concrete grade C25 (Thickness between 50mm-200mm). 提供及安裝符合 BS3506 B 級標準之 uPVC 管道(Ø≤100mm),包括每 2 米設管道之間的固定分隔器,提供並安裝級別 C15/20,75mm 闊之底料混凝土,圍繞 PVC 管級別 C25 之混凝土(厚度在 50mm 和 200mm 之間)	m	
4045	Supply and installation of uPVC pipes (100mm<Ø≤150mm) which comply with BS 3506 Class B, included plastic spacers placed at 2 meters interval, supply and cast of blinding concrete grade C15/20 in 75mm thick, and surround with Concrete grade C25 (Thickness between 50mm-200mm). 提供及安裝符合 BS3506 B 級標準之 uPVC 管道 (100mm<Ø≤150mm),包括每 2 米設管道之間的固定分隔器,提供並安裝級別 C15/20,75mm 闊之底料混凝土,圍繞 PVC 管級別 C25 之混凝土(厚度在 50mm 和 200mm 之間)	m	
4046	Supply and installation of trench covering 提供及安裝坑道蓋板	un	
<b>4060</b>	<b>LAYING, LIFTING UP, REMOVAL, OR RELOCATING OF CABLES - Included Transportation &amp; corresponding survey x-y-z coordinates of installed cables (Installed by direct buried: points per every 50m or every turns in &amp; out; Installed inside ducts: points per manhole)</b> <b>鋪設、掛起、回收、或遷移電纜 - 包括相關物料運送及提供相關電纜坐標測量(直埋安裝: 每 50 米或每轉向出入口一點; 安裝於通井內:每井位一點)</b>		

4061	LV cable CU 4x6 mm <sup>2</sup> 低壓銅線 4x6 mm <sup>2</sup>	m	
4062	LV 4 cores cables CU or AL (≤ 240mm <sup>2</sup> ) 低壓 4 芯銅線或鋁線(≤ 240mm <sup>2</sup> )	m	
4066	Optical Fiber Cable (≤36 cores) 光纖電纜(≤36 芯)	m	
4067	LV cable CU or AL 4x16 mm <sup>2</sup> 低壓銅線或鋁線 4x16 mm <sup>2</sup>	m	
4068	LV cable CU or AL 1x35 mm <sup>2</sup> 低壓銅線或鋁線 1x35 mm <sup>2</sup>	m	
<b>4080</b>	<b>DISTRIBUTION BOXES, C.D.I.P</b> <b>照明控制箱</b>		
4081	Installation & connection of different type of CDIP with its internal components including foundation base and earthing connection 安裝及接駁不同種類的照明控制箱及其內部配件包括混凝土基礎、接地棒及其連接	un	
4082	Removal & connection of different type of CDIP with its internal components 拆除及接駁不同種類的照明控制箱及其內部配件	un	
4083	Replacement & connection of different type of CDIP with its internal components (foundation base not necessary) 更換及接駁不同種類的照明控制箱及其內部配件 (不包括混凝土基礎)	un	
4084	Installation of mechanical protection to CDIP 安裝照明控制箱專用保護鐵架	un	
4085	Replacement of MCBs or Contactors or timers or twilight switches, or fuse bases, or fuses or terminals or connectors or meter windows. 更換 MCB、接觸器（索掣）、時間開關掣、光暗開關掣、保險絲底座、保險絲、接線端、連接器或電錶視窗	un	
4086	Adjust the timer or twilight switch. 調較時間開關掣或光暗開關掣	un	
4087	Reparation of CDIP foundation 維修照明控制箱之基礎	un	
4088	Reparation of CDIP box 維修照明控制箱之外部結構	un	
4089	CDIP cleaning. 清理照明控制箱	un	
4090	Adjust the MCB or Contactors 調整 MCB 或接觸器（索掣）	un	
4091	Communication Operation of CDIP (per SIM card & lease line service) 照明控制箱之通訊運行 (每張流動網絡卡及其本地專線服務)	un	
<b>4120</b>	<b>CONSTRUCTION OF MANHOLE INCLUDING COVERS OF DIFFERENT TYPES:</b> <b>SPHEROIDAL GRAPHITE CAST IRON COVER</b> - each set includes ≤ 6 triangle covers and anti-dropping frame (comply with BS EN 124:1994 Class D400); <b>RECESSED COVER</b> - each set include ≤2 rectangular covers and frame made of stainless steel with same finishing as the pavement (comply with BS EN 124:1994 Class B125). <b>Note: the dimensions refer to the volume of excavation to build the manhole(included the frame, steel bars, watertight sealing to all sleeves and all associated work)</b> <b>建設地線井,包含不同種類的井蓋:</b> <b>球墨鑄鐵的地線井蓋—包含≤ 6 個三角形井蓋連防下墮框架(須符合 BS EN 124:1994 Class D400 之規格)</b>		

	隱藏式地線井蓋－包含≤2個長方形井蓋及不銹鋼框架連相應路面完成裝配(須符合 BS EN 124:1994 Class B125 之規格) 備註:相關尺寸將因建造地線井所開掘坑道的容量而定(包含框架、鋼筋、水密封口及所有相應工序)		
4121	Manhole (≤ 0.75 m3, reference drawing no M-PL) 電井(≤ 0.75 m3, 參考圖則 no M-PL)	un	
4122	Manhole (>0.75m3 and ≤1.5 m3, reference drawing no M-011, M-021) 電井(>0.75m3 and ≤1.5 m3, 參考圖則 no M-011, M-021)	un	
4123	Manhole (>1.5m3 and ≤3.0 m3, reference drawing no M-001, M-002, M-009, M-010, M-012 and M-013) 電井(>1.5m3 and ≤3.0 m3, 參考圖則 M-001, M-002, M-009, M-010, M-012 and M-013)	un	
4124	Rebuild existing manholes 重建現有電井	un	
4125	Replace different types of existing covers (one triangle C.I. cover or one rectangular recessed cover) 更換不同種類之原有電井(一個三角型蓋或一個長方型蓋)	un	
4126	Supply & Install Anti-dropping frame inside existing manholes 提供並於現有電井內安裝防墮架	un	
4140	<b>PREFABRICATED CURB.</b> 預制路肩混凝土塊		
4141	Supply and Installation 提供和安裝	pc	
4142	Removal 清拆	pc	
4143	Installation only 安裝	pc	
4160	<b>LABOUR WORK</b> 勞動工作		
4161	Labour - Normal working hour (08:00 - 20:00) 勞動人員 - 辦工時間 (08:00 - 20:00)	H/h	
4162	Security guard (24 hrs.) 看守人員	Day	
4163	Policeman assistance in traffic based on DSAT request 按 DSAT 要求而安排交通警察協助指揮交通	H/h	
4180	<b>CLEANING AND HOLES SEALING FOR CABLE DUCT OR MANHOLE (1 un: All related PVC holes per each cable duct entrance or manhole)</b> 清理線槽或電井並進行封孔 (1 un: 以每一線槽出入口或電井之所有 PVC 孔計算)		
4181	Remove the water from cable duct or manhole and keep the cable duct or manhole (1un per room or manhole) 清除於線槽或井內的積水 (1un: 以 1 間房或電井計算)	un	
4182	Remove all kinds of sewage waste from cable duct or manhole and keep the cable duct or manhole (1un per room or manhole) 清除於線槽或井內的一切污水或異物 (1un: 以 1 間房或電井計算)	un	
4183	Seal the cable duct with HILTI CP611A 在線通口進行封閉 HILTI CP611A	un	
4184	Seal the cable duct with Raychem RDSS – Rayflate Duct Sealing System 在線通口進行封閉 Raychem RDSS – Rayflate Duct Sealing System	un	
4185	Seal the cable duct with Cements & Sands Mixtures 在線通口進行沙泥封閉	un	
4186	Supply & install Pipe Covers	un	



	提供及於線通口安裝封蓋		
<b>4220</b>	<b>PUBLIC LIGHTING CONNECTIONS</b> <b>公共照明街燈接駁</b>		
4221	All the connections for the Lighting poles 街燈柱之所有接駁	un	
4222	All the connections for the PL protection boxes 街燈保護盒之所有接駁	un	
4223	All the connections for the PL pillar boxes (CDIP) 照明控制箱之所有接駁	un	
4224	PL cable joints 街燈電纜之連接直箱	set	
4225	Cable VAV 4x6 mm2 connections 接駁電纜 VAV 4x6 mm2	set	
4226	Install and connect the cable between the lighting pole handhole and the lantern, toponymical signaling post and telephone cabin. 安裝並接駁在電燈柱手孔至燈罩之間的電線	set	
4227	Remove and disconnect the cable between the lighting pole handhole and the lantern, toponymical signaling post and telephone cabin. 清拆並斷開在電燈柱手孔至燈罩之間的電線	set	
4228	Optical Fiber Cable (≤36 cores) 光纖電纜(≤36 芯)	set	
4229	Measuring the illumination of specific area Between two consecutive lighting poles, according to the arrangement of the lanterns (one side arrangement, cross arrangement, opposite arrangement, central arrangement), set a 5x5 matrix and make measurement for each point with a Lux meter 測量指定區域之亮度,根據燈具佈置情況(單側佈置,交錯佈置,相對佈置,雙主線佈置)把兩盞燈具與燈具之間的地面距離劃分為一個 5x5 的網格,並用亮度(勒克斯)測量器測量每一格的亮度	module	
4230	One of the connection for the Lighting poles 街燈柱之一個接駁	un	
4231	One of the connections for the PL protection boxes 街燈保護盒之一個接駁	un	
4232	One of the connections for the PL pillar boxes (CDIP) 照明控制箱之一個接駁	un	
4233	Adjust the MCB or Contactors in Lighting Pole or CDIP 調整街燈或照明控制箱內 MCB 或接觸器 (索掣)	un	
<b>4250</b>	<b>FACILITY LOCATION DATA RECORDING</b> <b>設備位置數據</b>		
4251	Provide survey records for cable and corresponding underground facilities, lighting system, CDIP. Record included layout plans, sections, coordinates, levels, photographs, etc. (measured by points where data to be recorded in SAI format) 提供對電纜及相關地下設施、照明系統、照明控制箱的測量記錄。記錄包括平面圖,切面圖,坐標,水平及相關照片。(數據需以 SAI 格式列點記錄)	point	
<b>4300</b>	<b>REPARATION OR REPLACEMENT FOR FAULT COMPONENT OF LIGHTING POLE</b> Component included but not limited to: lamp, diffuser, reactance, capacitor, igniter, electrical cable between junction box and lanterns, fuse, fuse base, or circuit breaker, contactor, terminal or perform of lantern cleaning 修復或更換故障之燈柱元件		

	元件包括但不限於: 燈泡、擴散器、透明膠罩、電抗器、鎮流器、電容器、點燈器、燈罩至控制盒之電纜、保險絲、保險絲底座、電路斷路器、連接器、線頭或燈罩清潔。		
4301	Repair or Replace the first component for one lighting pole ( $\leq 12\text{m}$ ) 為一燈柱 ( $\leq 12$ 米) 進行第一項元件修復或更換	un	
4302	Repair or Replace the first component for one lighting pole ( $>12\text{m}$ and $\leq 18\text{m}$ ) 為一燈柱 ( $>12$ 米及 $\leq 18$ 米) 進行第一項元件修復或更換	un	
4303	Repair or Replace the first component for one lighting pole ( $>18\text{m}$ and $\leq 20\text{m}$ ) 為一燈柱 ( $>12$ 米及 $\leq 18$ 米) 進行第一項元件修復或更換	un	
4304	Repair or Replace the first component for one lighting pole ( $> 20\text{m}$ ) 為一燈柱 ( $>20$ 米) 進行第一項元件修復或更換	un	
4305	Repair or Replace each additional component for one lighting pole ( $\leq 12\text{m}$ ) 為一燈柱 ( $\leq 12$ 米) 進行每一額外元件修復或更換	un	
4306	Repair or Replace each additional component for one lighting pole ( $>12\text{m}$ and $\leq 18\text{m}$ ) 為一燈柱 ( $>12\text{m}$ 及 $\leq 18\text{m}$ ) 進行每一額外元件修復或更換	un	
4307	Repair or Replace each additional component for one lighting pole ( $>18\text{m}$ and $\leq 20\text{m}$ ) 為一燈柱 ( $>18\text{m}$ 及 $\leq 20\text{m}$ ) 進行每一額外元件修復或更換	un	
4308	Repair or Replace each additional component for one lighting pole ( $>20\text{m}$ ) 為一燈柱 ( $>20$ 米) 進行每一額外元件修復或更換	un	
4309	Replacement of one lantern set included lamp for one lighting pole ( $\leq 18\text{m}$ ) 為一燈柱 ( $\leq 18$ 米) 更換一套燈罩連燈泡	un	
4310	Replacement of one lantern set included lamp for one High mast ( $> 18\text{m}$ ) 為一高桿燈柱 ( $> 18$ 米) 更換一套燈罩連燈泡	un	
<b>4400</b>	<b>REPARATION OF PL CABLE FAULT</b> <b>修復公共照明電纜故障</b>		
4401	Repair the PL cable fault included locating PL cable fault point, excavation, connecting joint, disconnect the aerial cable and cable commissioning testing. 修理公共照明電纜的故障, 包括故障點定位、挖掘、連接直箱、切斷架空電纜及經驗修測試。	un	
4402	Connect a PL cable joint including PL cable test after making the joint, disconnect the aerial cable and cable commissioning testing. 接駁公眾照明系統電纜直箱, 工作包括接駁電纜直箱後進行公共照明電纜的測試、切斷架空電纜及經驗修測試。	un	
4403	Install or replace PL cable including excavation, connecting joint, disconnect the aerial cable and cable commissioning testing. 安裝或更換公共照明電纜, 包括挖掘、駁上連接器、切斷架空電纜及經驗修測試。	un	
4404	Resolve PL network circuit trip problem, include find out PL cable fault section, reparation of cable terminal or connection, resume the switch. 解決公共照明電路跳閘問題, 包括確認電纜故障線段, 電纜終端或接駁的維修, 及重啟電路開關。	un	
<b>4500</b>	<b>INSTALLATION OF CONCRETE POLES AND/OR LIGHTING POLES (including the opening of ditches in all type of soils, foundation base in concrete, necessary earth rod and bonding cable installation, transportation, refilling and reinstatement of pavement)</b>		

	安裝混凝土柱和／或街燈柱（包括開挖任何類型泥土,混凝土底座,接地棒安裝和連接線接駁,運送物料到現場,回填和回復路面）		
4501	Install concrete poles up to 9/500 KGF (inclusive) 安裝混凝土柱達到(包括) 9/500KGF	un	
4502	Install metallic poles up to 8m, included bracket (single arm, double arm or two arm), associated lantern set, FVV cable and all connection 安裝金屬支柱達到 8 米,包括燈具(單臂,雙臂或高低臂),相應的燈罩,燈泡,FVV 線及所有接駁	un	
4503	Install metallic lighting poles ( $\leq 12$ m), included bracket (single arm, double arm or two arm), associated lantern set, FVV cable and all connection 安裝金屬燈柱( $\leq 12$ 米),包括燈具(單臂,雙臂或高低臂),相應的燈罩,燈泡,FVV 線及所有接駁	un	
4504	Install metallic lighting poles ( $> 12$ m and $\leq 15$ m), included bracket (single arm, double arm or two arm), associated lantern set, FVV cable and all connection 安裝金屬燈柱( $> 12$ 米及 $\leq 15$ 米),包括燈具(單臂,雙臂或高低臂),相應的燈罩,燈泡,FVV 線及所有接駁	un	
4505	Install metallic lighting poles ( $> 15$ m and $\leq 18$ m), included bracket (single arm, double arm or two arm), associated lantern set, FVV cable and all connection 安裝金屬燈柱( $> 15$ 米及 $\leq 18$ 米),包括燈具(單臂,雙臂或高低臂),相應的燈罩,燈泡,FVV 線及所有接駁	un	
4506	Install base-mounted metallic lighting poles ( $\leq 12$ m) with concrete foundation base, steel plate and the anchor bolts, included bracket (single arm, double arm or two arm), associated lantern set, FVV cable and all connection 安裝底座安裝型金屬燈柱( $\leq 12$ 米) 連相關混凝土基座,金屬板和固定螺栓,包括燈具(單臂,雙臂或高低臂),相應的燈罩,燈泡,FVV 線及所有接駁	un	
4507	Install wall-mount /pole-mount brackets (single arm or double arm), associated lantern set, FVV cable and all connection 安裝壁掛式/柱掛式燈具(單臂或雙臂),相應的燈罩,燈泡,FVV 線及所有接駁	un	
4508	Install metallic poles up to $\leq 4$ m, included bracket (single arm, double arm or two arm), associated lantern set, FVV cable and all connection 安裝金屬支柱達到 $\leq 4.5$ 米,包括燈具(單臂,雙臂或高低臂),相應的燈罩,燈泡,FVV 線及所有接駁	un	
4509	Install metallic poles up to 6m, included bracket (single arm, double arm or two arm), associated lantern set, FVV cable and all connection 安裝金屬支柱達到 6 米,包括燈具(單臂,雙臂或高低臂),相應的燈罩,燈泡,FVV 線及所有接駁	un	
4510	Install base-mounted metallic lighting poles $\leq 4$ m with concrete foundation base, steel plate and the anchor bolts, included bracket (single arm, double arm or two arm), associated lantern set, FVV cable and all connection 安裝底座安裝型金屬燈柱 $\leq 4.5$ 米連相關混凝土基座,金屬板和固定螺栓,包括燈具(單臂,雙臂或高低臂),相應的燈罩,燈泡,FVV 線及所有接駁	un	
4511	Install base-mounted metallic lighting poles 6m with concrete foundation base, steel plate and the anchor bolts, included bracket (single arm, double arm or two arm), associated lantern set, FVV cable and all connection	un	

	安裝底座安裝型金屬燈柱 6 米連相關混凝土基座, 金屬板和固定螺栓, 包括燈具(單臂,雙臂或高低臂), 相應的燈罩,燈泡,FVV 線及所有接駁		
4512	Install base-mounted metallic lighting poles 8m with concrete foundation base, steel plate and the anchor bolts, included bracket (single arm, double arm or two arm), associated lantern set, FVV cable and all connection 安裝底座安裝型金屬燈柱 8 米連相關混凝土基座, 金屬板和固定螺栓, 包括燈具(單臂,雙臂或高低臂), 相應的燈罩,燈泡,FVV 線及所有接駁	un	
4520	<b>REMOVAL OF CONCRETE POLES AND/OR LIGHTING POLES (including the opening of trench in all type of soils, foundation base in concrete, refilling, transportation, reinstatement of pavement)</b> 拆除混凝土柱和／或街燈柱(包括開挖任何類型泥土, 混凝土底座, 運送物料, 回填和回復路面)		
4521	Remove concrete poles up to 9/500 KGF (inclusive) 拆除混凝土柱達到(包括) 9/500KGF	un	
4522	Remove metallic poles up to 8m, included bracket (single arm, double arm or two arm), associated lantern set, FVV cable 拆除金屬支柱達到 8 米, 包括燈具(單臂,雙臂或高低臂), 相應的燈罩, 燈泡,FVV 線	un	
4523	Remove metallic lighting poles 12m, included bracket (single arm, double arm or two arm), associated lantern set, FVV cable 拆除金屬燈柱 12 米, 包括燈具(單臂,雙臂或高低臂), 相應的燈罩,燈泡,FVV 線	un	
4524	Remove metallic lighting poles (>12m and ≤15m), included bracket (single arm, double arm or two arm), associated lantern set, FVV cable 拆除金屬燈柱(>12 米及≤15 米), 包括燈具(單臂,雙臂或高低臂), 相應的燈罩,燈泡,FVV 線	un	
4525	Remove metallic lighting poles (>15m and ≤18m), included bracket (single arm, double arm or two arm), associated lantern set, FVV cable 拆除金屬燈柱(>15 米及≤18 米), 包括燈具(單臂,雙臂或高低臂), 相應的燈罩,燈泡,FVV 線	un	
4526	Remove base-mounted metallic lighting poles 12m and related concrete foundation base, steel plate and the anchor bolts, included bracket (single arm, double arm or two arm), associated lantern set, FVV cable 拆除底座安裝型金屬燈柱 12 米及相連的混凝土基座, 金屬板和固定螺栓, 包括燈具(單臂,雙臂或高低臂), 相應的燈罩,燈泡,FVV 線	un	
4527	Remove wall-mount /pole-mount brackets (single arm or double arm), associated lantern set, FVV cable 拆除壁掛式/柱掛式燈具(單臂或雙臂), 相應的燈罩,燈泡,FVV 線	un	
4528	Remove metallic poles up to ≤4m, included bracket (single arm, double arm or two arm), associated lantern set, FVV cable 拆除金屬支柱達到≤4.5 米, 包括燈具(單臂,雙臂或高低臂), 相應的燈罩,燈泡,FVV 線	un	
4529	Remove metallic poles up to 6m, included bracket (single arm, double arm or two arm), associated lantern set, FVV cable 拆除金屬支柱達到 6 米, 包括燈具(單臂,雙臂或高低臂), 相應的燈罩, 燈泡,FVV 線	un	
4530	Remove base-mounted metallic lighting poles ≤4m and related concrete foundation base, steel plate and the anchor bolts, included bracket (single arm, double arm or two arm), associated lantern set, FVV cable	un	

	拆除底座安裝型金屬燈柱≤4.5 米及相連的混凝土基座, 金屬板和固定螺栓, 包括燈具(單臂,雙臂或高低臂), 相應的燈罩,燈泡,FVV 線		
4531	Remove base-mounted metallic lighting poles 6m and related concrete foundation base, steel plate and the anchor bolts, included bracket (single arm, double arm or two arm), associated lantern set, FVV cable 拆除底座安裝型金屬燈柱 6 米及相連的混凝土基座, 金屬板和固定螺栓, 包括燈具(單臂,雙臂或高低臂), 相應的燈罩,燈泡,FVV 線	un	
4532	Remove base-mounted metallic lighting poles 8m and related concrete foundation base, steel plate and the anchor bolts, included bracket (single arm, double arm or two arm), associated lantern set, FVV cable 拆除底座安裝型金屬燈柱 8 米及相連的混凝土基座, 金屬板和固定螺栓, 包括燈具(單臂,雙臂或高低臂), 相應的燈罩,燈泡,FVV 線	un	
4533	Remove base-mounted metallic lighting poles (>12m and ≤15m) and related concrete foundation base, steel plate and the anchor bolts, included bracket (single arm, double arm or two arm), associated lantern set, FVV cable 拆除底座安裝型金屬燈柱(>12 米及≤15 米)及相連的混凝土基座, 金屬板和固定螺栓, 包括燈具(單臂,雙臂或高低臂), 相應的燈罩,燈泡,FVV 線	un	
4540	<b>INSTALLATION OF OVERHEAD / TEMPORARY CABLES (including clamps, saddles, hooks, anchors, screws and bolts)</b> 安裝架空 / 臨時電纜 (包括安裝線碼, 線鉤, 線鞍, 螺絲)		
4541	Install and connect 4 cores CU or AL aerial cables (≤ 35mm <sup>2</sup> ) 安裝及接駁 4 芯銅線或鋁線架空電纜 (≤ 35mm <sup>2</sup> )	m	
4542	Install and connect 4 cores CU or AL aerial cables (>35mm <sup>2</sup> and ≤ 150mm <sup>2</sup> ) 安裝及接駁 4 芯銅線或鋁線架空電纜 (>35mm <sup>2</sup> 及 ≤ 150mm <sup>2</sup> )	m	
4543	Supply & Install Cable Protection Cover 提供及安裝線蓋板	m	
4550	<b>REMOVAL OF OVERHEAD CABLE ON POLES AND/OR ON WALL (including removal of clamps, Hooks and accessories)</b> 移除架空電纜在柱和 / 或牆上 (包括移除線碼, 線鉤, 線鞍, 螺絲)		
4551	Disconnect and remove 4 cores CU or AL aerial cables (≤ 35mm <sup>2</sup> ) 斷開接駁及移除 4 芯銅線或鋁線架空電纜 (≤ 35mm <sup>2</sup> )	m	
4552	Disconnect and remove of 4 cores CU or AL aerial cables (>35mm <sup>2</sup> and ≤ 150mm <sup>2</sup> ) 斷開接駁及移除 4 芯銅線或鋁線架空電纜 (>35mm <sup>2</sup> 及 ≤ 150mm <sup>2</sup> )	m	
4553	Cable Protection Cover removal 移走線蓋板	m	
4550	<b>INSTALLATION OF PROTECTION BOXES</b> 安裝膠箱 / 纖維箱盒子		
4551	Plastic boxes from 100 x 100 to 300 x 100 mm 膠箱由 100 x 100 至 300 x 100 mm	un	
4552	Polyester/metallic type CCL (350 type or 500 type) 纖維或金屬箱(350 型或 500 型)	un	
4553	Clamps for mounting in columns/wall 柱/牆身固定用線碼	un	
4560	<b>SUPPLY AND INSTALL WALL-FIXING OR POLE-FIXING PVC PIPE</b> 提供及安裝固定於柱或牆上的 PVC 管		

4561	PVC pipes and fixing with clamps ( $\leq 1.5$ inches) PVC 管並以線碼固定( $\leq 1.5$ 吋)	m	
4562	PVC pipes and fixing with clamps ( $>1.5$ and $\leq 2$ inches) PVC 管並以線碼固定( $>1.5$ 及 $\leq 2$ 吋)	m	
4563	PVC pipes and fixing with clamps ( $>2$ and $\leq 3$ inches) PVC 管並以線碼固定( $>2$ 及 $\leq 3$ 吋)	m	
<b>4570</b>	<b>EARTHING CONNECTION, LEGENDS, CLEANING AND PAINTING OF WALL MOUNTED ARM BRACKETS OF LIGHTING POLES</b> 接地棒接駁, 制定標識編號, 對置於牆上的支架或電燈柱清潔及涂上油漆		
4571	Installation of Earth rod, earthing cable (V 35 or 70 mm <sup>2</sup> ) with all connection 安裝接地棒, 接地線(V 35 or 70 mm <sup>2</sup> ) 與所有接駁	un	
4572	Installation of PL Legends Identification on lighting poles or brackets 於燈柱或燈具上安裝街燈標識編號	un	
4573	Application of anti-corrosion, Speed Undercoat Gloss finish paint (Black) 塗上防鏽油、快乾底油及光面漆油(黑色)	un	
4575	Cleaning and painting for metallic lighting poles (8m to $\leq 18$ m) 為金屬燈柱(8m 至 $\leq 18$ m) 清潔及涂上油漆	un	
4576	Cleaning and painting for arm brackets (wall/pole mount) 為壁掛式/柱掛式燈具清潔及涂上油漆	un	
4577	Cleaning and painting for metallic lighting poles ( $\leq 6$ m) 為金屬燈柱( $\leq 6$ m) 清潔及涂上油漆	un	
<b>4580</b>	<b>HIGH MAST</b> 高桿燈		
4581	Installation of high mast ( $\leq 20$ m) – Included material transportation to site, excavation and construction of the foundation, embedding of anchor bolts and two set of $\varnothing = 2$ inches PVC concealed cable conduits; erection and assembly of High Mast, lifting device, head frame, 6 or 8 lanterns and all necessary accessories, necessary reinstatement of pavement 安裝高桿燈( $\leq 20$ m), 包括運送材料至工地、開挖及建造基座、內置的爆炸螺絲及兩條包有 $\varnothing = 2$ 吋 PVC 塑膠的電纜軟管、豎設及組裝高桿燈、升降裝置、主支架、6 或 8 組燈具及其他所需配件、以及相關路面回復。(圖則 C-071)	un	
4582	Installation of high mast ( $> 20$ m) – Included material transportation to site, excavation and construction of the foundation, embedding of anchor bolts and two set of $\varnothing = 2$ inches PVC concealed cable conduits; erection and assembly of High Mast, lifting device, head frame, 6 or 8 lanterns and all necessary accessories, necessary reinstatement of pavement 安裝高桿燈( $> 20$ m), 包括運送材料至工地、開挖及建造基座、內置的爆炸螺絲及兩條包有 $\varnothing = 2$ 吋 PVC 塑膠的電纜軟管、豎設及組裝高桿燈、升降裝置、主支架、6 或 8 組燈具及其他所需配件、以及相關路面回復。(圖則 C-071)	un	
4583	Removal of high mast ( $\leq 20$ m) – Included material transportation to CEM warehouse, excavation and destruction of concrete foundation, necessary reinstatement of pavement 移除高桿燈( $\leq 20$ m), 包括運送材料往澳電倉庫、開挖及清拆基座, 以及相關路面回復。	un	
4584	Removal of high mast ( $> 20$ m) – Included material transportation to CEM warehouse, excavation and destruction of concrete foundation, necessary reinstatement of pavement	un	

	移除高桿燈 (>20 m)，包括運送材料往澳電倉庫、開挖及清拆基座，以及相關路面回復。		
4585	Repair High Mast with scaffolding, included erection and dismantle of scaffolding, reparation or maintenance of lifting device, head frame, 6 or 8 lanterns 以棚架方式維修高桿燈，包括搭建及清拆棚架方式，維修及保養升降裝置、主支架及 6 或 8 組燈具。	un	
4586	Repair High Mast with internal lifting device included reparation or maintenance of head frame and 6 or 8 lanterns 以內置的升降裝置維修高桿燈，包括維修及保養主支架及 6 或 8 組燈具。	un	
4587	High mast lifting device mechanical maintenance (including inspection, maintenance report, maintenance proposal and related maintenance procedure) 高桿燈升降裝置機械保養（包括檢查、維修報告、維修建議及其維修程序）	un	
4588	Repair High Mast with lifting platform truck, included reparation or maintenance of lifting device, head frame, 6 or 8 lanterns 使用高空作業車方式維修高桿燈，包括維修及保養升降裝置、主支架及 6 或 8 組燈具。	un	
4589	Supply and install of galvanized anchor bolts and nuts (4 nuts per bolt) (reference drawing I-399) 提供並安裝鍍鋅螺栓和螺母(1 螺栓配 4 螺母) (參考圖則 I-399)	un	
4590	Supply and install of galvanized base plate for anchor bolts installation (reference drawings I-397 & I-398) 提供並安裝螺栓連接用鍍鋅底座 (參考圖則 I-397 及 I-398)	un	
<b>4600</b>	<b>LICENSE APPLICATION</b> <b>準照申請</b>		
4601	Application to related government department according to structural needs or work perform near or crossing Natural Gas network 因應結構需要或施工範圍鄰近或需穿越天然氣管網時向相關政府部門的入則申請	un	
<b>4700</b>	<b>EMERGENCY SERVICE</b> <b>緊急服務</b>		
4701	Emergently Repair or replace MCB or Contactors or timers or twilight switches, or fuse bases, or fuses or terminals or connectors in CDIP. 緊急維修或更換照明控制箱中的 MCB、接觸器（索掣）、時間開關掣、光暗開關掣、保險絲底座、保險絲、接線端、連接器	un	
4703	Emergently Adjust the MCB or Contactors in Lighting Pole or CDIP 緊急調整街燈或照明控制箱內 MCB 或接觸器（索掣）	un	
4704	Emergently install and connect 4 cores CU or AL aerial cables ( $\leq 25\text{mm}^2$ ) 緊急安裝及接駁 4 芯銅線或鋁線架空電纜 ( $\leq 25\text{mm}^2$ )	m	
4705	Emergently install and connect 4 cores CU or AL aerial cables ( $>25\text{mm}^2$ and $\leq 150\text{mm}^2$ ) 緊急安裝及接駁 4 芯銅線或鋁線架空電纜 ( $>25\text{mm}^2$ 及 $\leq 150\text{mm}^2$ )	m	
4706	Emergently Install metallic poles up to $\leq 4\text{m}$ , included bracket (single arm, double arm or two arm), associated lantern set, FVV cable, all connection and all excavation and pavement reinstatement 緊急安裝金屬支柱達到 $\leq 4.5$ 米，包括燈具（單臂，雙臂或高低臂），相應的燈罩，燈泡，FVV 線及所有接駁，所需的所有開挖及路面回復	un	

4707	Emergently Install metallic poles up to 6m, included bracket (single arm, double arm or two arm), associated lantern set, FVV cable, all connection and all excavation and pavement reinstatement 緊急安裝金屬支柱達到 6 米, 包括燈具 (單臂, 雙臂或高低臂), 相應的燈罩, 燈泡, FVV 線及所有接駁, 所需的所有開挖及路面回復	un	
4708	Emergently Install metallic poles up to 8m, included bracket (single arm, double arm or two arm), associated lantern set, FVV cable, all connection and all excavation and pavement reinstatement 緊急安裝金屬支柱達到 8 米, 包括燈具 (單臂, 雙臂或高低臂), 相應的燈罩, 燈泡, FVV 線及所有接駁, 所需的所有開挖及路面回復	un	
4709	Emergently install metallic lighting poles ( $\leq 12$ m) - included bracket (single arm, double arm or two arm), associated lantern set, FVV cable, all connection, and all excavation and pavement reinstatement 緊急安裝金屬燈柱( $\leq 12$ 米) - 包括燈具(單臂,雙臂或高低臂),相應的燈罩,燈泡,FVV 線及所有接駁,所需的所有開挖及路面回復	un	
4710	Emergently install metallic lighting poles ( $>12$ m and $\leq 18$ m) - included bracket (single arm, double arm or two arm), associated lantern set, FVV cable and all connection, and all excavation and pavement reinstatement 緊急安裝金屬燈柱( $>12$ 米及 $\leq 18$ 米) - 包括燈具(單臂,雙臂或高低臂),相應的燈罩,燈泡,FVV 線及所有接駁,所需的所有開挖及路面回復	un	
4706	Emergently Remove metallic poles up to $\leq 4$ m, included bracket (single arm, double arm or two arm), associated lantern set, FVV cable, all connection and all excavation and pavement reinstatement 緊急拆除金屬支柱達到 $\leq 4.5$ 米, 包括燈具 (單臂, 雙臂或高低臂), 相應的燈罩, 燈泡, FVV 線及所有接駁, 所需的所有開挖及路面回復	un	
4707	Emergently Remove metallic poles up to 6m, included bracket (single arm, double arm or two arm), associated lantern set, FVV cable, all connection and all excavation and pavement reinstatement 緊急拆除金屬支柱達到 6 米, 包括燈具 (單臂, 雙臂或高低臂), 相應的燈罩, 燈泡, FVV 線及所有接駁, 所需的所有開挖及路面回復	un	
4708	Emergently Remove metallic poles up to 8m, included bracket (single arm, double arm or two arm), associated lantern set, FVV cable, all connection and all excavation and pavement reinstatement 緊急拆除金屬支柱達到 8 米, 包括燈具 (單臂, 雙臂或高低臂), 相應的燈罩, 燈泡, FVV 線及所有接駁, 所需的所有開挖及路面回復	un	
4708	Emergently Remove metallic poles ( $\leq 12$ m), included bracket (single arm, double arm or two arm), associated lantern set, FVV cable, all connection and all excavation and pavement reinstatement 緊急拆除金屬支柱( $\leq 12$ m), 包括燈具 (單臂, 雙臂或高低臂), 相應的燈罩, 燈泡, FVV 線及所有接駁, 所需的所有開挖及路面回復	un	
4707	Emergently remove metallic lighting poles ( $>12$ m and $\leq 18$ m) - included bracket (single arm, double arm or triple arm), associated lantern set, FVV cable, all connection and all excavation and pavement reinstatement 緊急拆除金屬燈柱( $>12$ 米及 $\leq 18$ 米) - 包括燈具(單臂,雙臂或叁臂),相應的燈罩,燈泡,FVV 線及所有接駁,所需的所有開挖及路面回復	un	
4708	Emergently remove high mast ( $\geq 20$ m) – Included material transportation to CEM warehouse, excavation and destruction of concrete foundation, necessary reinstatement of pavement 緊急移除高桿燈 ( $\geq 20$ m) - 包括運送材料往澳電倉庫、開挖及清拆基座,以及相關路面回復。	un	
4709	Emergently install wall-mount /pole-mount brackets (single arm, double arm or triple arm), associated lantern set, FVV cable and corresponding	un	



	connection 緊急安裝壁掛式/柱掛式燈具(單臂,雙臂或叁臂),相應的燈罩,燈泡,FVV 線及相關接駁		
4710	Emergently remove wall-mount /pole-mount brackets (single arm, double arm or triple arm), associated lantern set, FVV cable 緊急拆除壁掛式/柱掛式燈具(單臂,雙臂或叁臂),相應的燈罩,燈泡,FVV 線	un	
4711	Emergently replace & connect of different type of CDIP with its internal components (foundation base not necessary) 緊急更換及接駁不同種類的照明控制箱及其內部配件 (不包括混凝土基礎)	un	

### ANNEX III - a

#### SAMPLE OF DECLARATION (TYPE I)

\_\_\_\_\_ [name], \_\_\_\_\_ [marital status], residing in Macau at \_\_\_\_\_ [address], declares to fully assume the responsibility for the proposal(s) submitted for the public tender launched by Companhia de Electricidade de Macau - CEM, S.A. on \_\_\_\_\_ [day] of \_\_\_\_\_ [month] of \_\_\_\_\_ [year] for the “Construction, Maintenance, Operation and Emergency Service for Public Lighting Network”, and will execute the Contract and supply all the required materials and equipment in accordance with the technical specifications and quality requirements as specified on the tender document.

The undersigned declares that all documents submitted are valid and true.

Dated this (day/month/year).

Signature \_\_\_\_\_

(Signatures shall be officially recognised by a notary)

Note: This sample is used as a reference only; Bidders shall produce their document based on their own suitable contents or it may be considered as missing submission.

## ANNEX III - b

### SAMPLE OF DECLARATION (TYPE II)

\_\_\_\_\_ *[name of Company]*, with its headquarter located in Macao at \_\_\_\_\_ *[company address]*, with the branches that are related to the execution of the Contract namely \_\_\_\_\_ *[Name of Corporate]*, the director(s) of the executive committee are: \_\_\_\_\_ *[names]*, the other persons entitled with sufficient legal powers to represent it are: \_\_\_\_\_ *[names]*, to set up the company and its amendment to the constitution and statutes registered at the “Conservatória dos Registos Comercial e de Bens Móveis” with the registration number \_\_\_\_\_, \_\_\_\_\_ pages of Book \_\_\_\_\_, declares to fully assume the responsibility for the proposal(s) submitted for the public tender launched by Companhia de Electricidade de Macau - CEM, S.A., on \_\_\_\_\_ *[day]* of \_\_\_\_\_ *[month]* of \_\_\_\_\_ *[year]*, for the “Construction, Maintenance, Operation and Emergency Service for Public Lighting Network”, and will execute the Contract and supply all the required materials and equipment in accordance with the technical specifications and quality requirements as specified on the tender document.

The undersigned declares that all documents submitted are valid and true.

Dated this (day/month/year).

Signature \_\_\_\_\_

(Signatures shall be officially recognised by a notary)

Attachment: Commercial Registry of the constitution and the amendments.

Note: This sample is used as a reference only; Bidders shall produce their document based on their own suitable contents or it may be considered as missing submission.

## ANNEX IV

### Financial Services Bureau (DSF) Evidence Document Template

Certificate No. \_\_\_\_\_

\_\_\_\_\_, Head of Tax Department

Upon being requested by “\_\_\_\_\_”, dated \_\_\_\_\_ of \_\_\_\_\_ of the current year, registered in this Bureau under the number \_\_\_\_\_, which is filed here, that after examining the file of business registration tax and other information that are stored in this Bureau, it is certified that the company named “\_\_\_\_\_”, in English “\_\_\_\_\_”, and in Chinese “\_\_\_\_\_”, located at \_\_\_\_\_, registered under the name of \_\_\_\_\_, and registered in our Department with business registration tax number “\_\_\_\_\_”, owes nothing to the Fiscal Administration of the Macao Special Administrative Region in respect of taxes and duties.

For being true, I instructed the issuance of this certificate which will be signed by the undersigned and authenticated with the embossed seal of this Department.

Dated this \_\_\_\_\_ day of \_\_\_\_\_ 2021.

Signature \_\_\_\_\_

Note: This template serves as a reference only; Bidders must apply the certificate from Financial Services Bureau

## ANNEX V

### Social Security Fund (FSS) Evidence Document Template

Certificate No. \_\_\_\_\_

This is to certify that \_\_\_\_\_ *[name of company]*, located at \_\_\_\_\_ *[address]*, employer registration no. of FSS \_\_\_\_\_, has contributed to the Social Security Fund from \_\_\_\_\_ *[month and year]* to \_\_\_\_\_ *[month and year]*. A record of contribution of the company and the number of benefited employees is attached herewith.

This certificate is only for use of tenders of public works.

This certificate contains \_\_\_\_\_ pages, all of which are authenticated with embossed seal and initialled, and must be affixed with tax stamp.

Dated this \_\_\_\_\_ day of \_\_\_\_\_ 2021.

Signature \_\_\_\_\_

Note: This template serves as a reference only; Bidders must apply the certificate from Social Security Fund - FSS

## ANNEX VI

### TENDER SECURITY (SAMPLE)

By this Guarantee, we, \_\_\_\_\_ with Head Office at \_\_\_\_\_, at the request of \_\_\_\_\_ (hereinafter called "the Bidder"), are bound unto Companhia de Electricidade de Macau - CEM, S.A. (hereinafter called "CEM") in the sum of **MOP3,300,000.00** (PATACAS THREE MILLION AND THREE HUNDRED THOUSAND ONLY) required for the admission to the tender for **“CONSTRUCTION, MAINTENANCE, OPERATION AND EMERGENCY SERVICE FOR PUBLIC LIGHTING NETWORK”**, for which payment the Bank binds itself, its successors and assigns by these presents.

The conditions of this obligation are:

1. The Bank undertakes to pay to CEM any sum up to the above amount upon receipt of written demand from CEM. The execution of this covenant must offer CEM equal guarantee to the one resulting from a money deposit made by the Bidder, so, the Bank will deliver the money demanded by CEM without delay.
2. The guarantee will remain irrevocably in full force and effect up to 30 days after the period of validity of the Bidder's offer or, should the Contract be awarded to the Bidder, until its replacement by the Performance Security for the Works.

This guarantee is governed by the laws and regulations of Macao SAR.

**N.B. This security must be signed with the authorized signatures of the Bank, with the witness of a Public Notary.**

**This sample is used as a reference only; Bidders shall produce their document based on their own suitable contents or it may be considered as missing submission.**

## ANNEX VII

### SAMPLE OF DECLARATION

\_\_\_\_\_ [Name], \_\_\_\_\_ [Marital Status], residing in Macau at \_\_\_\_\_ [Address], legal representative of \_\_\_\_\_ [name of Company], hereby declares that materials of qualities not meeting or below the requirements as specified in the related plan of the Programme of Tender, materials and equipment specified in Specifications will not be used in the execution of the Contract of “Construction, Maintenance, Operation and Emergency Service for Public Lighting Network”.

Dated this (day/month/year).

Signature \_\_\_\_\_

(Signatures shall be officially recognised by a notary)

Note: This sample is used as a reference only; Bidders shall produce their document based on their own suitable contents or it may be considered as missing submission.

## ANNEX VIII

### SAMPLE OF DECLARATION

\_\_\_\_\_ [Name], \_\_\_\_\_ [Marital Status], residing in Macau at  
\_\_\_\_\_ [Address], legal representative of  
\_\_\_\_\_ [name of Company], hereby declares that during the execution  
of the Tender and Contract "Construction, Maintenance, Operation and Emergency Service for  
Public Lighting Network", he/she accepts and complies strictly with the "Rules for Integrity and  
Honesty" as listed below:

1. Contractors, their shareholders and employees should strive not to commit any act of corruption and bribery; if the contractors suspected infringements of their staff in crimes of corruption and bribery, they must report immediately to the Commission Against Corruption (CCAC) of the Macao SAR.
2. When the contractors, their shareholders and employees deal with staff of Companhia de Electricidade de Macau – CEM, S.A. (henceforth referred to as CEM) for business purposes (especially during tendering process or the execution of Contract), they cannot offer any benefits or hospitality for CEM staff or their family members, unless the hospitality is consumable on site and is according to traditional custom (for example supply of drinks to the site inspectors), and / or for the fulfillment of contractual obligations.
3. During the tendering process and execution of the Contract, if it appears there is existence of intimate relationships between the contractors themselves, their shareholders and employees, and CEM staff responsible for the work [eg, spouses or cohabitants, lineal relatives or collateral relatives or relatives by marriage (parents, children, sons-in-law, daughters-in-law, siblings, brothers-in-law, sisters-in-law etc.)], or partners of common interests (for example, business partners or debt or credit of above thirty thousand patacas), or at severe enmity (for example, a private prosecution is taking place), contractors are obliged to report the fact immediately to CEM in writing.
4. In the event of the existence of relationships of interests between the contractors and supervising entities (for example, a transaction is taking place between themselves, or are parent company and subsidiary, or ancillary or partners), contractors are obliged to report this fact immediately to CEM actively written.
5. After the hiring of subcontractors, contractors will have to deliver the information of subcontractors immediately to CEM; in addition, contractors will have to admonish subcontractors against the commitment of any act of corruption and bribery.



6. In case of any suspicion of the contractors on subcontractors or pieceworkers for involvement in any act of corruption and bribery, contractors must report the case immediately to CCAC.
7. If the contractors, their shareholders, subcontractors and employees violate the above terms, the awarding entity is entitled to terminate the Contract and the contractors will be responsible for any expenses arising therefrom.

The awarding entity will have the right to terminate the Contract for any infringement of the above terms. We are liable for any compensation arising therefrom.

Dated this (day/month/year).

Signature \_\_\_\_\_  
(Signatures shall be officially recognised by a notary)

Note: This sample is used as a reference only; Bidders shall produce their document based on their own suitable contents or it may be considered as missing submission.

**ANNEX IX**  
**SAMPLE OF DECLARATION**

\_\_\_\_\_ [Name], \_\_\_\_\_ [Marital Status], residing in Macao at \_\_\_\_\_ [Address], is the owner of the company or its legal representative of \_\_\_\_\_ [name of company]/legal representative of \_\_\_\_\_ [name of company], for all intents and purposes, hereby declares that he, or the current / former shareholders and current / former members of executive committee have not been sentenced by the court due to involvement in acts of active or passive corruption during services in the last five years.

Dated this (day/month/year).

Signature \_\_\_\_\_  
(Signatures shall be officially recognised by a notary)

Note: This sample is used as a reference only; Bidders shall produce their document based on their own suitable contents or it may be considered as missing submission.

**ANNEX X**  
**SAMPLE OF DECLARATION**

\_\_\_\_\_ *[Name]*, \_\_\_\_\_ *[Marital Status]*, residing in Macao at \_\_\_\_\_ *[Address]*, is the owner of the company or its legal representative of \_\_\_\_\_ *[name of company]*/legal representative of \_\_\_\_\_ *[name of company]*, declares that he has not been sentenced by the court or any administrative authority to have employed illegal workers, hired workers to perform functions outside the contract or without authorisation in the last five years.

Dated this (day/month/year).

Signature \_\_\_\_\_  
(Signatures shall be officially recognised by a notary)

Note: This sample is used as a reference only; Bidders shall produce their document based on their own suitable contents or it may be considered as missing submission.

**ANNEX XI**  
**SAMPLE OF DECLARATION**

\_\_\_\_\_ [Name], \_\_\_\_\_ [Marital Status],  
residing in Macao at \_\_\_\_\_ [address], is  
the owner of \_\_\_\_\_ [company] or is the  
legal representative of \_\_\_\_\_ [company], hereby  
declares the bidder has / has not been given additional penalties as specified in item no. 1 (1) of  
article no. 82 of Law no. 16/2021 (i.e. to be deprived of right to participate in direct negotiation,  
restricted enquiries or public tenders), for a period of \_\_\_\_\_ years \_\_\_\_\_ months.

Dated this (day/month/year).

Signature \_\_\_\_\_  
(Signatures shall be officially recognised by a notary)

Note: This sample is used as a reference only; Bidders shall produce their document based on  
their own suitable contents or it may be considered as missing submission.

## ANNEX XII

### SAMPLE OF DECLARATION

\_\_\_\_\_[Name], \_\_\_\_\_[Marital Status],  
residing in Macao at \_\_\_\_\_ [address],  
legal representative of \_\_\_\_\_ [company], registration  
no. \_\_\_\_\_, hereby declares that during the execution of Contract for “Construction,  
Maintenance, Operation and Emergency Service for Public Lighting Network”, he will follow  
strictly the related regulations as specified in the tender documents so as to guarantee the safety  
and health of the workers and the surroundings (including the general public), as well as to bear  
all technical responsibilities.

Dated this (day/month/year).

Signature \_\_\_\_\_  
(Signatures shall be officially recognised by a notary)

Note: This sample is used as a reference only; Bidders shall produce their document based on their  
own suitable contents or it may be considered as missing submission.

## ANNEX XIII

### PERFORMANCE SECURITY (SAMPLE)

By this Guarantee, we, \_\_\_\_\_ with Head Office at \_\_\_\_\_, at the request of \_\_\_\_\_ (hereinafter called "the Contractor"), are bound unto Companhia de Electricidade de Macau - CEM, S.A. (hereinafter called "CEM") in the sum of **MOP6,600,000.00** (PATACAS SIX MILLION SIX HUNDRED THOUSAND ONLY), for which payment the Bank binds itself, its successors and assigns by these presents.

Whereas CEM has awarded the Contractor the contract for **“CONSTRUCTION, MAINTENANCE, OPERATION AND EMERGENCY SERVICE FOR PUBLIC LIGHTING NETWORK”**

The conditions of this obligation are:

1. The Bank undertakes to pay to CEM any sum up to the above amount upon receipt of written demand from CEM. The execution of this covenant must offer CEM equal guarantee to the one resulting from a money deposit made by the Contractor, so, the Bank will deliver the money demanded by CEM without delay and without it being necessary to prove to the Bank the defects or shortcomings or debts of the Contractor.
2. This guarantee is valid until **30/Jun/2029**. *(Remarks: The validity period is 5 years which shall cover the contract period plus 2 years for the guarantee period)*

This guarantee is governed by the laws and regulations of Macao SAR.

**N.B. This security must be signed with the authorized signatures of the Bank, with the witness of a Public Notary.**

**This sample is used as a reference only; Bidders shall produce their document based on their own suitable contents or it may be considered as missing submission.**

## ANNEX XIV

### Organization Chart for the Team

Except indicated as optional items, all fields must be filled in completely and all personnel shall not overlap with other teams required in this contract nor any other existing contracts with CEM. For detailed requirement on human resources, please refer to General Technical Condition Section 8.

Remarks: The personal data to be collected during this tender is only used for selection of award. All the data submitted will be handled according to the Personal Data Protection Act.

除個別標註為可選項目外，必須填滿所有表格，而所有人員不得同時與本合同要求的其他團隊或澳電任何正在生效的合同重疊。相關人手之詳盡要求，請參閱一般技術條款第 8 部分。

註：本招標所收集到的個人資料僅供本次選標用途，所有遞交的資料將按照個人資料保護法的規定處理。

#### 1. Management Team 管理團隊

Management Team 管理團隊			
Position 職位	Name 名字	ID Card Number* 身份證號碼*	Mobile Number 手機號碼
Contract Manager 合同經理			
Engineer (Planning) 工程規劃工程師			
Engineer (Construction) 施工現場工程師			
Engineer (Maintenance) 維修保養工程師			
Safety Inspectors 安全督導員			
Main Contact Person 主要聯繫人			
Backup Contact Person 後備聯繫人			
Additional Engineer (Optional) 額外工程師 (可選部份)			
Additional Safety Inspectors (Optional) 額外安全督導員(可選部份)			

\* First 4 digits 首四位數字

Remarks: Related CV and proofs of qualifications shall be submitted with the chart for all the personnel stated above (except for the optional part).

註：須隨表提交上述所有人員（可選部份除外）的相關履歷表及資格證明。

2. Planning and document control Team  
工作規劃及文件管理團隊

Planning Team 規劃團隊			
Position 職位	Name 名字	ID Card Number* 身份證號碼*	Mobile Number 手機號碼
Planning coordinator 規劃協調員			
Document Controller 文件管理員			

\* First 4 digits 首四位數字

Remarks: Related CV and proofs of qualifications shall be submitted with the chart for all the personnel stated above.  
註：須隨表提交上述所有人員的相關履歷表及資格證明。

3. Construction & Maintenance Team - Excavation, Lighting installation and cable laying  
挖掘，路燈安裝，電纜鋪設工程之建設和維護團隊

Construction & Maintenance Team 1 建設和維護團隊 1				
Position 職位	Name 名字	ID Card Number* 身份證號碼*	OHS Card Number 職安卡號碼	Expiry Date 到期日
Team Leader 小組負責人				
Team Member 隊員				
Team Member 隊員				
Team Member 隊員				
Team Member 隊員				
Construction & Maintenance Team 2 建設和維護團隊 2				
Position 職位	Name 名字	ID Card Number* 身份證號碼*	OHS Card Number 職安卡號碼	Expiry Date 到期日
Team Leader 小組負責人				
Team Member 隊員				
Team Member 隊員				
Team Member 隊員				
Team Member 隊員				

\* First 4 digits 首四位數字

Remarks: Related CV and proofs of qualifications shall be submitted with the chart for all the personnel stated above.  
註：須隨表提交上述所有人員的相關履歷表及資格證明。



Construction & Maintenance Team 3** 建設和維護團隊 3**				
Position 職位	Name 名字	ID Card Number* 身份證號碼*	OHS Card Number 職安卡號碼	Expiry Date 到期日
Team Leader 小組負責人				
Team Member 隊員				
Team Member 隊員				
Team Member 隊員				
Team Member 隊員				

\* First 4 digits 首四位數字

Remarks: Related CV and proofs of qualifications shall be submitted with the chart for all the personnel stated above.  
註：須隨表提交上述所有人員的相關履歷表及資格證明。

\*\* If the chart cannot be filled in completely during tender submission, the Bidder must provide it to CEM within twenty (20) days after the award of contract.

若投標人未能於報標時填滿相關名單，則須於合同判給後二十（20）日內向澳電提交上述名單。

#### 4. Emergency Team - Excavation, Lighting Pole/Lantern installation and cable laying works 挖掘，燈柱/燈具安裝，電纜鋪設工程之搶修團隊

Emergency Team 1 搶修團隊 1				
Position 職位	Name 名字	ID Card Number* 身份證號碼*	OHS Card Number 職安卡號碼	Expiry Date 到期日
Team Leader 小組負責人				
Team Member 隊員				
Team Member 隊員				
Team Member 隊員				
Team Member 隊員				

\* First 4 digits 首四位數字

Remarks: Related CV and proofs of qualifications shall be submitted with the chart for all the personnel stated above.  
註：須隨表提交上述所有人員的相關履歷表及資格證明。

Emergency Team 2 **搶修團隊 2**				
Position 職位	Name 名字	ID Card Number* 身份證號碼*	OHS Card Number 職安卡號碼	Expiry Date 到期日
Team Leader 小組負責人				
Team Member 隊員				
Team Member 隊員				
Team Member 隊員				
Team Member 隊員				

\* First 4 digits 首四位數字

Remarks: Related CV and proofs of qualifications shall be submitted with the chart for all the personnel stated above.  
註：須隨表提交上述所有人員的相關履歷表及資格證明。

\*\* If the chart cannot be filled in completely during tender submission, the Bidder must provide it to CEM within twenty (20) days after the award of contract.

若投標人未能於報標時填滿相關名單，則須於合同判給後二十（20）日內向澳電提交上述名單。

## 5. Aerial Cable Team

架空電纜隊伍

Aerial Cable Team 架空電纜隊伍				
Position 職位	Name 名字	ID Card Number* 身份證號碼	OHS Card Number 職安卡號碼	Expiry Date 到期日
Team Leader 小組負責人				
Team Member 隊員				
Team Member 隊員				
Aerial Cable - Emergency Team **架空電纜 - 搶修隊伍**				
Position 職位	Name 名字	ID Card Number* 身份證號碼	OHS Card Number 職安卡號碼	Expiry Date 到期日
Team Leader 小組負責人				
Team Member 隊員				
Team Member 隊員				

\* First 4 digits 首四位數字

Remarks: Related CV and proofs of qualifications shall be submitted with the chart for all the personnel stated above.  
註：須隨表提交上述所有人員的相關履歷表及資格證明。

\*\* If the chart cannot be filled in completely during tender submission, the Bidder must provide it to CEM within twenty (20) days after the award of contract.

若投標人未能於報標時填滿相關名單，則須於合同判給後二十（20）日內向澳電提交上述名單。

## ANNEX XV

### Equipment List

#### Critical Equipment List

#### 關鍵設備清單

The Bidder must fill in the following equipment list completely and provide related equipment information such as catalogues, technical specifications or photos whichever available, and must confirm the following equipment have already been obtained.



投標人須填滿下列設備清單及提交相關的設備資料例如產品目錄，技術規格或圖片（如有），以及確定已經配備以下設備。

Critical Equipment List 關鍵設備清單				
Equipment 設備	Quantity 數量	Already Equipped 已配備		Reference Photos 參考圖片
		Yes 有	Brand & Model 牌子及型號	
Excavating machine (Middle) 開挖機 (中型)	2 set 2 台	✓		
Excavating machine (Small) 開挖機 (小型)	1 set 1 台	✓		
10-14m Truck mounted Aerial work platform 10-14 米高空作業車	2 set 2 台	✓		

## Necessary Equipment List 必備設備清單

The Bidder must submit the following equipment list and provide related equipment information such as catalogues, technical specifications or photos whichever available, and must confirm the following equipment will be obtained within twenty (20) days after the award of contract. If the following list cannot be filled in completely during tender submission, the Bidder must complete it and submit related equipment information to CEM within twenty (20) days after the award of contract.

投標人須提交下列設備清單及相關的設備資料例如產品目錄，技術規格或圖片（如有），以及確定會於合同判給後二十（20）日內配備以下設備。若投標人未能於報標時填滿下列清單，則須於合同判給後二十（20）日內填滿及向澳電提交相關設備資料。

Necessary Equipment List 必備設備清單				
Equipment 設備	Quantity 數量	Must be equipped within 20 days after the award of contract 須於合同判給後 20 日內配備		Reference Photos 參考圖片
		Yes 有	Brand & Model 牌子及型號	
10-14m Truck mounted Aerial work platform 10-14 米高空作業車	1 set 1 台	✓		
2-10m truck with lifting platform 2-10 米高空作業車	2 set 2 台	✓		

Total number of excavating machines: Three (3) sets

開挖機總數量：三（3）台

Total number of Trucks with lifting platform: Five (5) sets

高空作業車總數量：五（5）台

All platform trucks mentioned above cannot be duplicated with any trucks registered in CEM existing contracts. Other necessary equipment and tools should also be provided during the jobs.

上述所有平台車不能與任何澳電現行合同登記的平台車重覆。其它必要的設備和工具也應該在工作期間提供。

## ANNEX XVI

Experience of the excavation works in Public Road (area) from 2018-2023

由 2018 年至 2023 年間於公共道路（地區）開挖坑道的經驗

Item# 項目#	Project Name 工程名稱	Project Owner 工程業主	Project Location (Name of road) 工程地點(街名)	Start Date 開始日期	End Date 完工日期	Trench Length (Meter) # 坑道長度 (米) #				Amount (MOP) 金額 (澳門元)
						>200m ~ 500m >200 米~ 500 米	>500m~2km >500 米~2 千米	>2km~5km >2 千米~5 千米	>5 km >5 千米	
Total Length*: 總長度*:										

# The length of each items in the list shall be over 200m, each item shall provide related proof.

表中所提交的每一項目長度必須多於 200 米，每一項目必須提供相應證明。

\* The total length shall be at least 2000m, accumulated from the items in the list.

表中所提交的項目累計總長度須至少要 2000 米。

## ANNEX XVII

Experience of the LV electrical equipment installation from 2018-2023

由 2018 年至 2023 年間於低壓電氣設備安裝的經驗

Item# 項目#	Project Name 工程名稱	Project Owner 工程業主	Location (Name of Road or building) 工程地點 (街道或建築物名稱)	Start Date 開始日期	End Date 完工日期	Project Amount of Electrical Equipment Installation part (MOP) 電氣設備安裝部分的工程金額 (澳門元)		
						> 1 Million ~ 3 Million > 一百萬~ 三百萬	> 3 Million ~ 5 Million > 三百萬~ 五百萬	> 5 Million > 五百萬
Total Amount*: 總金額*:								

#The project amount of each item in list shall be over MOP 1,000,000, each item shall provide related proof.

表中所提交的每一項目金額必須多於澳門元 1,000,000 圓，每一項目必須提供相應證明。

\* The total amount shall be at least MOP 3,000,000.

表中所提交的項目總金額須至少要澳門元 3,000,000 圓。

## ANNEX XVIII

Experience of the LV electrical Equipment maintenance from 2018-2023

由 2018 年至 2023 年間於低壓電氣設備維修保養的經驗

Item# 項目#	Project Name 工程名稱	Project Owner 工程業主	Location (Name of Road or building) 工程地點 (街道或建築物名稱)	Start Date 開始日期	End Date 完工日期	Project Amount of Electrical Equipment Installation part (MOP) 電氣設備安裝部分的工程金額 (澳門元)		
						> 500 Thousand ~ 3 Million > 五十萬~ 三百萬	> 3 Million ~ 5 Million > 三百萬~ 五百萬	> 5 Million > 五百萬
Total Amount*: 總金額*:								

#The project amount of each item in list shall be over MOP500,000, each item shall provide related proof.

表中所提交的每一項目金額必須多於澳門元 500,000 圓，每一項目必須提供相應證明。

\* The total amount shall be at least MOP1,500,000.

表中所提交的項目總金額須至少要澳門元 1,500,000 圓。

**ANNEX XIX**  
**TENDER OPENING PARTICIPANTS FORM (Sample)**

To: Companhia de Electricidade de Macau – CEM S.A.

It is to inform that the following personnel:

	Name	ID Card Number (First 4 digits)
1.	_____	_____
2.	_____	_____
3.	_____	_____

will be representing our company \_\_\_\_\_, with Head Office located at \_\_\_\_\_, to participate in the Tender Opening for **“CONSTRUCTION, MAINTENANCE, OPERATION AND EMERGENCY SERVICE FOR PUBLIC LIGHTING NETWORK”** at 10:00 of 18<sup>th</sup> May, 2021.

Bidder: \_\_\_\_\_

Authorized Signature\* / Company Stamp: \_\_\_\_\_

Date:

\*Signatures shall be officially recognised by a notary

Remarks: The personal data to be collected during this tender is only used for selection of award. All the data submitted will be handled according to the Personal Data Protection Act.



# “CONSTRUCTION, MAINTENANCE, OPERATION AND EMERGENCY SERVICE OF PUBLIC LIGHTING NETWORK”

## I. SPECIFICATIONS

## **A. GENERAL CONDITIONS OF CONTRACT (GCC)**

### **1. GENERAL CLAUSES**

#### **1.1 Objective of contract**

- 1.1.1 The objective of this contract is the works, supply and services necessary for the integral execution of the jobs of **construction, maintenance., operation and emergency service of Public Lighting Network** according to the List of units price attached, to be carried out in the whole territory under the jurisdiction of Macao SAR, over a period of **3 (Three) years**, beginning from the date of the contract, in accordance with the present Rules and Regulations.
- 1.1.2 The Contractor is bound to carry out, by himself, and at his own risk, within the set period for each case, all the jobs will be requested through CEM's "Purchase Order", eventually followed by details of the project, when necessary.

#### **1.2 Parties of the contract. Their representation**

- 1.2.1 The parties in the contract are the Companhia de Electricidade de Macau - CEM, S.A., in this case called CEM, and the Contractor.
- 1.2.2 The Inspector will represent CEM in the job location, which will be the regular interlocutor of the Contractor to solve and advise on questions relating to the contract jobs.
- 1.2.3 The Contractor will appoint a representative with complete power to solve the majority of the problems relating to the execution of the contract, whose replacement can be demanded by CEM under reasonable grounds.

#### **1.3 Responsibility of the Contractor. Guarantee.**

- 1.3.1 When requested to carry out a contract job, the Contractor will be responsible for its execution and maintenance during the period of guarantee, in accordance with the codes of practice and other contractual clauses.
- 1.3.2 Until the final taking-over of each contract job, the Contractor will carry out, by himself, any possible necessary repair work, or correction of errors and deficiencies in the execution of the job, or materials applied.
- 1.3.3 CEM can demand demolition to find out about possible deficiencies, the Contractor being responsible for the expenses if proved to be correct or CEM being responsible if on the contrary.

- 1.3.4 CEM will never accept any damage to the assets (equipment, property, environmental resources, labour, public image, etc.), under the responsibility of the Contractor, or third parties, even in cases of force majeure, and the Contractor shall be liable to those damages.
- 1.3.5 All fines levied by the Official Entities, resulting from negligence on the part of the Contractor, in the carrying out of work belonging to the contract, are the responsibilities of the Contractor.
- 1.3.6 All the necessary licenses for erection of the building site, the temporary installation and supply of water, as well as consumption, will be requested, and the respective cost borne by the Contractor.
- 1.3.7 To guarantee the complete execution of the contractual obligations and the repetition of works which have not been accepted by CEM, the Contractor will present a cash deposit guarantee (cheque/bank draft payable to CEM and drawn on one of the approved banks in Macao SAR), without interest, or present a bank guarantee given by a Bank accepted by CEM, taking on all the costs incurred.
- 1.3.8 The contractor shall be liable to indemnify for any losses to CEM caused by the contractor. Neither the effecting of insurance nor the approval of any such insurance by CEM shall limit any liability or obligation of the contractor under the contract.
- 1.3.9 The contractor has the obligation to employ personnel of local (Macao SAR) residents unless approved by the Macao SAR Government with special reasons.
- 1.3.10 When the construction is near GAS network, all the necessary licenses should be applied from Macao SAR, are the responsibilities of the Contractor. Included all kinds of coordination with Macau SAR until gain the corresponding license from Macau SAR.

## **1.4 Insurance**

### **1.4.1 Presentation of Insurance Policy**

The Contractor shall arrange the insurance as stated below and deliver to CEM, within 8 (eight) days from signature of the contract, a copy of the full set of insurance policy and all its respective receipts.

The Contractor cannot initiate any contract job without previously presenting to CEM the said documents.

### **1.4.2 Insurers**

CEM only accepts Insurance Policy arranged with insurance companies registered in Macao SAR.  
A list of the registered insurers accepted by CEM is shown below:

**CEM Accepted Insurers List**

- AIG Insurance Hong Kong Limited
- Asia Insurance Company Ltd.
- MSIG Insurance (Hong Kong) Ltd.
- China Taiping Insurance (Macau) Company Limited
- Luen Fung Hang Insurance Company Ltd.
- Macau Insurance Company
- QBE General Insurance (Hong Kong) Ltd.
- Chubb Insurance Macau Limited
- Fidelidade Macau- Insurance Company Limited
- Berkshire Hathaway Specialty Insurance Company
- AXA General Insurance Hong Kong Limited

1.4.3 Insurance Requirement & Coverage

1.4.3.1 Contractor's All Risks Policy

This policy shall include loss of or damage to CEM's assets and third party liability during the carrying out of the work.

Insured Name:

Companhia de Electricidade de Macau, S.A. (as Principal) and (Contractor's Full Company Name)  
(as Main Contractor) and all its Sub-contractors (as Contractor)

Limit of Indemnity:

Seven Million Patacas (**MOP7,000,000.00**) for any one accident and unlimited for the whole period of Indemnity

Period of Insurance

Contract validity

Description:

Maintenance, Construction and Emergency Service of electrical networks over the whole territory under the jurisdiction of Macao SAR which shall include the works of "Construction, Maintenance Operation and Emergency Service of Public Lighting Network".

Extension clauses to be included:

Accidental Pollution Cover; Motor Liability at Site/Private Areas; Primary Insurance; Waiver of Subrogation against Insured Parties; Cross Liability Clause; Vibration or Weakening/Removal of Support Clause; Principal Property Extension Clause; Strikes, Riot and Civil Commotion Clause.

#### 1.4.3.2 Transportation Insurance Policy

This policy shall be on "all risks" basis which shall cover loss of or damage to the Insured properties during transportation on door-to-door basis including loading and unloading.

Insured Name:

Companhia de Electricidade de Macau, S.A. (as Principal) and (Contractor's Full Company Name) (as Main Contractor) and all its Sub-contractors (as Contractor)

Amount Insured:

One Million Five Hundred Thousand Patacas (**MOP1,500,000.00**)

Period of Insurance:

Contract Validity

Description:

This policy covers loss of or damage to the Insured properties caused by all risks of all direct physical loss including but not limited to accidents, robbery, burglary, theft, fire and lightning, explosion, typhoon, windstorm, riot & strike and malicious damage whilst in transit from warehouse or designated locations to the appointed construction sites or other predetermined destinations and vice versa.

Extension clauses to be included:

Automatic Reinstatement of Sum Insured Clauses

#### 1.4.3.3 Vehicle Insurance

The Contractor shall maintain enough insurance for any vehicles involved in the work in accordance with Decree-Law No. 57/94/M dated 28 November.

#### 1.4.3.4 Employees' Compensation

The Contractor shall maintain enough insurance against his responsibility to compensate his workers in accordance with Decree-Law No. 40/95/M dated 14 August.

This policy shall cover work accidents and professional illnesses for the Contractor's and/or its sub-contractors' employees.

#### Extension Clause - Indemnity to Principal Clause

It is hereby understood and agreed that this policy is extended to indemnity C.E.M. (hereinafter called the principal) against liability at law (including liability under the legislation set out in the schedule) in like manner to the insured (The Contractor) but only so far as concerns the liability of the principal (C.E.M.) to employees of the insured (The Contractor) engaged in connection with a contract undertaken by the insured for the principal (C.E.M.).

### **1.5 CEM Safety, Health, Environment and Quality Requirements & Responsibilities for Contractor**

1.5.1 The Contractor shall comply with all safety and security regulations in force in CEM, specifically the latest version of “Health and Safety Manual For CEM Contractors” – Appendix I, as well as with all applicable safety laws and standards in force in Macao SAR.

1.5.2 The Contractor shall comply with the requirements stated in the latest version of “CEM Safety, Health, Environment and Quality Requirements & Responsibilities for Services Suppliers” – Appendix II

#### 1.5.3 Reporting and Investigation of Near Misses and Accidents

Any accident/incident happens during the execution of works should be immediately report to the inspection.

##### A. Incident Investigation

The incident investigation has the following objectives:

- Understanding what caused the incident
- Preventing a similar incident from happening again

Depending on the nature, complexity or consequences of the incident, an investigation may be carried out to identify the truth and understand the circumstances of its occurrence as well as the “roots causes” in order to avoid recurrence in the future. Investigation shall be compulsory in the following situations:

- Critical incidents/accidents or crisis situations;
- Death, near miss death risk or serious injury of any person;
- Loss or damage arising from the incident are estimated to be worth more than MOP20,000;
- Whenever the incident root cause is not identified in the written notification.

The incident investigation shall be conducted as soon as possible after the occurrence in order to ensure its success as in some cases witness testimony is crucial to the successful investigation. Whenever possible, the scene of the incident shall be preserved in order to facilitate the reconstitution of events.

B. The incident investigation shall consist of:

- Gathering and organizing data
- Analyzing the data to determine causal factors
- Identifying root causes of the event
- Elaborating on effective recommendations
- Writing incident investigation report

C. Incident Investigation Report

Once the investigation has been completed, an Investigation Report must be issued with the purpose to record all information collected during the investigation for future reference, and to prove duty of care for any external parties, such as Government or the Insurer. The Investigation Report shall be submitted within one week of the occurrence of the incident or as otherwise determined, depending on the incident complexity and severity, and potential involvement of third parties. The Incident Report should consist of the following parts:

Description of the incident	<ul style="list-style-type: none"> <li>• Where and when the incident occurred;</li> <li>• Who and what were involved and/or affected;</li> <li>• Operation personnel and other witnesses;</li> <li>• Sequence of events;</li> <li>• Extent of injuries, losses and damages;</li> <li>• Incident type.</li> </ul>
Incident analysis	<ul style="list-style-type: none"> <li>• Casual factors (e.g. human error, equipment fault, etc);</li> <li>• Root factors (e.g. equipment design process, procedures, supervision, standards and policies, training, communication practices, maintenance practices, etc).</li> </ul>
Recommendations	Corrective/preventative actions that may include the following but not limited to them;

	<ul style="list-style-type: none"> <li>• Repairing and/or replacing the unsuitable condition(s);</li> <li>• Designing or engineering a new process;</li> </ul>
	<ul style="list-style-type: none"> <li>• Re-designing the causes of the unsafe condition(s);</li> <li>• Providing training for the worker(s) involved and/or other as appropriate;</li> <li>• Drafting new procedures.</li> </ul>
Action Plan	<ul style="list-style-type: none"> <li>• Recommended corrective/preventative actions;</li> <li>• Priorities and due dates;</li> <li>• Estimated costs (as appropriate).</li> <li>• Responsible parties for implementing recommendations.</li> </ul>

The Investigation Report has to be submitted to CEM.

## **2. EXECUTION AND TAKING-OVER OF CONTRACT JOBS**

### **2.1 Projects for execution**

- 2.1.1 The details of the Project, presented in the Tender Documents, represent profile-types and are only for information; they do not restrict the nature and extent of the work.
- 2.1.2 CEM reserves the right to introduce into the projects, at any time, modifications due to the circumstances or thought to be convenient.
- 2.1.3 During the course of the works, and in the event of the Contractor needing any detail missing from the project, he must request clarification from the Inspection beforehand, to avoid delays.
- 2.1.4 For Emergency Service, the contract jobs shall be carried out in accordance with the requirements set out in the **GTC**.

### **2.2 Period for the execution and co-ordination of works**

- 2.2.1 Relative to the same job, and always when specific works exist, CEM will issue separately “Purchase Order” for these same works.
- 2.2.2 Each contract job must be started according to pre-defined schedule, starting from the time of receipt by the Contractor, of the “Purchase Order” with the exception of:
- a) Urgent work;
  - b) Recognized impossibility, when starting date of the job must be agreed with CEM;
  - c) Convenience for CEM.



d) Emergency Service

e) Disaster or Major Situation

In cases referred in items b) and c), CEM and the Contractor, by mutual agreement, will determine the period for the execution of the referred job, which will automatically count from the time of reception, by the Contractor, of the “Purchase Order”.

- 2.2.3 In the event that an agreement with the Contractor regarding the period of execution for a specific job is not possible, CEM reserves the right to determine the referred period unilaterally, taking into consideration the particular conditions of the job.
- 2.2.4 During the period of execution it is established that all working and non-working days, are counted.
- 2.2.5 When the Contractor asks for an extension of the period of execution, with justified reasons, he must request it in writing to the Inspection, setting out the reasons for his request.
- 2.2.6 If, during the course of a job, any modifications are determined by CEM, the Contractor can request for extension of work completion. The request for extension will only be accepted by CEM if the Inspection considers that such modifications cause delays to the progress of the works.
- 2.2.7 The delays caused by neglect or lack of organization of the jobs on the part of the Contractor, or any of his sub-Contractors, will be exclusively his own responsibility.
- 2.2.8 Delays caused by bad climatic conditions will be sufficient reason for the extension of the period of execution, if confirmed by the Inspection.
- 2.2.9 CEM reserves the right to authorize the execution of any type of works defined in the contract, to anyone she chooses.
- 2.2.10 At the job location, no work can be carried out outside established working hours, without previous authorization by the Inspection, who can object to this execution if such work demands, for their part, effective assistance but this cannot be guaranteed. The official working hours are from 8:00 am to 8:00 pm.
- 2.2.11 The Contractor should immediately attend to maintenance requests as result of public lighting network faults and public safety issues. All the works performed under these circumstances would always be considered as **Emergency work**.

## **2.3 Overtime**

- 2.3.1 Overtime is defined as the work carried out between 8:00 pm and 8:00 am.

2.3.2 Overtime works will have an extra pay of **50%** for all items, except the stated in the below clause 2.3.3 and 2.4.

2.3.3 There is no night rate and extra rate for Security Guard as the unit rate (Day) is for a shift of 24 hours.

## **2.4 Emergency Service**

2.4.1 The Contractor should immediately attend to emergency requests.

2.4.2 There is no night rate or extra rate for Emergency Service as it is 24 hours per day.

2.4.3 The Contractor should provide enough manpower and equipment to stand-by for the emergency work during typhoon or flooding, those manpower and equipment are not allowed to stand-by for other works at the same time.

## **2.5 Installations**

2.5.1 The Contractor is obliged to build, by himself, all necessary installations to carry out the contract jobs. Their location must be approved by CEM.

2.5.2 The Contractor will be responsible to maintain the order of the site and place all the materials in clear, tidy and safe conditions, for all of its installations.

## **2.6 Organization of Contractor & Personnel**

2.6.1 All works, which have to be carried out by the Contractor, must be managed by one or more technicians of recognized competence and accepted by the Inspection.

2.6.2 For the purpose of works clarification, evaluation of the schedule and receiving instructions, the Contractor's appointed technicians, should be at the site daily to ensure the job progress.

2.6.3 It is the exclusive responsibility of the Contractor to deal with all the obligations in connection with the labour in the Contract Jobs. However, the Inspection have the right to order the replacement of workers whom they consider do not have sufficient professional education or that their staying at the work site is thought to be inconvenient for good discipline and/or steady carrying out of the work by others.

- 2.6.4 ALL the involved employees working for this contract should hold valid “Occupational Safety Cards” issued by DSAL (The Labour Affairs Bureau); it is compulsory to submit the information of these cards to CEM with the submitted proposal for this tender.
- 2.6.5 In order to optimize on-site arrangements and coordination of all projects and to strengthen on-site management, the contractor should assign a construction coordinator on site to assist in traffic arrangements and reduce the impact on the public.

## **2.7 Protection and Signals**

- 2.7.1 All the trenches, material storage, equipment and, generally, all obstructions, must be duly protected and signalized as set out by the official entities, so that accidents can be prevented.
- 2.7.2 The use of correct and adequate traffic signs is compulsory when executing works on public roads.
- 2.7.3 The day and night signals will be taken care of by the Contractor, without any charges to CEM, under the conditions set down by the Inspection or by the official entities supervising the public roads where the jobs are being carried out.
- 2.7.4 The protection and signals used must be maintained until the works are completed.
- 2.7.5 No work will be carried out under any circumstances without protection and signals, and the consequences resulting from the absence of them are the entire responsibility of the Contractor. Consequently, any accidents, which occur in the works area, due to lack of protection and signals, are the entire responsibility of the Contractor.
- 2.7.6 If the driveway will be occupied temporarily or traffic will be affected, the Contractor must obtain the license for establishing and placing temporary traffic signal boards. The standard of the traffic signal board shall follow the requirements of the Transport Bureau otherwise, penalties will be applied according to 3.2.8.

## **2.8 Materials, Machine Tools and Portable Tools**

- 2.8.1 The supply and use of machines, equipment, instruments, tools, scaffolding and whatever else necessary for the efficient carrying out of the works is part of the responsibility of the Contractor, except that which is stipulated to the contrary in the contract document.
- 2.8.2 Approved machine tools shall conform where practical to approved international standards.
- 2.8.3 Portable tools selected for the job shall be suitable.

- 2.8.4 All machine tools shall have a risk assessment conducted prior to use, to ensure risks are minimal and acceptable, and suitable and sufficient controls are in place.
- 2.8.5 All dangerous parts of machines should be guarded to protect against hazard from moving parts and high temperature.
- 2.8.6 An inventory of all machine tools and portable tools should be developed and kept available for use at any time.
- 2.8.7 Inspections records of machine tools, manufacturers' certification, instructions manual and maintenance records should be kept available for reference.
- 2.8.8 To carry out public lighting works, the contractor is responsible to ensure that appropriate lifting equipment is used, an inventory is maintained, regular inspections records are kept, and ensuring that all people involved in the lifting operations are competent.
- 2.8.9 The Contractor will be fully responsible for all the equipment, materials, machine tools and portable tools supplied by him until temporary receipt of the installations.
- 2.8.10 The safekeeping and maintenance of the materials and equipment supplied by CEM will be the entire responsibility of the Contractor, from the moment they are delivered to him and until taking-over, with no additional cost.
- 2.8.11 If the job is temporarily suspended by the Inspection for reasons that are not Contractor responsibility, when requested by CEM, 24-hour security guards should be provided in accordance with the unit price.
- 2.8.12 The Contractor must request the materials and equipment, which are to be supplied by CEM, from the Inspection.
- 2.8.13 The delivery of these supplies will be made through copy of the "store material reservation" issued by the Inspection and handed over to the warehouse by the Contractor.
- 2.8.14 The materials and equipment supplied by CEM will be first delivered to CEM warehouse and demanded by the Contractor from CEM, except where indicated to the contrary in the GTC.
- 2.8.15 Pick up of these supplies at CEM's warehouses will be carried out in accordance with the delivery dates given by the Inspection and will be the entire responsibility of the Contractor. The possible delays in the completion of the contract job due to the non-collection of the supplies in due time are the entire responsibility of the Contractor.

- 2.8.16 Any delay in the supply of equipment or materials on CEM's part must be immediately communicated in writing by the Contractor. In the absence of this information, CEM is not responsible for these delays.
- 2.8.17 Transport to the job location of the equipment, materials, tools, instruments, etc., supplied and used by the Contractor, will be on his account and his own responsibility. Transport of the equipment and materials supplied by CEM are also from his own account, and are his responsibility from the places of delivery.
- 2.8.18 All loading and unloading operations of the equipment and materials which were transported by him at the job location will be the Contractor's responsibility and to his account.
- 2.8.19 All handling operations of the equipment and materials whose installation has been included in the contract job at the job location, whether or not belonging to his own supply, will be the Contractor's responsibility and to his account.
- 2.8.20 The removal and transport of the equipment and materials from the job location of the scraps, residues, empty drums etc. relating to the works of his contract job, is the Contractor's responsibility and to his own account, even if supplied by CEM. In this case it must be returned to the warehouse of origin, accompanied by a material return note/scrap/recovery issued by the Inspection.
- 2.8.21 If the Contractor does not carry out the removal within the specified period set by the Inspection, they will do it themselves and all the costs will be the responsibility of the Contractor.
- 2.8.22 When laying cables in Substations, Switching Stations, Customer Substations (PTs) and manholes, it will be the Contractor's responsibility to seal all cable ducts with the materials supplied by CEM without any charges to CEM.

## **2.9 Inspections and Control**

- 2.9.1 The management and supervision of the works or supplies will be carried out by CEM or Consultant designated by CEM, through their representatives appointed for this purpose, named in short as "Inspection".
- 2.9.2 The Inspection will check locally the fulfillment of the contract and will co-ordinate the activities of the parties in the carrying out of the jobs.
- 2.9.3 The tasks of the Inspection are, namely:

- a) To check the implantation of the job;
- b) To check all the details referring to the job dimensions and the processes of execution, in accordance with the conditions at the work site, the materials to be used, and the details of the project;
- c) To approve the materials and respective methods of use;
- d) To control the carrying out of the works in accordance with the schedule;
- e) To inform the Contractor of any alterations introduced by CEM to the works, or in their planning and to follow through its fulfillment.
- f) To issue the “store material reservations” which allow the Contractor to pick up the equipment and material in CEM’s warehouses.
- g) To inform and advise about the work progress;
- h) To order the suspension of activities which develop with disrespect to the legal proceedings and safety conditions, to the codes of practice and to the contractual clauses.
- i) To determine and, if necessary, arrange the removal and transport of the residues.

When deemed necessary, CEM can summon the Contractor’s “Responsible Technician” or his representative to meetings.

- 2.9.4 The actions of the Contractor to the Inspection, such as complaints, proposals, clarifications and others are only legally valid when presented in the form of a written document.
- 2.9.5 The actions of the Inspection do not diminish the responsibility of the Contractor relating to the good execution of the work, except for that expressly determined by the Inspection himself, and against the opinion of the Contractor. To be effective this decision can only be invoked when put in writing; the Contractor in such a case will be able to demand such action.
- 2.9.6 All the orders given to the representatives of the Contractor by the Inspection will have the same importance as the ones given to the Contractor himself.

## **2.10 Taking-over of Contract Jobs**

- 2.10.1 The Contractor must perform all the work requirements defined in the contract before taking-over.

- 2.10.2 Inspection for official purposes of taking-over will be carried out by the Inspection in the presence of the Contractor or his representatives.
- 2.10.3 If, due to any deficiencies found, the work is not in condition to be accepted, an official document will be written, pointing out the faults and the defects, and will establish a suitable period for its correction.
- 2.10.4 If at the end of this period the corrections have not been carried out or if they had not fully amended the deficiencies found, CEM can carry them out in a way they consider most convenient, deducting the charges from the amount still to be paid to the Contractor.
- 2.10.5 Once it has been checked by the Inspection that the work carried out is in accordance with the contract, a Service Entry Sheet will be drawn up and signed by the Inspection and the Contractor. This document will be considered as the official document of taking-over certificate, and the period of guarantee, which will be **2 years**, will be counted as from that date.
- 2.10.6 The Contractor is equally responsible for the damages and repairs, which, possibly, result from faulty execution of the work or due to defective quality of materials used.
- 2.10.7 The final taking-over certificate is considered as automatically occurring at the end of the period of the guarantee referred to in 2.10.5, if until such date no claim has been made by CEM or by official entities.

### **3. PAYMENT TO THE CONTRACTOR**

#### **3.1 Prices**

- 3.1.1 Prices in this Contract consist of “List of Unit Prices” which will form an integral part of this contract.
- 3.1.2 In the situations referred in 2.10.1, the price of the alterations (more or less) will be calculated based on the contractual unit prices.  
The eventual increase or decrease of corresponding charges must be immediately evaluated in full by the Contractor, based on the contractual List of Unit Prices and will be communicated in writing to CEM for approval, together with a detailed description of the reported alterations.
- 3.1.3 Always, when CEM requests in writing, the execution of work in the period of time between 8:00 pm and 8:00 am, the payment will be considered as overtime in accordance with paragraph 2.3.1.

- 3.1.4 If, for the good execution of any project, the Inspection considers it necessary to carry out works whose prices have not been foreseen in the contract, the Contractor will study new prices at the same level of similar works considered in the “List of Unit Prices” of the proposal, and will present them to CEM within three (3) days of the time the work had been requested.
- 3.1.5 The doubts or disagreements regarding the application of prices cannot, in any case, justify the delay of carrying out of the work, services or supplies.
- 3.1.6 Possible revisions to the List of Unit Prices can only be introduced by written agreement between CEM and the Contractor. Revisions at intervals of time of less than one year are unacceptable. The contractor must submit his proposal within ninety (90) days of the end of the contract.

### **3.2 Penalties**

CEM will give a written notice when applying penalty.

- 3.2.1 For non-compliance of any contractual clause, CEM will notify the Contractor with a warning in written.
- 3.2.2 For the accumulation of three warnings, a penalty of MOP20,000.00 will be applied on the month where the third warning occurred. If there is no payment made on that month, the penalty of MOP20,000.00 will be deducted from the following month.
- 3.2.3 Any non-compliance with standards and procedures that can be a non-fulfillment of Safety or Environmental legislation, CEM internal rules, manpower or equipment will be penalized with a warning in written.
- 3.2.4 If from the non-compliance with standards and procedures that can be a non-fulfillment of Safety or Environmental legislation result an environmental accident/incident which has impact on third party and/or on the surrounding public areas and/or CEM image, CEM has the right to immediately interrupt the works and to terminate the contract. CEM has also the right to be reimbursed of the total amount required to re-establish the situation, repair the damage and put the equipment in service and a penalty of **10%** of the total value of the contract jobs that have been assigned to the Contractor until the incident happened will be applied. If the damage on CEM exceeded the penalized amount, CEM reserves the right of reimbursement.
- 3.2.5 If the Contractor exceeds the established period when executing any jobs according to this contract, the Contractor is liable, until the end of the work, to the following fines, per week of delay:  
  
**2%** (two per cent) of the total value of that particular contract job in the first week of delay;



In each of the subsequent weeks of delay the fine will be **1%** (one per cent) per week until the penalty amount reaches the maximum of **5%** (five per cent) of the total value of that particular contract job.

Any penalty applied to the Contractor by CEM will be communicated to the Contractor in written, with acknowledgment of receipt.

- 3.2.6 If the Contractor damages CEM facilities, regardless of whether the works are for CEM or for other entities, the following penalties, together with the maintenance fee in addition to that, shall be applied. However, the above does not prevent the Contractor from being liable for additional loss or damage:

a)	High Voltage Network or Facilities	MOP 500,000.00
b)	Medium Voltage Network or Facilities	MOP 300,000.00
c)	Communication Network or Facilities	MOP 200,000.00
d)	Low Voltage Network or Facilities	MOP 50,000.00
e)	Public Lighting Network or Facilities	MOP 10,000.00

Besides the abovementioned compensation amount, the Contractor shall be responsible for the replacement/repair of such loss/damage.

- 3.2.7 If the contractor fails to fully perform or only partially performed any of the following items, a penalty of MOP20,000.00 will be applied for each item that fails to be fully performed or only partially performed; the maximum penalties of one month is MOP100,000.00.

- a) Night patrol for the whole Macau every 2 days. Patrol record and corresponding illuminance measurement report shall be submitted within 2 days; or upon receiving CEM request, Contractor shall perform illuminance measurement for specific roads and submit corresponding report within 2 days.
- b) Zone assessment for the whole Macau every year and submit monthly report with the proposed follow up action.
- c) Quality checking for all the CDIP every year, each month must submit the corresponding number of test report and recommendation of follow-up actions.
- d) Test all the lighting poles, lanterns, lighting arms and wall mounts every year, each month must submit corresponding number of test report and recommendation of follow-up actions.

- e) Test and repair all the high mast at least once within 3 years, each month must submit the corresponding number of test report and recommendation of follow-up actions.
- f) Test all the lighting cable at least once within 3 years, each month must submit corresponding number of test report and recommendation of follow-up actions.
- g) The team of the Contractor must arrive on site within 1 hour and start fault handling, and report through CEM specified Apps for records.
- h) Unless otherwise required on government license, Contractor must ensure to solve the problem of PL outage within 1 day.
- i) Contractor must resume basic lighting within 6 hours if lighting outage occurred.
- j) Temporary cable shall be installed within 1 working day.
- k) Cable fault shall be identified with reason, location and submit fault report within 2 working days. The report shall include site photos, drawing, load measurement result, cable test result and repair measures.
- l) CDIP outgoing tripping or cable fault shall be identified with reason, location and submit fault report within 2 working days. The report shall include site photos, drawing, load measurement result, cable test result, identification with reason, and solution.

3.2.8 The following penalties shall be applied each time during the construction period or after the completion of the work if any of the following is violated:

a)	Occupy the road or parking spaces after traffic license expires	MOP 30,000.00
b)	Occupy the road or parking spaces without traffic license	MOP 30,000.00
c)	Construction area exists the permitted area stated in the traffic license	MOP 20,000.00
d)	Insufficient or inappropriate temporary traffic signs or measures	MOP 15,000.00
e)	Traffic signs or hot sols were not restored within the deadline of the traffic license after completion of construction work	MOP 20,000.00
f)	Traffic signs or hot sols were wrongly restored after completion of construction work	MOP 15,000.00
g)	The excavation area exists the permitted area stated in the IAM license	MOP 20,000.00
h)	Extra penalty for any repeated violation of above items within 30 days.	MOP 20,000.00

3.2.9 When there is failure on public lighting facility, the following penalties shall be applied each time if any of the following is violated:

a)	Repeated fault over 2 times to same lantern within 1 week.	MOP 500.00
b)	Repeated fault over 2 times to same outgoing within 1 week.	MOP 1,000.00
c)	Repeated fault over 2 times to same CDIP within 1 week.	MOP 5,000.00

3.2.10 The following penalties shall be applied for each submission of reports for any of following occasions:

a)	Submission of report with incorrect design * over 2 times within 1 month.	MOP 5,000.00
b)	Revision to the design or documents required for license application for the same case over 2 times, but still cannot meet CEM or government entities' standards.	MOP 5,000.00

\*CEM will provide sample in the beginning of the contract period and will inform the Contractor through email when there are any updates. CEM will point out the error in the information or report submitted by the Contractor and request the Contractor for revision.

3.2.11 Safety Non-Compliance

Breach of safety obligations

The Contractor in control of the site is responsible for presiding and maintaining safe working and environmental conditions for staffs and visitors.

In the event of breaching Safety, Health and Environmental obligations, the Contractor shall pay to CEM the fines/penalties according to the latest version of “SHE Non-Compliance in Contracts Managed by CEM” – Appendix III, and without prejudice to the right of CEM to claim the Contractor for indemnification due to such non-compliance.

3.2.12 When situations occur where the Contractor considers he has the right to disagree, he must request to Inspection a record of the facts and their consequences, which are necessary for future valuation.

3.2.13 Any disagreement must be presented in writing, within three days from the allegation being made by CEM in respect of the above and must comply with the requirements of the above clause.

3.2.14 If contractor fails to submit proper documents within the indicated time according to General Technical Condition, a penalty of **MOP10,000.00** will be applied to every 4 working days of delay per item; penalty will be doubled after 8 working days of delay, i.e. from the 9<sup>th</sup> working day of delay onwards, a penalty of **MOP 20,000.00** will be applied to every 4 working days of delay per item and so on. The total amount of penalty shall be the sum of each fixed penalty per item, and the

maximum amount of penalty shall be **MOP100,000.00**. In conclusion, penalties will be calculated as reference table below:

Delay time*	Fixed Penalty	Total Penalty of each item
0 – 4 working days	MOP 10,000.00	MOP 10,000.00
5 – 8 working days	MOP 10,000.00	MOP 20,000.00
9 – 12 working days	MOP 20,000.00	MOP 40,000.00
13 – 16 working days	MOP 20,000.00	MOP 60,000.00
17 – 20 working days	MOP 20,000.00	MOP 80,000.00
21 – 24 working days	MOP 20,000.00	MOP 100,000.00
> 24 working days	For the case of serious delay over 24 days, in addition to the penalty stated above, CEM reserves the right to terminate or suspend the contract and request the Contractor to make improvements.	

\* If it is less than a day, it will still be counted as one whole day.

### 3.2.15 Requirements of disasters or major situation:

	CDIPs for main road	Patrolling and repair
Within 24 hours	Temporarily resume operation	Resume the basic lighting of the main road and the bridge
Within 48 hours	Resume 95% of the lighting	
Within 72 hours		Resume the basic lighting of whole Macau

If fails to resume the specified items within the indicated time according to the above table, a penalty of **MOP20,000.00** will be applied to every 4 hours of delay per item; penalty will be doubled when every 12 hours of delay, i.e. from the 12<sup>th</sup> hour of delay onwards, a penalty of **MOP40,000.00** will be applied to every 4 hours of delay per item; from the 24<sup>th</sup> hour of delay onwards, a penalty of **MOP80,000.00** will be applied to every 4 hours of delay per item and so on. The total amount of penalty shall be the sum of each fixed penalty per item, and the maximum amount of penalty shall be **MOP1,220,000.00**. CEM reserve the right to terminate the contract if the Contractor fails to provide enough manpower, equipment according to the requirements in General Technical Condition Section 5.2.5, or there is a serious delay in the resuming progress.

Calculation of Penalties per item:

Delay time*	Fixed Penalty	Acuminated Penalty
0 – 4 hours	MOP 20,000.00	MOP 20,000.00
4 – 8 hours	MOP 20,000.00	MOP 40,000.00
8 – 12 hours	MOP 20,000.00	MOP 60,000.00
12 – 16 hours	MOP 40,000.00	MOP 100,000.00
16 – 20 hours	MOP 40,000.00	MOP 140,000.00
20 – 24 hours	MOP 40,000.00	MOP 180,000.00
24 – 28 hours	MOP 80,000.00	MOP 260,000.00
28 – 32 hours	MOP 80,000.00	MOP 340,000.00
32 – 36 hours	MOP 80,000.00	MOP 420,000.00
36 – 40 hours	MOP 160,000.00	MOP 580,000.00
40 – 44 hours	MOP 160,000.00	MOP 740,000.00
44 – 48 hours	MOP 160,000.00	MOP 900,000.00
48 – 52 hours	MOP 320,000.00	MOP 1,220,000.00
> 52 hours	For the case of serious delay over 52 hours, in addition to the penalty stated above, CEM reserves the right to terminate or suspend the contract and request the Contractor to make improvements.	

\* If it is less than an hour, it will still be counted as one whole hour.

### 3.3 Payment of invoices to the Contractor

3.3.1 Invoice shall be submitted on monthly basis with monthly reports

3.3.2 After the conclusion and taking-over of the works, the Contractor must invoice job per job, in accordance with the “**Services Entry Sheet**” of the respective job, and in accordance with the prices shown in the List of Unit Prices.

3.3.3 Invoices for the amount of all completed works, **together with the related reports**, shall be submitted to CEM **on/before 25<sup>th</sup> of each month** for examination and approval; if accepted, CEM will pay until the end of the following month.

### **3.4 Suspension**

- 3.4.1 Depending on the gravity of the damages, the Contractor will be incurred in a suspension from working to CEM for a period between 3 to 6 months.

### **3.5 Cancellations and Contractual Resolution of Contract**

- 3.5.1 CEM reserves the right to either totally or partially cancel the contract in the following cases:

- a) The Contractor, without the consent of CEM, assigns either totally or partially the contractual position of the works to any third party;
- b) The Contractor does not submit the program of the approved works to CEM within the due period;
- c) There is absence or serious omission in the execution of the contract, namely delays attributed to the Contractors without the consent of CEM, even if they refer to intermediate dates in the program of the approved works;
- d) The Contractor suspends either total or part of the approved works for more than 10 successive days or 15 intermittent days;
- e) Refusal by the Contractor to carry out repairs or modifications necessary to the good functioning of the installations, in accordance with the state of art, and/or the contractual specifications and resolutions;
- f) The Contractor, without justification and repeatedly, does not follow the guidance and/or instructions of the Inspection, within the scope of their position;
- g) The Contractor repeatedly does not comply with the SHEQ requirements;
- h) The Contractor repeatedly does not reply or attend the call for works that are attributed to the Contractors;
- i) Damages on CEM network;
- j) The Contractor does not comply with the requirements in Emergency Service;
- k) The Contractor does not comply with the requirements in disaster or major situation.

- 3.5.2 The cancellation of the contract, either totally or partially, will be communicated to the Contractor in writing. Upon cancellation of the contract, CEM will suspend the payments until the amount is mutually agreed by both parties.

- 3.5.3 In the event of cancellation of contract, CEM can decide, without any opposition from the Contractor, to use any of the work site installations, machines, tools or other forms of operation that the Contractor has in service committed to the contract job, in exchange for a payment of an

annual rent equal to **10%** (ten percent) of the total amount of the related equipment that was actually purchased.

3.5.4 At any time, and by agreement of both CEM and the Contractor, they can dissolve the contract and determine the respective effects.

3.5.5 Any dispute for the validity, explanation and execution of the contract shall be governed by the jurisdiction of the Courts of Macao SAR.

#### **4. ESTABLISHMENT AND RELATED CHARGE OF CONTRACT**

According to item 1b) of article 12 of Decree-Law No. 122/84/M dated 15 December amended and republished by -Law No. 5/2021, written contract must be established for the award of this public tender.

Stamp duty and all handling fees due to the signing of the written contract shall be borne by the Contractor.

The constitution of the written contract is as follows:

- (a) The written contract;
- (b) Programme of Tender and the Specifications;
- (c) The proposal submitted by the Contractor, and clarifications if any.

In case of contradictions in the documents listed above, the preceding document shall prevail over the documents that follow, in the sequence set forth here above.

##### **4.1 Confidentiality**

Each party shall keep confidential and not disclose or otherwise make available to any third party any confidential information, advice or material of any nature that is provided or made available by the other party, including but not limited to, any written reports or other data, without the prior written consent of the other party. This Section shall not apply to any information that:

- is in or comes into the public domain, other than as a result of breach by the recipient of its obligations under this Contract,
- the recipient acquires from a third party who owes no obligations of confidentiality to the other party to this Contract in respect thereof, or
- was already known to the recipient at the time it received such information from the other party to this Contract as shown by the recipient's prior written records.

If either party is requested or required by any legal or investigative process to disclose any information that it is not permitted to disclose, that party shall provide the other with prompt notice of each such request and the information requested so that the other party may seek to prevent

disclosure or the entry of a protective order. If disclosure is required and a protective order is not obtained, the party from whom disclosure is required shall disclose only such information that it is advised by its counsel to be legally required to be disclosed.

#### **4.2 Offers, Payments, Agreement and Promises**

The Contractor hereby represents and warrants that neither the Contractor nor any of its officers, directors, employees, representatives and/or any agent acting on behalf of the Contractor has made or will make, directly or indirectly, any offer, payment, agreement or promise to pay money or anything of value, or has authorized or will authorize the offer, gift, agreement or promise to pay money or anything of value, in either case to any person or entity unlawfully to influence or induce any act, omission or decision of the CEM including, without limitation, in connection with this Contract, the negotiation, preparation, execution or performance of this Contract or the procurement process leading to the award of this Contract.

#### **5. Resolution of cases**

Aside from the requirements set in the contract and in the integral part of the contract, the Contractor shall follow applicable laws in force in Macao SAR, especially Decree-Law No. 122/84/M dated 15 December amended and republished by Law No. 5/2021, Decree-Law No. 63/85/M dated 6 July, and Decree-Law No. 74/99/M dated 8 November.



## **Appendix I**

**Latest version of**  
**“Health and Safety Manual For CEM Contractors”**  
*(see file named “Appendix I”)*

## **Appendix II**

**Latest version of  
“CEM Safety, Health, Environment and Quality Requirements & Responsibilities for Services  
Suppliers”**

*(see file named “Appendix II”)*

**Appendix III**

**Latest version of**

**“SHE Non-Compliance in Contracts Managed by CEM”**

*(see file named “Appendix III”)*

## **B. GENERAL TECHNICAL CONDITIONS (GTC)**

### **1 Objective**

These General Technical Conditions apply to “**Construction, Maintenance, Operation and Emergency Services of Public Lighting Network**”, with required conditions under contract signed between Companhia de Electricidade de Macau - CEM, S.A. and service supplier.

Companhia de Electricidade de Macau - CEM, S.A. is named henceforth as CEM, and service supplier is named henceforth as Contractor.

This specification defines the Technical Conditions for the supply of services of Maintenance Contract for Companhia de Electricidade de Macau - CEM, S.A. henceforth referred to as CEM, Public Lighting Network that extend over the whole of the territory under the jurisdiction of Macao SAR.

This contract will be granted for a period of **three years** and may be renewable.

### **2 Employer Description**

Companhia de Electricidade de Macau – CEM, SA (hereinafter referred to as “CEM”) is an investor owned utility responsible for generating and selling electricity to more than 250,000 customers in all regions under the jurisdiction of Macao Special Administrative Region (MSAR) of China.

#### **2.1 General Description of Public Lighting Network**

The Public Lighting Network (PLN) includes about 460 distribution control boxes (CDIPs) with about 23,000 public lightings over the whole territory under the jurisdiction of Macao SAR.

Basically, these public lightings are included lighting pole, wall-mounting, high mast, spotlights, flooding lighting, classic pole and fluorescent lamp.

### **3 Contractor general responsibilities**

#### **3.1 General responsibilities**

- 1) To propose, for CEM approval, a list of the required spares with minimum stock and provisional annual consumption if supply of spare parts under CEM responsibility.
- 2) To inform CEM of the necessary spare parts required to perform the works in due time for not to delay the works if supply of spare parts under CEM responsibility.
- 3) After CEM approval of the stock issue, to retrieve the materials from CEM Stores (located either at CEM Taipa Stores). If supply of spare parts under CEM responsibility.
- 4) Provide a location for temporary storage for 50 lighting poles, 100 lantern with lamps and other necessary parts.

- 5) To implement the defined construction and maintenance plan on CEM Management System
- 6) To perform all the actions defined on the construction and maintenance plan
- 7) To perform all the corrective or deferred maintenance
- 8) To assemble all kind of cable terminations and joints.
- 9) To perform the relevant operational tests before and after construction and maintenance actions
- 10) To keep the records of the amount of all waste produced by its activities and transport and dispose in appropriate place where to be defined by CEM.
- 11) To supply the general usage consumable materials (cleaning products, drills, sandpaper, cleaning clothes, greases, welding rods, paintings and so on) required to perform the construction and maintenance works
- 12) To supply all the required appropriate equipment and tools for the construction and maintenance service (including photographic equipment, thermal imaging camera, etc.)
- 13) To supply the necessary forklifts, trucks and other vehicles necessary to support its activities
- 14) To operate the overhead car cranes and winches whenever necessary for the construction and maintenance activities
- 15) To clean the working areas used to perform construction and maintenance services
- 16) To perform a report for every construction and maintenance activity (including CDIP, lamp posts, wall mounted arm brackets, PL cable, etc.), in English and Chinese, that must include:
  - Report on the condition of the equipment before and after the construction and maintenance action (including images);
  - Detailed report of the work performed including detail of measurements performed, parts replaced, and so on
  - Human resources (number, specialty and hours) allocated to perform the work
  - When applicable the existing forms filled with all the relevant information.
- 17) Nominated the dedicated Engineer(s) and Technician(s) for the daily planned and scheduling of the PLN Construction and Maintenance works based on CEM requirement
- 18) All data, including but not limited to engineering information, commissioning reports, inspection reports, etc., must be uploaded or sent through the designated platform requested by CEM

## 3.2 Service support for maintenance and emergency

### 3.2.1 Excavation, Refill and Cable Installation service

Contractor shall provide fault and potential fault excavation construction service according below:

- a. Contractor shall provide fast and low noise main excavation equipment (low noise pneumatic breaker or with sound proof installation), based on the proposed and approved main equipment list for emergency excavation service.
- b. Contractor shall follow the CEM standard and Macau government requirements to perform the refilling service.
- c. Manpower requirement refer to **GTC Section 8.1**.
- d. Construction management requirement refer to **GTC Section 6**
- e. Construction Technical Specification refer to **GTC Section 11**

### 3.2.2 Temporary Cable Installation & Removal Service

Contractor shall provide the temporary aerial cable transportation, installation and connection service and removal service in the safe way.

Requirement:

- a. Contractor shall transport the designated number and size of temporary aerial cable / underground cable from the storage area to fault location within 1 hour after CEM start to inform the contractor.
- b. Contractor shall take care the complaint about unsafe temporary cable installation (origin of the complaint is from contractor) – no additional charge will be provided
- c. Contractor shall remove the temporary cable within one day after CEM inform
- d. Any accident occurs in work area due to absence or inadequate protection, it will be the contractor's responsibility.
- e. Contractor shall provide standby or safe guard service with designated number of persons on request by CEM for those temporary cables when needed.
- f. Manpower requirement, refer to GTC 8.1.

### 3.2.3 Temporary cable management service

Contractor shall provide the housekeeping and safekeeping temporary aerial cable service. Minimum stock level of temporary cable and accessories shall be maintained. Contractor shall report any defect on the temporary aerial cable after used, and is responsible to repair the defect, in order to provide condition for next using (including all the temporary cable stored in CEM premises or contractor warehouse). After checking, contractor shall provide the report (monthly report for inventory and quarterly report for test record) to CEM representative.

Requirement:

- a. Contractor shall check and recover the quality of the cable within one day after removal from the site. They required to perform the below:
  - i. Phase identification
  - ii. Insulation testing
  - iii. Cable lug replacement, if necessary
  - iv. Reporting temporary cable condition, if any defect is found and need replacement, if necessary
  - v. CEM has the standard form for contractor to fill in the testing result and contractor shall submit the report after each checking

Remark: In case replacement of old temporary cable is needed, CEM will request contractor to provide transportation of new cable to the storage area. Contractor obliges to cooperate and provide the transportation service with no extra charge. Contractor shall also check the quality of cable when replacement is needed and perform recovery for the cables according to above items (i) - (iv).

- b. Contractor shall provide their location for storage temporary cable for CEM consideration. After confirmed by CEM, below no. of cable will be stored
  - 6 sets of LXS 4 x 10mm<sup>2</sup>                      Length = 50m per set
  - 3 sets of LXS 4 x 25mm<sup>2</sup>                      Length = 100m per set

#### **3.2.4 Communication Service of CDIP**

Contractors are required to provide the local lease line service and supply & install the mobile network cards used for local lease line service at each CDIP in order to real time monitor the status of CDIPs. The mobile network cards should be provided by the same service provider.

If there is any network incident happened, Contractor is required to submit an incident report within 2 working days after the incident occurs.

If Contractor needs to replace the existing installed mobile network cards, it is required to submit a detailed replacement plan and obtain approval from CEM before proceeding.

#### **3.2.5 Transportation Service**

Contractor shall provide transportation service of the equipment or material (including Cable, lighting pole and so on) between material storage location and fault location.

Requirement:

- a. Pick up equipment and material from CEM equipment and material storage location and transport to fault location will be carried out by contractor.
- b. All loading and unloading operations of the equipment and materials which were transported by contractor at the designated position at the site will be the contractor's responsibility and to his account.
- c. The removal and transport of the equipment and materials from the work location of the scraps, residues, empty drums, etc. relating to emergency work to the designated storage location is the contractor responsibility and to his own account

### **4 CEM responsibilities**

#### **4.1 CEM will be responsible of the following**

- Provide all construction drawings, and verified as-build drawings.
- Provide existing network maps and cable identifications as requested.
- Provide the necessary Isolation as requests.
- Apply and get the necessary permits from the official entities to carry out the works.
- Arrange site meeting with official entities representatives before work starts.

#### **4.2 CEM will provide the following materials**

- All kind of Public lighting cable.
- Terminations, joint boxes, terminals, unions, connectors.
- Signaling, identification and protection plates for the cables.
- Distribution, column and protection boxes.
- Earth circuits which include conductors, electrodes & connectors.
- Concrete, metallic lighting poles.
- Brackets, lanterns and light bulbs.
- Hooks, clamps, saddles, turnbuckles, screws, nuts and anchor bolts.
- Tension and suspension clamps and corner guides.
- Reactance, capacitors, igniters and starters.
- Circuit breakers, fuses, fuses-bases, cut out boxes, cable ties and heat- retractable accessories.

## 5 Maintenance & Emergency Service

### 5.1 Maintenance

#### 5.1.1 Objectives & Requirement

- Contractor must ensure to solve the problem for the PL outage within 1 day, except those stated in the government license.
- Same facility fault shall not be repeated over 2 times within 1 week.
- 95% of light bulbs must be working properly at all time.
- Temporary cable shall be installed in one working day
- Cable fault shall be identified with reason, location within 2 working days and prepare the reparation plan with temporary and permanent action
- Perform the inspection of the 3<sup>rd</sup> party excavation of public lighting network
- Perform the inspection to aerial cable of public lighting
- Perform night patrol to public lighting system every 2 days, covering whole Macau
- Except for the high mast pole and PL cables, all the detailed testing for PL systems shall be carried out every year, subject to detailed testing schedule.
- All the detailed testing of high mast pole and PL cables shall be carried out every 3 years, the contractor shall finish the detailed testing within 3 years.
- Check the effectiveness of PLN and propose relevant improvements
- Zone assessment shall take one year as a cycle covering whole Macau and shall submit a plan to CEM within one month after award of contract.

#### 5.1.2 Scope of work

Scope	Time & Requirement	Details Reference	Penalties Reference
<b>Daily Patrol &amp; site Inspection</b>	Covering all PL facilities in Macau and complete within 2 days	GTC Clause 5.1.3	GCC clause 3.2.7
<b>Corrective maintenance</b>	All facilities resume in service within 1 day.	GTC Clause 5.1.4	GCC clause 3.2.7
	Fault shall not be repeated over 1 time within 1 week		GCC clause 3.2.9
<b>Preventive maintenance</b>	Monthly Zone assessment & Routine Checking with reports submission	GTC Clause 5.1.5	GCC clause 3.2.7
<b>Illuminance measurement</b>	Upon receipt of CEM's request or within 3 days when found suspect dark area during daily patrol	GTC Clause 5.1.6	GCC clause 3.2.7

#### 5.1.3 Public Lighting Network Patrol

Public Lighting Network patrol shall include but not limited to the following:

- Patrols of all PLN for whole Macau every 2 days.
- Ensure the conditions of Public lighting facilities



- Handle the extinguishment of light and ensure the luminance of the lamp
- To ensure the safety and quality of public lighting, contractor shall inspect the following:
  - conditions of the lamppost operation and maintenance door,
  - fixing conditions and the degree of tilt of the lamp post, spotlights or wall mounted arm brackets
  - conditions of the parts inside or outside the CDIPs
- Ensure temporary power cables on public lighting are in good status, consolidate in daily report and aerial cable summary.
- Inspection to 3rd party excavation works related or near public lighting networks, to avoid any impact on public lighting
- Night patrolling. All public lighting facilities shall be confirmed in normal service with enough illuminance cover public streets. Report the suspected dark area, perform the illuminance measurement, and propose improvement measurement.

#### **5.1.4 Corrective Maintenance**

Based on PL outage found in patrol or preventive maintenance, or upon clients' request for repair or complaint, contractor shall proceed corrective maintenance according to the contract terms and conditions but not limited to the following:

- To resolve the PL outage by replacement or maintenance of light bulbs, lanterns, capacitors, igniters, ballasts, diffusers, MCB, connectors, the internal wires of the lamp posts and related accessories. The failure rate of public lighting must be controlled in a certain standard.
- To carry out PL cable fault locating and cable fault repair including temporarily aerial cable installation, excavation and joint connection. Shall assist CEM for necessary license application.
- Replacement of damaged public lighting pole or damaged CDIP.
- Replace the pole if the base of the pole is in corrosion or unstable.
- Fix or relocate wall mount lighting if bracket did not fixed well on the wall.
- Replacement of CDIP components including MCB, Contactor, timer and twilight switch.
- Follow-up of the emergency services of the public lighting networks
- Replace the existing CDIP
- Submit fault report for any lighting outage, include site photos, fault reason, location, corrective action (temporary and permanent) and as-built drawings.
- Submit follow up reparation plan with materials required, work method statement as well as temporary traffic plan
- Re-install the cover of pole and lantern if the cover is missed or unstable.
- Re-install lantern bracket if twisted or unstable
- Re-install the aerial cable if the sagging margin is over 1m.
- Re-install the aerial cable if the height of section crossing street is less than 6m.
- Update the existing aerial cable list and consolidate in weekly report with photos and progress of aerial cable removal, especially the progress of license application.

### 5.1.5 Preventive Maintenance

Preventive Maintenance Plan shall be submitted for CEM's approval within 1 month after contract award. Preventive Maintenance Plan shall consist of zone assessment, routine checking, immediate corrective actions, and necessary follow up action for all PLN equipment in Macau, so as to enhance individual zone PL condition, ensure all public lighting facilities are in good condition and will not create any risks to public. Corresponding measures include but not limited to the following:

- The zone assessment and routing inspection plan shall cover whole Macau with zone demarcation indicated in the diagrams.
- Each zone shall cover all the lanterns under at least 35 CDIPs.
- Perform routine checking and testing to all public lighting facilities in whole Macau except high mast and cable in annual base.
- Perform routine checking and testing to all the high mast and cable system conditions in 3 year time.
- Quality check shall be conducted to all the CDIP in annual base.
- Prepare and submit all necessary material for applying related license to conduct zone assessment and routing inspection
- On site check and confirm the condition and quantity of aerial cables in zone and update aerial cable database. All data shall be included in the monthly consolidation report with photos, drawings, and progress of corrective actions.
- On site check and find out all PL facilities in risk, worse performance or bad status, find out the dark area in the public streets of zone.
- Perform necessary illuminance measurement to ensure public street illuminance condition and support reports.
- Detection and location of weak points at public lighting poles material.
- Detection and location of weak points at public lightings poles surface treatment against corrosion.
- Detection and location of the lighting poles being tilt to avoid the risk of dumping.
- Detection and location of aerial cable being tilt or loosen to avoid the risk of dropping.
- Preform Identification, mark and repaint number to public lighting facilities
- Preform cleaning to public lighting facilities, include but not limited to lanterns and CDIPs
- Preform replacement to the bulb of its aging
- Repaint the base of lamp pole or whole lamp pole.
- Adjust the timer of the public lighting switch ON/OFF schedule monthly according to CDIP's Timer Adjustment Time Table in GTC Section 12.
- Check earthing resistance conditions, detect and locate weak points.
- For any issues found during zone assessment and routine checking, contractor shall perform corrective action to the facilities according to clause 5.1.4 Corrective Maintenance.
- All finding through zone assessment shall be consolidated in monthly report with follow up action plan and submit to CEM for review. The report shall include but not limited to optimization plan, and detail execution plan, pole replacement plan, aerial cables removal plan, and zone excavation plan with related drawings.

### 5.1.6 Illuminance measurement

- Contractor shall perform illuminance measurement to the street according to CEM request.
- Contractor shall perform necessary illuminance measurement during daily patrol to confirm enough illuminance for public street.
- Contractor shall consolidate the measurement result and submit the consolidated report.
- Dark area is defined here as places over 25m<sup>2</sup> continuous area which do not fulfill the requirement of Guidelines of Macau Public Lighting (Directrizes para os Projectos de Iluminacao Publica de Macau). Illuminance measurement shall be performed to suspected area with at least 4 points to every 25m<sup>2</sup> and submitted as report with photos and location within 3 working days after detection.
- In cases of detection of dark areas, temporary solution such as installation of additional lantern shall be propose and submitted within 3 working day with measurement report after detection while long-term solution such as or excavation plan for new pole installation shall be provide within 3 working days when necessary.
- Prepare and submit the material if any need to apply the related license in order to process zone assessment.

## 5.2 Emergency Service

### 5.2.1 Objectives & Requirement

- To better guarantee the efficiency and consistency of managing Public Lighting Network (PLN) emergency service shall be provided in a 24-hour, 7-day basis.
- To minimize the interruption time during emergency.

### 5.2.2 Scope of work

Scope	Time & Requirement	Details Reference	Penalties Reference
<b>Fault handling</b>	Response to emergency request within 3 minutes	GTC clause 5.2.4	Warning will be issued. (GCC clause 3.2.2)
	Crew arrive site within 1 hour		GCC clause 3.2.7
	Resume lighting within 6 hour		
	Resume normal operation of all lighting facilities within 1 day		
	Facility Testing within 48 hours after restoration		Repeated fault penalty (GCC clause 3.2.9)
<b>Disaster or Major Situation Handling</b>	Conduct drill before June every year	GTC clause 5.2.5	Warning will be issued. (GCC clause 3.2.2)
	Dispatch crew going out once typhoon No. 8 lower down. 1st round Action Plan shall be ready 1 hour before crew dispatched.		
	Dedicated teams handle cases from CEM once after disaster or major situation		GCC clause 3.2.15
	Resume all power to CDIPs within 24 hours		
	Resume 95% lighting of whole Macau within 48 hours		
	Resume basic lighting for all street 72 hours		

### 5.2.3 General Requirement

Emergency works are considered to be those incurred by Public Lighting network faults or high-potential Public Lighting network faults. The contractor shall provide the below emergency work services and according to the following requirements:

- Contractor shall provide 24-hour, 7-day emergency services to CEM (include typhoon and flooding)
- Removal / Relocation of wall mount lighting based on emergency services requests
- Removal / Replacement of damaged public lighting poles or damaged CDIPs based on emergency services requests
- Replacement of CDIP components including MCB, Contactor, timer and twilight switch based on emergency services requests
- Install and connect temporary power cables on public lighting based on emergency services requests
- Install the temporary lighting based on emergency services requests
- Repeated fault over 2 times to same equipment within 1 week is not allowed.

### 5.2.4 Emergency & Fault Handling:

- It is part of the responsibility of the Contractor to fulfill laws of Macau whenever implementing the requirement of this contract.
- This emergency service contract covers unplanned work (emergency request without prior notice), not include planned work.
- Organization of Contractor.
  - Contractor shall provide two dedicated contact person with telephone number (and person) for different type of service (free to propose and with agreement by CEM).
  - Contractor shall follow their proposed emergency handling organization and manpower to fulfill the scope of the work and requirement. Any changes to organization chart will have to be approved by CEM in advance.
  - All emergency works, which have to be carried out by the Contractor, must be managed by recognized competence technician, who also acts as the supervisor for work supervision on-site and the site single contact point who direct communicates with CEM work responsible. The technician shall ensure all works to be carried out in a proper way, including safety issue of persons from Contractor, environments, public safety & CEM equipment protection.
  - CEM's Inspection have the right to order on replacement of workers whom considered do not have sufficient professional education or that their staying at the work site is thought to be inconvenient for good discipline and/or steady carrying out of the work by others.
- Contractor shall provide sufficient tools, equipment and elevating platform to handle the fault. Machines & Equipment requirement refer to **GCC 2.8** and **GTC 8.2**
- Contractor shall immediately attend to emergency requests within **3 minutes** upon CEM's request and notification. Contractor competent workers shall arrive at the fault location within **1 hour**. Request and notification from CEM include,
  - Phone call or message from CEM
  - The SMS from system PLOM (Public Lighting Online Monitoring).
- CEM could cancel a request within 15 minutes and Contractor cannot claim for any work executed. If there is more than 12 times of request cancellation in every half year, Contractor can charge for

a fix cost for each request starting from the 13<sup>th</sup> cancellation. The fix cost is contractor's labour cost of 5 man-hours.

- The fault/abnormal SMS from system PLOM will indicate the location, CDIP number and its faulty outgoing. Contractor shall check on site, resume the facilities in service. Afterward, contractor will receive SMS claimed that fault elimination. If not, contractor shall update with reason and remarks to the pending list in daily report for contractor to further follow up in maintenance.
- Contractor is responsible to deliver all necessary equipment or material (including Cable, lighting pole and related accessories) from material storage location to fault location within **1 hour** after CEM request or notification.
- Contractor shall provide different type of emergency service (e.g. excavation, aerial cable installation, installation assistance service) and shall start the work in **1 hour** once CEM inform the contractor. Contractor shall report to CEM once the designated number of competent workers arrive and recorded the actual start time. Once the facilities were repaired and confirmed resumed to normal service, actual finish time shall also be recorded. Contractor shall prepare written report and submit to CEM.
- Dismantle or fixed the damage public lighting network installation e.g. lamp-pole, lantern and its accessories in case of emergency
- Temporary aerial cable installation, connection, removal and disconnection, in case of emergency
- Locate and isolate the faulty section of aerial/underground cable of public lighting. Update the drawing with new aerial cable and excavation plan in order to resume the temporary cable to underground, prepare and submit the material for related licenses application.
- Transport, Lifting or Removal of Concrete or Metallic Poles
  - Lifting instruction from manufacture must be followed to make sure concrete or metallic pole is lifted up with no dynamic overburden.
  - Vehicle for transporting concrete or metallic poles must be equipped to hold the pole not bending form turning or on uneven road.
  - Contractor shall provide temporary storage for the removed poles and transport altogether back to CEM warehouse with no addition charge for the service.
  - It is forbidden to drag pole along the ground.
  - Crane or suitable mechanical device must be used to unload or remove poles. Poles must be mounted on a portico by winch when removed or unloading. Removal or unloading by simply sliding the poles on ramps is not permitted.
  - The hoisting devices will be provided with soft lining which will efficiently protect the concrete or metallic from risk of breaking or damage the galvanization.
  - Contractor shall provide at least 2 competent contractor workers (not included the driver) in the whole process.
- The Contractor will be responsible to maintain the site and place all the materials in clear, tidy and safe conditions, of all its installations.
- Contractor shall keep the connection and routing of public lighting network as possible during emergency handling. In case any change, contractor shall record and update in daily report. Submit the update drawing and zone excavation plan indicated the changes, prepare and submit the material for related license application.
- For the emergency case related to any safety risk to public, contractor shall perform site investigation; provide information to CEM with photos, risk evaluation and proposed solution. For

the cases to clear the risk through temporary removal, shall submit the re-installation plan within 1 week with material for license application if need.

- For the emergency case related to lighting outage in large area, include those caused by outgoings trip, contractor shall resume the lighting in 6 hours, keep progress update to CEM, and measure the loading of related outgoing after restoration.
- After restoration to lighting outage in large area, in next daytime within 48 hours, contractor shall perform necessary testing to the facility include cables, so as to ensure the facility in good status, fix the problem if any, consolidate the report and submit to CEM.
- For the emergency case related to repeat lighting outage at the same large area within 7 days, include MCB tripping of same outgoing, contractor shall inform CEM immediately, resume temporary lighting in 6 hours. In coming 48 hours, without any interruption to lighting service at night, contractor shall perform necessary testing, identify the root cause with indication of damage or weak point of cable connection, take necessary action to fix and avoid further outage, consolidate as fault report and submit to CEM.
- Contractor shall provide necessary information through the application specified by CEM, include but not limited to progress, site photos, loading measurement after restoration to outgoing trip.
- The Contractor shall perform site investigation to identify the root cause once fault happen, and provide solutions. Take temporary action to prevent repeat outage from same facilities.
- Contractors are responsible for understanding and complying with CEM Safety, Health and Environmental (SHEQ) Policy and with all regulations in force in Macau (at CEM premises, construction sites and public roads) **refer to GTC 7**

### 5.2.5 Disaster or Major Situation

The disasters or major situation mechanism will be activated according to the activation of such mechanism by the Civil Protection Operation Center (COPC) of Macau SAR, once there is any modification in the regulation of the COPC, corresponding changes will be made to such mechanism. In addition to the normal emergency services, contractors are required to provide the following services in case of disasters or major situation:

- a. Once outdoor condition is safe and ready to perform patrol and restoration (e.g. typhoon signal No.8 lower down), contractor shall dispatch their crew for emergency service immediately.
- b. In one hour before crew dispatch, contractor shall consolidate first round repair-list through automatic email from PLOM system.
- c. Arrange staff to coordinate 24 hours a day at the CEM center to resume the PLN, and this staff shall be able to communicate in Cantonese or English. Provide hourly statistic update of PLN repair progress as CEM request.
- d. The contractor should provide 5 teams (minimum 10 persons) after the disaster to temporarily resume the power to the CDIPs for all main streets in 24 hours, and resume/temporarily resume 95% lighting within 48 hours.
- e. The contractor should provide 6 teams (minimum 24 persons) to carry out the patrolling and repairing. Resume the basic lighting of the main roads and bridges within 24 hours, at the same time, to handle the dangerous situation immediately. Resume the basic lighting for the whole Macau within 72 hours. Each team must be equipped with a lift truck and a suitable operator with a team leader who can communicate in Cantonese.

- f. The contractor should provide 4 teams (minimum 16 persons) to handling the request from CEM center. Each team must be equipped with a lift truck and a suitable operator with a team leader in Cantonese.
- g. After restoration, contractor shall prepare reports and follow up action plan for future follow up.
- h. Requirement of Manpower during Disasters or Major Situation

	CDIPs for main streets	Patrolling and repairing	Emergency Request
Macau (Non-Flooding area)	1 team	1 teams	1 team
Macau (Flooding area)	2 team	2 teams	1 team
Taipa	1 team	2 teams	1 team
Coloane	1 team	1 team	1 team

Each team should include 1 leader with Cantonese communication skill and 3 workers (not included the driver). Patrolling and repairing team and the team which handle the emergency request from CEM center should be equipped with a lift truck and suitable operator.

- i. Requirement on resuming of the lighting

	Within 24 hours	Within 48 hours	Within 72 hours
CDIPs for main streets	Temporarily resume operation	Resume 95% of the lighting	Resume the basic lighting of the whole Macau
Patrolling and repair	Resume the basic lighting of the main road and the bridge		

- j. Every year, Contractor shall submit the updated document of disaster drill with procedures to CEM for further approval before end of March. Finalize the plan of disaster drill according to CEM requirement before end of April. Conduct the drill before end of May.

### 5.3 Document Control

Penalties according to GCC clauses 3.2.10 and 3.2.14 will be applied if contractor fails to submit below documents on time.

Documents	Time	Detail Reference
<b>Preventive Maintenance plan</b>	Submit within 1 month after contract award and update every year	GTC Clause 5.3.1
<b>Daily Report</b>	Daily submission	GTC Clause 5.3.2
<b>Weekly Meeting Minutes</b>	Submit within 2 working days before meeting	GTC Clause 5.3.3
<b>Weekly summary report</b>	Submit within 2 working days after meeting	
<b>Monthly Consolidated report</b>	Before the 5 <sup>th</sup> working day of each month: - Maintenance summary report On the 1 <sup>st</sup> working day of each month: - Aerial cable report - LED installation report - Pole painting report	GTC Clause 5.3.4
<b>Half-yearly Report</b>	Submit every half year - before 15-Jun and 15-Dec of each year	GTC Clause 5.3.5
<b>Fault and incident report</b>	Submit within 2 working days from fault or incident	GTC Clause 5.3.6
<b>Repair Report after disaster</b>	Submit within 7 days after disaster happen	GTC Clause 5.3.7

<b>illuminance Measurement report</b>	Consolidate result and proposed on solution within 3 working days	GTC Clause 5.3.8
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CEM reserve the right to request the Contractor to add, delete and change any report, content, format or requirement whenever necessary. The language used in all communication and report shall be in English. Chinese is an alternative if CEM agrees.

#### **5.3.1. Report to be submitted after award**

Within 1 month after contract award, the contractor shall submit the yearly plan of maintenance include the diagrams indicated geographic zones, refer GTC section 4. Contractor shall update in the CAD drawings (provided by CEM) with public lighting network location.

After award, the contractor on his interest may submit a detailed report of the condition of PLN systems within 1month. This report is not compulsory.

If necessary, this report must include proposals of modifications to achieve a better performance of the PLN systems referring their costs/benefits and the required schedule to implement them.

This assessment will be utilized only for reference and cannot be the base for any claim from the Contractor for additional payments; the Contractor will assume the maintenance of all the equipment under the scope of supply on the as found condition.

#### **5.3.2. Daily report**

- Contractor must submit reports stating the damages and potential risks found in patrol of the previous day, or Saturday, Sunday and public holiday. All reports serving the said purpose should include photos. The contractor must submit the reports stating the 3rd parties excavation condition which may affect the PLN with photos. If serious damages are found during inspection, the contractor shall be obliged to report immediately.
- The daily report shall submit in the next working day.
- The daily report shall include
  - Patrol report with record of patrol routing, night patrol findings
  - Repair record of maintenance and emergency
  - Pending list, include pending reasons, site illuminance condition, temporary action, proposed solution, application number, related record in Public Lighting Online Monitoring System (PLOM) with update progress
  - Safety and Quality inspection records with daily photos of all excavation site with street name and timestamp through the application specified by CEM. The photos shall indicate all temporary traffic symbol.

#### **5.3.3. Weekly meeting and report**

- Contractor representative shall attend weekly meeting with CEM at CEM premises to review the implementation of the contract and follow-up actions identified during maintenance and emergency work, previous weekly meetings or post-fault review meeting.
- The weekly meeting minutes shall be consolidated and submit to CEM within 2 working days after the weekly meeting. The weekly meeting minute shall indicate
  - the progress and due date of pending maintenance
  - the progress and due date of pending excavation



- the progress and due date of pending design and preparation for licenses
- The weekly meeting minutes shall be update as progress report 2 working days before the next meeting,
- The weekly summary report shall include
  - Summary of construction, maintenance and emergency with completion of works orders,
  - detail progress report to the pending case or cases in process,
  - the statistic update to public lighting asset,
  - finding report of dark area in public streets with proposed action
  - consolidated pending list with progress, diagrams, site photos

#### **5.3.4. Monthly Report**

5.3.4.1 The monthly construction and maintenance report must be submitted to CEM before the 5<sup>th</sup> working day of each month, for examination of payment, which shall include but not limited to the following:

- Completed Cases Report
  - Consolidated report of cases handled in emergency
  - All necessary all necessary as-built documents and commissioning reports
- Findings and follow up action report from Patrol, Zone Assessment, and Routine Inspection
  - Public lighting facilities status checking result, include but not limited to lantern, pole, CDIP, and aerial cable. Raise out the facilities in safety risk, bad condition or worse performance
  - Provide/Update drawing in pdf and CAD files indicate the aerial cables in zone
  - Photos for above items
  - Optimize/update excavation plan in drawing with execution and excavation proposal, include but not limited to aerial cable removal
  - Progress report to the optimized items in process
  - Dark area summary with proposed action
- Consolidated report for follow up actions,
  - List of pending cases can't fix in monthly maintenance. Contractor shall provide the follow up action, reasons of delay, drawings indicated location, and target schedule.
  - The pending cases shall include but not limited to the required task informed by CEM, pending corrective maintenance due to license and AVISO, temporary measurement due to material
  - The pending cases shall also include the approved action which proposed through zone assessment and preventative maintenance.
  - Update and optimize the excavation plan of zone if need for the proposed action.
- Excavation Plan
  - Within agreed duration with CEM, provide design, drawings, method statement, all necessary documents for license or Aviso applications.
- Provide and update the statistic data of public lighting asset
- Update the performance indicators as required,
  - The most relevant events in terms of maintenance performed
  - Accumulated/Updated data and figure of Availability, Reliability and Mean Time between Failure of PLN
  - The figures required by CEM Environmental, Safety and Health Targets and Procedures and Macao Environmental and Labour Legislation (SHE Indicators)

5.3.4.2 The reports below shall be consolidated and submitted to CEM individually on the 1<sup>st</sup> working day of each month,

- Monthly Pole painting report (when necessary)
- Monthly LED installation report (when necessary)
- Monthly aerial cable report, provide and update the summary of aerial cables, and progress of removal as CEM requirement.

#### **5.3.5. Intermediate Annual Report and Annual Report**

Contractor shall submit consolidated report every half year, which shall include but not limited to,

- The submission shall be before 15-Jun and 15-Dec of each year.
- Pending case list of equipment in potential risk, include wall mounted brackets, lampposts or high masts, attached with justifications, photos, temporary and permanent solution
- Update the zone assessment plan (if any)
- Proposals of modification of the maintenance plan (if any)
- Proposals of modification of the systems or equipment (if any)
- Annual data and figure of Availability, Reliability and Mean Time Between Failure

#### **5.3.6. Incident and fault report**

- Whenever any problem or incident observed on site, contractors shall report to CEM immediately and also provide consolidated report with site photos or damaged condition for record, proposed corrective action and drawings afterwards as required.
- Whenever any facility repeat faulty within 7 days, the contractor shall report to CEM immediately, and provide investigation report with site photos, previous record, root cause identification, proposed solution.

#### **5.3.7. Repair report of disaster**

Contractor shall consolidate the repair report with follow up action within 7 calendar days after disaster, which shall include but not limit to,

- Record the follow up works and develop the restoration plan with CEM and execute.
- Submit the report and improvement suggestion after the repair is completed.
- Submit consolidate maintenance report to completion cases and pending cases, include but not limited to,
  - Restoration date and time of each case
  - Photos as record
  - Statistic data and figure
  - Pending cases and follow up action plan (include temporary and permanent measures)

#### **5.3.8. Illuminance measurement report**

- Whenever any dark area observed on site, from contractor or CEM, contractors shall report to CEM. Perform illuminance measurement to the streets and consolidate report with measurement result in Lux unit, site photos, drawing indicated location and record, proposed action and drawings afterwards as required.

- The submission shall be within 3 working days.
- For the definition, detection and measurement requirement refer to GTC 5.1.6.

## 6 Construction Management

### 6.1 Objective

Contractor shall perform the plan, design and license preparation, execution for the construction work of public lighting network as below in required time.

The construction site work shall include but not limited to,

- Trench to install/re-locate/remove poles, CDIP and PLN facilities
- Trench to build, dismantle or repair the manholes and duct for PLN
- Trench to install piping and manhole for public lighting network
- Trench to relocate aerial cable of public lighting to underground
- Modification or identification for the PLN
- LV cables laying for public lighting
- Checking to the effectiveness of public lighting facilities and propose relevant improvements
- Connection, disconnection, replacement, re-location to public lighting facilities
- Installation, re-location, replacement, removal of public lighting facilities
- Site Inspection & Investigation
- Preconstruction Planning & Arrangement
- Construction Reports
- Signaling and protection in the job areas.
- Supply of all tools, machinery's, scaffolding, equipment and whatever else necessary to carry out the contract jobs.
- Installation of temporary passageways for pedestrian beside the trenches.
- Supply and installation of iron plates with 1 inch (25.4mm) thickness on road crossings.
- Pumping of water from flooded trenches/ditches.

### 6.2 Scope of work

Scope	Time & Requirement	Details Reference	Penalties Reference
<b>Pre-construction arrangement</b>	<ul style="list-style-type: none"> <li>• Within 1 week after CEM notification</li> <li>• Progress update weekly / as CEM request</li> </ul>	GTC Clause 6.3	GCC Clauses 3.2.10 and 3.2.14
<b>Execution and commissioning</b>	<ul style="list-style-type: none"> <li>• Set up signs and fences before commencement</li> <li>• Daily inspection to site</li> <li>• Daily submission of site photos</li> <li>• Perform commissioning within 1 week after completion</li> </ul>	GTC Clause 6.4	GCC Clauses 3.2.3, 3.2.4, 3.2.5, 3.2.6, 3.2.8, 3.2.11 and 3.2.14
<b>Construction report</b>	<ul style="list-style-type: none"> <li>• Daily Reporting</li> <li>• Weekly Report</li> <li>• Monthly Report</li> <li>• Commissioning Report</li> <li>• Incident Report</li> </ul>	GTC Clause 6.5	GCC Clauses 3.2.10 and 3.2.14

## **6.3 Pre-Construction Arrangement**

### **6.3.1 Site Survey and preparation of license application**

For all construction, maintenance, modification or optimization jobs notified by CEM, the Contractor shall be responsible to perform site survey and submit work method statement and related supporting documents within 1 week, which include but not limited to:

- Site survey for project preparation
  - Site investigation to plan excavation, confirm site condition and plan excavation work
  - submit appropriate proposal to fulfill the requirement
  - Video or photos that recorded site condition for trench that is to be done;
  - Reporting on any constraints that affect the original design of the jobs or any update required;
- Work Method Statement
  - Equipment and Tools to be used
  - Risk Assessment Plan for the job
  - Work Programme for the corresponding jobs
  - Work Task Procedures
  - All necessary technical drawing
- Preparation for license application, include but not limited to,
  - IAM Excavation license, the material shall include but not limited to site photos, accuracy diagrams, traffic plan, affected list of traffic facilities with site photos.
  - Prepare the application form, upload the necessary materials as required by IAM and CEM to IAM excavation license system.
  - DSAT AVISO license, the material shall include traffic plan, information of vehicles. Prepare the application form, upload the necessary materials as required by DSAT and CEM to DSAT RMS system.
  - DSSCU Natural Gas license, the material shall include application form, drawings, work method statement and the necessary materials as required by DSSCU.

### **6.3.2 Progress update**

- Contractors shall update the progress of preparation in CEM request time.
- Contractors shall arrange authorized person to attend dedicated meeting held in CEM building as CEM request.
- Contractors shall arrange authorized person to attend weekly meetings held in CEM building to report existing jobs status as well as discuss jobs that planned to start 3 weeks from the meeting.

### **6.3.3 Preliminary measures on site**

After CEM obtain certain work permit from IAM or DSAT, CEM will inform contractor the further requirement if from IAM or DSAT and the schedule date. The contractor shall perform necessary preliminary measures included but not limited to,

- Before starting the works, the Contractor must obtain information from CEM regarding underground facilities (CEM network, water, telecommunication, gas, sewage pipes, etc...).
- Prepare, submit and implement Environmental Management Plan
- Prepare, submit and implement Safety Management Plan
- Perform Pre-work risk assessment before starting any work.

- Perform a pre-work inspection of related tools and machines (such as ladders, scaffoldings, working platforms, lifting equipment, cranes, etc.)
- Arrange competent person to operate the equipment.
- Prepare relevant legal requirements.
- For all excavation works (especially close to slope and retaining wall) investigation and assessment should be implemented in order to get rid of any potential or direct danger to the stability and analysis to the factor of surrounding environment and influence of construction in order to adopt the corresponding precautions

## **6.4 Execution and commissioning**

### **6.4.1 General Site Arrangement**

After CEM obtain certain work permit from IAM or DSAT, CEM will send email for all documents that required on the constructions (e.g. IAM License, DSAT Aviso etc.) to contractors. After receiving these documents, the Contractor shall prepare the site according to agreed date and provide all kind of site management and coordination included the following service but not limited to:

- Contact all affected residences or shops in advance to explain there is excavation in polite and respective manner
- Dedicate on-site Ambassadors on every site to support and explain the impact of construction to avoid any negative impression to public as well as to ensure the site environment is in safe and tidy condition to pedestrians
- Provide site emergency contact information on every construction site
- Supply of all tools, machinery's, scaffolding, scissor platform, hoardings, fences, or any equipment which necessary to carry out the contract jobs
- Provide site work briefing to each worker that work on particular site before they can perform any site work commencement
- Set up sufficient signs, fences or any necessary protection at the job areas, refer to GTC6.4.2
- Installation of proper temporary passageways for pedestrian next to the trenches to prevent inconveniences to residences
- Supply and installation of iron plates with 1 inch (25.4mm) thickness on road crossings for temporary usage if necessary
- Provide site notice board onsite for updating the daily site status as well as daily labor attendance
- Pumping of water from flooded trenches/ditches if necessary
- Provide necessary transportation of all materials or equipment needed for the jobs including materials provided by CEM
- Provide necessary certificate for any structural modification on any trench work whereas required by government entities
- Provide all necessary on-site support and communication to citizens related to impact from works
- Perform site inspection to construction site, refer to GTC6.4.3.
- Process the commissioning as requirement after completion, refer to GTC6.4.4.

### **6.4.2 Signaling and protection before commencement**

- Contractor must put barriers and signals according with CEM and official entities requirements.

- All work area including trenches and crossings must be duly protected, restricted and signalized, thus avoiding any situation from the pedestrian and the traffic.
- In public roads Contractor must provide signboard (drawing F-029 & F-034) on site for placing the licenses and drawings as well as signboard (drawing F-030) for public information. Signboards should be placed in both trench ends. Protection must be carried out with PE traffic barriers that must be interlocked, high impact resistant, non-fading colours and UV stabilized according to drawing F-033.
- Contractor must take care of the day and night signals with no addition charge.
- All protected area must be signalized by yellow illuminated devices, and must be visible from 30 meters.
- All signalling lights must be fixed on barriers.
- High Visible Strobe lights or Barricade warning lights with 12V minimum must be installed in both trench ends.
- The signalling devices must be maintained until completion of the job.
- In public roads the Contractor must use warning, directional and temporary traffic signs with the colours and dimensions standardized by official entities and in good conditions. Defect signs or not visible during night time is equivalent to absence of signaling.
- Contractor must repaint the horizontal traffic signs and re-install the supports and vertical traffic signs, railings and metallic barriers in the same locations with good condition and in accordance with official entities requirements after work completion with no additional charge
- Any accident occurs in work area due to absence of signaling, or inadequate protection, it will be the contractor's responsibility.
- All fines levied by the Official bodies due to the absence of signaling, or lack of protection in the work area, will be paid off by contractor.
- Government regulation on roadwork must be followed.
- When necessary, the Contractor should use temporary traffic lights or hire police, where appropriate, for the purpose of traffic control during the execution of works as required by the government entities.
- When checking the PLN in the day time and need to turn on the lighting, contractor should put barriers and notice under each lighting.
- Contractor should put the notice with the urgent contact phone number on site.

#### **6.4.3 Work Execution Inspection**

- Contractor shall perform daily inspection on to the construction site and report to CEM
  - Any problems may affecting the progress
  - Urgent connection or isolation request for existing excavating jobs
  - Any extension that may be required due to unexpected conditions
- Contractor shall submit daily submission of photo to all construction site, refer to GTC6.5.2
- For any inspections that required for the jobs, contractors shall request the inspection with at least 48 hours' notice for access to CEM premises.
- CEM can request the Contractor to provide the services below,
  - Additional inspections to construction site as CEM required

- dedicated Meetings on site
  - Provide information as per CEM's request
- Periodically CEM will perform inspections/meetings/audits requesting the presence of the Contractor's contract manager.
- CEM can use external resources to perform audits to the Contractor's services
- Contractors shall ensure the construction progress in schedule and finish in time. Submit the extension request with reason for CEM approval. The extension request shall submit to CEM in advance as following,
  - Notice of extension on DSAT Aviso - 3 working days before expired.
  - Notice of extension on IAM License - 5 working days before expired.
  - Notice for IAM's inspection on trench back fill or application of pavement - 2 working days before the process
- Under any circumstances, the Contractor shall be liable to any damages occurred during work.

#### **6.4.4 Work Commissioning**

- Contractors shall provide all kinds of test and certificates in compliance with the requirement of CEM or government entities.
- Consolidate report and submit to CEM, refer to **GTC 6.5.5**.
- The construction tasks shall be processed with the verification from CEM supervisor. The submission for commissioning must include the signature from CEM supervisor.

### **6.5 Construction Reports**

#### **6.5.1 Document control**

Penalties according to GCC clauses 3.2.10 and 3.2.14 will be applied if Contractor fails to submit below documents on time.

<b>Documents</b>	<b>Requirement</b>	<b>Detail Reference</b>
<b>Daily Reporting</b>	Daily submission	GTC Clause 6.5.2
<b>Weekly Report</b>	Within 24 hours before Friday Meeting	GTC Clause 6.5.3
<b>Monthly Report</b>	Before 20th of Every month	GTC Clause 6.5.4
<b>Commissioning Report</b>	Within 1 week after completion	GTC Clause 6.5.5
<b>Incident Report</b>	Within 2 working days after Incident	GTC Clause 6.5.6

#### **6.5.2 Daily Reporting**

Contractors must report verbally to CEM supervisor on a daily basis before closing of business of every working day included but not limited to the followings,

- Any problems affecting the progress condition affect, any design change required
- Any urgent connection or isolation request for existing excavating jobs
- Any extension required due to unexpected conditions
- Contractors must submit the photos of daily inspection through CEM specified apps as record and for further supervision.

#### **6.5.3 Weekly reporting**

Contractors should submit the following plans or report every week within **24 hours before the weekly progress meeting** which include the following but not limited to:

- Weekly Progress report which record status up till 48 hours before the weekly meeting which included but not limited to the following:
  - Daily weather condition of the week
  - Daily personnel attendance list of each job
  - Photo record on job site condition for every day COB
  - Completion status for all on hand jobs with expected finish date
  - Any delay on jobs and reasons.
- Preliminary connection or isolation schedule for each on hand jobs for the coming week from the meeting
- Weekly Site Work Completion report based on each IAM License
- Site Survey report and DSAT application plan for assigned jobs which planned to start on the 2<sup>nd</sup> week from the meeting
- Vacancy of teams for accepting jobs for the 3<sup>rd</sup> week from the meeting.

#### **6.5.4 Monthly Reporting**

Contractors should provide the following monthly reports and submit:

- Self-evaluation report for minimum 3 jobs' site inspections based on environmental and safety conditions with corresponding photo records.
- Jobs completion and acceptance status for each completed jobs include acceptance document such as IAM acceptance record as well as traffic resume conditions photo record.

#### **6.5.5 Commissioning Report For Each Job**

When any jobs that have been completed or partially completed, Contractor has to provide commissioning report for the job in e-format within one week after completion which included but not limited to:

- Provide survey records to the newly installed cable routes according to CEM requested format, including layout plans, sections, coordinates, levels, photographs etc.
- Provide underground markers records if necessary (Attachment - Underground Facilities Marking System Installation Guideline)
- Provide work commencement briefing record for each job (including supervisor and workers attendance list and photo)
- Provide Site daily record with weather and progress information
- Provide electrical connection record and cable laying record when necessary
- Provide Photo record during construction period which shall include but not limit to,
  - Site survey photo before job commence
  - trench excavations and trench opened
  - blinding concrete application if necessary
  - cables or pipes laying
  - pipes cleaning record
  - concrete surrounding pipes
  - pavement of trench
  - traffic conditions resumed photo record



- As-built drawing in AutoCAD format as well as SAI information.
- Service payment assessment of each job in excel format with break down
- All kinds of test report and certificates in compliance with the requirement of government entities, include but not limited to,
- Cable acceptance test report after terminations or joints being done with CEM responsible site verification record
- Test certificates for concrete or asphalt pavement
- Test of density of back-filled trench
- Test certificates of the cast iron manhole covers in compliance with BS EN 124 Class D400
- Such reports must be submitted to CEM supervisor to verify before any examination of payment.

#### **6.5.6 Incident Report and Record**

Whenever any problem or incident observed onsite, Contractors shall report to CEM immediately and also provide incident photos as record, damaged condition and proposed action within 2 working days.

### **7 Safety, Health and Environmental responsibilities**

- To perform all the necessary actions to comply with CEM Environmental, Safety and Health Targets and Procedures and Macao Environmental and Labour Legislation and to supply/report all the related figures to CEM
- The use of helmet and safety shoes is compulsory in all situations.
- It is compulsory to place barrier and warning notice to isolate the working area.
- It is compulsory to use ear defender & protective eyeglasses when operating pneumatic breaker.
- It is necessary to set ear protection zone signs
- Pneumatic breaker could only be used on Monday to Saturday from 8:00 to 20:00 except for special cases upon the approval of CEM inspection
- The use of safety belts or safety harness is compulsory when working above two meters from the ground surface.
- Above 5.6 meters is compulsory the use of mobile elevating equipment by competent person who shall ensure the platform is durable, stable ground foundation, good communication between operator and supervisor and set operation zone.
- It is necessary to fence off the operating zone and post notices on prominent areas.
- All Personal Protective Equipment shall comply with international standards
- It is compulsory to use reflective vest when working in public roads.
- Signaling and protection in the working areas.
- Gathering of samples of soil and delivering to CEM.
- Supply of all tools, machinery's, scaffolding, equipment and whatever else necessary to carry out the maintenance services.
- Installation of temporary passageways for pedestrian beside the trenches.
- Supply and installation of anti-slip iron plates with 1 inch (25.4mm) thickness on road crossings.
- Pumping of water from flooded trenches/ditches.
- At least two people should work together inside CEM premises
- Provide the on-site supports and communication to the citizens due to the impacts of the works

## **8 Resource**

### **8.1 Human Resources and Organization**

- In terms for management level, contractor has to provide organization chart which includes below but not limited to:
  - 1 contract manager, with either minimum 10 years related experience, or minimum 5 years related experience but equipped with diploma or above degree, obliged to answer in less than one hour to any CEM request
  - 3 engineers, with minimum 2 years related experience and equipped with related professional engineer certificate, good command of spoken and written Chinese and English obliged to stay in CEM office to arrange and schedule the daily works of Planning, Construction and Maintenance tasks for the PLN
  - 1 safety inspector, with minimum 3 years related experience and equipped with safety inspector certificate, obliged to provide safety risk assessment, safety inspection and work on all kind of safety related issue
  - 2 emergency contact (1 main and 1 backup), with minimum 2 years related experience and equipped with safety inspector certificate, good command of spoken and written Chinese and English, obliged to arrange and follow up emergency tasks for the PLN
- For works related to planning and document control, contractor shall provide minimum 1 planning coordinator, with minimum 2 years related experience, good command of spoken and written Chinese and English, obliged to collect information and provide work plans for PLN tasks with detail drawing and arrangement, as well as 1 document controller, obliged to control all kinds of document submission and written order from CEM.
- For jobs related to Excavation, Lighting installation and cable laying works, contractor shall provide minimum 3 construction or maintenance teams and 2 emergency team simultaneously while each team shall include but not limited to minimum 4 competent workers (not included driver or logistic workers) plus minimum 1 team leader/supervisor.
- For jobs related to aerial cable works, contractor shall provide minimum 2 teams, one for daily operation and one for emergency handling. Each team should include but not limited to minimum 2 workers plus minimum 1 dedicated team leader/supervisor.
- For jobs related to material transportation works, contractor shall provide minimum 2 competent workers (not included the driver) to provide transportation service in time to support the tasks of construction, operation, maintenance and emergency.
- All Contractor personnel shall only be registered and worked with single contract during the contract period. For any personnel amendment from the organization chart, Contractors have to revise the organization chart and submit to CEM 1 month in advance for approval
- “Curriculum Vitae” of management team and planning team has to be provided, as well as the number and technical qualifications of the team personnel proposed.
- The contractor must provide the necessary manpower in accordance with his contractual obligation and which allow him to perform the maintenance of the PL system under any exploitation condition, following the relevant O&M Instructions in order to meet CEM requirements in term of needs to

comply with the good engineering practices. The contractor must prove that all the staff has the required educational level and professional experience for the function assigned.

## **8.2 Equipment**

The minimum resource of each contract is requested as bellows:

- Three 10-14m Truck mounted Aerial work platform
- Two 2-10m Aerial work platform
- Two Excavating machine (Middle)
- One Excavating machine (Small)
- Two Crane for the lighting pole transportation

## **8.3 Daily work**

8.3.1 Contractor shall be able to perform **3 excavation works for construction or maintenance works** at different locations at the same time (not included the emergency works)

8.3.2 If the working site is more than 2 (excavation or aerial cable installation), contractor should dedicate one supervisor on site and each excavation site shall have at least **5 competent workers with suitable equipment and tools** (not included the driver).

## **8.4 Emergency work**

Contractor shall provide sufficient manpower to handle **one excavation works, three temporary cable installation works at the same time** (not included the daily work). Sufficient manpower must be provided in order to repair the PLN after typhoon, flooding, disaster or major situation happen.

## **8.5 Planning work**

Contractor shall provide sufficient manpower to perform site assessment, provide design with excavation planning, and prepare material for license application, report consolidation.

# **9 Support Documents, Procedures and Working Structure**

## **9.1 Support Documents**

After award CEM will make available all technical documentation required to perform the activities included on the scope of contract.

All the technical data supplied by CEM are mandatory, but the contractor must confirm or complement them. Any lack of information cannot be invoked as reason for delays or for not to perform the activities.

These documents belong to CEM and cannot be transmitted to third parties.

## **9.2. Procedures and Working Structure**

### **9.2.1 Work Guidelines**

Whenever a Work Order is received, the Contractor must assess the priority assigned and develop the necessary actions in order to perform the work within the relevant time period.

From this action we must point out:

- For corrective maintenance: to assess the defect reported in order to determine the cause of the defect and the necessary corrective actions; a forecast of the required human and material resources must be performed;
  - To propose to CEM the date to perform the work; after receiving this confirmation from CEM, to send for CEM the relevant “Work Request” by written paper.
  - After approval the “Work Request” by CEM responsible and before starting to work the Contractor has to receive from CEM responsible the relevant “Work Permit”, and has to confirm if the required safety conditions to perform the work are fulfilled.
  - After performing the work, the Contractor has to return to CEM responsible the relevant “Work Permit” and has to assist CEM responsible in testing the equipment to confirm if the defect is solved.
- 9.2.2 If to perform the construction and maintenance action it is required CEM to supply any materials, the Contractor has to inform CEM, and after receiving the relevant “Stock Issue” form, to retrieve the material from stores.
- 9.2.3 Whenever CEM verifies technical incapacity or unavailability of the Contractor to perform the required Construction or Maintenance actions, CEM will, after informing the Contractor, assume their performance, and will charge to the Contractor the relevant costs.
- 9.2.4 CEM has the right of not to accept the Contractor’s proposals of modification of list of spares, stating the reasons for that. CEM has to inform the contractor of its decision within 15 days of the proposals submission.
- 9.2.5 Whenever it is economically and technically possible to recover a replaced spare, the Contractor will be responsible for that action without any additional costs for CEM. The recovered spare will be returned to store for further use.
- 9.2.6 Any replaced spare only can be scrapped after CEM approval.

## **10 Quality Management**

The possession of Management and Quality Certifications such as ISO 9001, ISO 14001 and ISO 45001 will be taken into consideration in the evaluation.

The Contractor must comply with the requirements of the document of Contractor Health and Safety Regulation of CEM.

### **10.1 General requirements**

The Contractor must have a Quality Plan to assure the correct performance of the awarded services. The Quality plan must define the Organizational Model and the required Procedures to perform the awarded services.

The Quality Plan must consider the monitoring of all activities related with the awarded services in order to evidence the compliance with the codes, standards, specifications, best practices and remaining requirements of this tender specification.

The Quality plan, after CEM approval will become a contractual document.

Together with the remaining documents of the proposal, the Contractor is required to submit a program of Quality Assurance, including, besides any information considered relevant by the Contractor, the following:

- Organic and Functional Structure of the team that will perform the awarded contract
- Structure responsible for Quality Assurance
- Responsibilities and Job Functions allocated to every staff allocated to the Contract

The structure responsible for Quality Assurance will be responsible before CEM for the Quality of the activity performed.

## **10.2 Materials Quality Control**

CEM has the right to control the quality of all the materials supplied by the contractor and not to allow their use if they do not meet the technical requirements of this contract and do not have a Quality Control Certificate issued by an external certifying entity recognized and accepted by CEM.

## **10.3 Chemical Products and Painting Quality Control**

CEM has the right to control all the chemical products and Painting supplied by the contractor and to reject them if they do not meet the required specification.

# **11 Construction Technical Specification**

## **11.1 Trench Opening**

- 11.1.1 Trench location and dimension are indicated in project drawing. Contractor will carry out their demarcation with the assistance of the inspection.
- 11.1.2 For payment purpose we will only consider the trench dimensions indicated in the drawing with exception to modifications requested by the inspection.
- 11.1.3 Any change from design must be approved by CEM beforehand, otherwise, re-install might be considered with no additional cost.
- 11.1.4 Trench dimensions must be confirmed and sign-off by the inspection before backfilling. Otherwise, CEM will conclude the trench dimensions for the final payment.
- 11.1.5 Before excavating on concrete or asphalt pavements, the edges of trenches must be cut by a mechanical saw.
- 11.1.6 Temporary disposal material, such as clean soil, must be placed adequately to avoid blocking passage for pedestrians or vehicles. Moreover, this material must also be placed to avoid flooding.
- 11.1.7 Contractor must prevent excavated material, silt or debris entering drainage system located in roads and footways. Draining water to gullies must not obstruct the drainage system.
- 11.1.8 Contractor must make sure that the surroundings of the trench be clear of and clean from any materials, silt or debris.
- 11.1.9 Building materials and/or waste from the excavation, deposited near the trench, must be protected with planks along the whole trench.
- 11.1.10 Contractor must dispose excavated material on that day, which is not suitable for backfilling, with no additional charge.
- 11.1.11 Caution when excavating reaching the deep of 300mm to avoid damaging underground installation.
- 11.1.12 Always, when the excavation of a trench, takes place on a road crossing it will be carried out with a width of 1.00 m and a depth of 1.00 m, depending on whether one or two layers of pipes, stacked one above the other, are placed inside it.

- 11.1.13 When building a road crossing trench, portion of road occupation and period of work must be strictly followed. Temporary traffic signs must be placed on before work starts.
- 11.1.14 Road crossing must be done with reinforced concrete.
- 11.1.15 Excavation must be carried out by hand or hand tools adjacent to underground facilities.
- 11.1.16 Trench shuttering (shoring) must be used for the effective safety of people, protection of nearby buildings and to avoid trench collapse, if trench is more than 1.4 m deep.
- 11.1.17 In some locations with heavy traffic, population and narrow streets and after the Inspection instruction, the contractor should use Non- slip trench covers to minimize the inconvenience to the public. The surface of the trench cover should have anti-slip line and a locking device that keep the unit one after one.

## 11.2 Duct installation and manholes

- 11.2.1 Rigid uPVC pipes for cable protection profiled to provide good mechanical protection of buried cables.

The specification of the uPVC pipes should be:

uPVC pipes shall be joined by socket with solvent cementing.

<b>Standards</b>	<b>BS 3506:1969 – Specification for Unplasticized PVC Pipe for Industrial Uses</b>
<b>all thickness of pipe</b>	<b>Class B</b>
<b>Length</b>	<b>6.0 m.</b>
<b>Colour (Grey)</b>	<b>Permanent non-fading, colour resistant to chemical change.</b>
<b>Material</b>	<ul style="list-style-type: none"> <li>▪ <b>Non-toxic and non-corrosive uPVC.</b></li> <li>▪ <b>Not provide food source to micro/macro organisms and fungi.</b></li> </ul>
<b>Resistance</b>	<ul style="list-style-type: none"> <li>▪ <b>Resistant to chemical attack by a wide variety of substances such as acids, alkalis and oils;</b></li> <li>▪ <b>High resistant to fungus and bacterial attacks, ultraviolet radiation, rain and atmospheric conditions.</b></li> </ul>
<b>Flammability</b>	<b>Self-Extinguishing.</b>
<b>Specific Gravity</b>	<b>1.40 ~ 1.43 Grams / cm<sup>3</sup>.</b>
<b>Specific Heat</b>	<b>0.25 Kcal. / Kg. / °C.</b>
<b>Thermal Conductivity</b>	<b>0.13 Kcal. Cm. H °C.</b>
<b>Coefficient of Linear Expansion</b>	<b>5 x 10<sup>-6</sup> maximum / °C.</b>
<b>Vicat Softening Temperature</b>	<b>85 °C at 1 Kg. Load and 79 °C at 5 Kg. Load.</b>
<b>Tensile strength at 20 °C</b>	<b>500 Kg/cm<sup>2</sup> (minimum).</b>
<b>Elongation</b>	<b>80 % (minimum).</b>
<b>Modulus of Elasticity</b>	<b>1200 ~ 1500 Mpa</b>
<b>Hardness - Shore D</b>	<b>85 ~ 90</b>

- 11.2.2 In road crossing or where specified, each pipe must be apart by 100 mm and encased with grade C25 concrete, and 200 mm of concrete on the most upper layer of pipes and 150 mm of concrete below the bottom layer of pipes. 75mm thick blinding concrete grade C15/20 shall be cast at the bottom of the trench.

- 11.2.3 Manufactured plastic spacers must be placed at maximum 2 meters apart for maintaining desired separation between pipes, providing the required support during assembly and preventing excessive deflection from loading or buoyancy forces during concrete encasement. The bottom spacer must provide sufficient clearance off the trench floor to permit the specified thickness of concrete to gather at the bottom.
- 11.2.4 Final check by Inspection is needed before backfilling. Otherwise, CEM could request to re-open up trench for checking. Contractor is responsible for any delay due to this reason.
- 11.2.5 Manholes shall be constructed in grade C30 concrete with steel reinforcement Ø10//150mm in 2 directions and 2 layers for walls, bottom slab and top slab. Concrete surfaces, which are to be in contact with underground, shall be coated with bituminous paint.  
Manhole cover on carriageway shall be made of spheroidal graphite cast iron and comply with BS EN 124:1994 Class D400 (test load = 400 kN). Removable fall-protection galvanized steel frame shall be installed under the cover.  
Manhole cover on footway and pedestrian area shall be recessed cover made of stainless steel with same finishes as the pavement and comply with BS EN 124:1994 Class B125 (test load = 125 kN).  
Provide the coordinates of the duct and manholes (X, Y, Z), Test certificates to the compliance of the referred standard of manhole cover shall be provided.
- 11.2.6 Acceptance test for cable ducts  
Upon completion of the duct installation, a standard mandrel shall be pulled through each duct to loosen particles of earth, sand, or foreign material left in the duct, and to test for out-of-round conditions  
The OD of a test mandrel is normally 80% of the ID of nominal size of the duct. A brush with stiff bristles shall then be pulled through each duct to remove the loosened particles. The diameter of the brush shall be the same as, or slightly larger than, the diameter of the duct  
If testing reveals obstructions or out-of-round conditions, the Contractor shall replace affected section(s) of duct and retest to the satisfaction of the inspection at no cost to CEM.  
Mandrel pulls shall be witnessed by the inspection.

### **11.3 Cable Installation and Trench Backfill**

- 11.3.1 Cable drums rolling direction must be followed.
- 11.3.2 Ramp for unloading cable drum must be less than 1:4 in slope.
- 11.3.3 Unwinding of cables must be done with the drums placed on jacks or on special racks by means of an axle of resistant iron.
- 11.3.4 Rollers must be used to support cables.
- 11.3.5 Cables must be pulled slowly and progressively using traction sleeves with appropriate strength. Direct buried cable must be provided the cable coordinates (X, Y, Z) after the cable laying. Provide the actual used pipes when the cable is laid in the piping system.
- 11.3.6 Sharp edge, such as pipe entrance, must be protected in order not to damage the cable shielding during installation.
- 11.3.7 3 meters surplus in cable end must be reserved for jointing. Cable surplus in customer substations or primary substations or poles must be confirmed with the Inspection.
- 11.3.8 Bending radius during cable installation must be greater than 30D, which D is the cable overall diameter, unless otherwise referred by the Inspection.

- 11.3.9 Bending radius after cable installed must be greater than  $15D$ , which  $D$  is the cable overall diameter, unless otherwise referred by the Inspection.
- 11.3.10 Cable installation must be under authorization and supervision of the Inspection.
- 11.3.11 Cable must be placed on minimum of 100 mm thickness unless otherwise directed by the Inspection, of fine sand or granite powder, which with fineness on a mesh of  $1/16''$ , to avoid cable shielding being damage by stones or any other substances.
- 11.3.12 Cable ends must be sealed until the moment of assembling termination and joint.
- 11.3.13 Cables in same circuit should be tied up by plastic ties every 1.00 m. It must be an about 5mm gap loosening in plastic tie, to avoid cable being damage from tie up too strong.
- 11.3.14 Before starting backfilling, trench must be cleaned from any kind of debris, wasting materials, woods, plants, etc
- 11.3.15 Cables must be covered at least 300 mm thickness, of fine sand or granite powder, which fineness on a mesh of  $1/16''$ . Contractor must request from the supplier of fine sand or granite powder test certificates for the compliance of the said requirements. The filling shall be formed to the levels, slopes and dimensions shown on the drawings or as directed by the Inspection.  
Protection plates, warning signals and tapes should then be installed on the top of this layer.
- 11.3.16 Trench must only be backfill after Inspection approval and with very fine soil and could not contain any small stone or sharp material that can damage the installed cable.
- 11.3.17 Contractor must collect soil samples for examination on Inspection requests. Detail of sand information must be provided as well.
- 11.3.18 Complete trench backfill must only be started after cable testing with good condition.
- 11.3.19 Field compactions must be carried out during trench backfill with 200 mm thickness of fine sand or granite powder.
- Compaction must be done by hand-rammer in the 200 mm layers on top of cable. To avoid dust spray water to the trench is necessary
  - Compaction on layer upper the signal plates could be done by hand-rammers or vibration roller.
  - Compaction before paving could be done by hand-rammers or vibration roller.
  - If fine sand or granite powder need to be added for trench backfill compaction, the compaction should be done one time again.
- 11.3.20 Contractor could only start the pavement works after approval by the Inspection.
- 11.3.21 New pavement must be the same quality as before, complying with the requirement of government entities and providing required test certificates for road base and pavement, and whole length must be uniform.
- 11.3.22 Concrete used in the paving must be in accordance with the requirement of government entities, except instructed by the Inspection.
- 11.3.23 New pavement must be cleaned afterwards. If water is used for cleaning, contractor should make sure no obstruction would make the drainage system block.
- 11.3.24 Sand bags must cover live cables in trench. Contractor shall use HV/MV Insulated Gloves when performing works near live cables
- 11.3.25 Joint must be put in a flat surface and covered with sand bags. Should keep the cable straight near the joint around 3m.
- 11.3.26 Where applicable, the bituminous carriageway is to be reinstated in accordance with the requirement of Macau Grand Prix Racetrack. Corresponding Technical Specification is detailed in Clause 11.14.



- 11.3.27 PG100 type high-strength, high-elasticity polymer-modified asphalt (non-resin-based modification) shall be performed according to Clause 11.15.
- 11.3.28 If the restoration work involves any road traffic signs, markings, and lines, it shall be carried out according to the guidelines provided by DSAT.

## **11.4 Cable Connection**

### **11.4.1 Lighting poles connections**

The lighting poles connections are executed with cable VAV 4x6mm<sup>2</sup> and will comprise the following works:

- a) -setting and fixing the cut-out box in the PL poles and install and connect the circuit breaker, 1 pole - 6A in the cut-out box
- b) -preparation of cables and removing cable over-sheath
- c) -fitting the cable terminals
- d) -connect the cables (in and out) VAV 4x6mm<sup>2</sup> in the cut-out box and connect the shield of the cable to earth.

### **11.4.2 PLN cable joints**

The PLN cable joints are executed according to the installation instructions of manufacturers and in generally will comprise the following works:

- a) -preparation of the work checking that all components are available
- b) -align and support the cables at the jointing position ensuring that they are level
- c) -mark the centre of the joint and abrade the cable over sheath, set the cores and fit the connectors (unions)
- d) -re-insulating the connectors and fitting the armour bond
- e) -completing the joint and back filling the compound

### **11.4.3 Cable VAV 4x6mm<sup>2</sup> connections**

The cable VAV 4x6mm<sup>2</sup> connections include the outgoing connections of PL distribution box, the connections of telephone kiosk, the connections of bus shelter, illuminated ads, etc., exclude the PL poles connections, and will comprise the following works:

- a) -preparation of the cable and removing the over-sheath
- b) -fitting the cable terminals
- c) -connect the cable VAV 4x6mm<sup>2</sup> and connect the shield of the cable to earth.

### **11.4.4 PLN protection boxes connection**

The PL protection boxes connections are executed with cable VAV 4x6mm<sup>2</sup> or any section of bundle cable and will comprise the following works:

- a) -preparation of cables and removing cable over sheath
- b) -fitting the cable terminals and connect the cables (in and out) in the PLN boxes.

### **11.4.5 PL Distribution boxes connections**

The PL Distribution boxes connections are executed according with the drawing n° I-9888 and will comprise the following works:

- a) -setting and fixing the Chassis for PL pillar box and the Ebonite board of 1/4"
- b) -setting and fixing the Rail mounting, size - 50cm and the Terminal blocks

- c) -setting and fixing the fuse base, contactor, circuit breakers and the twilight switch or timer.
- d) -installation and connections between equipments with cable V16 and V10mm<sup>2</sup>
- e) -setting and fixing the meter window in the PL pillar box.

#### **11.4.6 Final test**

- a) -Before connecting the cable in the light pole, check the phase sequence using the multimeter.
- b) -After the connection and before labelling the light pole, switch on the circuit breaker to check if the phase sequence is correct.

### **11.5 Distribution Box (CDIP) and Pothead (PH) Installation**

- 11.5.1 Contractor is required to supply and install all necessary materials for proper fixing, levelling and positioning of distribution box (CDIP) with a foundation base as shown in drawing D-252 and D-336, provide the coordinates of the CDIP (X, Y, Z).
- 11.5.2 Contractor is required to install metallic barrier to protect CDIP as shown in drawings D-150, D-151 and D336.
- 11.5.3 Installations of earth cable and earth electrode are included in the unit price of CDIP installation.

### **11.6 Painting of Metallic Poles**

- 11.6.1 Required repainting should achieve the best effect of anti-rust, anti-erosion and anti-ultraviolet and it shall be processed using compatible layers of painting as follows requirement:
  - To remove carefully the rust and any old paint on the pole and/or pole arms avoiding to damage the original hot-dip galvanized coating. Stripping of the surface by abrasive jet is not allowed and not practical.
  - To apply one layer of compatible primer based in epoxy resins and containing aluminium like a pigment, 150 Microns dry film thickness.
  - To apply three layers of compatible Finish Paint, 3x25 Microns dry film thickness, colour to be agreed with CEM engineer.
- 11.6.2 It is required the submission of both Paint-scheme and detailed Material Specifications before the start of the works for prior approval by CEM.
- 11.6.3 Required **warranty period- five (5) years** after taken-over date.

### **11.7 Transport, Lifting or Removal of Concrete or Metallic Poles**

- 11.7.1 Contractor must make sure pole is in good condition before having it installed.
- 11.7.2 Lifting instruction from manufacture must be followed to make sure concrete or metallic pole is lifted up with no dynamic overburden.
- 11.7.3 Vehicle for transporting concrete or metallic poles must be equipped to hold the pole not bending form turning or on uneven road.
- 11.7.4 It is forbidden to drag pole along the ground.
- 11.7.5 Crane or suitable mechanical device must be used to unload or remove poles. Poles must be mounted on a portico by winch when removed or unloading. Removal or unloading by simply sliding the poles on ramps is not permitted.
- 11.7.6 The hoisting devices will be provided with soft lining which will efficiently protect the concrete or metallic from risk of breaking or damage the galvanization.

- 11.7.7 Concrete poles will be installed directly into the ground, and surrounded with dry stones. Any non-standard installation, approved design will be given by CEM.
- 11.7.8 Foundation base is necessary for metallic pole. Dimension of foundation base for metallic poles up to 10 m high will be 600 mm x 600 mm x 600 mm. Above 10 m approved designs will be given by CEM.
- 11.7.9 All lighting poles to one meter high above the concrete base shall be painted with: one coat of anti-corrosion paint (such as ICI Etch Primer P 565-26090); one coat of speed undercoat (such ICI Dulux Speed Undercoat A543-111); two coats of gloss finish (such as ICI Dulux Gloss finish A365-Line (Black colour)).
- 11.7.10 Contractor must final check the installed pole where there is any crack or damage. Contractor must inform CEM once this situation is found.  
Public Lighting Pole number is marked as PPP, C, NNN.  
PPP - CDIP No  
C - Circuit reference  
NNN - Public lighting pole sequential no.

## **11.8 Foundation Base**

- 11.8.1 Concrete substances must be submitted for CEM's approval.
- 11.8.2 Cement must be the Portland type and must comply with the Regulations for Concrete for Hydraulic Connections.
- 11.8.3 Water used in mixing of concrete must be clean and free of organic matter.
- 11.8.4 Stone and sand used for foundations must be free of any earthy or organic matter. Grains of sand must be between 0.5 and 3mm in size. Stone must pass through a sieve with a maximum of 60 mm and a minimum of 20 mm.
- 11.8.5 The volumetric proportion to be adopted will be as follows:
- 1/3 of sand
  - 2/3 other matters
- 11.8.6 Concrete with a proportion of 250 kg of cement per cubic meter of concrete must be used. The concrete must be made in a mechanical concrete mixer, except in special cases where, after previous agreement by CEM, a manual mixer can be used.
- 11.8.7 If foundation bases of cyclopic concrete were specified in the project, the composition would be as follows:
- 250 kg of cement
  - 860 g of broken stone
  - 430 g of sand without salt
- The blocks of stone to be used must not exceed, at maximum dimension, 200 mm, and those of broken stone 75 mm.
- 11.8.8 CEM can demand that the making of the concrete be done in the presence of one of its representatives. The state of art must be obeyed and in particular the following:
- a) No kind of transport for the concrete can be utilized if it is susceptible of separating its contents, or allows initial hardening before the mixing.
  - b) It is expressly forbidden to introduce any blocks of stone to the non-cyclopean concrete.
  - c) The concrete will be arranged in successive layers so as to obtain a well-compacted concrete.

- 11.8.9 It is forbidden to filling-in the concrete into flooded ditches. In such cases the height of the water must first be reduced, by means of pumping to the minimum possible. In these cases the concrete will be made with a proportion of 400 kg of cement for each cubic meter of water, and using a minimum quantity of water in the mixing. It is forbidden to use concrete obtained by dry mixing the ingredients.

### **11.9 Earth Circuit**

- 11.9.1. Earth electrodes will be installed for CDIP installation and for all metallic lighting poles. For the concrete poles the earth electrodes will be installed in the places indicated in the drawings.
- 11.9.2. If the earth measurement reading of an electrode is more than 10 ohms, contractor must inform the Inspection.
- 11.9.3. VV 35mm<sup>2</sup> cable, unless otherwise specify by the inspection, must be used for connecting earth electrode and equipment. Cable should be protected by PVC pipe with 1-inch mechanical resistance until 2.5 m above ground level. Connector must be installed near pipe entrance, which allows disconnecting from earth electrode when needed.
- 11.9.4. Neutral must be isolated from the earth.
- 11.9.5. Extra earth electrodes will be installed if earth resistance is greater than 10 ohms. Contractor will be paid for this extra work, however, contractor should have CEM permission beforehand.
- 11.9.6. Special care must be taken for installing earth electrodes to avoid damage the underground installation.

### **11.10 Foundations and Installation of High Mast Lamp Poles**

#### **11.10.1 Excavation**

The sides of excavation shall be vertical unless otherwise permitted by the Inspection. Temporary supports or other methods shall be used to maintain excavations in a stable condition and to prevent settlement of structures or utilities due to excavation or dewatering.

A layer of hardcore shall be laid under footings. The hardcore is to be composed of clean, dry, broken brick, stone or concrete, broken to 50mm-70mm gauge, leveled, well rammed and consolidated to the thickness showing on the drawing.

The upper surface is to be blinded with 25mm layer of sand watered as necessary and tamped into interstices of the hardcore to provide a fair and partly impervious surface. Hardcore beds are to be rolled until fully compacted and dense close-knit surface obtained.

Lay over hardcore beds 0.08mm thick polythene sheeting lapped 150mm and taped to seal at all joints to prevent leakage of the water content of the concrete. The building paper shall be turned up at edges of footing and sealed around any through pipes or other fixtures.

A building layer of concrete, 100mm thick with a crushing strength of 12 Mpa at 28 days (or of a nominal 1:3:6 mix) shall be laid to provide a firm and reasonably level surface on which to place the reinforcement.

#### **11.10.2 Concrete work**

Formwork shall be designed by the Contractor to support the weight or pressure of the wet concrete with due allowance for equipment, impact and vibration.

Formwork shall be left in place until it can be removed without injury to the concrete.

Reinforcement for concrete shall be high tensile steel bars as shown on the detailed drawings free from loose mill scale, loose rust, oil, grease or other matter.

High tensile steel reinforcement shall be hot rolled deformed bars with a minimum yield or 0.2% proof stress of 410 Mpa and an ultimate strength of not less than 490 Mpa.

The concrete to be used shall be Grade 30/20 with minimum cement content 390 kg/m<sup>3</sup> and water ratio (w/c) ≤ 0.45.

Concrete shall be placed in such a manner that the formwork, reinforcement or built-in components are not displaced.

Unless otherwise permitted by the Inspection, concrete other than concrete placed by tremie shall be placed in horizontal layers to a compacted depth of not more than 450mm if internal vibrators are used and to a compacted of not more than 150 mm in other cases.

Concrete shall be compacted to form a dense and homogeneous mass.

Unless otherwise permitted by the Inspection, concrete shall be compacted by means of internal vibrators of suitable diameter. Vibrators shall be used in such a manner that vibration is applied continuously and systematically during placing of the concrete until the expulsion of air has practically ceased; vibrators shall not be used in a manner, which will result in segregation. Internal vibrators shall be inserted to the full depth of the concrete placed and shall be withdrawn slowly.

Curing concrete

During its initial hardening period of not less than 7 days, the concrete shall be protected from the harmful effects of sun, wind, rain or running water and from mechanical injury. All exposed surfaces shall be kept continuously damp during this period.

At least three 150 mm test cubes shall be made from each batch of concrete. Those test cubes shall be tested to determine the compressive strength at 28 days.

#### 11.10.3 Installation of High Mast Lamp Poles

The installation of High Mast Lamp Poles (polygonal mast), 20 meters high, 1358 kgs weight, shall comprise assembly of the galvanized steel column shafts, head frame, winching system and electrical equipment, erection of lamp pole on the foundation and all associated works for completion.

Before concreting, anchor bolts (M24) shall be installed on the top of the concrete column.

Six numbers of lanterns of 400 Watt 240 volt high-pressure sodium lamp each shall be installed on the head frame.

The detail information of the High Mast Lamp Poles is available at CEM office for inspection.

### 11.11 Ditch Opening

11.11.1 Ditches will be open with dimensions at least equal to those indicated in drawings.

11.11.2 If dimension is not mentioned in project, ditches will be 1.2 m depth. In the case of metallic poles without bracket, a depth of 1.0 m will be sufficient.

11.11.3 If ground is made up of compact and solid rock, reduced foundations can be accepted only under the Inspection authorization.

11.11.4 Ditch opening must follow trench-opening requirement.

11.11.5 Temporary supports or other methods shall be used to maintain excavations in a stable condition and to prevent settlement of structure or utilities due to excavation and dewatering.

11.11.6 Ditch bottom must be maintained as natural ground, perfectly horizontal and correctly leveled.

11.11.7 Contractor must put effort to leave ditch open as shorter time as possible.

11.11.8 Contractor must immediately inform CEM if there is any unexpected situation.

### **11.12 Ditch Backfilling**

- 11.12.1 After having done the foundation bases of the poles, the earth electrodes are then placed in position. All poles, which are indicated in the drawing for this purpose, must be equipped with earth electrodes. Provide the coordinates of the lighting poles (X, Y, Z).
- 11.12.2 Backfilling must be carried out with the same excavated material, free from roots and all vegetable matter well watered and carefully rammed and consolidated in layers not exceeding 200 mm thickness.
- 11.12.3 The Contractor shall dispose of excavated material, which is surplus to the requirements of the backfilling work.
- 11.12.4 Contractor must replace pavement, trenches, railings, barriers, etc., damaged by the construction works.
- 11.12.5 Before ditch filling, contractor must inform the Inspection if there is any canalization in the vicinity so that CEM can make drawings showing their location.

### **11.13 Tolerance of Losses in Handling**

#### **11.13.1 Cables**

Except under special conditions, the losses of cable accepted by CEM must not surpass 1% of the total length of cables delivered. Within these losses are included the length of cables lost and the unusable parts. Length of cables less than 3 meters are considered scrap.

Above this tolerance, the losses will be the full responsibility of the Contractor, who will be invoiced at the price of the cable as new.

Contractor is required to seal cable ends with measured length confirmed by Inspection when delivering the cables to CEM warehouse.

#### **11.13.2 Equipment's and accessories for LV overhead and public lighting network**

- 11.13.2.1 Loss for accessories must be within 2%.
- 11.13.2.2 Material including protection & column boxes, suspension & tension clamps, lanterns, and light bulbs must be returned in exact quantities.

### **11.14 Partial Pavement of Macau Grand Prix Racetrack**

#### **11.14.1 Specification**

This technical specification comprises the necessary works for the execution of "Improvement Works for Partial Pavement of Macau Grand Prix Racetrack (2007)".

#### **11.14.2 Approval, Acceptance and Testing**

The approval and acceptance of the construction materials and all its elements shall be based on the compliance with the characteristics specified in the Specifications or in the Contract.

All tests mentioned in the Technical Specification or specified in standards, norms, regulation or legislation currently in effect are considered compulsory and the contractor's responsibility, except for those specifically mentioned. An official laboratory or other competent and approved by the Employer shall perform the tests.

#### **11.14.3 Materials**

##### **11.14.3.1 Bitumen**

Bitumen for bituminous concrete and bituminous mixtures shall comply with ASTM (American Society for Testing and Materials) D946, grade 60-70.

#### 11.14.3.2 Tack Coat

Tack coat shall comply with BS 434: Part I, bitumen emulsion Class A1-40 or Class K1-40.

#### 11.14.3.3 Filler for Bituminous Materials

Filler to be used shall comply with the following:

- a) Be crushed rock filler and Portland cement.
- b) Be dry, free of silt and other deleterious substances.
- c) Comply with the following grading values
  - Percentage of particles passing 0.425mm ASTM Sieve..... 100
  - Percentage of particles passing 0.180mm ASTM Sieve..... > 95
  - Percentage of particles passing 0.075mm ASTM Sieve..... > 65

#### 11.14.3.4 Mixture of Aggregate for Bituminous Concrete (Wearing Course)

Aggregate shall be homogeneous, clean, durable, minimally altered by climatic agents, with acceptable adhesiveness to the binding agent, of uniform quality and free of decomposed materials, organic materials or other deleterious substances.

The homogeneous characteristics of the aggregate components of the bituminous mixtures shall be considered as a basic condition for continuous application on the works.

Aggregate for wearing course shall comply with the following characteristics:

Particle size distribution of aggregate, type 0/13 mm, shall comply with the following values:

1	Percentage by mass passing
19.0mm (3/4")	100
12.5mm (1/2")	80 – 95
9.5mm (3/8")	70 – 90
4.75mm (no. 4)	50 – 70
2.00mm (no. 10)	32 – 46
0.425mm (no. 40)	16 – 27
0.180mm (no. 80)	9 – 18
0.075mm (no. 200)	6 - 10

Maximum percentage of "Los-Angeles" Abrasion Test (Grading B) ..... 30

Flakiness Index ..... ≤ 25%

Water Absorption..... ≤ 2%

The results of "Marshall Test" for the bituminous materials shall comply with the following values:

Number of blows on each face..... 75

Stability ..... > 1200 Kg

Bitumen Saturation ..... 72 – 82 %

Void Ratio..... 4 – 6 %

Flow ..... < 3.5 mm

Allowable tolerance for constituents of bituminous materials

Percentage of particles passing 0.075mm ASTM Sieve ..... 1 %

Percentage of particles passing 0.180mm, 0.425mm and 2.00mm ASTM Sieve ..... 3 %

Percentage of particles passing $\geq 4.75\text{mm}$ ASTM Sieve .....	5 %
Bitumen Content .....	0.2 %

#### 11.14.4 Execution of Works

##### 11.14.4.1 Bituminous Materials

##### 11.14.4.1.1 Preparation of Surfaces

The surfaces on which bituminous materials are to be laid shall be free from rubbish, loose materials and dust. These shall be cleared away from the working area. Prior to the spray of tack coat, dust and loose particles shall be removed by compressed air.

##### 11.14.4.1.2 Tack Coat

The tack coat shall be evenly applied at a rate of between  $0.4 \text{ L/m}^2$  and  $0.6 \text{ L/m}^2$  using application equipment complying with BS 434: Part.

##### 11.14.4.1.3 Fabrication, Transport, and Laying of Bituminous Materials

Bituminous materials produced at an adequate mixing plant shall comply strictly with the following :

- The Contractor shall submit to the Employer the mix design of bituminous materials by means of “Marshall test” for approval. Execution of works shall not be carried out prior to the Employer’s approval.
- Moisture content of bituminous materials shall not exceed 0.5% during mixing or application.
- Bitumen shall be heated up gradually and evenly at a temperature between  $100$  and  $150^\circ\text{C}$ . The suggested temperature is  $130^\circ\text{C}$ .
- Bituminous materials shall be laid under dry weather conditions and with the ambient air temperature above  $15^\circ\text{C}$ . The surface on which bituminous materials are to be applied shall be dry and its temperature shall be above  $10^\circ\text{C}$ . The laying operation shall be processed in a continuous manner.

##### 11.14.4.1.4 Compaction

The compaction and finishing of bituminous materials shall comply with the following points:

- The finished surface shall be even with the correct transverse profile. No depressions, prominences and wrinkles are allowed. The irregularity, measured with a 3 m straightedge, shall not exceed 3 mm.
- Smooth wheel roller shall only be used to even the finished surface.
- Rollers have to pass minimum of 2 times in an area before change of direction.
- The compaction, referred in “Marshall” Test, shall not be less than 95%. When the temperature of the bituminous materials is higher than  $60^\circ\text{C}$ , the bituminous materials shall be compacted with a minimum of 4 passes using a pneumatic-tyre roller. The tyre pressure shall be around  $6 \text{ Kg/cm}^2$ , and shall be adjusted in accordance with the mix being used.
- Under no circumstances, may bitumen solvents or any other substances that any way may affect the basic characteristics, be applied in order to avoid gravel lifting during compaction.

##### 11.14.4.1.5 Jointing

Longitudinal joints and transverse joints shall be made in such a way as to ensure perfect joining with sections previously completed.

The existing bituminous material shall be cut for the full depth of the layer forming a vertical face. All loosened materials shall be removed and the face shall be coated with bituminous emulsion. The hot



bituminous materials shall then be laid and compacted against the coated face. The surfaces around manholes, curbs, etc. coming into contact with the bituminous materials shall also be coated with bituminous emulsion.

In order to avoid irregularities occurring between existing and new pavement, the bituminous pavement at joints shall be softened by heating and then re-compacted.

#### 11.14.4.1.6 Mix Design

The Contractor shall submit to the Employer the mix design of bituminous materials by means of “Marshall test” for approval.

Execution of works shall not be carried out prior to the Employer’s approval.

The submitted mix design, for at least 5 different bitumen percentages, shall include the following test results:

- a) Percentage of “Los Angeles” Abrasion Test for grading B aggregate (for each supplier)
- b) Penetration, softening point, flash point, ductility of bitumen. Test report may be dispensed if a product certificate with 3 months validity is attached.
- c) Material constituent and particle size distribution.
- d) Specific gravity of materials including bitumen.
- e) According to “Marshall Test” method: determination of sieve analysis curve of aggregate, preparation of specimen, determination of density, calculation of theoretical maximum density, void ratio and saturation of bitumen, determination of stability and flow value, and selection of optimum bitumen content according to the grading curves.

#### 11.14.4.2 Equipment for the Execution of Bituminous Works

In order to execute the works effectively, the Contractor shall supply and maintain in good working order the respective equipment, which shall be submitted to the Employer for approval.

The Contractor shall have at his disposal a fleet of trucks adequately dimensioned in accordance with the distance between the mixing plant and the site.

The Paving machine shall be capable of spreading the materials evenly, not cause segregation and lay the materials according to the alignment, transverse inclination and design thickness. The vibration straightedge of the paving machine shall be capable of providing a minimum compaction of 95%. Whenever possible a thermometer shall be placed in the hopper at a point before the screw auger.

Static roller shall be equipped with appropriate water spray system. Pneumatic-tyre roller shall be equipped with “protection skirt”.

#### 11.14.4.3 Characteristic of Roughness of Wearing Course

According to the test of texture depth (BS 598: Part 105: 1990 Methods of test for the determination of texture depth), the minimum average texture depth shall be 0.6 mm.

#### 11.14.5 Summary of Quality Control Actions

Prior to the works commencing, the Contractor shall submit to the Employer the following information:

- Mix design of bituminous concrete
- Materials
  - Bitumen (refer to item 11.14.3.1)
  - Catalogue

- Bituminous emulsion for tack coat (refer to item 11.14.3.2)
  - o Catalogue
- Filler (refer to item 11.14.3.3)
  - o Grading and sieve analysis
- Aggregate (refer to item 11.14.3.4)
  - o Sieve analysis
  - o Maximum percentage of “Los Angeles” Abrasion Test
  - o Flakiness Index
  - o Water absorption

Aggregates shall be tested prior to use.

After the approval of the submitted information, the Contractor shall prepare the proposed trial mix and obtain samples for the following tests, and verification in conformity with the requisites in item 11.14.3.4.

- Particle size distribution
- Stability and flow values measured by “Marshall Test”
- Bitumen saturation level
- Void ratio

If the trial mix is not in accordance with the requirements a new mix will have to be prepared. If the trial mix is in accordance with the requirement it is in a condition to be approved and applied.

For quality control purposes in the application of the bituminous mix, fresh samples shall be taken, once for every 4,000 m<sup>2</sup> for the following tests, and verification of the requirements of item 11.14.3.4.

- Particle size distribution
- Stability and flow values measured by “Marshall Test”
- Bitumen saturation
- Void ratio

For quality control purposes in the application of the bituminous mix, core samples shall be taken from the pavement for every 4,000 m<sup>2</sup> for the following tests, and verification of the requirements of item 11.14.4.1.4.

- Degree of density of bituminous material
- Thickness of bituminous material

In order to control the execution of the paving works, the following points shall be verified:

- Regularity of the pavement with a 3-meter straightedge complying with the requirement of item 11.14.4.1.4.
- Roughness of the pavement for every 4,000 m<sup>2</sup> complying with the requirement of item 11.14.4.3.

## **11.15 PG100 type high-strength, high-elasticity polymer-modified asphalt (non-resin-based modification)**

### **11.15.1. Specifications/Standards**

AASHTO: American Association of State Highway and Transportation Officials.

ASTM: American Society for Testing and Materials.

JTG: Specifications for Design of Highway Subgrades

### **11.15.2. Approval Procedure**

Definition:

- High modulus asphalt surface layer system consists of a high modulus asphalt wearing layer and a high modulus asphalt base layer. A high modulus asphalt intermediate layer may be added depending on the structural system requirements.
- Batch quantity (asphalt mixture) refers to the asphalt mixture of the same layer, same type, or same category.
- Batch quantity (raw materials of asphalt mixture) refers to the raw materials of the asphalt mixture, such as asphalt binder, aggregates, and layer bonding materials, which have the same shape, size, and source, and are used for the same layer, same type, or same category of asphalt mixture.

#### Quality Assurance

Before producing high modulus asphalt wearing layer mixture and carrying out paving construction, the following quality assurance data must be submitted to the authorities:

- Description of the mixing, transportation, and paving methods for the asphalt mixture.
- Asphalt mixture design report (valid for a maximum of 6 months for the same batch).
- Performance test report of asphalt binder (bitumen) (valid for a maximum of 6 months for the same batch).
- Performance test report of aggregates (including coarse aggregates, fine aggregates, and fillers) (valid for a maximum of 6 months for the same batch).
- Performance test report of the bond coat (emulsified asphalt) layer (valid for a maximum of 6 months for the same batch).
- Performance test report of the asphalt mixture (valid for a maximum of 6 months for the same batch).

#### 11.15.3. Acceptance Procedure and Criteria

The high modulus asphalt wearing layer, using high-performance polymer-modified asphalt as the binding material, is a hot mix asphalt mixture. It employs a special skeleton dense-graded design with a high asphalt content. The formed pavement exhibits excellent crack resistance, rutting resistance, and impermeability, ensuring the prevention of early distress such as looseness, potholes, and shoving. However, to ensure the bonding effect between layers, a high-viscosity modified emulsified asphalt is sprayed as a tack coat between the wearing layer and the underlying layer.

##### 1) Asphalt Mixture Design

Before producing high modulus asphalt wearing layer mixture and carrying out paving construction, it is necessary to conduct the asphalt mixture design as a basis for controlling the production and mixing of the asphalt mixture in the plant. The asphalt mixture design process should validate the requirements for different pavement performance of the asphalt mixture. The report for asphalt mixture design should include the following information as specified in the table below.

Item	Unit	Requirement	Testing Method
Void ratio	%	3 - 6	T0705 、ASTM D2726 、ASIM D2172 、ASTM D6307
Void ratio of coarse aggregate skeleton ( $VCA_{mix}$ )	%	$\leq VCA_{DRC}$	T0705 、ASTM C29
Marshall Stability	kN	$\geq 6$	10709 、ASTM D1559

Wheel Track Stability ( 60°C • 0.7MPa)	次/mm	$\geq 6000$	T0719
Loss on Cantabro Abrasion	%	$\leq 8$	T0733
Residual (Soaked) Marshall Stability	%	$\geq 85$	T0709 、 ASTM D1559
Residual strength ratio in freeze-thaw splitting test	%	$\geq 80$	T0729
Permeability coefficient	ml/min	$\leq 120$	T0730
Note: Each type or category of asphalt mixture should undergo these tests before formal production and construction.			

## 2) Performance Testing of Asphalt Binder (Bitumen)

The asphalt binder (bitumen) used in the high modulus asphalt wearing layer is a high-viscosity, high-elasticity polymer-modified asphalt (non-resin modified). The acceptance criteria and qualified standards for the asphalt binder (bitumen) are as follows, as shown in the table below.

Item	Unit	Requirement	Testing Method
Penetration ( 25°C, 5s, 100g)	0.1mm	30-60	T0604 、 ASTM D5
Softening point TR&B	°C	$\geq 95$	T0606 、 ASTM D36
Flash point	°C	$\geq 230$	T0611 、 ASTM D92
Solubility (trichloroethylene)	%	$\geq 99$	T0607 、 ASTM D2042
Elastic recovery ( 25°C)	%	$\geq 98$	T0662 、 ASTM D6084
60°C Complex shear modulus G*	kPa	$\geq 12$	T0628~ASTM D7175 、 AASHTO T315
60°C Dynamic viscosity	Pa·s	>580000	T0620 、 ASTM D2171
TFOT(Or RTFOT) Residue			
Quality loss	%	$\pm 1.0$	T0610 ( Or T0609) 、 ASIM D1754 、 ASTM D6 ( Or ASTM D2872)
Penetration Index ( 25°C)	%	$\geq 70$	T0604 、 ASTM D5
G*/sin $\delta \geq 2.2$ kPa Critical temperature	°C	$\geq 100$	T0628 、 ASTM D7175 、 AASHTO T315
Note: The sampling frequency is per batch, and relevant supporting documents shall be submitted, including origin, batch number, certificate of quality, etc.			

## 3) Aggregate Performance Testing (Including Coarse Aggregate, Fine Aggregate, Fillers)

- Coarse Aggregate

The coarse aggregate requirements include high-quality basalt and diabase hard stones that are processed and shaped using impact crushing methods, with excellent wear resistance and adhesive properties. The acceptance criteria for coarse aggregate are shown in the table below.

Item	Unit	Requirement	Testing Method
Polished Stone Value	BPN	$\geq 42$	T0321
Los Angeles Abrasion Loss	%	$\leq 20$	T0317 、ASTM C131 、ASTM C535
Aggregate Crushing Value	%	$\leq 18$	T0316
Apparent Relative Density	-	$\geq 2.6$	T0304 、ASTM C127
Water Absorption	%	$\leq 1.0$	
Flakiness and Elongation Index 3:1	%	$\leq 8$	T0312
Adhesion with Bitumen		$\geq 5$	T0616
Soundness	%	$\leq 8$	T0314
Fine Particles Passing No. 200 Sieve	%	$\leq 1$	T0310
Soft Stone Content	%	$\leq 1$	T0320
Particle Size Analysis	-		ASTM C136
Note: The sampling frequency is per batch, and relevant supporting documents shall be submitted, including origin, batch number, certificate of quality, etc.			

▪ Fine Aggregate

Fine aggregate is required to be manufactured sand, which must be 100% crushed and clean without impurities, meeting the 0-3mm specification. Fine aggregate must be made from neutral or alkaline manufactured sand. The acceptance criteria for fine aggregate are shown in the table below.

Item	Unit	Requirement	Testing Method
Sand Equivalent	%	$\geq 65$	T0334
Soundness of Coarse Aggregate ( for larger than 3mm )	%	$\leq 12$	T0340
Apparent Relative Density	-	$\geq 2.5$	T0349 、ASTM C128
Particle Size Analysis	-	-	T0327 、ASTM C136
Note: The sampling frequency is per batch, and relevant supporting documents shall be submitted, including origin, batch number, certificate of quality, etc.			

▪ Fillers

Fillers are preferably made from hydrophobic alkaline rocks such as limestone or igneous rocks ground into mineral powder. Fillers should be dry, clean, and able to flow freely from the filler bin. Effective moisture prevention measures should be taken to avoid clumping. The acceptance criteria for fillers are shown in the table below.

Item		Unit	Requirement	Testing Method
Apparent Density		t/m <sup>3</sup>	≥ 2.50	T0352 、ASTM C128
Moisture Content		%	≤ 1.0	10103 、ASTM D2216
Particle Size Distribution	<0.6mm	%	100	T0351 、ASTM C136
	<0.15mm		90-100	
	<0.075 mm		75-100	
Appearance		-	No agglomeration, no clumping	-
Hydrophilic Coefficient		-	≤ 1.0	T0353
Plasticity Index		%	≤ 4.0	T0354 、ASTM D4318
Note: The sampling frequency is per batch, and relevant supporting documents shall be submitted, including origin, batch number, certificate of quality, etc.				

#### 4) Binder (Emulsified Asphalt) Performance Testing

For the high modulus asphalt wear layer, the sprayed binder should be a non-sticky SBS (Styrene-Butadiene-Styrene) polymer-modified high-viscosity emulsified asphalt (not SBR modified). The application rate can be carried out at 0.8-1.0 kg/m<sup>2</sup> and should be thoroughly broken. The acceptance criteria for the emulsified asphalt are shown in the table below.

Item		Unit	Requirement	Testing Method
Residue on sieve (1.18mm sieve)		%	≤ 0.1	T0652
Particle charge		-	Cation (+)	T0653
Viscosity (Asphalt standard viscosity meter C25,3)		s	12-60	T0621
Evaporative residue	Residue content	%	≥ 55	T0651
	Penetration (25℃)	0.1mm	40-60	T0604 、ASTM D5
	Softening point	℃	≥ 80	T0606 、ASTM D36
	Ductility (5℃)	cm	≥ 20	T0605 、ASTM D113
	Solubility	%	≥ 97.5	T0607 、ASTM D2042
	Elastic recovery (25℃)	%	≥ 92	T0662 、ASTM D6084
Note: The sampling frequency is per batch, and relevant supporting documents shall be submitted, including origin, batch number, certificate of quality, etc.				

#### 5) Asphalt Mixture Performance Testing

- Production and construction temperature of asphalt mixture

During the production of high-modulus asphalt wearing course, the heating temperature of high-viscosity, high-elastic polymer-modified asphalt (non-resin modified) and aggregates, as well as the production and construction temperature of the asphalt mixture, can be referred to in the table below.

Asphalt Heating Temperature	180-190°C
Aggregate Temperature	190-220°C
Mixture Factory Exit Temperature	170-210°C , discarded if it exceeds 220°C
Temperature upon arrival at the site	Not lower than 170°C
Paving Temperature	Not lower than 160°C , considered as waste if below 140°C
Rolling Temperature	Not lower than 110°C
Curing and Opening to Traffic	After completing the rolling operation, when the pavement temperature is below 50°C .

▪ Asphalt Mixture Quality during Production and Construction

During the paving of high-modulus asphalt wearing course, on-site sampling and testing of the asphalt mixture are required. The acceptance items and criteria for the asphalt mixture can be found in the table below.

Item		Unit	Requirement	Testing Method
Marshall	Density	g/cm <sup>3</sup>	-	-
	Void Ratio (VV)	%	3-6	-
	Aggregate Void Content (VMA)	%	-	80%
	Voids Filled with Asphalt (VFA)	%	-	-
	Stability	kN	≥ 6	80%
	Flow Value	mm		-
	Bitumen Content (for asphalt mixture)	%	Deviation from Design -0.2, +0.2	95% 95%

	Aggregate Analysis	%	Refer to the aggregate gradation range for high-modulus asphalt wearing course mixture and aggregate gradation range for aggregate mix.	- 80% - - 80% -
Residual (Soaked) Marshall	Density	g/cm <sup>3</sup>		
	Void Ratio (VV)	%	3 — 6	
	Aggregate Void	%		
	Voids Filled with	%		
	Residual Marshall Stability	%	≥ 85	
	Flow Value	mm		
Rutting Dynamic Stability (60°C, 0.7MPa)		cycles/mm	≥ 6000	80%
<p>Note:</p> <ol style="list-style-type: none"> <li>1. The sampling frequency for Marshall testing is per batch, with one test conducted in the morning and one in the afternoon for each mixing plant (machine) daily. Relevant production and factory certification documents should be submitted.</li> <li>2. The sampling frequency for Residual (Soaked) Marshall testing and Rutting Dynamic Stability is per batch, with one test conducted for each mixing plant (machine) daily. Relevant production and factory certification documents should be submitted.</li> <li>3. For each batch of asphalt mixture, when the number of sampled tests is ≤ 10, the acceptance criteria shall be based on the average value of the test results.</li> <li>4. For each batch of asphalt mixture, when the number of sampled tests is &gt; 10, the acceptance criteria shall be based on (3) and the acceptance rate.</li> </ol>				

- Aggregate gradation range for high-modulus asphalt wearing course mixture.

Asphalt mixture	Weight percentage (%) passing through square sieve (mm)									
	16.0	13.2	9.5	4.75	2.36	1.18	0.6	0.3	0.15	0.075



Upper limit of gradation	100	100	75	45	32	22	18	16	12	8
Lower limit of gradation	100	90	50	22	15	13	11	8	6	4
meet the design requirements										
Deviation from the design standard gradation (%)	±6				±5					±2

▪ Quality of Asphalt Mixture after Paving

After the completion of asphalt pavement paving, the appearance should be uniform, without segregation, and without any visible scratches. There should be no oil bleeding, looseness, or whitish material. The acceptance items and criteria after paving completion can be found in the table below.

Item		Frequency	Qualification Criterion <sup>(1)</sup>	Qualification Criterion <sup>(2)</sup>	Test Method
Thickn ess	Represe ntative Value	Every 2000m <sup>2</sup> - 1 point	-10% of the design value	95%	T0912 、  ASTM D3549
	Extreme Value		-20% of the design value	95%	
In-situ Density and Compa ction	Represe ntative Value	Every 2000m <sup>2</sup> - 1 point	96% of the laboratory standard density	95%	T0924 、 ASTM D2041 、 ASTM D2726
	Extreme Value		92% of the maximum theoretical density	95%	
Smoothness		Every 1km - 10 locations  Continuously for 10 consecutive 3-meter rulers	≤5mm	80%	T0931
Friction Coefficient (Skid Resistance Value)		Every 1km - 5 measurement points	≥55 BPN	80%	T0965 、 ASTM E303

Structural Texture	Every 1km - 5 measurement points	$\geq 0.6\text{mm}$	80%	T0961
Permeability Coefficient	Every 1km - 5 measurement points	$\leq 120\text{ml/min}$	80%	T0971

Note:

(1) For high-modulus asphalt wearing course, when the number of sampled tests is also 10, the acceptance criteria shall be based on the average value of the test results.

(2) For high-modulus asphalt wearing course, when the number of sampled tests is  $> 10$ , the acceptance criteria shall be based on (1) and the acceptance rate.

#### 11.15.4. Construction Safety and Health Requirements

##### 1) Asphalt Mixture Mixing

- i) The heating temperature of high-quality modified asphalt and aggregates, as well as the temperature of the asphalt mixture at the factory, should be strictly controlled. The construction temperature range for asphalt mixture can be found in the table below.

Asphalt heating temperature	180°C~190°C
Aggregate temperature	190°C~220°C
Asphalt mixture factory temperature	170°C to 210°C, exceeding 220°C is considered waste
Temperature upon arrival at the site	Not lower than 170°C
Paving temperature	Not lower than 160°C, below 140°C considered as waste material
Compaction temperature	Not lower than 110°C

Note:

- All temperature gauges used for testing should be semiconductor digital thermometers and should be sent for calibration to the local metrology department in a timely manner, or calibrated with standard thermometers under supervision.
  - All temperature measurements should be carried out using the correct method to avoid inaccurate readings due to improper positioning of the thermometer probe.
  - Compaction temperature refers to the internal temperature of the compacted layer.
- ii) The control room of the mixing plant should print the quantities of modified asphalt and various aggregates, as well as the mixing temperature for each batch. Regular calibration should be performed for weighing and temperature measurement in the mixing plant. The total mixing amount should be checked daily for material proportions and errors in asphalt mixture.

- iii) The mixing time and feeding sequence of asphalt mixture should be determined through trial mixing. The mixing time and feeding sequence for asphalt mixture should be selected according to the table below, ensuring that all aggregate particles are fully coated with asphalt binder and that the asphalt mixture is uniformly mixed.

Adding aggregates	Dry mixing for approximately 10 seconds	Adding asphalt	Wet mixing for approximately 45 seconds	Discharging
Adding mineral powder				
Total production time should be no less than 55 seconds				

- iv) Perform visual inspection of the uniformity of the mixture and promptly analyze any abnormal phenomena such as whitening, smoking, segregation, and bleeding. If it is confirmed to be a quality issue, appropriate measures should be taken, including proper waste disposal and timely correction.
- v) Strictly control the asphalt-aggregate ratio and aggregate gradation to prevent issues such as excessive asphalt or loose mixture. Adjust the method of adding mineral powder to avoid insufficient particles smaller than 0.075mm in mineral aggregate mixtures. After each mixing operation, take one set of mixture samples in the morning and afternoon for Marshall testing and sieve analysis to inspect the volumetric parameters of asphalt-aggregate ratio, aggregate gradation, and mixture properties.
- vi) The mixture should not be stored in the storage bin for a long time to prevent asphalt bleeding, and overnight storage is not allowed.
- vii) At the end of each day, perform total quantity reconciliation using the printed quantities of each material from the mixing plant. Conduct online inspection of aggregate gradation based on the usage of each bin and sieve analysis results. Calculate the average construction gradation and asphalt-aggregate ratio, and compare them with the design specifications. Calculate the average thickness based on daily production and compare it with the designed pavement thickness.

## 2) Transportation of Asphalt Mixture

- Use calibrated digital display insertable thermocouples to measure the factory temperature and on-site temperature of the asphalt mixture. The insertion depth should be greater than 150mm. Create dedicated inspection holes on the middle part of the side of the transporting truck, with the hole opening approximately 300mm from the bottom of the truck bed.
- When the mixing plant loads the material onto the transport truck, the truck should move forward and backward, dividing the material into five piles to reduce the segregation of coarse aggregates.
- The transportation capacity of the asphalt mixture truck should exceed the mixing capacity and paving speed. There should be at least three trucks waiting to unload in front of the paver.
- The transport truck should be covered with intact and undamaged double-layer tarpaulin. The tarpaulin should remain covered during the unloading process and should only be removed after the unloading is complete to ensure thermal insulation, rain protection, and to avoid environmental pollution.

- During continuous paving, the transport truck should stop approximately 10-30cm in front of the paver and must not collide with the paver. During the unloading process, the truck should be in neutral gear and pushed forward by the paver.

### 3) Paving of Asphalt Mixture

- It is recommended to use two pavers in tandem or a large-scale stepwise paver for full-width paving to improve the uniformity of the paving layer and reduce the number of construction cold joints. The paving speed of the paver should be adjusted according to the output of the mixing plant, the supporting construction machinery, and the paving thickness. It is advisable to adjust the speed to approximately 3-6m/min, usually not exceeding 10m/min, and allow it to slow down to 1-2m/min, ensuring slow, uniform, and continuous paving. Rapidly paving for a few minutes and then stopping to wait for material is not permissible.
- Construction personnel should not enter or tread on the mechanically laid mixture before compaction. Manual repairs should not be used, except in special circumstances. If necessary, under the guidance of the site supervisor, manual patching or replacement of the mixture may be allowed. In cases where the defects are severe, they should be removed, and adjustments to the paver or improvements to the paving process should be made.
- It is preferable to use non-contact balance beam devices to control the paving thickness. When two pavers are working together, after the front paver passes, the longitudinal joint of the paving layer should form a slope, and the rear paver should overlap the joint by 5-10cm. The distance between the two pavers should not exceed 10m.
- The paver should be adjusted to its optimal working condition. The automatic material level sensors at both ends of the auger should be properly calibrated, and the gate opening, chain plate feeder speed, and auger rotation speed should be matched. The material quantity in the auger should be higher than the center of the auger, ensuring the uniform distribution of the mixture in front of the screed plate across the full width. The material quantity should be adjusted before starting each day's paving to avoid the occurrence of segregation in the paving layer. The uniformity of coarse and fine aggregates should be analyzed and adjusted at any time, and the loose pavement thickness should be checked for compliance with specifications. The screed plate should be preheated to the specified temperature (not lower than 10°C) before paving, and a medium-strong show grade should be used for the screed plate during paving, ensuring that the initial compaction of the pavement is not less than 90%. The screed plate of the paver must be tightly joined without any gaps to prevent aggregates from getting stuck and causing streaks on the pavement.
- Pay attention to the operation procedure of the paver's material hopper to minimize the segregation of coarse and fine aggregates. The paver's hopper should start unloading the next truck of hot mix when the scraper is still covered, and there is approximately 10cm of hot mix remaining, achieving continuous material supply and avoiding the concentration of coarse aggregates. Take appropriate measures to ensure that the paver does not run out of materials, reducing surface segregation.
- Paving should not be carried out when the road surface temperature is below 5°C. In the event of rain during paving, construction should be immediately stopped, and any uncompacted mixture should be removed. Mixtures that have been rained on should be discarded and should not be unloaded and paved by the paver.

#### 4) Compaction of Asphalt Mixture

- Sufficient rollers should be prepared during the construction process. For the compaction of the PG 100 type high-modulus, high-elasticity polymer-modified asphalt (non-resin modified) wearing course, double steel drum rollers should be mainly used. The initial compaction should be done with static compaction by double steel drum rollers, with a recommended speed of 2-3 km/h. The intermediate compaction should be done with vibratory compaction by double steel drum rollers, with a recommended speed of 3-5 km/h and 3-5 passes. The final compaction should be carried out immediately after the intermediate compaction, with static compaction by double steel drum rollers for at least 2 passes until no obvious wheel tracks are visible.
- The compaction should follow the principle of close and slow compaction. The mixture should be compacted as soon as possible after spreading, preferably at a high temperature, and should not be repeatedly compacted at low temperatures to prevent the abrasion of aggregate edges, crushing of aggregates, and disruption of aggregate interlock. The length of each compaction section should be controlled within 20m-30m.
- When using double steel drum rollers, the roller tracks should overlap 1/3 to 1/4 of the compaction width. It is prohibited to spray oil or oil-water mixtures on the roller surface. The water spraying system should not be in constant operation. If needed, clean water or water solution containing release agent can be sprayed in a mist-like manner, without causing the roller to stick. The use of diesel and oil-water mixtures for spraying is prohibited.
- The roller should be operated at a uniform speed. The loose pavement thickness, compaction sequence, number of passes, compaction speed, and compaction temperature should be checked by dedicated personnel. If phenomena such as crushed stones or significant abrasion of aggregate edges are observed during compaction, the compaction should be immediately stopped, and the causes should be analyzed.

#### 5) Treatment of Construction Joints

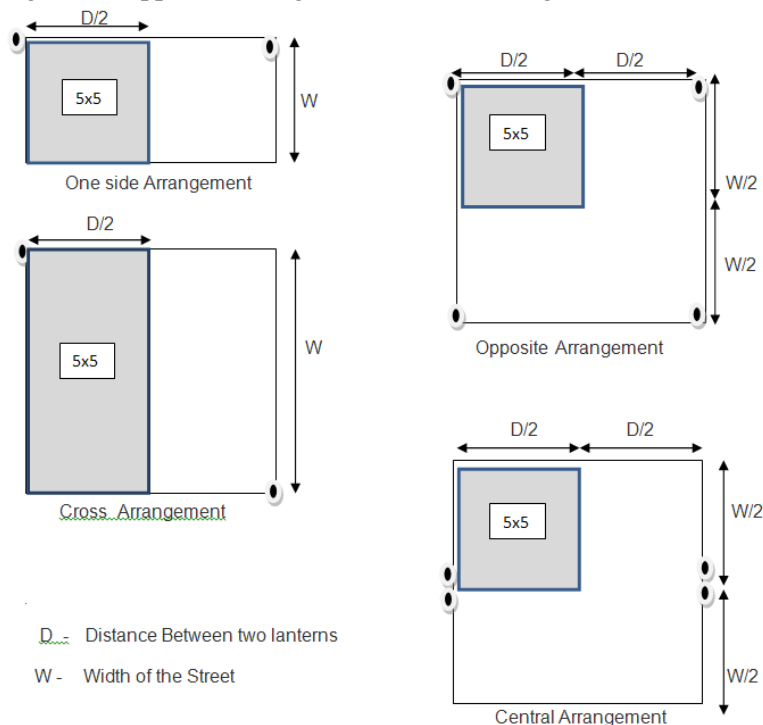
- Longitudinal Construction Joints: For longitudinal joints formed by two pavers working in tandem, a 10-20cm wide section of the mixture should be left unrolled as a reference surface for the subsequent elevation, with an overlap of approximately 5-10cm of the paving layer. The joint should be sealed using a hot joint and compacted to eliminate visible joints.
- Transverse Construction Joints: All joints should be butt joints. Using a three-meter ruler along the longitudinal position, the joint position should be marked where the ruler is suspended at the end of the paving section and is not in contact with the pavement. A joint saw should be used to cut the joint, and the excess material should be removed. When continuing the paving, the mortar left from the joint sawing should be cleaned, and the paver screed plate should start paving from after the joint. During compaction, a steel drum roller should gradually move from the previously paved surface across the joint towards the new pavement layer.
- Transverse construction joints should be at least 20m away from bridge expansion joints and should not be placed directly over the expansion joint to ensure a smooth surface on both sides of the expansion joint.

6) Maintenance and Opening to Traffic

- The PG 100 type high-modulus, high-elasticity polymer-modified asphalt (non-resin modified) wearing course should only be opened to traffic when the pavement temperature is below 50°C. During the maintenance period, vehicles should not be allowed on the wearing course to prevent tire marks and damage to the surface appearance or integrity of the pavement.

### 11.16 Measuring of Illumination

Measurement of illumination is to be performed for the points in a 5x5 matrix with a Lux Meter between two consecutive light poles, according to the arrangement of the lanterns (one side arrangement, cross arrangement, opposite arrangement, central arrangement) as detailed below.



Each module is a matrix with 5x5 points. The quantity of modules to be measured will be included in the Purchase Order.

The units of the illumination to be measured are Candela (cd) on the road and Lux on the sidewalks and junctions.

The implementation of measurement, including setting out of the measuring points and the recording of the reading from Lux Meter, shall be performed in an effective and accurate way arranged by the Contractor themselves.

### 11.17 Macau SAR license Application for Power Facility Interfaced with Natural Gas Pipelines

For constructions that related to installing CEM facility which will interfaced with existing natural gas pipelines, contractor is responsible to the following but not limited to:

- 11.17.1 Review the geological conditions within the proposed construction sections based upon the existing ground investigation data;
- 11.17.2 Review the as-built records of the surrounding structures/buildings, infrastructures and underground utilities in the vicinity of the proposed construction sections;

- 11.17.3 Understand the requirements from CEM on the planning, design, construction, operation and maintenance of the captioned power facility;
- 11.17.4 Identify the major site constraints and requirement, including but not limited to geotechnical, civil, traffic, environmental, health & safety and other related aspects at the proposed locations;
- 11.17.5 With the consideration of cable connection requirement, develop the section(s) and sectional details of installation if necessary;
- 11.17.6 Based on the Macau Administrative Law Number 31/2002 <Technical Regulations relating to Gas Fuel Distribution Network> and Number 2/2012 <Technical Regulations relating to High Pressure Gas Fuel Transmission Cables>, review on the physical clearance between the planned power facility and the existing natural gas pipelines according to technical and statutory requirements and the stipulations regarding the captioned facility installations surrounding the existing natural gas pipelines;
- 11.17.7 Recommend a suitable power facility installation method with supporting technical analysis on the influence to the existing natural gas pipelines in particular;
- 11.17.8 Identify the statutory submission requirement and construction application process for the power facility installation with Macau SAR and other government entities, if applicable;
- 11.17.9 Prepare for presentations and meetings with relevant government departments and the gas concession company to address the statutory and technical issues;
- 11.17.10 Develop a Detailed Excavation Design for the power facilities. The design package will contain sufficient construction drawings, method statement/ specifications and the endorsed responsibility declaration for application and submission to Macau SAR;
- 11.17.11 Perform sufficient analysis and propose the feasibility of relaxation in certain stipulations regarding planning and design of any new power facility installation works
- 11.17.12 Provide statutory endorsement for any work involving construction and site supervision
- 11.17.13 Provide Environmental Impact Assessment
- 11.17.14 Conduct a Qualitative Risk Assessment (QRA) for the design, analyze the risk and assess their impacts on the implementation of the Project, and propose possible mitigation measures to minimize the associated risks;
- 11.17.15 Prepare the Statutory Submissions to summarize the findings as stated above (included but not limited to)
  - Full Statutory Submissions (including Construction Drawings, Specifications and Statutory Declaration,
  - Technical Note on Qualitative Risk Assessment
  - Final Statutory Submissions
- 11.17.16 Follow-up the comments from government bodies and relevant stakeholders, and refine the submissions if necessary.

## **12 Public Lighting Standard**

All proposed equipment, materials used and all workmanship shall comply with the latest edition of the under mentioned standards or in accordance with such corresponding internationally acceptable standards as CEM may consider to be equal or superior to the standards specified.

IEC 598-1

Luminaries – Part 1: General requirements and tests;

IEC 598-2-3                      Luminaries – Part 2: Particular requirements, Section three – Luminaries  
    for road and street lighting;  
 CIE No. 32B (TC-4.6)      Lighting in situations requiring special treatment;  
 BS5489                              Road Lightings – Part 2: Code of practice for lighting for traffic routes.

**CDIP's Timer Adjustment Time Table**

Schedule for CDIP's timer adjustment

Monthly	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Switch ON	18:00	18:15	18:30	18:45	18:45	19:00	19:00	18:45	18:15	18:00	17:45	17:45
Switch OFF	7:15	7:00	6:45	6:15	6:00	6:00	6:00	6:15	6:30	6:30	6:45	7:00

**This schedule may be changed by CEM at any time.**



### Annex - List of Drawings

Item	Drawing No.	Description
1	F-033	Protection Barrier for Trench Works
2	F-029	Work Messages Signboard
3	F-030	Apology Signboard
4	F-034	Work Information Signboard
5	I-9888	C.D.I.P. One Line Diagram