

CTCN Technical Assistance: Energy Efficient Street Lighting Technologies and Financing Models in Thailand

Study of Regulations Standards and Guidelines of Street Lighting in Thai Municipalities

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Introduction

The purpose of this study is to review national regulations and guidelines, energy performance standards, standards of road design, illumination requirements of different categories of roads, standard and labeling requirements of lamps, lighting fixtures, accessory and control gears, installation standards and operations and maintenance (O&M) guidelines for the street lighting including relevant laws at municipal level. Findings from the review will be used for the Provincial Electricity Authority (PEA) to develop a set of standardized design parameters which energy efficient design and retrofit options can be recommended in a techno-economic study of energy efficient street lighting technologies for decision making in a large-scale implementation in Thailand.

Summary of Key Regulatory Standards and Guidelines for Public and Street Lighting Design in Thailand

Organizations and authorities have been involved in installation, operation and maintenance (O&M) of public and street lighting in Thailand include: 1) Provincial Electricity Authority - PEA; 2) Metropolitan Electricity Authority - MEA; 3) Department of Highway - DOH; 4) Department of Rural Roads - DORR; 5) Expressway Authority of Thailand – EXAT; and 6) Local Administrative Organizations - LAOs)^{1, 2}.

Responsibilities of these organizations and authorities are summarized in table 1

Table 1 : Summary of Areas of Responsibilities of each Organization and Authority for Public and Street Lighting in Thailand

Organizations and/or Authorities	Areas of Responsibilities in Public and Street Lighting
Provincial Electricity Authority (PEA)	<ul style="list-style-type: none"> Provision of subsidy^{3, 4} in electricity charges for public and street lighting owned by LAOs,

¹ Local Government Organizations include: 1) Provincial Administrative Organization (PAO) - 76; 2) Municipality (City, Town and Sub-district) – 2,441; 3) Sub-district Administrative Organization (SAO) – 5,333; 4) Bangkok Metropolitan Administration (BMA) – 1; and 5) City of Pattaya – 1 (as of Dec 1, 2017). Retrieved Jan 5, 2018 from <http://www.dla.go.th/work/abt/>.

² Hyodhyad, K. & Supanaroj, K. (2006). *Energy Saving Project for Street Lighting of Provincial Electricity Authority (PEA)*, The 2nd Joint International Conference on “Sustainable Energy and Environment (SEE 2006)”, 21-23 November 2006, Bangkok, Thailand.

³ ADB (2011). *Mainstreaming Energy Efficiency Measures in Thai Municipalities: Options for Reform of Municipal Quota of Free Electricity*. “Since 1960, the mechanism through which free electricity is provided to the LAOs. In 1987, the quota mechanism was introduced. Under the original formula, the quota of free electricity for LAOs, under PEA’s responsible area for the distribution and sale of electricity, was set at 10% of the electricity consumed by residential customers within its boundaries. In 1996, the monthly quota was revised as 10% of consumption by customers within PEA’s residential and small general business tariff groups, but subject to a maximum of 200 kilowatthours (kWh) per customer per month. The quota continues to be applicable only for public lighting”

	DOH and DORR ⁵ in PEA's responsible areas (in 74 provinces except Bangkok; Nonthaburi; and Samutprakan, that are responsible by MEA
Metropolitan Electricity Authority (MEA)	<ul style="list-style-type: none"> • Installation of public and street lighting per clients' service request • Provision of subsidy in electricity charges for public and street lighting owned LAOs, DOH and DORR in 3 provinces: Bangkok; Nonthaburi and Samutprakan, • Installation of public and street lighting per clients' service request
Department of Highway (DOH) ⁶	<ul style="list-style-type: none"> • Installation and O&M of street lighting on motorways⁷, national highways and concession highways⁸ that is maintained at public expense
Department of Rural Roads (DORR) ^{10 11}	<ul style="list-style-type: none"> • Installation and O&M of street lighting on all rural roads¹² that is maintained at public expense • Development of specifications and standards

⁴ DLA's Letter No. Mor Tor 0890.3/Wor 2271 dated Nov 23, 2009, Subject: Adjustment of Municipal Quota of Free Electricity (Thai). "In 2009, the monthly quota was maintained at 10% of consumption within the residential and small business groups, but the maximum was increased to the first 250 kWh per customer per month". URL: http://www.nw-local.go.th/content/content/6906_1.pdf

⁵ Ministry of Energy (2015). *Thailand Smart Grid Development Master Plan B.E.2558-2579 (2015-2036)*, Intelligent Street Lights, p.77 (Thai). URL: http://www2.eppo.go.th/power/smart_grid%20plan.pdf

⁶ Notification of Ministry of Transport, Subject: Designation of Highway Districts according to the Ministerial Regulation on the Organization of the Department of Highways, Ministry of Transport B.E.2558 (2015) (Thai). URL: http://www.doh.go.th/doh/images/aboutus/area_directory.pdf

⁷ Motorway route map. Retrieved Jan 10, 2018 from <http://www.motorway.go.th/m-map>

⁸ "Concession Highway" means a way on which the State grants a concession to any person for its construction or maintenance by collecting tolls, whether it be at the level of, under, or above, the ground or under, or above, other immovable properties, and shall include a tunnel, bridge, ferryboat, ferry vessel, and ferry bridge provided for the benefit of the concession highway, as described in the Concession Highways Act, B.E.2542 (1999). URL:

<http://www.krisdika.go.th/wps/wcm/connect/2155350043099e8eac9ffc49333d9d74/CONCESSION+HIGHWAYS+ACT%2C+B.E.+2542+%281999%29.pdf?MOD=AJPERES&CACHEID=2155350043099e8eac9ffc49333d9d74>

⁹ Currently, DOH has one concession highway, namely, Utra Phimuk Elevated Tollway ("Don Muang Tollway"), under the Concession Agreement in respect of the Highway No. 31 Viphavadi-Rangsit Road. Total concession length is approximately 21.9 kilometers with the concession period until 11 September 2034. Don Muang Tollway Public Company Limited is the private company which granted concession for construct and operate.

URL: http://www.tollway.co.th/en/about_us/business_overview

¹⁰ Ministerial Regulation on the Organization of the Department of Rural Roads B.E.2558 (2015) (Thai) – URL: http://www.mot.go.th/file_upload/2559/regulations_mot/regulations_drr2558.pdf

¹¹ Reorganization of Ministry, Sub-ministry, and Department Act (Amendment No.6) B.E.2552 (2009). URL:

<http://www.ratchakitcha.soc.go.th/DATA/PDF/2552/A/048/1.PDF>

¹² The list of registered rural roads can be found from: DORR (2015). *Rural Road Network for the Fiscal Year 2015 (Thai)*. URL:

http://maintenance.drr.go.th/sites/maintenance.drr.go.th/files/Binder_New.pdf

	<ul style="list-style-type: none"> for construction and maintenance of rural roads including local highways that are under the responsibility of the local administrative organizations (LAOs) • Capacity building of LOA' staff on roadway work • Supervision and monitoring to meet the standards as specified
Expressway Authority of Thailand (EXAT)	<ul style="list-style-type: none"> • Installation and O&M of street lighting on all expressways¹³ • Payment of electricity charge of street lighting
Local Administrative Organizations (LAOs) i.e. Provincial Administrative Organization ¹⁴ ; Municipality ¹⁵ ; Sub-district Administrative Organization (SAO) ¹⁶ ; Bangkok Metropolitan Administration (BMA) ¹⁷ ; and City of Pattaya ¹⁸	<ul style="list-style-type: none"> • Installation and O&M of public and street lighting in their responsible areas • Payment of electricity charges of public and street lighting in own areas of responsibility

The study of regulation, standards and guidelines for public and street lighting design in Thailand found that the existing legal documents (such as acts and ministerial regulations) related to public and street lighting in Thailand stipulate only duties and responsibilities of the abovementioned organizations and authorities related to provision of roadway and public lighting as public services. There are neither rules/regulations nor national standards for public and street lighting design and O&M. However, TISI which is the national standard body has promulgated various product standards for street lamps and lighting equipment. In addition, several handbooks or guidelines setting out recommended luminance levels of different categories of roads and road design were developed by DLA and DOH. DLA has also developed an O&M guideline for replacement and new installation of public and street lighting.

Standards and guidelines related to public and street lighting products and their designs are shown in *table 2*.

Table 2 : Summary of Key Regulatory Standards and Guidelines for Public and Street Lighting Design in Thailand

Standards/ Guidelines/ Codes	Relevant Aspects on Public and Street Lighting	Issued by
Public Lighting Standard, Under the Standard of Local	<ul style="list-style-type: none"> • Illumination requirements of different categories of road 	Department of Local Administration (DLA) ¹⁹

¹³ List of expressways (Thai). URL:

http://www.exat.co.th/index.php/th_TH/news/article/view/5/149/

¹⁴ Provincial Administrative Organizations Act B.E.2540 (1997), Amendment No.4 B.E.2552 (2009)

¹⁵ Municipalities Act B.E.2496 (1953), Amendment No.13 B.E.2552 (2009)

¹⁶ Sub-district Councils and Sub-district Administrative Organizations Act B.E.2537 (1994)

¹⁷ Bangkok Metropolitan Administration Act, B.E.2528 (1985)

¹⁸ Pattaya City Administrative Organization Act, B.E.2542 (1999)

¹⁹ Department of Local Administration (2018), "Roles and Functions". Retrieved Jan 10, 2018 from <http://www.dla.go.th/en/index.jsp>. "DLA is a governmental agency established under the Ministry of Interior. Its main responsibility to promote and support the work of LAOs through the development and provision of advices on the local development plan, personnel administration, finance, and

Public Services	<ul style="list-style-type: none"> • O&M for replacement and new installation 	
General Specification for Street Lighting (September 2011)	<ul style="list-style-type: none"> • Requirements of materials and equipments • Recommended values for uniformity ratio • Illumination requirements of different categories of road • Street lamp installation 	Department of Highways (DOH)
Standard Drawing for Highway Design and Construction	<ul style="list-style-type: none"> • Street lamp installation 	Department of Highways (DOH)
Standard for Rural Roads	<ul style="list-style-type: none"> • Street lamp installation at road and intersection • Street lamp installation on a concrete, a steel and a high mast poles 	Department of Rural Roads (DORR)
TISI's lighting standards <ul style="list-style-type: none"> • TIS 673-2-2010 (2553) Ballasts for high pressure mercury vapour lamps Part 2: performance requirements • TIS 1955-2008 (2551) Lighting and Similar Equipment-Radio Disturbance Limits (Mandatory) • TIS 344-2549 Lamp holders for tubular fluorescent lamps and starter holders (Mandatory) • TIS 1448-2010 (2553) : Electromagnetic compatibility (EMC) Part 3-2: limits - limits for harmonic current emissions (equipment input ≤ 16 a per phase) : general requirements 	<ul style="list-style-type: none"> • Requirements of materials and equipments • Energy performance standard requirement of lamps • Safety standard 	Thai Industrial Standard Institute (TISI)

Table 3 presents the key performance parameters for public and street lighting design in Thailand including illuminance levels and uniformity ratios for different types of roads and areas as specified in the Public Lighting Standard (2004) and the General Specification for Street Lighting (2011) issued by DLA and DOH respectively.

Table 3 : Summary of Key Performance Parameters Set Out in Standards and Guidelines for Public and Street Lighting Design in Thailand

Road/ Area	Illumination	Uniformity
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administration in order to strengthen the capacity and efficiency of LAOs on provision of public services”.

Classification	DLA	DOH	DLA	DOH
Arterial	15	9.7 (Rural) 13 (Sub-Urban) 21.5 (Urban)	N/A	Emin/Eav \geq 1:2.5 Emin/Emax \geq 1:6
Collector	10	6.5 (Rural) 9.7 (Sub-Urban) 13 (Urban)	N/A	Emin/Eav \geq 1:2.5 Emin/Emax \geq 1:6
Intersection	22	15 (Rural) 21.5 (Sub-Urban) 21.5 (Urban)	N/A	Emin/Eav \geq 1:2.5 Emin/Emax \geq 1:6
Motorway	N/A	10.75 (Rural) 15 (Sub-Urban) 21.5 (Urban)	N/A	Emin/Eav \geq 1:2.5 Emin/Emax \geq 1:6
Local	N/A	2.1 (Rural) 6.5 (Sub-Urban) 9.7 (Urban)	N/A	Emin/Eav \geq 1:2.5 Emin/Emax \geq 1:6
Roundabout without traffic light	15	N/A	N/A	N/A
Public park	10	N/A	N/A	N/A
Market (in the building)	100	N/A	N/A	N/A
Market (outside building)	30	N/A	N/A	N/A
Playground	50	N/A	N/A	N/A
Public car park spaces	15	N/A	N/A	N/A
Community sports ground	50	N/A	N/A	N/A
Bridge	30	N/A	N/A	N/A
Footbridge	15	N/A	N/A	N/A
Pedestrian walkway (footpath)	7	N/A	N/A	N/A
Crosswalk	45	N/A	N/A	N/A
Bus shelter	30	N/A	N/A	N/A
Bus stop (no roof)	7	N/A	N/A	N/A

DLA - Department of Local Administration; DOH - Department of Highways

With regard to energy efficiency requirements for public and street lighting, the Department of Alternative Energy Development and Efficiency (DEDE) has an authority to regulate and set the policy measure on energy efficiency, however no legal measures related to saving energy from the use of energy efficient street lights have been developed or adopted by DEDE.

Regulations, Standards and Guidelines for Public and Street Lighting Design in Thailand

Public Lighting Standard, Under the Standard of Local Public Services

Public and street lighting have become fundamental public services that play important roles in enhancing safety and preventing road accidents and crime. In particular, provision of public services is one of major roles and responsibilities of the Local Administrative Organizations (LAOs) as specified in the Municipalities Act B.E.2496 (1953)²⁰, and the Sub-district Councils and Sub-district Administrative Organizations Act B.E.2537 (1995)²¹. The Public Lighting Standard²² is therefore developed as one part of the Standard of Local Public Services²³, by the Department of Local Administration, under the Ministry of Interior. This standard sets out a guideline for LAOs based on technical and budgetary capabilities to provide public lighting services in sub-district administration and municipal areas. This specifies practical steps involved in survey, design, installation, operation and maintenance, procurement and human resource management. The purposes are to: provide adequate lighting for roads and public spaces; ensure the safety of pedestrians; improve security and reduce crime; and enhance living environment. It includes guidelines for lighting installation at the intersection point, the roundabout, the bridge and the location that is connected to the roadway.

This standard has been compiled with reference to:

- BS 5489: Road lighting
- Public Electricity Standards of PEA and MEA (e.g. installation of light poles)
- Thai Electrical Code 2013 (2556) of the Engineering Institute of Thailand Under H.M. The King's Patronage
- Standards of Department of Highways (e.g. installation of equipment to ensure safety)

²⁰ Municipalities Act B.E.2496 (1953), Amendment No.13 B.E.2552 (2009), Section 51, 53 and 56 (Thai).

URL: <http://web.krisdika.go.th/data/law/law2/%B705/%B705-20-9999-update.pdf>

²¹ Sub-district Councils and Sub-district Administrative Organizations Act B.E.2537 (1994), Section 3 (Thai).

URL: <http://www.khuanpang.go.th/prb.pdf>

²² Public Lighting Standard, Department of Local Administration, Ministry of Interior, 2004 (2547) (Thai).

URL: http://www.dla.go.th/work/e_book/eb1/stan3.htm

²³ Standard of Local Public Services, Department of Local Administration, Ministry of Interior (Thai).

URL: http://www.dla.go.th/work/e_book/eb1/eb1.htm

Key Requirements

Level of Illuminance

Street Lighting

Table 4 : Recommended Luminance Levels for Street Lighting

Road Classification	Average illuminance at the lowest level (lux)
Arterial	15
Collector	10
Intersection	22
Roundabout without traffic light	15

Public Lighting

Table 5 : Recommended Luminance Levels for Public Lighting

Area type	Average illuminance at the lowest level (lux)
Public park	10
Market (in the building)	100
Marketplace (outside building)	30
Playground	50
Public car park spaces	15
Community sports ground	50
Bridge	30
Footbridge	15
Pedestrian walkway (footpath)	7
Crosswalk	45
Bus shelter	30
Bus stop (no roof)	7

Operation and Maintenance for Replacement and New Installation

The Local Administrative Organizations must set up a budget for maintenance and repair of electrical equipment for either existing and new construction or installation approximately 5% of the cost of public electrical installation equipment of the existing project and new project. Necessary spare parts are required for storage to ensure smooth operation and basic maintenance, not more than 3 months.

a) **Cleaning interval** - depends on factors such as the lamp lumen depreciation due to its lifetime, dirt deposition on the optical surfaces of the luminaire and pollution, which can be set up to three levels of maintenance according to the pollution conditions as follows:

- *High pollution* e.g. industrial areas, big cities with heavy traffic, very dusty/ insect and coastal areas (distance from the coast about 3 km) will need maintenance and cleaning the luminaire very often (6 months / time).

- *Medium pollution* e.g. a medium-sized urban community and residential or less dusty areas will require less maintenance and cleaning of the luminaire (9 months / time).

- *Low pollution* e.g. remote areas that are clean air will need very little maintenance (12 months / time)

In addition, it must regularly carry out lamp and damaged equipment replacement in order to ensure the good performance and safety.

b) **Spare parts needed for basic maintenance, not more than 3 months** – The performance of street lamp will be deteriorated due to its lifetime and accidental damage. Spare parts should be kept about 2-5 percent of the total luminaires installed as follows:

- Light bulb should be stored around 5 percent
- Fuse should be stored around 5 percent
- Ballast should be stored around 5 percent
- Starter should be stored around 5 percent
- Capacitor should be stored around 5 percent
- Ignitor should be stored around 5 percent
- Cover should be stored around 5 percent
- Circuit breaker should be stored around 2 percent
- Residual current device should be stored around 2 percent

Equipments for Operation and Maintenance

The Local Administrative Organizations should be provided the following measuring instruments for inspection for design, site acceptance test and maintenance and repair of public lighting:

- Digital Multi meter (DMM)
- Light meter
- Insulation Tester
- Earth Resistance Tester

Arrangement of Operation and Maintenance Personnel

The Local Administrative Organizations should arrange personnel together with measuring instruments for inspection for design, site acceptance test and maintenance and repair of public lighting as described in 0, at least should have one responsible person for each position to regularly monitor and maintain the public electricity system, for example, (1) electrician or electronics technician; (2) knowledgeable construction worker; and (3) surveyor.

Report of Street Light Out

The Local Administrative Organizations should arrange a Call Center, which allows people to report problems with public lighting services 24 hours. It may arrange officers to work overtime hours. There are many ways for people to report this, such as reporting by writing a letter of complaint, telephone, reporting via website, radio communication and the Civil Protection Volunteers etc.

Repair of street lights

- In case it can be done immediately, such as changing the light bulbs broken / cover damaged etc., the Local Administrative Organizations should repair within 24 hours after being notified.

- In case of repair and it is required to coordinate with other relevant agencies such as a light pole damaged by car crash accident, the Local Administrative Organizations should assign an officer to coordinate to repair as well as to communicate with the public about status of repair and timeframe to be completed. It can communicate via news broadcasting towers, community radios or community leaders etc.
- The responsible officer should report the result to the complainant within 5 business days.

General Specification for Street Lighting of the Department of Highways

The General Specification for Street Lighting (September 2011)²⁴ sets forth the requirements for the lighting design related to installing the street lighting equipment and system.

Key Requirements

Materials and Equipments

- Luminaire
 - If LED is selected, its standards shall reference relevant IEC standard
 - Lamps and other equipment shall be compliant with TIS (if applicable).
 - Classification of luminaire lighting distribution is based on the Illuminance Engineering Society of North America (IESNA)

Lighting Design

- Contractors must specify their installation design, following to the American Standard Practice for Roadway Lighting or the British Standard Code or else the Code of Practice by the Engineering Institute of Thailand, otherwise other recognized standards, except there are Special Provision.

Level of Illuminance

Error! Reference source not found. describes the recommendations for horizontal illumination levels for various roadway classifications.

Table 6 : Recommended Average Horizontal Illuminance Values at Ground Level (Lux - Lumen/meter²)

Road Classification	Urban Area	Sub – Urban Area	Rural Area
Motorway	21.5	15.0	10.75
Intersection	21.5	21.5	15.0
Arterial	21.5	13.0	9.7
Collector	13.0	9.7	6.5
Local	9.7	6.5	2.1

²⁴ General Specification for Street Lighting 2011 (2554), Department of Highways (September 2011) (Thai).

URL:

<http://www.doh.go.th:88/dohbangkok/images/download/electricity/002.pdf>

The recommended values for Uniformity Ratio:

- $E_{min}/E_{av} \geq 1:2.5$
- $E_{min}/E_{max} \geq 1:6$

Lighting Pole and Lamp Position Design

A general lighting pole on the highway has a height of 9 or 12 meters, depending on the width of the road surface. **Error! Reference source not found.** shows the approximate distance of the lighting poles at various illuminance levels.

Table 7 : Required Power for Street Light Area

Watt	Pole Height (Metre)	Road Surface Width		Illuminance (Lux)
		2 Lanes	3 Lanes	
100	6	38	-	6.5
250	9	50	-	10
250	9	32	-	21.5
400	12	-	40	21.5

Note: Types of lamp for each wattage are not specified by DOH.

Standard Drawing for Highway Design and Construction of the Department of Highways

The purposes of the Standard Drawing for Highway Design and Construction (Revision 2015) by the Department of Highways²⁵ are to guide or recommend various agencies under the Department of Highways to use for detailed design and construction work. To use this standard, designers must use their own judgment to select, apply or consider in order being consistent with the actual situation in each area. This standard drawings consists of 2 set: 1) general standard drawings for highway construction; and 2) standard drawings for bridge construction and others

²⁵ Standard Drawing for Highway Design and Construction (Revision 2015), Department of Highways (Thai).
URL: <https://yotathai.app.box.com/v/STD-FINAL-THAI>

The Standard Drawings for highway construction consist of 2 parts:

Part 1 - List of Drawings for Road Work includes 8 sections: 1) Typical Cross Section; 2) Geometric & General Design; 3) Traffic Sign, Marking and Safety Devices; 4) Drainage Systems; 5) Stability and Erosion Protection; 6) Highway Environmental and Handicap Walkway; 7) Roadway Lighting; and 8) Road Traffic Signals

Part 2 - List of Drawings for Structural Work includes 4 sections: 1) Bridge Span not more than 20.00 M; 2) Bridge Accessories; 3) Reinforced Concrete Box Culvert; and 4) Retaining Wall

Key Requirements

The standard drawing for Road Work in accordance with Section 7 of the standard specifications for installation of roadway lighting (page 182-194) includes:

- Electrical Connection to MEA's Power Supply
- Electrical Connection to PEA's Power Supply
- Grounding Schematic
- Supply Pillar and Installation
- Lighting Pole Installation for Ground Level Road
- Lighting Pole Installation for Elevated Road
- High Mast Lighting Pole
- Pile Foundation for High Mast Lighting Pole
- Spread Foundation for High Mast Lighting Pole
- Light Installation on Existing MEA or PEA Pole
 - Upsweep pipe bracket details
 - Installation of low voltage power line as specified in MEA or PEA standards
 - Brackets must be hot-dip galvanized
 - Equipment, transportation, storage, assembly and installation, quality testing and other relevant issues must follow DOH's latest release of general specifications and standard requirements for installation of street lighting and other DOH's special requirements (if any).
 - The level of illuminance and light quality values must be designed in accordance with the requirements of DOH. Unless there is a limitation to the position of the concrete pole, this shall be designed at the designer's discretion.
- Soffit Light Installation (e.g. Type 1: Between concrete box girders; Type 2: At concrete box girder; Type 3: Between I/U girders; Type 4: At I/U girders; and Type 5: Under Slab)
- Underground Cable, Conduit and Duct Bank Details

Standard of Department of Rural Roads

The Standard of Department of Rural Roads, April 2013 (2556)²⁶ contains 3 sets: 1) Standard for Road Work; 2) Standard for Bridge; and 3) Maintenance Work. The Standard for Road Work consists of 7 sections related to road design: 1) General; 2) Road Work; 3) Traffic Sign; 4) Drainage Systems; 5) Stability and Erosion Protection; 6) Electrical Work; and 7) Road Landscape.

The Section 6 of *Electrical Work* contains 3 sub-sections in relation to lighting design: 1) Flashing Light; 2) Traffic Signals; and 3) Lighting.

The sub-section of *Lighting* details the following:

- General terms and symbols of electrical lighting
- Lighting circuit model
- Power supply and lighting control system
- Details of electrical lamps
- Installation of a street lamp at road and Intersection
- Details of installation of street light
- Installation of a street lamp on a concrete pole
- Installation of a street lamp on a steel pole
- Underground electrical wiring and hand hole
- Pedestrian lighting
- Installation of a street lamp on a high mast pole 1/2
- Installation of a street lamp on a high mast pole 2/2

Key Requirements

Details of installation of street light shall comply with the following standards:

1. Operation and installation of electrical equipment, *Provincial Electricity Authority*
2. Electrical wiring and installation, *Metropolitan Electricity Authority*
3. Thai Electrical Code 2013 (2556), *Engineering Institute of Thailand Under H.M. The King's Patronage*²⁷

²⁶ Standard of Department of Rural Roads, April 2013 (2556) (Thai).

URL:

<http://www.drr.go.th/sites/default/files/aebbmaatthaanngaanthaangaekaikhkhrangthiii-16-05-2556.pdf>

²⁷ Thai Electrical Code 2013 (2556), Engineering Institute of Thailand Under H.M. The King's Patronage (Thai).

URL: <http://montri.rmutl.ac.th/assets/ee2556.pdf>

TIS Lighting Standards

The specific criteria for product certification of road and street lighting is reference to TIS 904-1989 (2532)²⁸. Each street lamp type must meet the following performance standards:

Lamp Type	TIS Standard
High Pressure Mercury Vapour Lamp	<ul style="list-style-type: none"> TIS 673-2-2010 (2553)²⁹ Ballasts for high pressure mercury vapour lamps Part 2: performance requirements
High/Low Pressure Sodium Lamp Metal Halide Lamp	<ul style="list-style-type: none"> TIS 1955-2008 (2551) Lighting and Similar Equipment-Radio Disturbance Limits (Mandatory)
Fluorescent	<ul style="list-style-type: none"> TIS 344-2549 Lamp holders for tubular fluorescent lamps and starter holders (Mandatory) TIS 1955-2551³⁰ Lighting and similar equipment: radio disturbance limits (Mandatory)
LED	<ul style="list-style-type: none"> TIS 1448-2010 (2553)³¹ : Electromagnetic compatibility (EMC) Part 3-2: limits - limits for harmonic current emissions (equipment input ≤ 16 a per phase) : general requirements TIS 1955-2008 (2551) Lighting and similar equipment: radio disturbance limits (Mandatory)

Street Lighting Requirements for Provincial Electricity Authority (PEA)

Key Requirements

Refer to the criteria set in PEA's Regulations of Purchasing (2013)³² and Hiring (2000)³³, in case of purchasing or hiring of any products that already have been set industrial standards and approved by TISI, it shall specify details or specifications according to those industrial product standards. However, there is no particular standard related to street lights specified in PEA's regulations. Products i.e. luminaire, lamp or driver, as found from PEA's procurement document for street lighting technologies, are reference to TIS or IEC standards

²⁸ TIS 904-1989 (2532) (Thai). URL: https://www.tisi.go.th/data/PR/pdf/2PR904_2532_01.pdf It is reference to IEC 60598-2-3 Edition 3.0:2002 Luminaires - Part 2-3: Particular requirements - Luminaries for road and street lighting

²⁹ TIS 673-2-2010 (2553) (Thai). URL: <http://www.ratchakitcha.soc.go.th/DATA/PDF/2554/E/099/6.PDF>

³⁰ TIS 1955-2008 (2551) (Thai). URL: <http://www.ratchakitcha.soc.go.th/DATA/PDF/2552/E/139/14.PDF>

³¹ TIS 1448-2010 (2553) (Thai). URL: <http://www.ratchakitcha.soc.go.th/DATA/PDF/2555/E/129/13.PDF>

³² PEA (2013). Regulation of Purchasing, Section 1 (Thai).

URL:

<http://www.oic.go.th/FILEWEB/CABINFOCENTER3/DRAWER039/GENERAL/DATA0000/00000376.PDF>

³³ PEA (2000). Regulation of Hiring (Thai).

URL:

<http://www.oic.go.th/FILEWEB/CABINFOCENTER8/DRAWER049/GENERAL/DATA0000/00000059.PDF>

and must pass safety standard such as IEC 60598-2-3 (Luminaires for road and street lighting). Light level or illuminance shall be in line with the standards of DOH and DORR for road user safety.

Street Lighting Requirements for Metropolitan Electricity Authority (MEA)

Key Requirements

There is no any specific requirement of lighting design for public and street lighting found in MEA's regulations from the study. Based on MEA's procurement document for recent installation of LED street lighting technologies, products are reference to TIS 1955, IEC standards, C78-377-2008³⁴, LM-79-08³⁵ and LM-80-08³⁶.

Street Lighting Requirements for Expressway Authority of Thailand (EXAT)

Key Requirements

There is no any specific requirement of lighting design for street lighting found in EXAT's regulations from the study. Based on EXAT's procurement document³⁷, requirements of installation of LED lighting technologies are reference to TIS-1955-2551, IES-LM79, IEC 61547³⁸, IEC 61000-3-2³⁹ or IEC 61000-3-3⁴⁰.

³⁴ C78-377-2008: American National Standard for the Chromaticity of Solid State (or Latest) Lighting Products

³⁵ IESNA LM-79: Approved Method for the Electrical and Photometric Testing of Solid State Lighting Devices: LM-79

³⁶ IESNA LM-80: Approved Method for Measuring Lumen Depreciation of LED Light Sources

³⁷ URL:

<http://www.exat.co.th/upload/default/procument/2017/04/skm554e170420190302017-04-2058f8a1dacf4f9.pdf>

³⁸ IEC 61547 - Equipment for general lighting purposes - EMC immunity requirements

³⁹ IEC 61000-3-2 - Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)

⁴⁰ IEC 61000-3-3 - Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection

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Concerned divisions / project related brief note to be included here



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