COVER OF REPORT

KING POWER PATTAYA COMPLEX

CHONBURI, THAILAND

ASEAN Energy Efficiency and Conservation (EE&C)

Best Practice Competition in Buildings

ASEAN Energy Awards - 2014

CATEGORY: GREEN BUILDING

ENERGY EFFICIENCY - ACTIVE & PASSIVE DESIGN

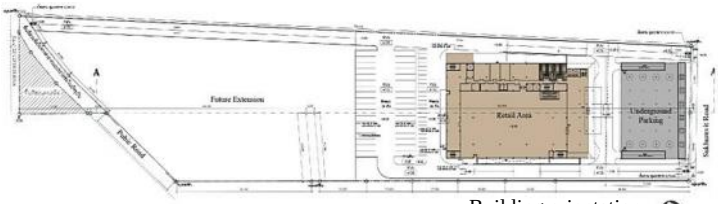
1.0 Passive Design Concepts

Orientation of building, Artist Impression, OTTV, RTTV and façade design

1.1 Building Thermal Transfer Value

- Overall Thermal Transfer Value (OTTV) 38.88 W/sq.m.
- Roof Thermal Transfer Value (RTTV) 5.21 W/sq.m.
- Orientation of building

The buildings is sited back about 50 meters away from the frontage street of Bangkok-Chonburi thoroughfare to allow for a large landscaped open space area which can be used for multi-function celebration events. The rectangular shaped building is located with its narrow elevations and oriented to the east and west to minimize sun exposure.



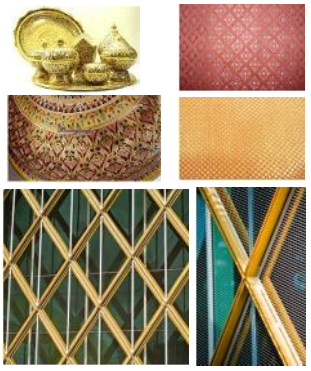
Building orientation


Building form

- Artist Impression

The building is characterized by a feature walled entrance, which embraces a structural diagonal weave pattern inspired by patterns found in Thailand's basketry, handicrafts and architectural motifs.

The gold woven pattern steel frame structure with stainless steel mesh infill acts as a sunscreen to reduce glare and increase shading coefficient for the curtain wall entry. The large canopy at the building entry and roof overhangs around the perimeter increase shading and weather protection for the building.

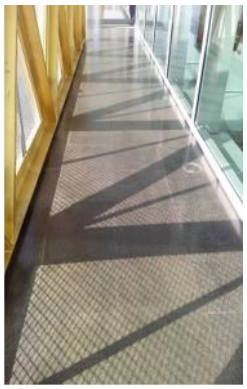

Conceptual design

1.2 Window to Wall Ratio 33%

1.3 U and SC value of windows and sunshades for east and west elevations

- East Elevation ; U value opaque walls = 1.912, 0.456, 0.521, 0.487, 1.879 W/m^2.^{o}C , SC Value = 0.73
- West Elevation ; U value opaque walls = 0.484 W/m^2.^{o}C, SC Value = .60


Shading Calculation



1.4 Overall heat transfer through building envelope
Wall = 38.88 W/sq.m., Roof = 5.21 W/sq.m.

1.5 Daylighting (the use of diffuse radiation in building: hall, atrium, corridor, parking, toilet, etc.)

Luminaire types

- Fluorescent batten type (T5 28W/14W)
- Adjustable down light (LED 23W/21W.)
- Recess down light luminaire fluorescent lamp 1x13W

Lighting load 13.7 W/sq.m. (Usable area)

1.6 Zoning for integrated lighting and daylighting

The use of natural light inside the building including lobby, hallways, restrooms, parking etc. is accomplished by integrating large wrap around curtain wall with sunscreen to the east at the building's main entry. Natural light is also provided along the north elevation for administrative offices area and along the south elevation for the small restaurant area adjacent to the shop area. LED light fixtures are provided throughout the building.

Natural light in building

1.7 Air-conditioned area over Gross Floor Area: 9,240/9,965 = 92.72%

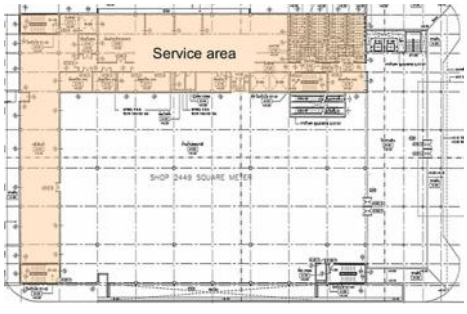
Non Air-conditioned area: 726 sq.m.

1.8 Other passive design concepts, roof gardening.

- Provide dedicated parking areas for bicycle and energy efficient cars.
- Orienting the rectangular shaped building with its narrow elevations oriented to the east and west to minimize sun exposure
- Reduce the exterior glazing usage and incorporate a sunscreen layer to control solar heat gain.
- Use of construction materials that are effective in reducing heat transfer such as Low-E glazing and insulated exterior walls comprising of prefabricated concrete wall, insulation and Aluminum Composite Panels.
- Service core areas are organized around the perimeter of the main air-conditioned space to minimize energy usage. The area occupies ½ of the building perimeter area.

Green area within project

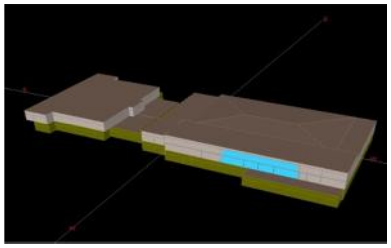
Sun shading device at building entry



Type of plants within project

2.0 Active Design Concepts

2.1 Air-conditioning system



- Energy Efficiency standard is based on ASHRAE/IESNA 90.1-2007 Energy Standard for Building Except Low-Rise Residential Buildings.
- The selection of the Central Chiller Equipment plants have COP better than the recommendation from ASHRAE Standard 90.1-2007 and shall use refrigerants with low ODP & GWP potentials, minimum leakage rate (Lr), efficient refrigerant charge (Rc), Low End-of-life Refrigerant Loss (Mr) and Long Service Life.
- Air conditioning units comprising of chilled water AHUs/FCUs. Large unit will be double skins modular type standard unit and will be located in AHUs room. Small unit will be ceiling mounted. Chilled water will supply to these AHUs/FCUs through the 2 ways auto balancing combination valve.
- Fresh air units (FAU) are provided in both Retail and Office Zone in order to pre -cooled fresh air intake that increase air ventilation in all occupied spaces as required under ASHRAE Standards 62.1-2007 ventilation rate procedures.
- Air Distribution System is designed to provide for 2 systems. The first System is Constant Air Volume where the velocity of the air in ducting system is low. The Second is VAV system, where the volume of air in ducting system is variable. The volume of air shall vary based on the heat load required in each occupied spaces.
- A chiller plant with a capacity of 1,050 TR feeds chilled water into the air-conditioning system. It's consisted of 3 units and designed for a high co-efficient of performance (COP) for CHILLER-1 to 3 (325 TR/Set) 0.628 kW/TR
- Cooling Tower Fan Control use VSD .
- Chilled water pump use VSD

Summary table:

Chiller Plant	Efficiency (kW/TR)
Chiller (A)	204 kW= 0.628 kW/TR
Chilled water pump (B)	15 kW= 0.046 kW/TR
Condenser water pump (C)	22.4 kW=0.068 kW/TR
Cooling tower (D)	11 kW=0.033 kW/TR
System efficiency (A + B + C + D)	0.775 kW/TR

2.2 Cooling load based on air-conditioned area = 296.58 W/sq.m.

2.3 Heat Recovery

- The utilization of energy recovery device which exchange heat between hot fresh air and cooled exhaust air, significantly reduces the cooling load. Reduce power by up to 7% of the total annual energy use in buildings

Can reduce power by up to 7% of the total annual energy use in buildings.

Summary of energy Saving from Heat Recovery Wheel
Project : King Power Pattaya
Brand : Greenheck US

Unit No	QTY	kw	Tons Save	Total Tons Save
AG-ERV-01	1	109	30.99	30.99
AG-ERV-02	1	103.5	29.42	29.42
A1-ERV-01	1	146.6	41.68	41.68
A1-ERV-02	1	111.8	31.78	31.78
Grand Total (tons)				133.87
COP A/C System (0.8kW/ton)				4.396
Power Saving (kW)				107.10
Hour Usage w/demand(hr)				1,592.5
Energy Saving per year (kWh)				170,560.1

Table EAp2-10. Exceptional Calculations

End Use	Exceptional Calculation Method Description	Energy Type(s)	Unit	Annual Energy Savings
Space Cooling	Heat/Energy Recovery System	Electricity	kWh	170,560.1
Electricity			kWh	170,560.1
Natural Gas				0
				0
Total			MMBtu	581.95

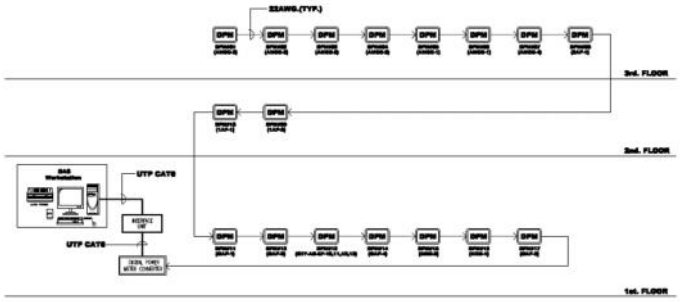
2.4 Lighting systems

- Electronic ballasts are provided for all fluorescent light fittings.
- The illumination power factor will be 0.9 lagging or better. Dimmers switching will be automatic in analog increments from 0%-100% based on the lux level sensors in order to take advantage of daylight available.
- The lighting switching circuits will be programmable based on the lighting control system for pattern/group on-off by 2 wire remote system. All nonemergency lighting circuits shall be automatically switched-off by time schedule functions.
- External lighting will be automatically controlled by photocells or time scheduling time from the BAS with manually switching to override on both on and off states.
- Lighting design, switching arrangement and light fitting selection shall comply with relevant ASHRAE/IESNA Standards 90.1-2007 on Lighting Power Density and shall comply with LEED-NC for Retail SS Credit 8 Light Pollution Reduction requirements. See Appendix A-Table 1: Interior Lighting Fixtures & Load Calculations and Table 2: Exterior Lighting Fixtures & Load Calculations.
- Lighting systems: Office 9.07 W/sq.m. and Retail 15.47 W/sq.m.

2.5 Energy Management in Buildings

- The project is provided the Building Automation System and Interconnected with the Energy Management System that will facilitate automatic control, equipment status, alarm and fault monitoring to able to monitor energy system performance of the building for the following aspects :
- MDB – kW and kW/hr for main incoming, DB, EMDB, Lighting System, Fresh Air Units (FAU), Exhaust Fan in Chiller Plant & Generator Room,

Exhaust Fan in Toilet, Exhaust Fan in Car park, Pressurized Fan at Roof, Chillers, Chilled Water Pumps, Condenser Water Pumps, VSD motors of Chilled & Condenser Water Pump, Cooling Towers, Motorized Valves, Cold Water Pumps, Jockey & Booster Pumps, Fire Pumps, Water Flow & Supervisory Switch, Air Handling Unit (AHU), VSD motors of AHU with VAV Systems, Fan Coil Units (FCU), Water Flow Switch



BUILDING AUTOMATIC SYSTEM DIGITAL POWERMETER DIAGRAM

2.6 Energy Performance.

- The project use Whole Building Energy Simulation. The project team will document improvement in the proposed building performance rating as compared to the baseline building performance rating per ASHRAE/IESNA Standard-90.1-2007.
- Compliant energy modeling methodology: Energy simulation runs for both the baseline and proposed building use the assumptions and modeling methodology described in EITHER ASHRAE 90.1-2007 Appendix G OR the analogous section of the alternative qualifying energy code used.

Table EAp2-15. Total Building Energy Use Performance

		Baseline		Proposed			
Energy Type	Units	Process Subtotal	Section 1.6 Total Energy Use	Section 1.6 Energy Use	Section 1.7 Energy Savings	Section 1.8 Renewable Energy Savings	Total Energy Use
Electricity	kWh	783,200	3,075,825	2,423,456	170,560.1	0	2,252,895.9
Natural Gas		0	0	0	0	0	0
		0	0	0	0	0	0
Totals	MMBtu	2,672.28	10,494.71	8,268.83	581.95	0	7,686.88
						Energy use savings (%)	26.75

TOTAL BUILDING PERFORMANCE SUMMARY

- Simulation program: eQuest.
- Energy code used: ASHRAE 90.1-2007.
- The project can get points to 8 points from LEED

RENEWABLE ENERGY

No renewable energy within project

WATER EFFICIENCY

All Water System shall be designed in order to maximize water savings by employing the following concepts:

- Use of water efficient fixtures better than as prescribed by the US-Energy Policy Act of 1992.

No.	Equipment type	Specification	Water consumption rate	Maker	Model
1.	Flush valve	For water closet	1.60 GPF	American Standard	A-5901-06N
2.	Sensor flow	Urinal sensor	0.55 GPF	American Standard	A-8604-000-50
3.	Faucet	Self-closing	0.06 GPC	GROHE	36 223
4.	Shower	Head shower	1.95 GPM	GROHE	27387000

Table 1. UPC and IPC Standards for Plumbing Fixture Water Usage

FIXTURE	UPC AND IPC STANDARDS
Water closets gallons per flush (gpf)	1.60
Urinals (gpf)	1.00
Showerheads gallons per minute (gpm*)	2.50
Public lavatory faucets and aerators (gpm**)	0.5
Private lavatory faucets and aerators (gpm**)	2.2
Public metering lavatory faucets (gallons per metering cycle)	0.25
Kitchen and janitor sink faucets	2.20
Metering faucets (gallons per cycle)	0.25

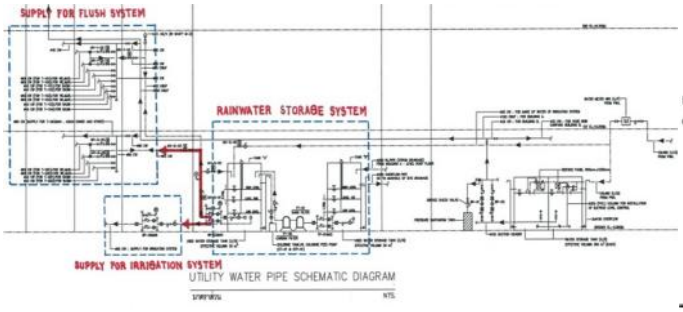
* When measured at a flowing water pressure of 80 pounds per square inch (psi).
** When measured at a flowing water pressure of 60 pounds per square inch (psi).

LEED Required 20% reduction of water use in fixtures

- Site can reduction 32.76%

- Capture of Rain Water from Roof of shopping complex and treatment at the Water recycling plant as reused purposes to be supplied in flushing systems at all water closets, urinals at the related places of building and for Landscape irrigation. Rain water and treated water shall be stored in Rain Water Tank separated from the Domestic Raw Water storage Tank collect from the Municipal Water Agency (MWA).

- The Rain Capturing Water Recycling System design is given as below:



Rainwater catchment area (m2)	5,305
Collection efficiency	90%

Amount of Rain water captured		water tank
(Gallons)		(cubic meter)
January	48,565	
February	2,018	
March	10,722	
April	65,595	
May	73,794	
June	225,041	
July	128,919	30
August	305,268	
September	161,717	
October	207,507	
November	2,523	
December	18,922	

Total rainwater capture 1,250,591.6

A. Water consumption for Green space	932,832.00	Gallons per year
B. Water consumption of the urinal and water closet	371,390.00	Gallons per year
C. Water consumption faucets and showerheads	75,560.00	Gallons per year
D. Total water used A + B + C.	1,379,782.00	Gallons per year
E. Rainfall can capture.	1,250,591.60	Gallons per year
F. Can reduce potable water use. (D/C x 100)	90.64%	

ENVIRONMENTAL SUSTAINABILITY

1. Sustainable construction
   a. Use of materials/ products with recycled content
      - The project following information from the Materials and Resource Calculator 44.9%.

Provide the following information from "Tab C. Summary" of the Materials and Resource Calculator.	
Total materials cost for the LEED project:	$ 3,178,573.45
Table MRc4-1. Summary for Recycled Content	
Total value of postconsumer + 1/2 preconsumer recycled content	1,430,071.17
Recycled content value as a percentage of total materials cost *Must be at least 10% for 1 point, 20% for 2 points, 30% for exemplary performance*	44.99
Percentage of MRc4 materials with cutsheets provided (by cost) *Must be at least 20% to document credit compliance*	44.93


The certification of the recycled materials used in the project.

   b. Good Environmental Management system during construction.
      - Pollution management during the construction period
      - The project Contractor planned for landslip by erecting a retaining wall. Not only was adequate drainage installed around the construction area to trap sediment and debris from the building materials, the gutters and sedimentation tank was thoroughly cleaned on a regular basis. In order to prevent debris from entering the water through public and adjoining areas which can make the public drainage system obstructed. The contractor also controlled the dust pollution by installing canvas around the site during construction to prevent dust from spreading to adjoining areas. The cleanliness of the cars entering the construction areas was also checked and delivery vehicles to be covered with canvas to prevent spread of contamination into the construction area.


Temporary Fence


Car wheel wash


Housekeeping in site


Earth dike cannel


Temporary site fence


Concrete lean slope protection


Pile head cut

Safety sign


Temporary toilet of manpower.


Remove soil out site.


Housekeeping out site.


Waste three bin store zone.

2. Waste Management construction.
   - The project provide waste recycling and Management Program in The King Power site fined for efficient management of waste and recyclable materials within site surrounding area in the most environmentally friendly way. Building consists of story building. To protect and maintain green environment within the King Power building area, the content of the programs.

Site layout for WASTE MANAGEMENT CONSTRUCTION plan

Table MRc2-1. Construction Waste Management

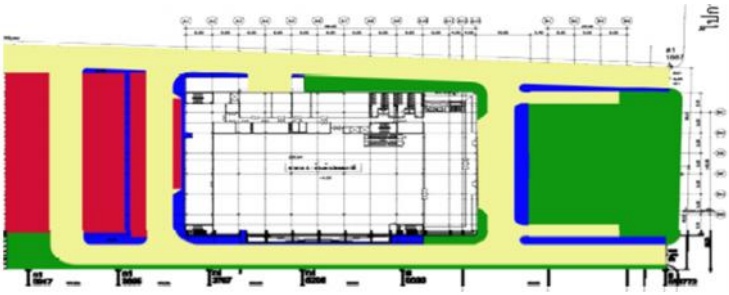
Complete the following table for all construction waste. For site-separated waste, list each waste type. For commingled waste, designate it as such using the drop down selection. Documentation is required for commingled waste only.

Construction Waste Description	Diverted or Landfill Waste	Commingled Waste		Total Waste Tons	Hauler or Location
		Percentage Diverted	Doc Provided		
Steel	Commingled	50	☒	13.05	recycle
concrete	Diverted	100	☐	13.36	Sea
wood	Commingled	50	☒	8.85	recycle
paper	Commingled	50	☒	1.79	recycle
soil	Diverted	100	☐	4,701	Sea
pile cut	Diverted	100	☐	315.18	Sea
garbage	Landfill Waste	0	☐	12.01	Sea
Total construction waste (Tons)				5,065.24	
Total waste diverted from landfill (Tons)				5,041.4	
Total percentage of construction waste diverted from landfill (%) *Must be at least 50% to achieve 1 point or 75% to achieve 2 points*				99.53	

3. Greenery

• Restore or protect a minimum of 50% of the site area (excluding the building footprint) or 20% of the total site area (including building footprint, whichever is greater, with native or adaptive vegetation.

- Total site area : 186,575.55 sf
- Site area restored or protected : 36,945.4 sf



• Development Density and Community Connectivity is attempted and the project team is including pedestrian-oriented hardscape in calculations.

- Vegetated open space within the project boundary: 36,945.4 sf
- Pedestrian-oriented hardscape area: 92,526.83 sf
- Percentage open space that is vegetated: 28.54 %

• Landscape space exceeds local zoning requirements 25%

- Site prepare 32.84 %

4. Provision of recycling facilities

• The project provide Waste recycling and Management Program in King power Duty-Free Pattaya project is defined for efficient management of waste and recyclable materials within the building and surrounding area in the most environmentally friendly way and the consist of an office buildings and parking garages.

• To protect and maintain green environment within the area, the content of the program comprise sections as following:

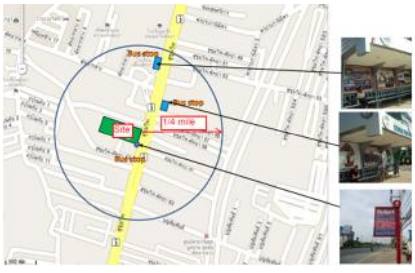
- Waste and recyclable materials separation and disposal.
- Waste and recyclable materials container location and collection.
- Waste and recyclable materials transfer record

5. Public transport accessibility

a. Distance from nearest bus stop/train station

• The project is located within 1/4-mile walking distance, measured from a main building entrance, of one or more stops for two or more public, campus, or private bus lines usable by building occupants.

Bus stop King power duty fee Project



Public transport line

6. Materials (Percentage of Using Local Materials)

- Total value of materials manufactured and extracted/harvested/recovered within 500 miles regional value as a percentage of total materials cost: 57.81%. Percentage of MRc5 materials with cut sheets provided (by cost) 91%

7. Barrier free and public access

- The project is within ½ mile of a residential zone or neighborhood with an average density of 10 units per acre net; is within ½ mile of at least 10 basic services; and has pedestrian access between the building and the services.


1 Santi Hardware


2 Lucky Laundry


3 SCB Bank


4 Stylist Beauty Salon


5 Careefour Supermarket


6 Naputsorn Pharmacy


7 The Red Lobster Restaurant


8 Convenience Grocery

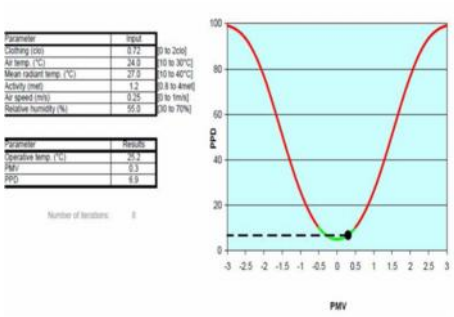
9 St. Nicolas Catholic


10 Pattaya School

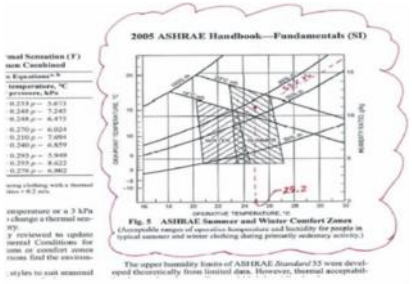
INDOOR ENVIRONMENTAL QUALITY

1. Thermal comfort – design indoor temp and relative humidity

• Indoor Environmental Quality on HVAC ventilation and Thermal comfort standards based on ASHRAE 62.1-2007, ASHRAE 55-2004, ASHRAE 52.1-1992 and SMACNA.



PMV.And PPD Calculation Sheet

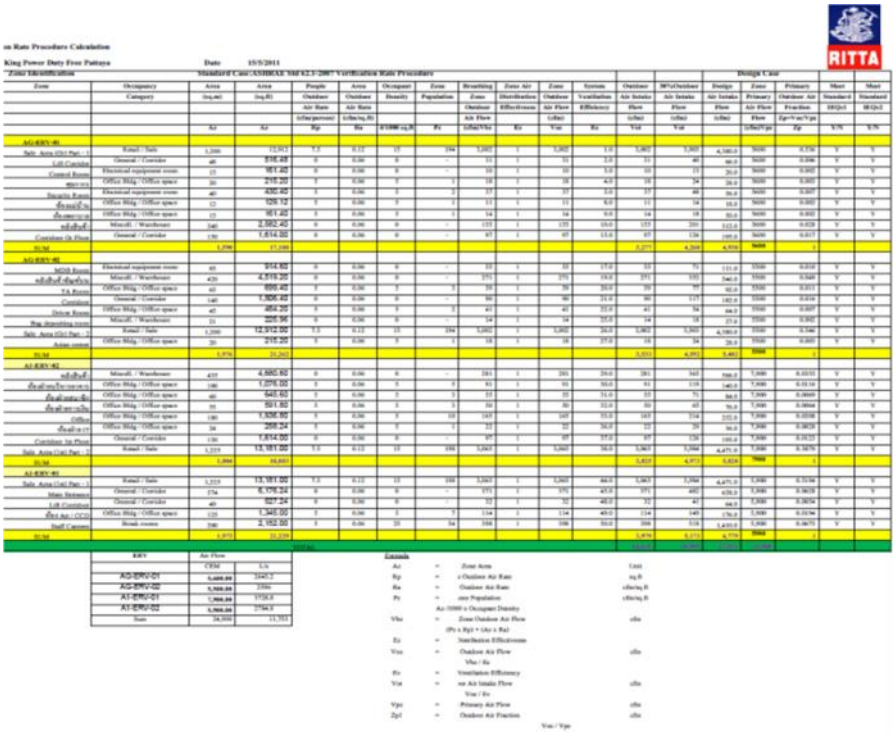


ASHRAE 55 highlight data use in design

2. Number of Ventilation air per person (CFM/person)

• Minimum Indoor Air Quality Performance. The project building is mechanically ventilated, in part or in whole.

- Provide Ventilation Rate Calculations based on ASHRAE 62.1-2007.



3. Use of low volatile organic compound and low formaldehyde emission products (VOC) paints , coatings and carpets.

3.1 Adhesives and Sealants Flooring Adhesives and Sealants

Table IEQc4-1. Flooring Adhesives and Sealants

Product Type	Product Manufacturer	Product Name / Model	Allowable VOC Content	Product VOC Content	Source of VOC Data	Source of VOC Data Provided
Multipurpose Construction Adhesives	DOW CORNIN	(1-2577 LOW VO	70	0	DOW CORNI	☒
Percentage of items with Source of VOC Data provided (%) *Must be at least 20*						100
All products meet allowable VOC content						Yes

3.2 Adhesives and Sealants Non-Flooring Adhesives & Sealants

Table IEQc4-2. Non-Flooring Adhesives & Sealants

Product Type	Product Manufacturer	Product Name / Model	Allowable VOC Content	Product VOC Content	Source of VOC Data	Source of VOC Data Provided
Multipurpose Construction Adhesives	DOW CORNIN	791 WEATHER	70	46	DOW CORNI	☒
Multipurpose Construction Adhesives	DOW CORNIN	795 SILICONE	70	28	DOW CORNI	☒
Percentage of items with Source of VOC Data provided (%) *Must be at least 20*						100
All products meet allowable VOC content						Yes

- Paints and Coating

NO PRODUCTS EXCEED THE ALLOWABLE VOC LIMITS

Table IEQc4-6. Indoor Paint and Coating Products

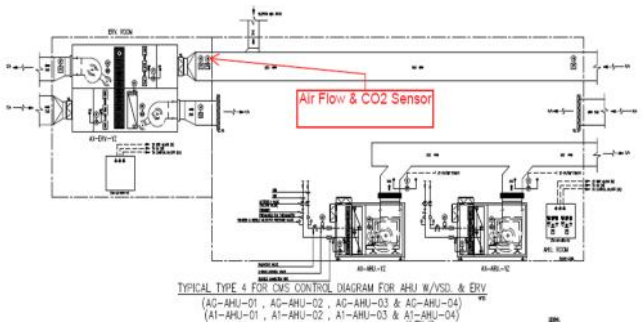
List all paints and coatings used on the interior of the building (i.e., inside weatherproofing system and applied on-site). Concrete, wood, bamboo, terrazzo, and cork floor finishes such as sealer, stain and finish are included in the IEQ Credit 4 requirements for both Options 2 and 3. If these products are used and both options are attempted, the products must be included in the documentation for both options.

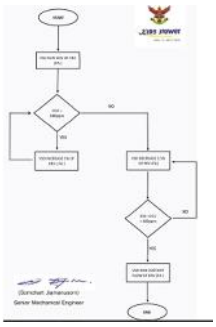
Product Type	Product Manufacturer	Product Name / Model	Allowable VOC Content	Product VOC Content	Source of VOC Data	Source of VOC Data Provided
Interior Flat Paint, Coating or Primer	TOA PAINT (TH	Supershield Du	50	8.6	Department of S	☒
Interior Flat Paint, Coating or Primer	TOA PAINT (TH	Supershield Du	50	6.6	Department of S	☒
Interior Flat Paint, Coating or Primer	TOA PAINT (TH	Supershield Du	50	10.8	Department of S	☒
Interior Flat Paint, Coating or Primer	TOA PAINT (TH	Supershield Du	50	5.8	Department of S	☒
Interior Flat Paint, Coating or Primer	TOA PAINT (TH	Supershield Du	50	2.4	Department of S	☒
Sealers and Undercoaters	TOA PAINT (TH	Shield-1 Nano s	200	13.7	Thailand Institu	☒
Percent of items with VOC data sources provided (%) *Must be at least 20%*						100
All products meet allowable VOC content						Yes

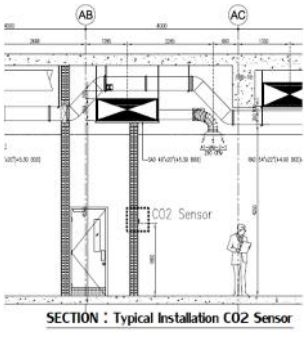
- Flooring Systems

Product Type [1]	Product Manufacturer	Product Name / Model	Referenced Standard	Meets Referenced Standard	Source of Compliance or Certification Data	Doc Prov
Carpet, Indoor	Carpet Internati	GLP5114	CRI Green Labe	☒	GREEN LABEL/ G	☒
Carpet, Indoor	Interface	InterfaceFLOR	CRI Green Labe	☒	Green label plus/.	☒
Percentage of products with compliance or certification data provided (%) *Must be at least 20*						100

4. Pollution (noise, vibration, EM wave, Dust, Bacterial count and CO_2 concentration sensoring)
   - Outdoor Air Delivery Monitoring.
     - Air Flow Sensor
     - Flow chart of fresh air unit control with CO_2 sensor
     - Detail CO_2 sensor Height above the floor







SECTION : Typical Installation CO2 Sensor

5. Environmental tobacco smoke (ETS) and smoke control

- Smoking is prohibited in the project building.
- Smoking is prohibited within 25 feet of entries, outdoor air intakes and operable windows.

6. Construction IAQ Management plan during Construction.

- The project provides the IAQ Management Plan for the project, including highlighted IAQ management practices implemented during construction and preoccupancy phases. The Indoor Air Quality (IAQ) Management Plan must be developed and implemented for both construction and pre- occupancy phases of the building in order to meet this goal. This plan must also meet or exceed the minimum requirements of the Sheet Metal and Air Conditioning National Contractors Association IAQ Guideline for Occupied Buildings under Construction, 1995.

Picture between construction

- Construction IAQ Management Plan, Before Occupancy.
  - Provide IAQ Management Plan, During Construction and Before Occupancy.
  - Flush conducting air before the building. To make impure air caused by construction. The purity of the air in the building.

7. Controllability of Systems, Lighting & Thermal Comfort.

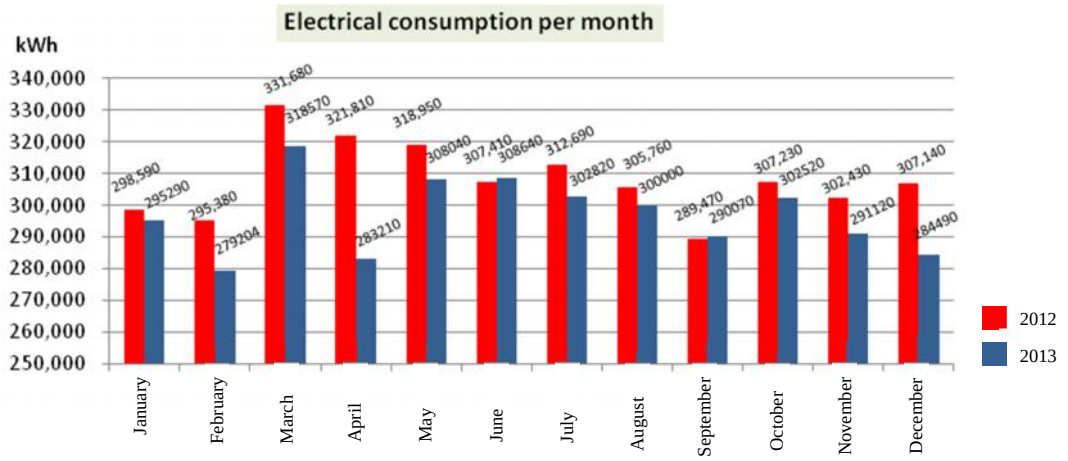
- Prepare a table lamp for employees.
- Prepare a switch control temp for employees.

8. Thermal Comfort Verification

- The survey using the attached questionnaire shall be carried out at least once every 3 months after occupancy. As such, the survey shall be conducted on every 3 months after occupancy. If more than 20% of the occupants are dissatisfied with the thermal comfort in the building, the facility management of King Power Duty Free Pattaya will undertake to develop a plan for corrective action to address the findings from the survey.

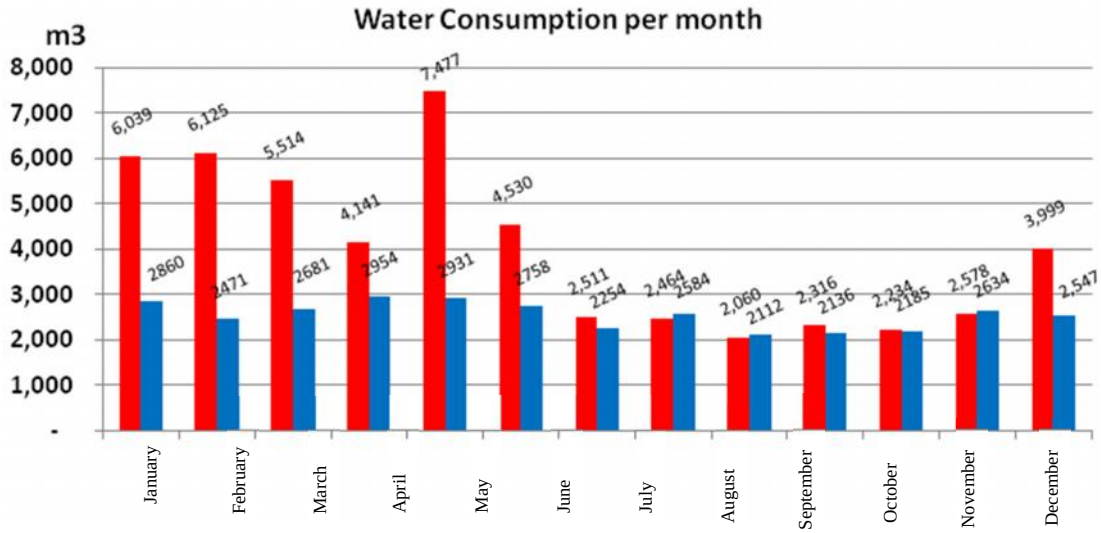
OPERATION AND MAINTENANCE & OTHER GREEN FEATURES, AND INNOVATION

Electrical Consumption Detail



- Cause of Reducing Electricity Consumption in 2013
  1. Leaving Chilled Liquid Temperature setting from 45 Fahrenheit to 50 Fahrenheit.
  2. Set highest performance percentage of Chiller from 100% to 90%.
  3. Open only one elevator for our staff last time we used 2 elevators and except 1st Floor and 3rd floor can use.
  4. Reduce the usage of electric light bulbs from passage way and underground car park around the Duty free shop area before we use 2 light bulbs and now we use 1 light bulb.

Water consumption Detail

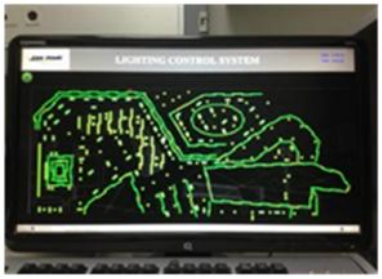


- Cause of Reducing Water Consumption in 2013
  1. Water leak checking in any location.
  2. Reduce the pouring time from 3 times to 2 times per day.

Energy Management System of Building

1. Building Automatic System (BAS) is using for On-Off timer setting and control any parameter in HVAC and humidity control and ventilation system in a building.

2.
3. Lighting Control System for building brightness control.

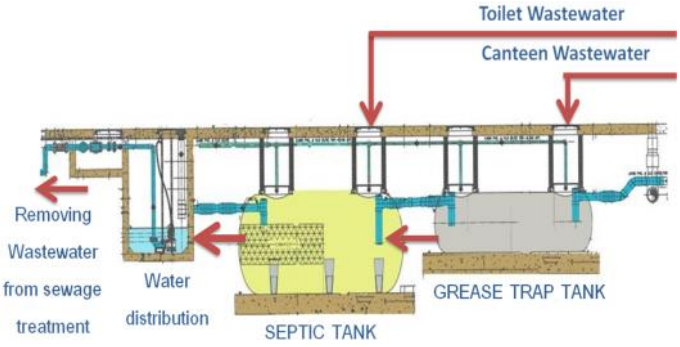


4. Variable Air Volume system (VAV) can reduce the energy consumed by HVAC system for saving energy.

5. Cooperate with Provincial Electricity Authority to change the meter to online (AMR)

6. Use VSD to control the speed of Chiller and Air Handling Unit.
7. Use high quality Chiller.
8. Use ERV (Energy Recovery Ventilator) for Energy saving.
9. Use LED light bulb in almost Duty free shop area.
10. Use escalator that has motion detector (2 minute → standby)

Waste Water Treatment



Waste Treatment

Innovation

1. Heat recovery

The utilization of energy recovery device which exchange heat between hot fresh air and cooled exhaust air, significantly reduces the cooling load. Reduce power by up to 7% of the total annual energy use in buildings.

OUTDOOR AIR COOLING LOAD REDUCTION

Unit	OA Load w/o Energy Recovery (kJ/h)	OA Load w/o Energy Recovery (kW)	OA Load w/o Energy Recovery (kJ/h)	OA Load w/o Energy Recovery (kW)	Reduction kW Saved (kW)
AG - ERV - 01	463,515.40	128.8	71,121.30	19.8	109.0
AG - ERV - 02	452,541.80	125.7	79,797.00	22.2	103.5
AG - ERV - 01	657,869.30	182.7	130.26	36.2	146.6
AG - ERV - 02	487,559.10	135.4	85,049.10	23.6	111.8

Table EAp2-10. Exceptional Calculations

End Use	Exceptional Calculation Method Description	Energy Type(s)	Unit	Annual Energy Savings
Space Cooling	Heat/Energy Recovery System	Electricity	kWh	170,560.1
Electricity			kWh	170,560.1
Natural Gas				0
				0
Total			MMBtu	581.95

2. Design education

The project also promotes the education through the preparation of involved documentation a regarding to the environment friendly building in both design and operation matters.

BUILDING INFORMATION

A. General Information

1. Name of the building : King Power Pattaya Complex
2. Name of owner and management company : King Power International Co., Ltd.
3. Address : 8 Sukhumwit Road Nongprau Banglamong Chonburi, Thailand
4. Tel.: +66(2)677-8888 Fax: +66(2)245-8163 E-mail : pairoj_l@kingpower.com

B. Building Physical Information

5. Physical building background

- Brief history

The second branch of the King Power Complex in Pattaya as completed in 2011and occupied the gross floor area of approximately 9, 745sq.m. With limited time, design and construction took only 10months. Its design is influenced by Thai architecture in particular of its front façade with diagonal weaving pattern, made from steel plates with gold polyurethane coating. The diamond-shape quadrangle structure was influenced by patterns in Thai handicrafts, gold ornaments and traditional architecture. In addition to the unique character of the building, King Power Pattaya also received a Leadership in Energy and Environmental Design (LEED) gold certificate from the U.S. Green Building Council (USGBC).

- Single function usage or mix function usage (specify) : Office & Retail

6. Age of building : 2 Years
7. Any retrofit done? When? What? : Not appicable
8. Total number of storeys : 3 Storeys
9. Total number of basement floor : 1
10. Number of car park storeys : 1
11. Total gross floor area : 9,965 sq.m.
12. Surface area of the envelope including the roof to gross floor area ratio: 0.16
13. Car park area : 1,248 sq.m.
14. Gross lettable area: None
15. Air-conditioned area : 9,240 sq.m.
16. Non-air conditioned area : 726 sq.m.
17. Plot ratio (total GFA / ground area) : 2.84

C. Building Design and Practice Information

18. Plants and landscape design/ wind and natural ventilation/ water features/ daylighting/ etc.

Shading device in front of building

Plants used in the projects are of species that can be grown in the eastern region of Thailand. Emphasis is place by locating large shady trees along the south and west elevation of the building to provide shades for the building. Irrigation system is designed to be efficient and economical. Facade and shading design

19. Facade and shading design

- Type of façade
  - The façade at the entry includes a glass curtain wall with an outer layer of diagonal pattern steel frame structure infill with stainless steel mesh.
  - Glazing (Low-E), on south, east and west façade.
  - Aluminum Composite Panel Cladding, on north and south façade.
  - Metal Siding, on north, south and west façade.
- Color of façade
  - Steel diagonal sunshade frame: Gold
  - Wire mesh screen: Stainless steel
  - Aluminum Composite Panel: White
  - Metal Panel: White
- Use of shading devices

Façade of building

The outer layer of the east facing entry façade is made up of diagonal pattern steel frame structure infill with stainless steel mesh that acts as a sunscreen to reduce glare and increase shading coefficient for building. The large canopy at the building entry and roof overhangs around the perimeter helps increase shading and weather protection for the building.

Use of Shading device in lobby area

20. Location of service core

Service core areas are organized around the perimeter of the main air-conditioned space to minimize energy usage. The area occupies ½ of the building perimeter area.

21. Shape of building

The shape of the building is rectangular with a dimension of 57.20 m x 90.50 m and 18 m. in height.

22. Overall heat transfer through building envelope:
Wall 38.88 W/sq.m. Roof 5.21 W/sq.m.

23. Lighting fixtures

Luminaire types

- (T5 28W/14W) Fluorescent batten type
- (LED 23W/21W.) Adjustable down light
- Recess down light luminaire fluorescent lamp 1x13W

Lighting fixture in retail area

24. Lighting load 13.7 W/sq.m. (gross floor area)

25. Building air-conditioner system and equipment

- Fresh air exchange rate: 16.6 m^3/hour/person
  0.83 m^3/hour/sq.m.
  23,446.35 m^3/hour
- Energy efficiency of aircon. chiller: 0.628 kW/TR

26. Cooling Load 296.58 W/sq.m. (air-conditioned area)

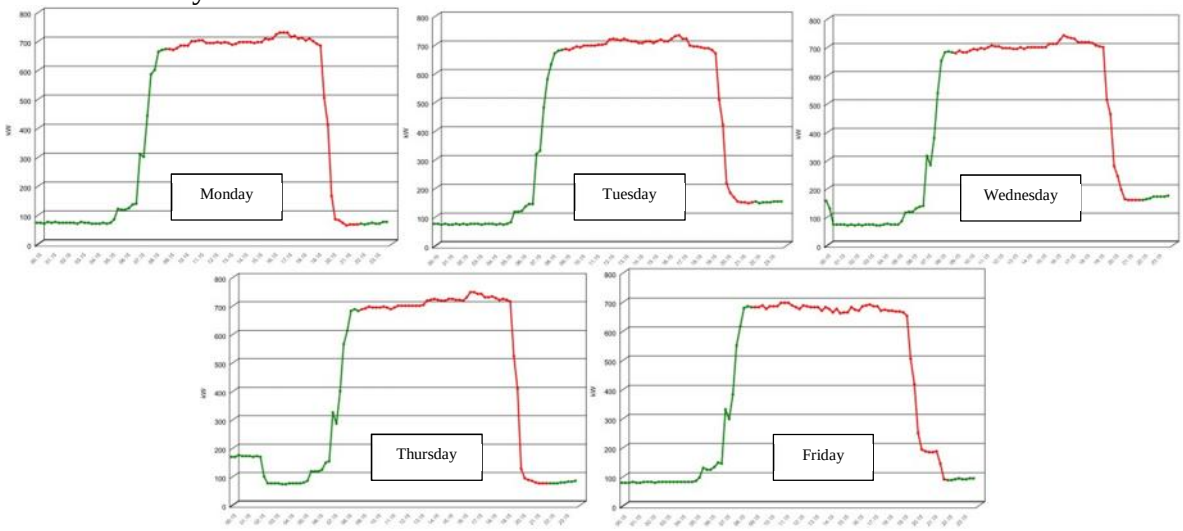
D. Operation Information

27. Occupancy rate (year 2013): 100 %
28. Total number of occupants 229,692
29. Ownership of building : King Power International Co., Ltd.
30. Building operating schedule
    - weekdays from 9:00 to 22:00
    - Saturday from 9:00 to 22:00
    - Sunday from 9:00 to 22:00
    - Operating hours/ yr : 4,745 hr/Yr
31. Building indoor environment: Indoor air quality setting: Temperature 25.2 ^{o}C, Relative Humidity 53 %

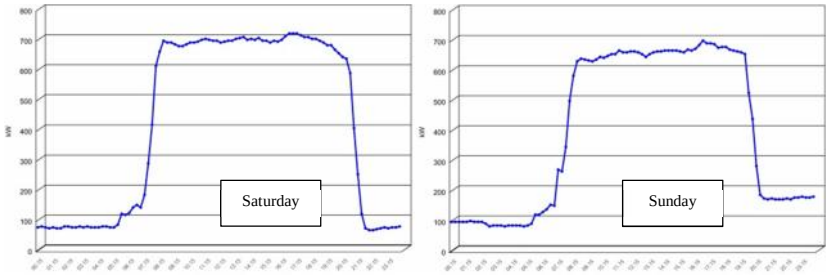
E. Energy Consumption Information

32. Peak demand : 966 kW (March 2013)
33. Energy used : 296,997.83 kWh (Average/month)
34. Typical Load curve (weekdays, weekends)

Weekdays



Weekends



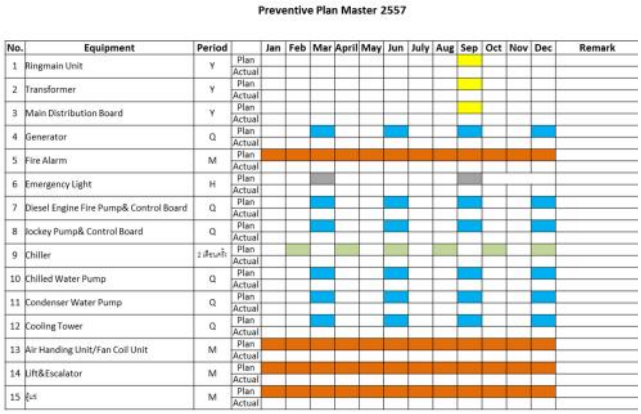
35. Energy efficiency index: air-conditioned area 163 kWh/sq.m./yr (based on 2,000 operational hours/yr)
36. Energy consumption: Electricity 151 kWh/sq.m./yr (based on 2,000 operational hours/yr)
    - Fuel 1,140 Liters/yr (not for electricity generation)

F. Energy Management Information

37. Building energy management system Connected physical points 589 (no)
38. Energy saving: Schedule programme 101,575 kWh/yr
    Duty cycle programme - kWh/yr
    Optimum start / stop programme - kWh/yr
    Power demand programme 825 kW (mean)

G. Maintenance Information

39. Maintenance programme



Preventive Plan Master 2557

No.	Equipment	Period		Jan	Feb	Mar	April	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Remark
1	Ringmain Unit	Y	Plan													
			Actual													
2	Transformer	Y	Plan													
			Actual													
3	Main Distribution Board	Y	Plan													
			Actual													
4	Generator	Q	Plan													
			Actual													
5	Fire Alarm	M	Plan													
			Actual													
6	Emergency Light	H	Plan													
			Actual													
7	Diesel Engine Fire Pump& Control Board	Q	Plan													
			Actual													
8	Jockey Pump& Control Board	Q	Plan													
			Actual													
9	Chiller	2 เดือนครั้ง	Plan													
			Actual													
10	Chilled Water Pump	Q	Plan													
			Actual													
11	Condenser Water Pump	Q	Plan													
			Actual													
12	Cooling Tower	Q	Plan													
			Actual													
13	Air Handing Unit/Fan Coil Unit	M	Plan													
			Actual													
14	Lift&Escalator	M	Plan													
			Actual													
15	อื่นๆ	M	Plan													
			Actual													

- Manpower: 18,240 man-hr/yr
- Maintenance contractor
  - MDB , Transformer : Ekarat Engineering Co., Ltd
  - Chiller : Johnson Control International (Thailand) Co., Ltd
  - Elevator & escalator : OTIS
  - Generator : Iyara Intertrade Co., Ltd.
  - Fire Pump : United Power Engineering Co., Ltd.
  - Chilled Pump & Condenser Pump : United Power Engineering Co., Ltd.
- Availability of energy management engineer : 2 Persons
- Training of maintenance workers: 184 cumulative hours/yr

H. Environmental Impacts

40. Impacts of waste

King Power International Limited operates a waste management system with in the project that includes an exterior garbage collection area with the waste being divided into general waste, organic waste and recycling waste which can be resold. Throughout the building separated waste cans are provided accordingly and emptied daily.

41. Impacts of pollution (air, noise, visual, exhaust, etc.)

House keeping

Car wheel wash

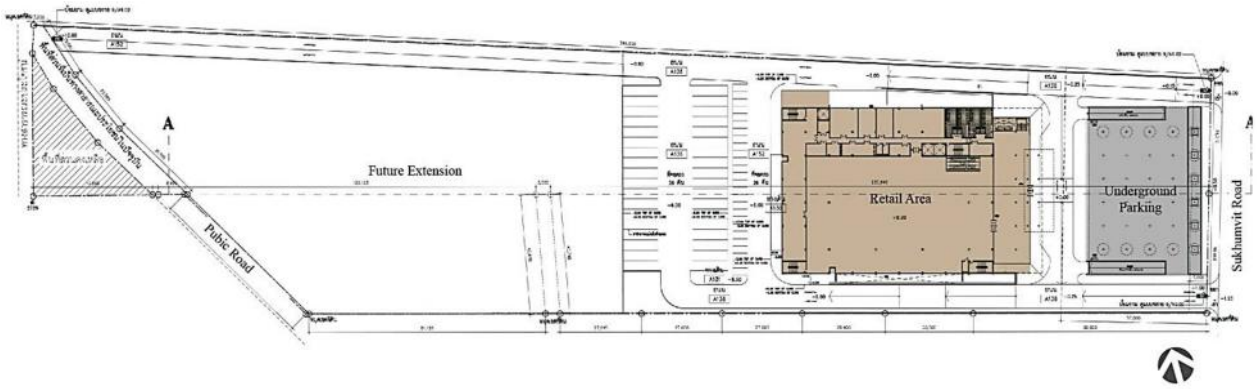
Sustainable construction and environmental management system was implemented during the construction in regards to the existing soil condition, air and water. Implantation plan includes the protection of top soil from leaching into neighboring sites, dust control and post water debris treatment prior to discharging into the city's system. Temporary site fence was erected to reduce visual impact during construction. Truck wheels are routinely washed before leaving the site.

I. Additional Information for Retrofitted Buildings

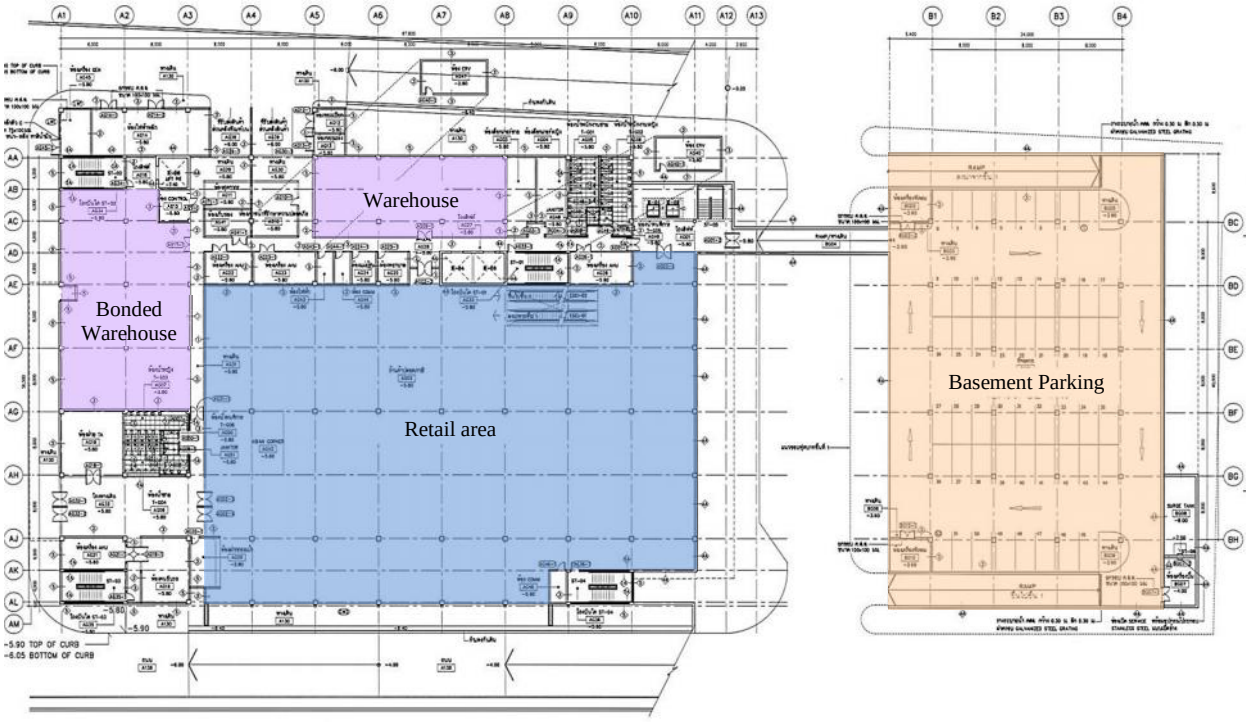
42. Energy savings in air-conditioned area 4.63 kWh/sq.m./yr (based on 2,000 operational hours/year
43. Energy savings in lighting systems - kWh/sq.m./yr (based on 2,000 operational hours/year)

    Retrofitted area: 0% of total area

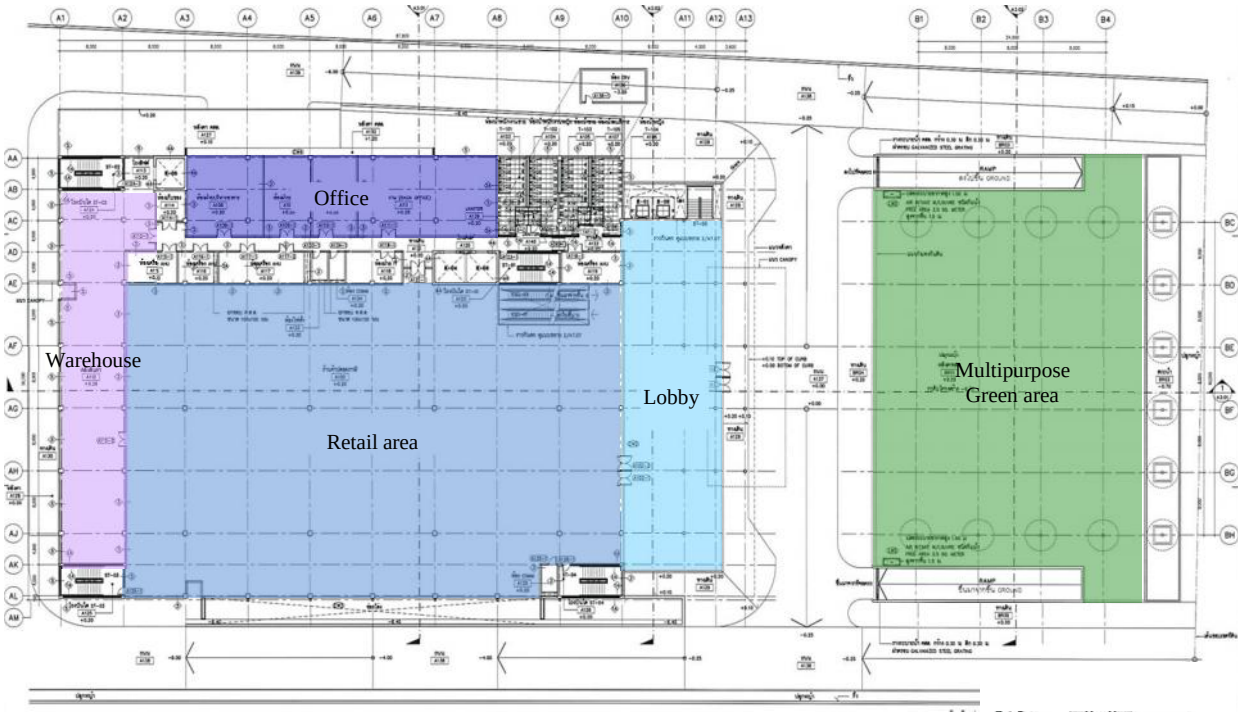
DRAWINGS



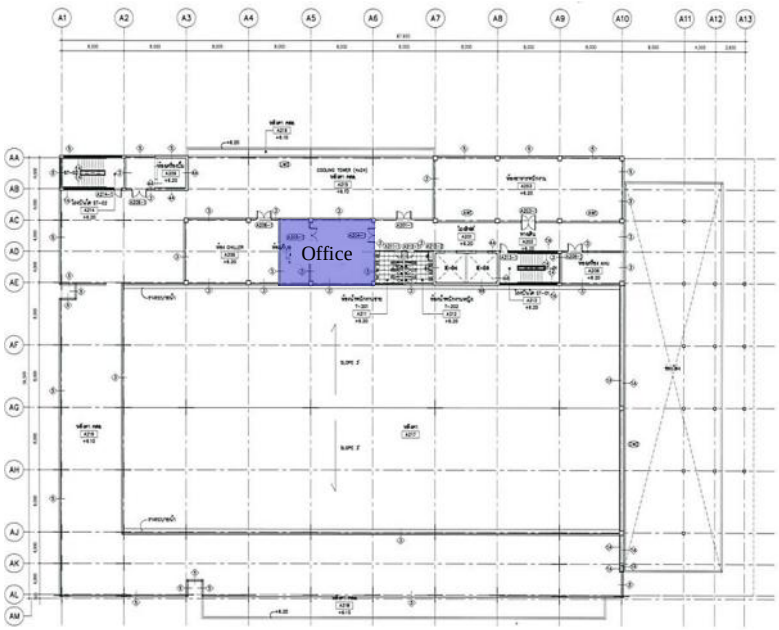
Site Layout



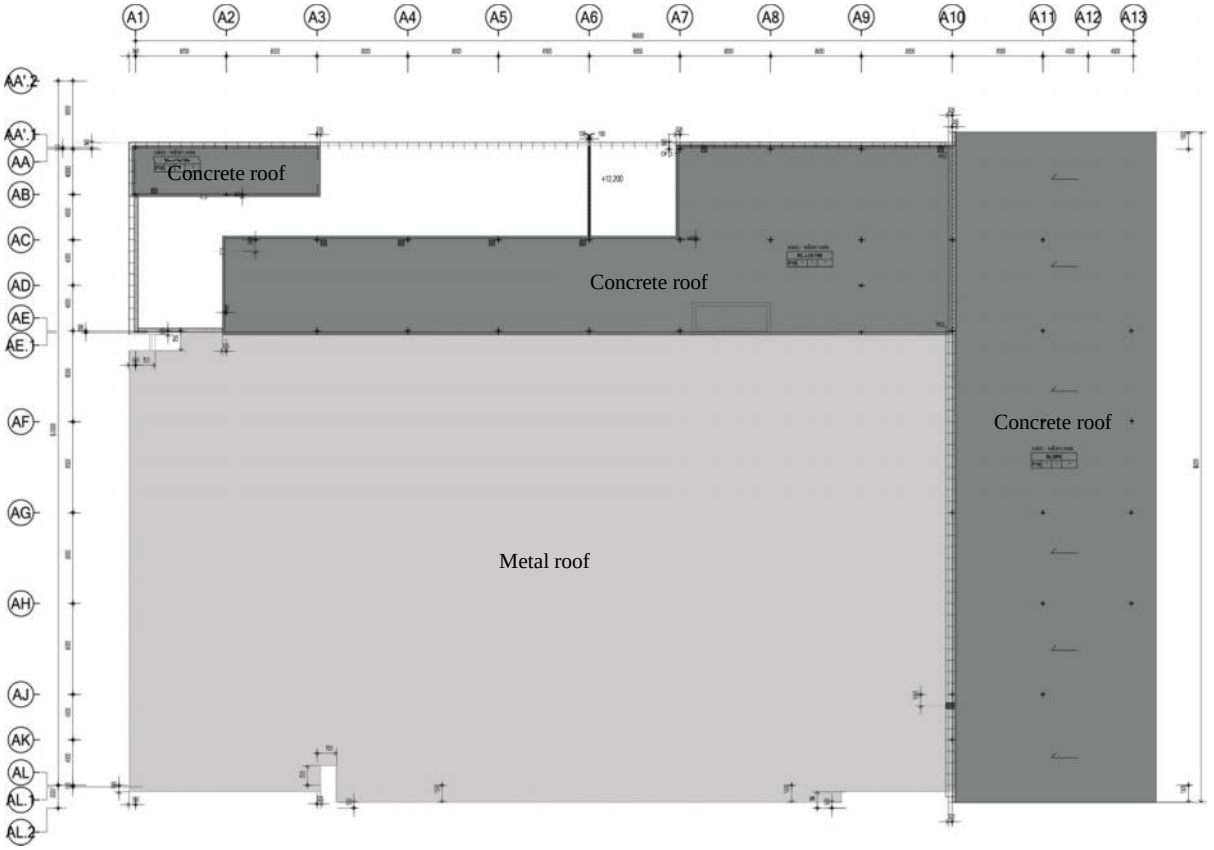
Ground floor plan



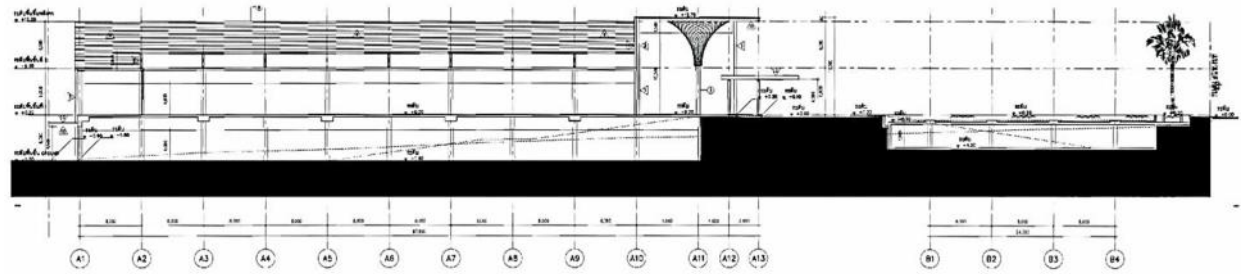
1st floor plan



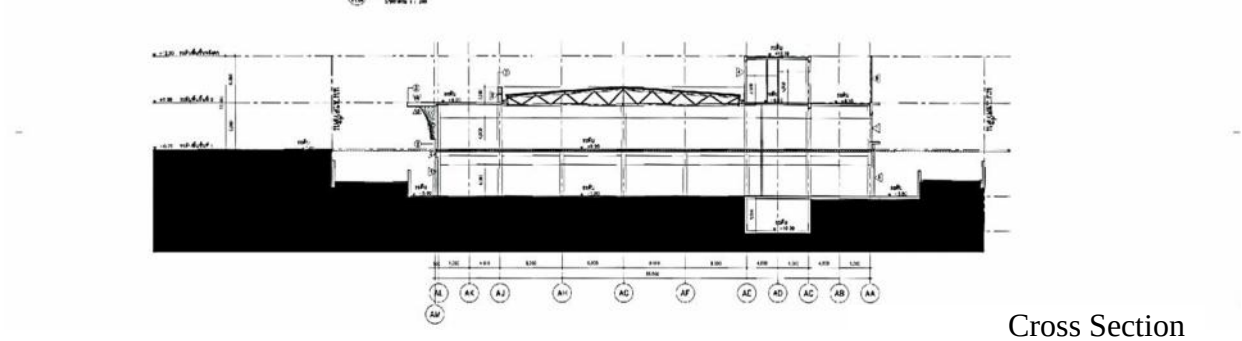
2nd floor plan



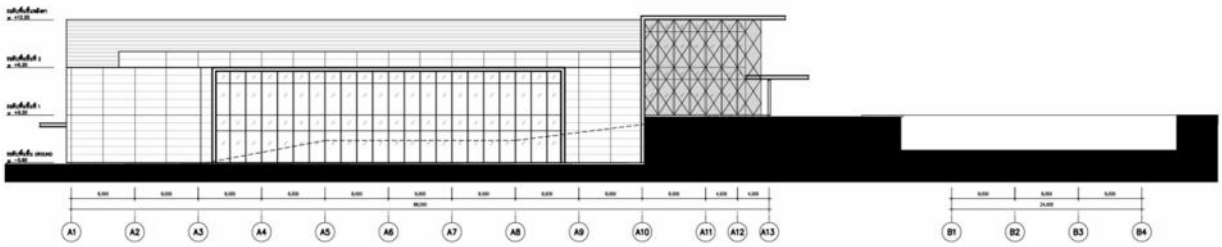
Roof plan



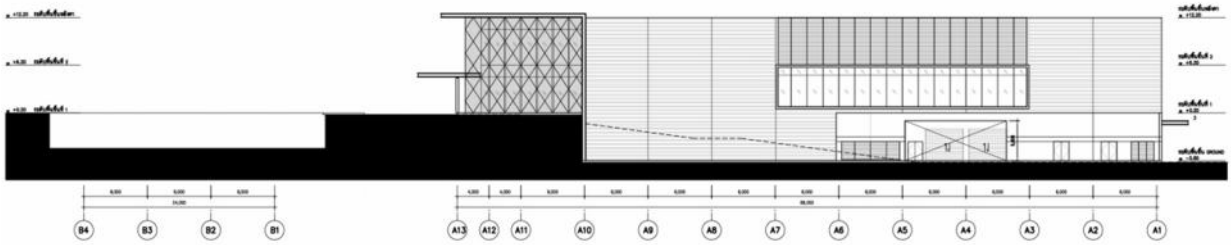
Longitudinal Section



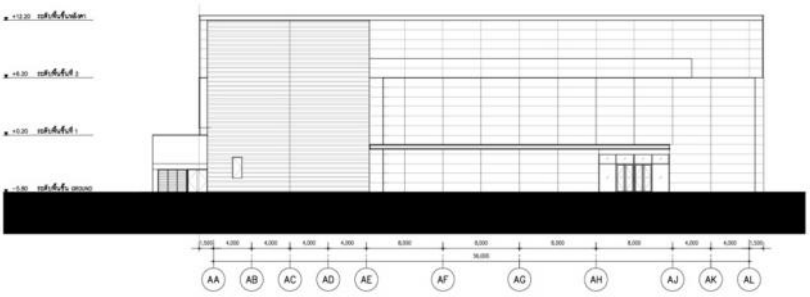
Cross Section



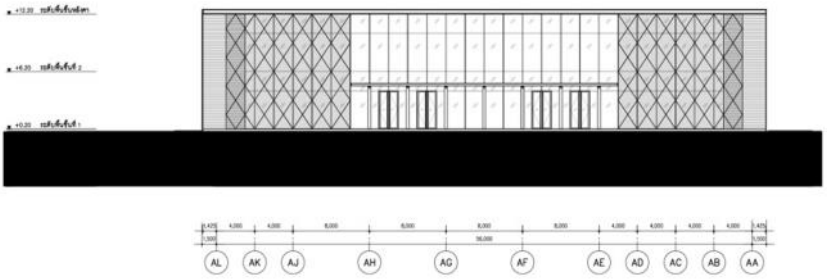
South Elevation



North Elevation



West Elevation



East Elevation