تحقيق رؤيه
Accomplishing a Vision

Qatar Rail
Msheireb Station

Delivering Sustainable Metro Stations - Achieving GSAS 5 Stars

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24th April 2018

Doha Metro - Overview

- **Phase 1** - construction of three out of the four lines (Red, Gold, and Green) and 37 stations. These lines are expected to be open to the public by 2020.
- **Phase 2** - involve the introduction of an additional line (Blue) and the expansion of the existing ones, with more than 60 additional stations and the first expansion will be completed by 2026.
- Most of the Doha Metro lines underground, tunneling plays a major role in construction. Specialized Tunnel Boring Machines (TBMs) used to dig the underground sections.
- The largest station, **Msheireb**, will fall at the heart of the Doha Metro with the Red, Green and Gold lines all meeting at this point.
- F:\Presentation - Qatar Society of Engineers\01 Doha Metro Project Overview.mp4

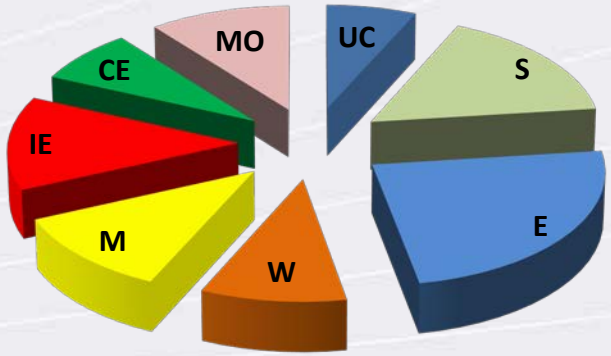
Msheireb Station – Delivering Sustainable Metro Stations
Qatar Rail – Architecture and Designs / Technical dept.
Sustainability Manager, Marc Chapman - 24th April 2018

Sustainability Approach

- Sustainability is **embedded** into the Doha Metro network and d**emonstrated** through the implementation of **GSAS Railways** for the stations
- **Contractual requirement** for **19 Metro Stations** and **Depot Buildings** to achieve **GSAS 4***
  - **Responsibility of the Design & Build Contractor to comply with the Employer's Requirement Vol 4, Section 21.1.3:** ***'The work under the contract shall be designed, constructed and operated to achieve a minimum of 4* Certification under GSAS.'***
  - **Remaining 18 'non-certified' stations** required to follow **the same design GSAS principles**
- **Msheireb Station** is the **only** Doha Metro station to be **dual certified** to both **GSAS** and **LEED** (Leadership in Energy Efficiency Design)
- **GSA**S (**G**lobal **S**ustainability **A**ssessment **S**ystem) is a Qatari developed 3rd party design verification scheme used to assess and benchmark sustainable buildings
- **LEED** is the **US** developed **sustainable building** assessment **methodolog**y. GSAS is the **1st integrated performance-based** green building assessment rating system specific to the region
- Both GSAS and LEED have 2 review phases – **Initial Review (Design)** & **Final Review (Post Construction**)

GSAS – Assessment Categories

- The GSAS rating system measures **8 key sustainability categories**
- Each category is **assigned a weight** and each category is broken down into specific criterion. A score is then assigned to each criterion depending on compliance.
- A total of **51 Criterion** are available to be targeted
- **Criterion all have different weightings** – with some offering significantly higher weightings and incentives
- Ratings range from **GSAS 1*** to **GSAS 6***
- **Overall the assessment is based on a cumulative score of all Categories and Criterion.**



Urban Connectivity (UC) 7%

Site (S) 17%

Energy (E) 25%

Water (W) 10%

Materials (M) 12%

Indoor Environment (IE) 14%

Cultural & Economic Value (CE) 8%

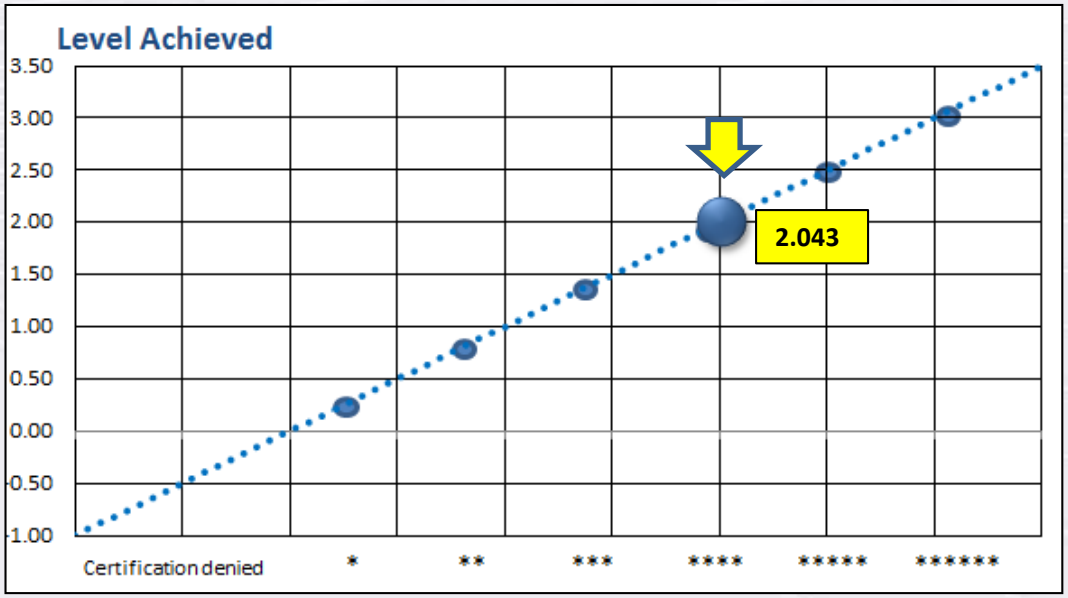
GSAS Railways – Assessment Categories & Criterion

No	Category / Criteria	Weights	Goals
UC	**Urban Connectivity**	**7.00%**	The building's planning shall incorporate urban considerations.
UC.1	Proximity to Infrastructure	1.70%	
UC.3	Public Transportation	1.87%	
UC.5	Sewer & Waterway Contamination	1.04%	
UC.7	Proximity to Amenities	1.03%	
UC.8	Accessibility	1.36%	
S	**Site**	**17.00%**	The building's development in relation to existing site conditions shall be controlled.
S.1	Land Preservation	1.25%	
S.2	Water Body Preservation	1.32%	
S.3	Habitat Preservation	1.15%	
S.4	Vegetation	1.14%	
S.5	GSAS Construction Management - Partial	1.69%	
S.6	Rainwater Runoff	0.68%	
S.7	Heat Island Effect	0.86%	
S.8	Wind Comfort	0.88%	
S.9	Noise Pollution	0.76%	
S.10	Light Pollution	0.75%	
S.11	GSAS Construction Management - Full*	2.60%	
S.12	Parking Footprint	0.84%	
S.13	Shading	0.98%	
S.14	Visual Comfort	0.84%	
S.15	Pathways	1.26%	
E	**Energy**	**25.00%**	The building's depletion of fossil energy over its service life shall be controlled.
E.1	Energy Demand Performance	7.15%	
E.2	Energy Delivery Performance	7.12%	
E.3	Primary Energy Sources	3.04%	
E.4	CO_2 Emissions and Offset	5.64%	
E.5	NO_x, SO_x & Particulate Matter	2.05%	
W	**Water**	**10.00%**	The building's impact on the overall water resource shall be controlled.
W.1	Water Efficiency	4.00%	
W.2	Water Consumption and Reuse	6.00%	

No	Category / Criteria	Weights	Goals
M	**Materials**	**12.00%**	The impact of the building's use of materials on the environment shall be controlled.
M.1	Regional Materials	2.05%	
M.2	Responsible Sourcing of Materials	0.95%	
M.3	Recycled Materials	2.70%	
M.4	Materials Reuse	1.75%	
M.5	Structure Reuse	0.95%	
M.6	Design For Disassembly	1.60%	
M.7	Life Cycle Assessment (LCA)*	2.00%	
IE	**Indoor Environment**	**14.00%**	The building's indoor environment shall be controlled.
IE.1	Thermal Comfort	2.03%	
IE.3	Mechanical Ventilation	2.53%	
IE.4	Illumination Levels	1.91%	
IE.5	Daylight	1.87%	
IE.8	Acoustic Quality	1.98%	
IE.9	Low-Emitting Materials	1.84%	
IE.10	Indoor Chemical & Pollutant Source Control	1.84%	
CE	**Cultural and Economic Value**	**8.00%**	The building's cultural and economic value shall be maintained or enhanced.
CE.1	Heritage & Cultural Identity	4.12%	
CE.2	Support of National Economy	3.88%	
MO	**Management & Operations**	**11.00%**	The building's management and operations plans shall be defined.
MO.1	Commissioning Plan	1.35%	
MO.2	Organic Waste Management	0.96%	
MO.3	Recycling Management	1.27%	
MO.4	Water and Refrigerant Leak Detection Systems	1.02%	
MO.5	Energy & Water Use Sub-metering*	3.12%	
MO.6	Automated Control Systems	1.43%	
MO.8	Sustainability and Awareness Plan	0.75%	
MO.10	Vertical Transportation	1.10%	
	Total	**104.00%**	

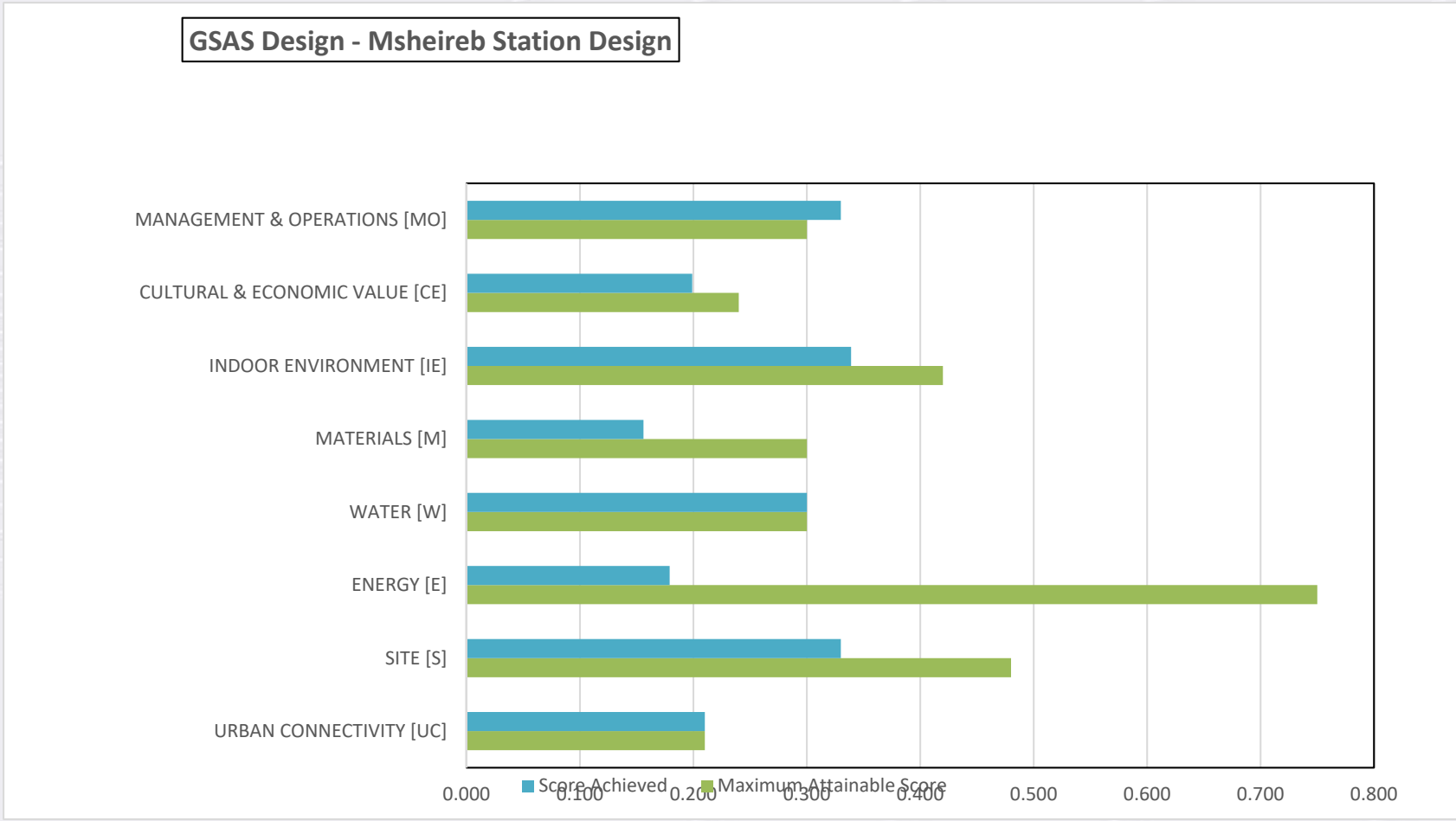
Msheireb Station - GSAS Rating

- *Msheireb Station has been assessed at the **Design Stage** using GSAS Railways*
- *A total of **2.043 Points** were attained resulting in a GSAS '**Letter of Conformance**' award of **5 ***
- *This the **highest score** attained by all **Doha Metro Stations** and only the **4th development** in Qatar to be awarded this high level of achievement.*



No	Category	Points 2.043
UC	Urban Connectivity	0.210
S	Site	0.330
E	Energy	0.179
W	Water	0.300
M	Materials	0.156
IE	Indoor Environment	0.339
CE	Cultural & Econonmic Value	0.199
MO	Management & Operations	0.330
	Level Achieved	**5 Stars**

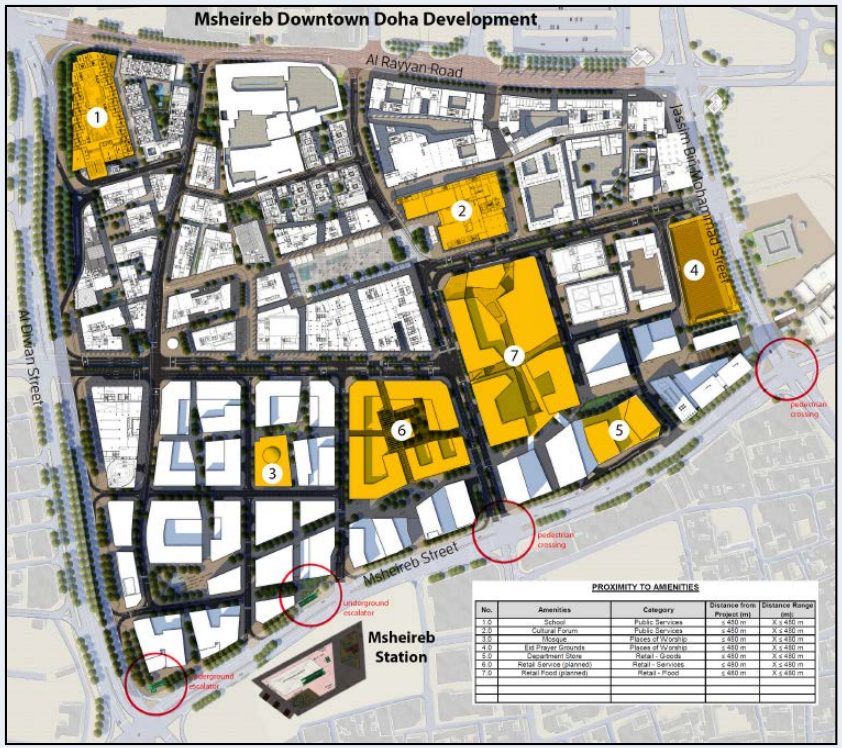
Msheireb Station: GSAS Score Achieved v Attainable

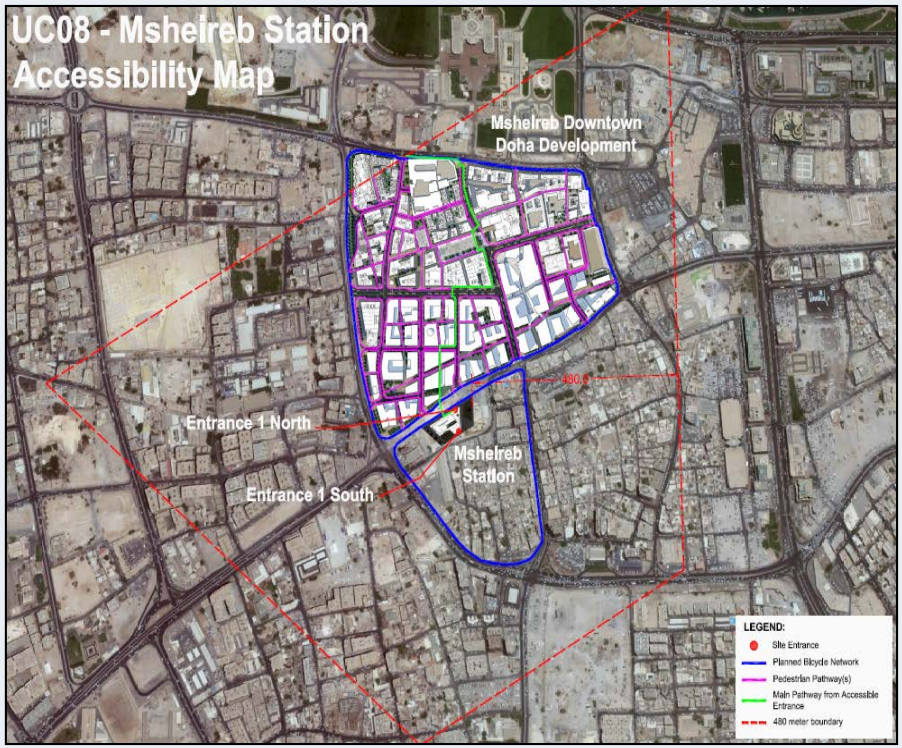


Urban Connectivity

CATEGORY & CRITERION

- ✓ Station located **near existing infrastructure**, **public transport** and **local amenities**
- ✓ Detailed **Station Area Plan (SAP)** providing links to bus stops/routes, bicycle lanes, drop-off points, etc.

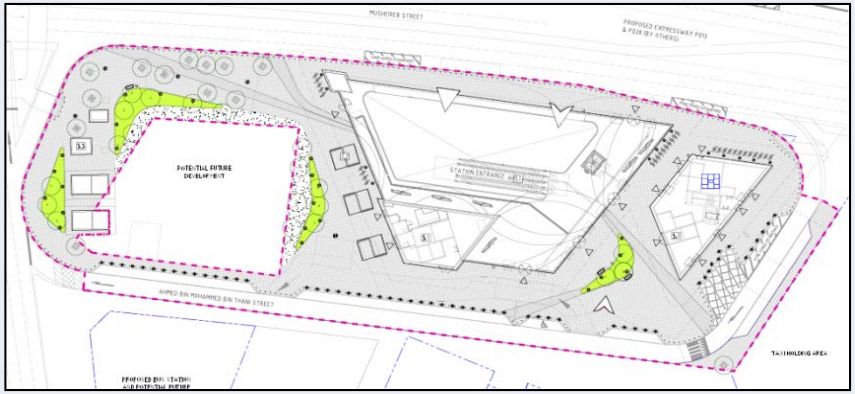


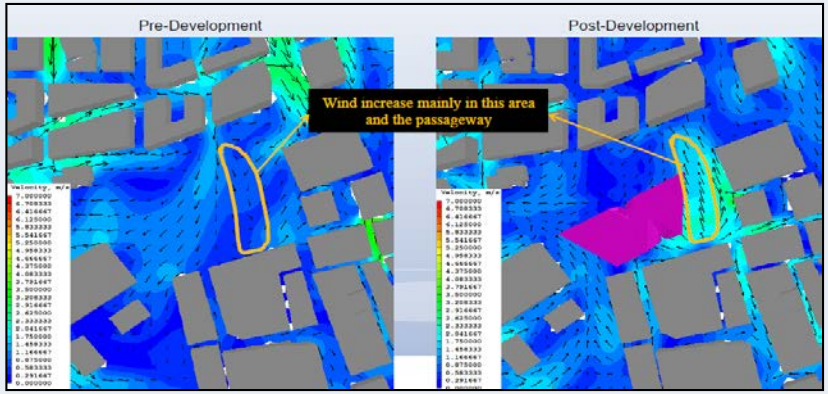


Sustainable Sites

CATEGORY & CRITERION

- ✓ Located on pre-developed **contaminated** brownfield site.
- ✓ Habitat preservation – All **trees relocated** to approved MME nurseries
- ✓ Vegetation – **>3%** of total landscaped area **vegetated** with **>75% native species. No grass.**
- ✓ Sustainable drainage - **Rainwater collection tank for storm events**. Reducing storm surges and silt run-off
- ✓ **Shading** of pathways and common areas
- ✓ **Reduced heat island effect** through selection of lighter roof and hardscaping materials
- ✓ **Low wind exposure** to pedestrians – demonstrated though wind simulation
- ✓ **Low noise impact of MEP equipment** on surrounding buildings
- ✓ Provision of **bike racks & changing/shower facilities**





Energy & Atmosphere

CATEGORY & CRITERION

- ✓ **Energy Demand & Use Credits** contribute to **25%** of the overall assessment. Msheireb Station benefits from a direct connection to one of Msheireb Properties **energy efficient** decentralized **District Cooling Plants (DCP)**
- ✓ **DCP plus energy efficient design** resulted in **savings of >29%** compared to similar building type
- ✓ **Energy recovery** of incoming **mechanically ventilated air** (**70% savings**)
- ✓ **Energy efficient** variable speed **Air Handling Units (AHUs**)
- ✓ **LED** lighting throughout Front of House areas
- ✓ **Lighting controls** linked to **intelligent building management system** (BMS), together with **daylight sensors** (FOH) and **occupancy control sensors** (BOH)

Water Efficiency & Reuse

CATEGORY & CRITERION

- ✓ **Maximum GSAS scores** awarded for GSAS Criterions **W1 – Water Efficiency** and **W2 – Water Consumption and Reuse**. Both Criterion highly weighted with 4% (W1) and 6% (W2) of total score.
- ✓ Efficient sanitary fixtures/fittings with **low flush WCs & urinals**, and **low flow taps & showers**.
- ✓ **Landscaping** – **>75% native** and **drought tolerant species**. Drip feed irrigation system.
- ✓ **Greywater** – Water treated from public facilities and **reused as landscape irrigation** water.

Fixture / Fitting	Manufacturer	GSAS Benchmark	Actual Performance
T01, T02 & T04 Toilets (WC)	Durvait	6.06 Litres Per Flush (LPF)	3.75 LPF
T03 Urinals	Duravit	1.8 LPF	0.5 LPF
T07 Electronic Sensor Taps	VOLA	1.9 Litres Per Minute (LPM)	1.5 LPM *

* Based of alternative calculation method accepted by GORD.

Materials & Resources

CATEGORY & CRITERION

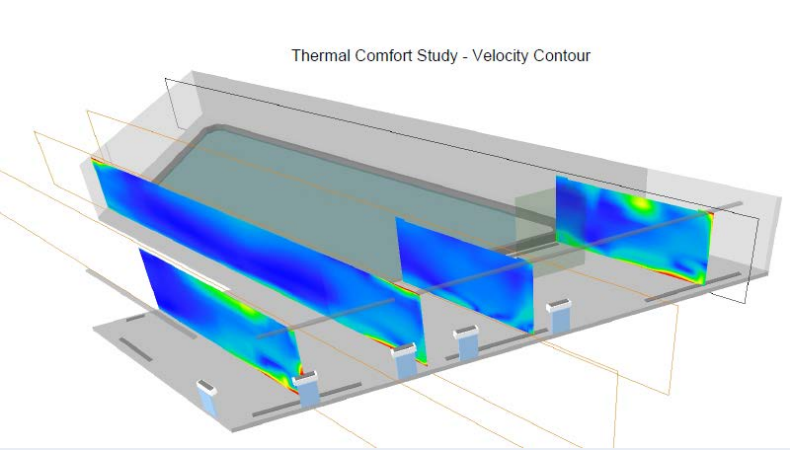
Materials & Resources

- ✓ **>20% recycled content of materials**. Materials which contribute include **concrete**, **steel** , **FOH architectural fit-out materials** (e.g. Acoustic Plaster; Terrazzo Flooring; Identity Wall Finishes; Ceiling Petals Infill and frame)
- ✓ **>30% of materials Regionally Sourced**
- ✓ **100%** Forestry Stewardship Council (**FSC**) **Certified timber**
- ✓ **Life Cycle Assessment (LCA)** – Several materials have valid international **Environmental Product Declarations** (EPD) stating the material environmental performance including embodied energy, waste, carbon emissions, etc. Materials include Qatar Steel (rebar), acoustic plaster, ceiling petals, and curtain wall glazing.
- ✓ **Design for Disassembly** – Several materials are designed to **be re-used/recycled over the lifespan of the station**, including roof structural steel, stainless steel ceiling petal infill and frames, Omani stone cladding, etc

Indoor Environment

CATEGORY & CRITERION

- ✓ **Thermal comfort** - Computational Fluid Dynamics (CFD) study conducted for occupants to deliver air at **comfortable speed, humidity and temp**. Maintained via BMS.
- ✓ **CO^2 sensors** in all densely occupied spaces (e.g. platforms) to assist in modulating the fresh air requirements based on the varying occupancy levels.
- ✓ **Acoustic treatment** of walls, ceilings and MEP ducting to reduce reverberation and background noise
- ✓ IESNA **compliant lighting** - **uniformity & illuminance**
- ✓ Low emitting materials – **low VOCs** of all materials
- ✓ **No smoking** within the station
- ✓ **Separate ventilation & extraction systems** for contamination sources (e.g. waste & chemical rooms)



Cultural & Economic Value

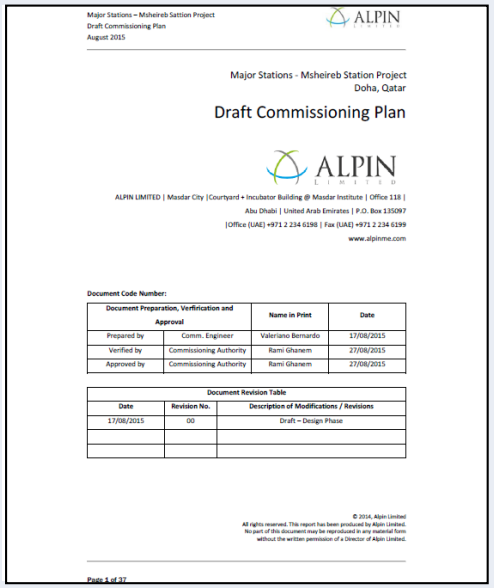
CATEGORY & CRITERION

- ✓ **GORD assessed design**: *"Heritage of the country with the 'tent shaped' and 'vaulted spaces' design inspired by traditional architectural elements. This theme is a true reflection of the Qatari culture, aesthetically and symbolically.'*
- ✓ Construction expenditure benefitting the local economy, with **>50% of expenditure** on **local contractors**, **construction** and **building materials**, **construction equipment**, and **temporary facilities**.

Management & Operations

CATEGORY & CRITERION

- ✓ Appointment of an **independent Commissioning Authority** (Alpin) & development of a **Commissioning Plan**
- ✓ Draft operational **Waste Management Plan**
- ✓ **Water and refrigerant leak detection systems** throughout the station
- ✓ **Energy & water use sub-metering** for all energy and water consuming systems
- ✓ Installation of a **BMS** to intelligently control the station **lighting, cooling, ventilation**, etc.
- ✓ **Energy efficient lifts, escalators and walkways**



Major Stations – Msheireb Sattion Project
Draft Commissioning Plan
August 2015

ALPIN

Major Stations - Msheireb Station Project
Doha, Qatar

Draft Commissioning Plan

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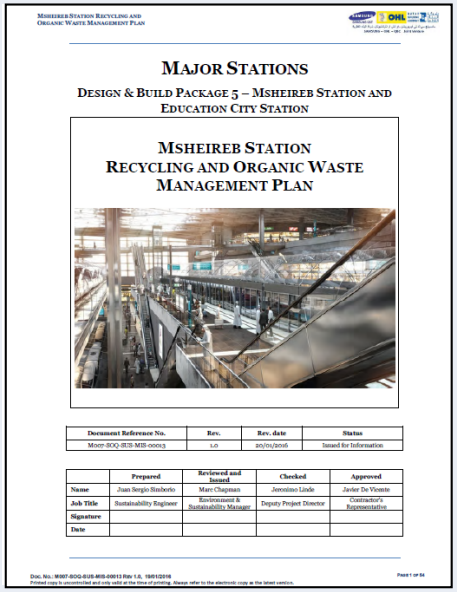

Msheireb Station Recycling and Organic Waste Management Plan

MAJOR STATIONS

DESIGN & BUILD PACKAGE 5 – MSHEIREB STATION AND EDUCATION CITY STATION

MSHEIREB STATION
RECYCLING AND ORGANIC WASTE
MANAGEMENT PLAN

Document Reference No.	Rev.	Rev. date	Status
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Job Title	Sustainability Engineer	Environment & Sustainability Manager	Deputy Project Director	Contractor's Representative
Signature				
Date				

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Doha Metro
Major Stations

Contract No:

FACILITY MANAGEMENT PLAN

Document Code No: DRAFT

Document preparation, verification and Approval		Name in print
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Approved by		

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DRAFT

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How GSAS 5 Stars was achieved

Based on GSAS credits from other stations there are several reasons why the higher level of sustainability (GSAS 5 Stars) was achieved:

- ✓ **Design Development Team (DDT):** Following the termination of the Design and Build Contractor at Major Stations (Msheireb and Education City Stations) all design responsibility was brought in-house to the DDT at Qatar Rail. This included all architectural and MEP design decision making.

- ✓ **Team Continuity:** The same GSAS CGP and MEP Designers were retained throughout the project.

- ✓ **MEP & Architectural Design Consultants:** Including specific GSAS requirements within their contract scope and ensuring relevant criterion were targeted from the start of the design process

- ✓ **Urban Connectivity:** Msheireb Downtown Doha is the world's first sustainable downtown regeneration project with inherently good urban connectivity. Maximum scores were gained for proximity to infrastructure, public transportation links, proximity to amenities & accessibility

- ✓ **Dual Certification Process:** Both LEED and GSAS have similar assessment criterion, but differ on certain credits. By targeting some specific LEED criterion meant achieving GSAS credits was easier.

How GSAS 5 Stars was achieved

- ✓ **Shading:** The larger main shelter canopy of Msheireb Station contributed to significant shading for the stations users within the exposed pathway and plaza areas

- ✓ **Energy:** Msheireb Station achieved the best performing energy ratings compared to other stations. Reasons for good performance include the provision of chilled water from Msheireb Properties District Cooling Plant and an overall energy efficient design (e.g. variable speed AHUs, mechanically ventillated incoming air (70% savings), LED lighting through FOH, BOH lighting sensors, and an intelligent Building Management System (BMS) for all lighting controls.

- ✓ **Acoustic Quality:** Acoustic modeling completed for Msheireb Station to determine compliance with the minimum requirements for background noise and reverberation time. Additional areas of acoustic paneling identified to ensure compliance.

- ✓ **Commissioning Plan:** An independent Commissioning Authority (Alpin) was appointed at both design and construction phases to develop a Commissioning Plan for all phases of the building process from pre-design to post-occupancy.


المنصورة
Al Mansoura
الرفاع
Al Rifa
لوسيل
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Thank you