International Urban Sustainability & Green Building Conference 2016 (IUS GBC 2016)

Green Practices in MRT Construction

By Ir. Yeoh Jit Shiong

“Better Places for People”

• To create a world in which buildings support healthier and happier lives for those who occupy them;
• To raise awareness of how buildings impact upon health and well-being and encourage those who design, build, own, occupy, operate or sell them, to shape buildings for the benefit of people; and
• Drive real, on-the-ground action and increase the uptake of greener, healthier buildings.
International Urban Sustainability & Green Building Conference 2016 (IUS GBC 2016)

“Climate change is real. It is happening right now ... We need to support leaders around the world who do not speak for the big polluters or the big corporations, but who speak for all of humanity.”

Leonardo DiCaprio, Oscars Speech 2016

Construction in Malaysia

• In recent year, architects and engineers contributed to environmental sustainability
• One key players in the construction value chain has not been well recognized – the Builders!
  • sustainability and environmental protection, go green and adopt ‘friendlier’ construction site management and practices
  • responsible to the environment, the neighbours and general public
• Environmental consciousness and professionalism of Builders
Construction in Malaysia

Wastage
• Concrete
• Rebar
• Office
• Water
• Electricity

Inconvenience
• Public access
• Traffic
• Safety
• Pollution
• Damages
• Security

Green Practices

Construction
• Company Policy
• Reduce/Reuse/Recycle
• Energy
• Environmental/Water
• Housekeeping
• Air Quality
• Innovation

Community
• Company Policy
• Accessibility
• Public Safety
• Noise & Vibration
• Communications
• Workforce Management
Green Construction

What can be done?

• Company Policy
  • Top management
  • Inculcating the middle managers, supervisors & workers
    • A step further, selecting supplier & sub-contractors that are green conscious
  • KPI’s for control of the environment
Green Construction

• Reduce/Reuse/Recycle
  • Collection & segregation of construction waste

Green Construction

• Reduce/Reuse/Recycle
  • Reuse/recycle office items
Green Construction

• Reduce/Reuse/Recycle
• KPI Setting and monitoring

Concrete Waste Record

<table>
<thead>
<tr>
<th>Month</th>
<th>Jan-12</th>
<th>Feb-12</th>
<th>Mar-12</th>
<th>Apr-12</th>
<th>May-12</th>
<th>Jun-12</th>
<th>Jul-12</th>
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<th>Apr-13</th>
<th>May-13</th>
<th>Jun-13</th>
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<tbody>
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<td>Wastage (%)</td>
<td>1.60%</td>
<td>2.00%</td>
<td>1.50%</td>
<td>1.50%</td>
<td>1.50%</td>
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<tr>
<td>KPI (%)</td>
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Rebar Waste Record

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<th>Apr-12</th>
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<tbody>
<tr>
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<td>Wastage (%)</td>
<td>4.60%</td>
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<td>4.70%</td>
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</tbody>
</table>
Green Construction

• Reduce/Reuse/Recycle
• Technology

Reduction of masonry works using dry wall
Green Construction

• Reduce/Reuse/Recycle
  • Use of construction scrap for non-structural applications

Reuse of Rebar

Used as a PPE stand

Waste timbers used for TCM purpose

Zinc sheets used as a roof for Temporary storage

Green Construction

• Reduce/Reuse/Recycle
  • Use of construction scrap for non-structural applications
Green Construction

- Reduce/Reuse/Recycle
- Use of construction scrap for non-structural applications

Green Construction

- Energy
- Monitoring of electricity usage

<table>
<thead>
<tr>
<th>Month</th>
<th>Usage (kWh)</th>
<th>Energy (kWh)</th>
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<td>Dec 12</td>
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<td>281,481</td>
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</table>
Green Construction

• Energy
• Technology

Green Construction

• Environment/Water
• Monitoring of water usage

Water Consumption

<table>
<thead>
<tr>
<th>Month</th>
<th>Jan 12</th>
<th>Feb 12</th>
<th>Mar 12</th>
<th>Apr 12</th>
<th>May 12</th>
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</tbody>
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3/13/2016
Green Construction

- Environment/Water
  - Monitoring/conservation of water

Green Construction

- Environment/Water
  - Real-time monitoring of Total Suspended Solids (TSS) system with CCTV
Green Construction

• Environment/Water
  • Additional control of Total Suspended Solids

TSS reading below 30mg/l

Green Construction

• Environment/Water
  • ECM plan
Green Construction

• Environment/Water
  • ECM implementation

Total Volume of the ECM plants = 610m³

![Diagram showing treatment plant, sedimentation tank, water recycle storage tank, and overflow discharge into storm water drain.](Diagram.png)
Green Construction

• Environment/Water
• ECM implementation

Use of water efficient fittings at site office
Green Construction

• Environment/Water
  • Use of product with green label

Green Construction

• Housekeeping & Air Quality
  • Procedures
  • Awareness
Green Construction

- Housekeeping & Air Quality
  - Designated storage space
  - Mitigate generation of dust

Green Construction

- Housekeeping & Air Quality
  - Mitigate generation of dust

Veolia – for Dust & cleaning
Bobcat – for Dust & cleaning
Spraying water
Green Construction

• Housekeeping & Air Quality
  • Mitigate generation of dust

Green Construction

• Housekeeping & Air Quality
  • Covered Bins for Collection of Food Waste At Designated Collection Point
Green Construction

• Housekeeping & Air Quality

• Briefing to workers

<table>
<thead>
<tr>
<th>SEGREGATION OF WASTE</th>
<th>Scrap</th>
<th>Construction</th>
<th>Food waste</th>
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</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Materials - Reduce / Reuse / Recycle bins - always closed the cover

<table>
<thead>
<tr>
<th>Maintenance of construction vehicles &amp; machineries</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>Brand</th>
<th>Model</th>
<th>Serial No.</th>
<th>Make</th>
<th>Year</th>
<th>Hours</th>
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</tbody>
</table>
Green Construction

- Housekeeping & Air Quality
- Designated personnel to oversee housekeeping & cleanliness on site

Public Convenience

How to minimize disturbance?
Public Convenience

• Company Policy
  • Top management
  • Inculcating the middle managers, supervisors & workers
  • System to gather feedback from public, staff, suppliers & sub-contractors

Public Convenience

• Procedure & Planning
  • Briefing, quiz & feedback
Public Convenience

• Accessibility
  • Clearly visible to public
  • Clean and well maintained site entrance
  • Positive image, boost confidence
Public Convenience

- Accessibility
  - Ramps, car parks, bicycle racks

Public Convenience

- Accessibility
  - Traffic management plans
  - Traffic controllers
Public Convenience
• Accessibility
  • Restricted delivery times

Public Convenience
• Accessibility
  • Addressing possible traffic obstruction
Public Convenience

• Accessibility
  • Signage for pedestrians

Public Convenience

• Public Safety
  • Covered walkway/Overhead crossing
Public Convenience

• Public Safety
  • Full height hoarding & netting

Public Convenience

• Public Safety
  • Footpath, vehicular barriers & safety information
Public Convenience

• Public Safety
  • Footpath, vehicular barriers & safety information

Public Convenience

• Public Safety
  • Footpath, vehicular barriers & safety information
Public Convenience

• Public Safety
  • Evacuation drill

Public Convenience

• Public Safety
  • Emergency Response Team
Public Convenience

• Public Safety
• Site safety

Strut force-Load Cell

Strut force-Strain Gauge
Public Convenience

- Public Safety
- Monitoring of surrounding

Settlement monitoring

water drawdown-Water standpipe & Piezometer

5th March 2016
Green Practices in MRT Construction

3/13/2016
Public Convenience

- Noise & Vibration
- Specific goals & KPIs

Vibration level

VIBRATION MONITORING

<table>
<thead>
<tr>
<th>ALERT</th>
<th>WORK SUSPENSION</th>
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<tbody>
<tr>
<td>10</td>
<td>15</td>
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Noise-Level

<table>
<thead>
<tr>
<th>The Kline</th>
<th>Noise-Level</th>
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<tbody>
<tr>
<td>Weekdays</td>
<td>7am to 10pm</td>
</tr>
<tr>
<td>Sundays/PM</td>
<td>-</td>
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<table>
<thead>
<tr>
<th>RKB 391</th>
<th>Noise-Level</th>
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<td>Sundays/PM</td>
<td>-</td>
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</tbody>
</table>

Public Convenience

- Noise & Vibration
- Addressing public complaints

CS12 – Action to stop work on noise feedbacks

- MRO receives feedback about noise from residents (more than one call)
- Report to PM or site in charge by WhatsApp or Call
- Investigate the noise source on site, if it is from CS12
  - Stop work
  - Investigate where the noise is from, if it is from CS12
  - Report to PM or site in charge by WhatsApp or Call
  - Check noise readings, if recorded, reading high
  - ECO receives feedback from NEA
Public Convenience

• Noise & Vibration
• Noise control

Sound Reduced machineries
LEV fan with Silencer

OA52 – On Site Noise control measures

Noise Control at Source (Day & Night)

1. Noise reduced from concrete mixer
2. Noise reduced from hammer
3. Noise reduced from underground excavation
4. Noise reduced due to dust suppression

Public Convenience

• Noise & Vibration
• Noise control
Public Convenience

- Noise & Vibration
- Noise control

Circulars to residents
Public Convenience

• Noise & Vibration
  • Alternative construction method/machines

Using Bore Pile instead of Percussion Pile  
Crusher used at Zone 6
Public Convenience

• Noise & Vibration
  • Installation of noise & vibration meter
Public Convenience

• Noise & Vibration
• Noise monitoring
Public Convenience

• Noise & Vibration
  • Noise monitoring

Vibration monitoring during piling work

Real time noise monitoring system

Public Convenience

• Communication
  • Setting a policy
  • Procedure of engagement
  • Circulation of letters, notification, flyers & progress updates
  • Feedback boxes
  • Banners
  • Designated PR personnel
  • Engagement with public
Public Convenience

• Communication

Engagement with Linear Condo (Stakeholder)

Engagement with SMRT Light Rail Pte Ltd (Stakeholder)

• Open day for public
Public Convenience

• Workforce management
  • Providing medical benefits
  • Workers Quarters complete with recreation area/facilities
Public Convenience

• Workforce management

Public Convenience

• Workforce management
  • Transportation
Public Convenience

• Workforce management
  • Worker’s day
Public Convenience

- Innovations

D-wall is changed to SBP wall at Zone 2 – to reduce water usage & bentonite

Filtration system implemented with Bio Balls

Bio balls in pre-fabricated cage
Public Convenience

• Innovations

Cuplok Staircase Tower

Recycle Auto Washing Bay
Public Convenience

• Innovations

Bi-directional Static Load Test for Piling which do not need the Kentledge Test saving concrete and time and equipment needed and save the environment with less use of diesel

Public Convenience

• Innovations

Customized Air Inflated Noise Barrier
Public Convenience

• Innovations

Backfilling using Liquefied Soil Stabilization

Public Convenience

• Innovations

Electric Cable Hanger

Fire Extinguisher Holder

Scaffolds Training Display
Public Convenience

- Innovations
  - RFID
International Urban Sustainability & Green Building Conference 2016 (IUS GBC 2016)

Be the change you wish to see in the world.

- Mahatma Gandhi