technical resolution
FIGURE 7.1 Final model of IFI Installation in SCC configuration
7.1 CNC CAD DRAWING APPLICATION

The diagram to the left illustrates typical fabrication CAD drawings prepared for CNC input. The colours used to indicate cutting and engraving are likely to be different between CNC machines.

**Damaged or lost components:**

If a component of the IFI Installation can no longer be used as a result of damage or loss it will be re-fabricated in the country it inhabits at the time. This will reduce the energy consumption associated with transporting the component over long distances.

The CNC CAD layout for the installation is stored on a digital information chip within each component. When the chip is scanned the drawings become available for remanufacture.
7.2 THE KIT OF PARTS

All installation components are routed from A Grade, fire retardant pine plywood panels (2440mm x 1220mm) adhered with formaldehyde-free PureBond adhesive (discussed in Chapter 5).
**Detail 01**

- 5mm natural anodised aluminium sleeve fit over temporary joint

**Detail section b**

- Allen wrench necessary if prefabricated panel is to be disassembled

---

**Detail section a**

- M4 steel connector bolts @ 205mm ctc counter sunk
- Temporary joint 02 acc to Detail 02
- Internal routed conduit
  - 300x24mm construction slot with 24mm radius rounded edges
- Temporary joint 02 acc to Detail 02

**Internal routered conduit**

- 20mm cutaway section in centre panel to accommodate LED ribbon light
- 15mmx3mm(deep) routed recess in side panels to accommodate LED ribbon light
- 10mm white LED ribbon light with backside adhesive. Fixed in centre panel recess
- 2mm curved 1328 white translucent acrylic panel

**865mm semi-permanent joint overlap**

- **M4x28 metric flat head bolt countersunk with hexagonal drive**
- Insert-Nut 4mm thread suitable for M4 connector bolts 13mm length
- Allen wrench necessary if prefabricated panel is to be disassembled

---

**External routered conduit**

- 40mm IO logo and Isocpeur font cut 3mm into plywood panel
- 865mm semi-permanent joint overlap

---

**300x24mm construction slot**

- 40mm IO logo and Isocpeur font cut 3mm into plywood panel
Controlling lateral instability:

Buildings and structures are usually stabilised against lateral loads by using any or a combination of the three following structural systems (Worksafe 2011):

- **Triangulation** - additional interconnecting diagonal components (bracing) connecting the columns and beams (See 02).
- **Rigid Structure** - if the joints in the structure are made rigid, the structure can resist lateral loads. This can be accomplished by using knee- braces, deep footings etc (See 03).
- **Shear** - if the supporting structure has walls rather than beams and columns, these walls or panels can be used to resist the lateral loads, i.e. a shear panel (See 04).

The IFI Installation will use shear support panels.
PREFABRICATED FLOOR PANEL SYSTEM

Prefab floor panel 01
Prefab floor panel 02

5mm deep routered numbering in floor panel to match corresponding vertical panel

Temporary joint between prefab panels

Semi permanent t&g joint
joints of three panels to be staggered

22mm wide allocation slot in flooring system

22mm slot cut into floor system to accommodate centre panel. Inside of slot to be painted to match corresponding vertical panel

5mm deep routered numbering in floor panel to match corresponding vertical panel

150mm Aluminium texture-grip ramp fixed to installation floor panel with self cutting aluminium screws @ 35C

sectional plan of exhibition flooring system

floor panel with aluminium threshold
Semi-permanent T&G joint of three panels to be staggered.

22mm slot cut into floor system to accommodate vertical panel. Inside of slot to be painted colour to match colour allocated to related IFI principal segment.

3x 16mm A Grade Pine Plywood floor panel with low VOC clear single pack polyurethane in matt finish fixed together with M6 connector bolts and insert nuts recessed in top panel.

10x4mm white LED ribbon light with backside adhesive fixed to bottom of top floor panel.

2x 16mm bottom floor panels to be recessed 30mm at edges to accommodate LED ribbon light.

22mm wide allocation slot in flooring system.

10mm routered conduit in centre floor panel.

3x 16mm A Grade Pine Plywood floor panel with low VOC clear single pack polyurethane in matt finish fixed together with M6 connector bolts and insert nuts recessed in top panel.

35mm recess to accommodate LED ribbon light.

10mm routered conduit in centre floor panel.

Insert-Nut 6mm thread suitable for M6 connector bolts 45mm length.

30mm recess to accommodate LED ribbon light.

M6×45 metric flat head bolt countersunk with hexagonal drive.
7.3 INTERMEDIATE SECTIONS

**Diagram Description:**

- **24mm A Grade Pine Plywood** horizontal slotted panel cnc routed with low VOC clear single pack polyurethane matt finish.
- **24mm A Grade Pine Plywood** seating slotted panel cnc routed with low VOC clear single pack polyurethane matt finish.
- **24mm A Grade Pine Plywood** horizontal slotted panel cnc routed with low VOC clear single pack polyurethane matt finish.
- **A Grade Pine Plywood** floor system slotted panel cnc routed with low VOC clear single pack polyurethane matt finish.
- **5mm natural anodised aluminium sleeve** fitted over panel joint acc to detail 01.

**Perspective Elevation of the 90deg Bend:**

- Prefabricated horizontal segment
- Prefabricated seating segment
- Prefabricated floor system segment
- Prefabricated internal horizontal segment
- Prefabricated raised floor segment

**Details:**

- The 90deg bend
- The 90deg bend segment
- Prefabricated raised floor segment
- Prefabricated floor system segment
- Prefabricated internal horizontal segment
- Prefabricated seating segment
- Prefabricated horizontal segment

**Notes:**

- plywood floor system as per floor detail drawing.
- 90 deg 28mm plywood horizontal
- 29mm plywood floor
- V4 slat fitted into vertical panels clear slip free low voc varnish finish
- 5mm aluminium sleeve fitted over panel joint acc to detail 01
Intermediate sections: the 45deg bend
intermediate sections: the straight

interchangeable intermediate prefabricated panels

possible configurations
7.4 THE CONTEMPLATION PAVILION

19mm A Grade Pine Plywood
back rest slotted panel
CNC routed with low VOC
clear single pack
polyurethane matt finish

19mm A Grade Pine Plywood
slotted base structure 01
CNC routed with low VOC
clear single pack
polyurethane matt finish

19mm structural slot

Prefabricated back rest
Prefabricated soft seating

Tools required: rubber mallet

I am contemplation pavilion
Seats 90 people
elevation with section allocations

plan with section allocations

installation: linear state
7.5 SECTIONS THROUGH PRINCIPLE SPACES WITH PROPOSED LIGHTING

section a-a
Lighting effect reference: lighting from horizontal panels. Galaxy SOHO Interior by Zaha Hadid (Hadid 2011)

section b-b
When a pedestrian walks across Rogier Sterk’s interactive ‘lightfader’ floor, his or her weight displaces fluid contained within the panel system, leaving light prints for about one minute after contact. The system may be constructed as an independent floor and can perform without the built-in light. In this installation, footprints allow light within an upper space to be visible (Sterk 2011)

section c-c
Slow Furl by Ruairi Glynn is a textile that acts and reacts on its inhabitation. The textile exists as a soft and pliable skin that lines the i belong space. The skin shifts. As guests enter and move within the ‘room’, the skin moves imperceptibly at deep time-frames, creating new cavities and spaces, revealing slits and apertures, manipulating light quality from horizontal light shelves (Glynn 2008).
Delight Cloth by Tsuya Textile Co., in conjunction with the Fukui Engineering Center, consists of super thin fiber optic strands woven into a tapestry (Tsuya 2011).

Scentevent scent systems are based on "dry wave technology"—no sprays, no aerosol, no mess, no residual odour or spills, which contributes to a green environment (Scentevent 2011).

Battery powered Mini Scent 2 from Scentevents attached to interior of shear panel 450mm above F.F.L.

section d-d

section e-e

section f-f
section g-g through iam contemplation space and auditorium

FIGURE 7.8 Ale lamp by Mocoloco
28 degree Sputnik spot light with LED light source from Regent Lighting

EB-Z8000 WUXGA Epson projector

Projector designed for auditoriums and large venues. The high definition, high brightness WUXGA projector featuring industry leading 3LCD technology.

STEP 1: Insert cable into Looping Gripper.
STEP 2: Pass cable through or around anchor point.
STEP 3: Insert cable back into Looping Gripper.

ADJUSTMENT: Remove load from cable, depress plunger & adjust cable height. Release plunger to lock cable position (cablegrippers 2010)

section h-h through iam contemplation space and auditorium
**7.6 ACOUSTIC SCREEN**

The acoustic principles of the suspended pavilion screen could be described as similar to that of a lecture hall.

The goal of the space is to allow audience members to easily hear and understand the presenter without the use of a sound reinforcement system.

**Related Codes & Standards (acoustics.com 2009):**
- Reverberation Time (RT 60)
- Noise Criteria (NC)

**Considerations:**
- Recommended reverberation time is 1 second.
- Potential noise impact to the space from exterior sources and/or excessive HVAC noise which can greatly degrade speech intelligibility. The NC (Noise Criteria) level should not exceed 25 to 30.
- The front and ceiling panels can be reflective, enabling sound to reach everyone.
- Absorptive material on the back and side panels will help reduce the reverberation time and unwanted reflections.
- Avoid parallel surfaces, which can cause flutter echoes. Consider splaying or canting the sidewalls.

**Application:**

- **i am space reverberation time:**
  - length: 11 500 mm
  - width: 11 000 mm
  - height: 7 800 mm

- **Surfaces:**
  - front: reflective plywood
  - back: 85% absorptive plywood
  - left: 40/60 mixture between 30% and 70% absorptive plywood

**Pavilion acoustic diagram:**

- The calculated time is slightly higher than recommended (acoustics.com 2009) but still suitable for the application.

The calculated time is 1.17 second.
EB-Z8000 WUXGA Epson projector

28 degree Sputnik spot light with LED light source from Regent Lighting

Adaptable plywood temporary ceiling suspended from exhibition hall rigging acc to detail

Slotted construction plywood seating acc to exploded detail

Acoustic reflective section

Acoustic absorptive section

Acoustic absorptive section

Acoustic absorptive section

Reflected ceiling plan

Degree of absorptive panels used to be determined on site prior to each event when Noise Criteria (NC) level has been established

Acoustic screen components:

- Acoustic reflective
- 30% acoustic absorptive
- 70% acoustic absorptive
- 85% acoustic absorptive

White felt adhered to back of perforated panel to increase sound absorption
7.7 EXISTING SERVICES IN EXHIBITION 1, SCC

Typical section through coffer slab Exhibition 1, SCC

Reflected ceiling plan: existing lighting and ducting at Exhibition 1, SCC
Electrical service points at Exhibition 1, Sandton Convention Centre with preferred installation layout
7.8 ELECTRICAL CONSIDERATIONS AND DESIGN

The travelling nature of the exhibition would require the installation to adapt to the electrical supply of different countries.

International power supply can be categorised into two main groups (Global Electric Directory 2011) namely 50 hertz or 115V (110-130V) and 60 hertz or 230V (220-230V). To accommodate this, a voltage input switch is used along with a distribution board to control the electrical flow and protect the installation and users. Various plug types would be part of the travel kit to allow the adaptation between countries.

<table>
<thead>
<tr>
<th>Country</th>
<th>Voltage</th>
<th>Frequency</th>
<th>Plug type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>240 V</td>
<td>50 Hz</td>
<td>I</td>
</tr>
<tr>
<td>Canada</td>
<td>120 V</td>
<td>60 Hz</td>
<td>A &amp; B</td>
</tr>
<tr>
<td>China, People's Republic</td>
<td>220 V</td>
<td>50 Hz</td>
<td>A, I, D</td>
</tr>
<tr>
<td>Egypt</td>
<td>220 V</td>
<td>50 Hz</td>
<td>C</td>
</tr>
<tr>
<td>Finland</td>
<td>230 V</td>
<td>50 Hz</td>
<td>C &amp; F</td>
</tr>
<tr>
<td>France</td>
<td>230 V</td>
<td>50 Hz</td>
<td>E</td>
</tr>
<tr>
<td>Germany</td>
<td>230 V</td>
<td>50 Hz</td>
<td>C &amp; F</td>
</tr>
<tr>
<td>Greece</td>
<td>220 V</td>
<td>50 Hz</td>
<td>C, D, E &amp; F</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>220 V</td>
<td>50 Hz</td>
<td>G, M</td>
</tr>
<tr>
<td>India</td>
<td>230 V</td>
<td>50 Hz</td>
<td>C &amp; D</td>
</tr>
<tr>
<td>Italy</td>
<td>230 V</td>
<td>50 Hz</td>
<td>C, F &amp; L</td>
</tr>
<tr>
<td>Japan</td>
<td>100 V</td>
<td>50/60 Hz</td>
<td>A, B</td>
</tr>
<tr>
<td>Mexico</td>
<td>127 V</td>
<td>60 Hz</td>
<td>A &amp; B</td>
</tr>
<tr>
<td>New Zealand</td>
<td>230 V</td>
<td>50 Hz</td>
<td>I</td>
</tr>
<tr>
<td>South Africa</td>
<td>220/230 V</td>
<td>50 Hz</td>
<td>M</td>
</tr>
<tr>
<td>Spain</td>
<td>230 V</td>
<td>50 Hz</td>
<td>C &amp; F</td>
</tr>
<tr>
<td>Taiwan</td>
<td>110 V</td>
<td>60 Hz</td>
<td>A, B</td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>220 V</td>
<td>50 Hz</td>
<td>G</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>230 V</td>
<td>50 Hz</td>
<td>G</td>
</tr>
<tr>
<td>United States of America</td>
<td>120 V</td>
<td>60 Hz</td>
<td>A &amp; B</td>
</tr>
</tbody>
</table>

TABLE 7.1 Possible countries to be visited during IFI Interiors Biennale 2013. Original table (Global Electric Directory 2011) edited by author

FIGURE 7.11 Plugs around the world
Power supply from exhibition host directed from floor service points to installation distribution boards. From there it is distributed to groups of four vertical panels.

Position of floor access panels within installation not to scale.

copper plate fixed in horizontal panel soldered to insulated copper wire
flame retardant PVC insulated single core copper wire
copper plate fixed in horizontal panel soldered to insulated copper wire
profiled copper plate soldered to copper spring
copper spring soldered to copper wire and copper dome
flame retardant PVC insulated single core copper wire

electrical ducting in plywood panel detail

lockable 9mm plywood hatch access door flush with surrounding floor panel

Floor recess to accommodate AC-DC converter and single phase DB

distribution board floor hatch not to scale
LED's use Direct Current (DC) electrical supply.

Power distribution diagram:

1. Power supply from exhibition host
2. Single-phase distribution box
3. AC-DC converter with input voltage switch and replaceable fuse
4. Distributed to systems of four vertical panels

**Input voltage switch**

- Single-phase distribution box, branched into three single-phase outputs. The distribution box to be fixed to the installation plate by screws, max. Ø 6 mm, two holes in the middle 75 mm ctc.

**AC-DC converter**

Fuses are overcurrent protective devices that contain a calibrated current-carrying element which melts and opens under specified overcurrent conditions. Fuses can be used for a variety of overcurrent and overload applications (Automation Direct 2011).
The IFI installation (SCC configuration) is broken up into its component groups to indicate their panel quantities. The calculated panel number together with additional intermediate sections and the acoustic screen would occupy three 20-foot containers (based on container exploration in Chapter 6).
7.9 POPULATION AND THERMAL COMFORT

Population of IFI Installation

Typical IFI installation length: 68.5m
Projected number of visitors per day: 11 thousand (100% Design London 2010)
Trading hours: 9am-19pm
10 hours = 600 min/day
Movement past any given point in installation: 11000/600 = 18.3 people per minute
Walking speed at an exhibition is approximately 1m/s (Envisage 2010).

If walk through median time is 3 min:
18.3 x 3 mins = 55

Population in exhibition: 55 people at a time more than 1 m per person at given time

Thermal Comfort

The dedicated exhibition venue provides a thermally comfortable space. The comfort range within the IFI Interiors Installation could however be influenced by several physical factors (Hausladen & Tichelmann 2010:4):

- interior air temperature
- average temperature of enclosing surfaces
- temperature distribution
- movements of the air
- moisture in the air

The above factors have a close, mutually influential relationship with the factors that are dependent on the people themselves:

- type of clothing
- physical activity
- age, sex, constitution, physical well-being
- food intake
- adaptability
- psychosocial factors
- ethnic influences
- daily and annual rhythms
- length of time in room

Further factors related to the room itself and its use have a substantial effect on the interior climate, too:

- room occupancy
- sources of heat and substances
- temperature distribution within the room
- air change rate
- air management in the room

Specific Factors applicable to IFI Interiors Installation
Room occupancy effect on interior climate

Occupant energy production between sedentary and moderate physical activity = 105 W/m² (Hausladen & Tichelmann 2010:4).

The “normal” BSA (Body Surface Area) is generally taken to be 1.7 m² (Mosteller 1987).

Average energy production of occupant:

- $105 \text{ W/m}^2 \times 1.7 \text{ m}^2 = 178.5 \text{ W}$
- $1 \text{ W} = 1.00 \text{ J/sec}$
- Walking speed: seconds per meter: 2.6

The following table applies the gathered information to calculate the heat gain in each principle space:

TABLE 7.2 Heat gain through installation occupancy

<table>
<thead>
<tr>
<th>space</th>
<th>occupancy</th>
<th>length (m)</th>
<th>time occupied (seconds)</th>
<th>occupants energy (Watt)</th>
<th>occupants energy (Joule)</th>
<th>'room' heat gain from occupants (Celsius)</th>
</tr>
</thead>
<tbody>
<tr>
<td>create</td>
<td>15</td>
<td>9.0</td>
<td>23.4</td>
<td>2677.5 W</td>
<td>114.4 J</td>
<td>0.06 °C</td>
</tr>
<tr>
<td>learn</td>
<td>5</td>
<td>5.7</td>
<td>14.8</td>
<td>892.5 W</td>
<td>60.3 J</td>
<td>0.03 °C</td>
</tr>
<tr>
<td>belong</td>
<td>15</td>
<td>9.0</td>
<td>23.4</td>
<td>2677.5 W</td>
<td>114.4 J</td>
<td>0.06 °C</td>
</tr>
<tr>
<td>work</td>
<td>10</td>
<td>6.2</td>
<td>16.1</td>
<td>1785 W</td>
<td>110.9 J</td>
<td>0.06 °C</td>
</tr>
<tr>
<td>live</td>
<td>5</td>
<td>4.3</td>
<td>11.2</td>
<td>892.5 W</td>
<td>79.7 J</td>
<td>0.04 °C</td>
</tr>
<tr>
<td>aspire</td>
<td>5</td>
<td>4.8</td>
<td>12.5</td>
<td>892.5 W</td>
<td>71.4 J</td>
<td>0.03 °C</td>
</tr>
</tbody>
</table>

FIGURE 7.12 Body temperature in relation to surrounding temperature
Conclusion

The heat gain from room occupancy is negligible if the length of time in each principle space remains as calculated. In the case that the installation interior climate becomes uncomfortable the shear panels specified could be allowed a higher degree of permeability to allow better movement of air.
7.10 INSTALLATION EMERGENCY EXITS

The SCC requires an exhibition layout that allows emergency evacuation of all in the venue within five minutes (Annexure B).

To adhere to this requirement two emergency exits should be accommodated in the Installation. During a conversation with Cilliers (2011) a previous employee at Set Squared exhibition designers, it was determined that the bend (45/ 90 deg) intermediate sections could provide a clear 1000mm emergency exit.

Emergency signage & two emergency exits to be accommodated within first and last third of installation.