

Summary of Preliminary Assessment on Structural, Fire and Electrical Safety

Name of the Factory	: Arrow Apparels Ltd
Address of the Factory	: Ground,1st and 3rd Floor, 248, Tatki, Jatramura, RupGonj, Narayangonj, Bangladesh
Present Status of the Factory	: Under Operation
Structural assessment conducted by	: Alliance
Date of Structural Inspection	: 21 Apr 2014
Fire & Electrical assessment conducted by	: Alliance
Date of Fire & Electrical Inspection	: 21 Apr 2014

BASIC INFORMATION:

The present garment factory comprises of two factory buildings with beam-column frame system. The following general information was noted:

i. Building Usage Type	: Garments Factory
ii. Structural System	: RC frame Building
iii. Floor System	: RC beam supported
iv. Floor Area	: 63,657 sft. and ancillary building-1042 sft.
v. No. of Stories	: 04 stories and ancillary building-02 stories
vi. Construction Year	: 1983 to 1985
vii. Foundation Type	: Unknown.
viii. Design Drawings	: Not available
ix. Soil investigation Report	: Not available
x. Construction Materials	: Reinforced concrete(masonry-chip aggregate concrete)
xi. Generator	: Ground floor(Ancillary)

RECOMMENDATIONS FOR CORRECTIVE ACTION:

The recommendations of corrective action for Structural, Fire and Electrical Safety comprises in Short Term, Mid Term and Long Term basis.

The recommendations for Structural Safety corrective actions are:

Immediate	: NA
Short Term: (3 Weeks)	:
	i. Develop a program to ensure that all live loads for which a floor or roof has been designed for will not be exceeded. The designated Load Manager shall oversee this program and ensure it is enforced.
	ii. Designate a representative as the Factory Load Manager. The Factory Owner shall ensure that at least one individual, the Factory Load Manager who is located onsite full time at the factory, is trained in calculating operational load characteristics of the specific factory.

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Mid Term: (6 Weeks)

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- i. As recommended elsewhere, under guidance from a qualified structural engineer arrange Detail Engineering Assessment of the structure to confirm structural integrity.
- ii. Have a qualified structural engineer provide further testing and analysis of cracking in columns and provide a remediation plan to correct noted issues.
- iii. Engage a qualified structural engineer to confirm structural performance of the structure through detailed engineering assessment (as recommended elsewhere).
- iv. Engage qualified structural engineer to conduct a detailed engineering assessment (DEA) of building within 6 weeks. DEA should include assessment of the strength of the concrete and quantity of the steel in the columns. Concrete strength shall be assessed by taking at least 4 nos. of 4 inch diameter cores from the area of concern. If cores are to be taken from column, it is advisable to take it from an upper level where the stresses are low (for practical reasons 3 inch cores may be taken from columns). In addition, UPV shall be used to have concrete strength in sufficient number of columns in the lower tiers so that a level of confidence is achieved. The calibrated results of core tests and UPV shall be used to determine a reliable value of concrete strength in columns. The size and diameter of steel rebar in most of the columns of two lowest tiers shall be authentically determined using a Ferro scanner or similar
- v. Engage a qualified structural engineer to provide additional investigation into the areas of cracking on 3rd floor and provide a remediation plan if required.
- vi. Engage a qualified structural engineer to confirm the causes of exterior cracking and corrosion and suggest appropriate remedial measures.
- vii. Engage a qualified structural engineer to confirm and document that provisions have been made to accommodate the concentrated loads of the water tanks. If provisions have not been made, have a qualified structural engineer to develop a remediation plan.
- viii. Have a qualified structural engineer confirm that capacity to support the load in the noted areas is available. Load Plans complying with Alliance Standard Part 8 Section 8.20.4.3 should also be developed.
- ix. Have a qualified structural engineer complete an analytical evaluation of the structural impact of the floor addition as part of detailed engineering analysis (as recommended elsewhere)
- x. Engage a qualified structural engineer to confirm satisfactory structural performance of the buildings under wind loading. Compliance may be waived if the Factory Owner provides satisfactory evidence of a cyclone operations plan that includes full evacuation of the factory in advance of any approaching cyclone.
- xi. Engage a qualified structural engineer to develop the required documents to confirm the structural integrity of the buildings. Documents must comply with Alliance Standard Part 8 Section 8.19 and 8.20

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- xii. Have a qualified structural engineer complete further analysis of the structure as part of detailed engineering assessment (also recommended elsewhere) and provide accurate As-Built drawings.
- xiii. Develop engineered plans to brace racks, water tanks and telecommunications tower to resist earthquake forces to comply with the BNBC and Alliance Standard. Install anchor and braces as shown on approved plans.
- xiv. Have a qualified structural engineer prepare credible as-built documents based on the requirements of Part 8 Section 8.19 of the Alliance Standard
- xv. The compressive strength of columns, floor framing and shear walls using MCAC shall be investigated by an appropriate program of in-situ testing and representative destructive testing of core samples.
- xvi. Under guidance from a qualified structural engineer, investigate the root cause of corrosion in the slab. At the direction of the engineer, resolve any noted issues and replace/repair slab as needed.
- xvii. As per previous recommendations and recommendations elsewhere in this report, live loads must be kept below the levels recommended by qualified structural engineers. Based on results of detailed engineering assessment (as recommended elsewhere) loads plans must be developed and followed.
- xviii. Have a qualified structural engineer develop Floor Loading Plans per the requirements of Part 8 Section 8.20.5.3
- xix. Have a qualified structural engineer prepare load plans including the information required in Section 8.20 of the Alliance Standard. Plans should be posted in each area.
- xx. Provide signage or the appropriate markings at all areas used for storage to indicate the acceptable loading limits detailed in the Load Plan.
- xxi. Under guidance from a qualified structural engineer arrange geotechnical investigation at close vicinity of the structure and make the report available for review.

Long Term (6 Months) : Necessary remediation after DEA.

The recommendations for Fire Safety corrective actions are:

Immediate (3 to 6 Days)	Remove all combustibles stored underneath the cutting tables at the noted locations.
Short Term (3 Weeks)	The available exit stair width will need to be increased (by adding additional exits) or the occupancy on each floor must be limited to the available capacity of the stair width (for example, on the 1st floor the maximum occupancy would be 323 persons). For each floor that has an occupancy that exceeds 500 persons, three means of egress (exits) must be provided. Alternatively, occupancy per floor must be limited to less than 500 (see recommendation regarding insufficient stair widths found elsewhere that will also limit occupancy per floor). Remove all hasps, locks, slide bolts, or other locking

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	<p>devices all doors to exits / means of egress. If locks are required for security reasons, utilize special door locking features complying with NFPA 101.</p>
Mid Term (6 Weeks)	<p>Post maximum occupant load for all areas (near exit). As noted elsewhere, floor loads must be limited to the available capacity of the exit stairs.</p> <p>Install signage adjacent to each stair door indicating the stair name (designate each stair with a unique name/ID) and the floor level at the noted locations.</p>
Long Term (6 Months)	<p>Interior exit stairways and ramps shall terminate at an exit discharge except where terminating at an exit passageway is constructed to meet the same rating requirement as the exit that is being served and shall not be less than 1 hr fire-resistance rated construction, therefore a fire rated exit passageway would need to be established for both stair discharges.</p> <p>Remove all sliding or rolling doors at and within the exit stairs and along all portions of the means of egress. Replace with side-hinged swinging type doors in compliance with Standard. As noted elsewhere, exit enclosures require fire rated door assemblies (which should be side-hinged). Factory will need to install fire rated door assemblies at all exits (1.5 hour rating). Fire doors assemblies shall conform to NFPA 252, BS 476 Part 22, EN 1364-1, GB 12955-2008, or IS 3614. Part II. Doors must remain in closed position or be of self-closing type. Doors may be provided with locking hardware from the ingress side provided that a panic bar is installed on any door with an occupant load exceeding 49 persons.</p> <p>Install properly rated fire construction at west-north wall. This can be accomplished by installing fire rated window assemblies (1.5 hour), sealing windows completely with fire rated construction materials (2 hour), or sealing exit enclosure with fire rated construction materials (2 hour). Consult a qualified fire protection engineer to design the required rated construction barriers.</p> <p>Install automatic fire alarm system with sufficient smoke/heat detectors as per NFPA 72. Automatic detectors should be tied into the fire alarm system. Alarm system should initiate occupant notification upon activation of detectors in addition to the manual fire alarm stations. All fire alarm installations shall be submitted for review by the Alliance for review prior to commencement of installation.</p> <p>Provide fire-resistive rated assemblies at the exit access corridors noted. The rated assembly should be approved and/or designed by a qualified fire protection engineer. Alternatively automatic sprinkler protection could be provided for the building. If sprinkler protection is provided, corridor rating is not required.</p>

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	<p>Handrails shall be provided on both sides of each exit stairway and ramp. New handrails shall have a minimum height of 865 mm (34 in.) and a maximum height of 965 mm (38 in.) as measured from the leading edge of the tread.</p> <p>Install appropriate means of emergency lighting. Egress paths shall be illuminated at all times the building is occupied. Illumination shall be a minimum of 10 lux for all corridors, exit doors, and stairways. Aisles shall be provided with a minimum 2.5 lux. Means of egress illumination shall be provided with emergency power or supplemented with battery powered lights that provide minimum 10 lux for no less than 30 min in the event of failure of normal lighting.</p> <p>As noted elsewhere, install appropriate means of emergency lighting. Means of egress illumination shall be provided with emergency power or supplemented with battery powered lights that provide minimum 10 lux for no less than 30 min in the event of failure of normal lighting. Document all testing of emergency illumination.</p> <p>Installation of automatic fire alarm system (as noted elsewhere) should include an fire alarm control panel / annunciator. Until that time that a central station monitoring service or direct connection to the Fire Service and Civil Defense can be set up, a person shall be assigned to contact the fire department in the event of fire alarm activation. An annunciator shall be located in a constantly attended location to alert this person.</p> <p>Separate generator and transformer by 2-hour fire rated construction. Separate generator and fuel storage areas by a minimum 2 hour fire rated construction. The boiler room shall be separated from other occupancies by a minimum 1 hour construction and therefore a fire rated door assembly (0.75 hr rating) should be installed. Install fire rated window assemblies or enclose openings in the exit stairs along the north and south sides of the building where exposed to adjacent structures. It is recommended to retain the services of a qualified fire engineer to design the aforementioned segregation.</p> <p>Provide a uniform slope/ramp at the noted locations (slope should not exceed 1 in 20 in the direction of travel). Any protrusions or lips must be smoothed down to less than 1/4 in.</p> <p>Egress courts should be protected with 1-hr. rated walls and appropriate assemblies (window) up to 3050 mm (10 ft) above the floor of the court.</p> <p>Create a Fire Safety Director position and fill the position with an individual that has had sufficient training to be able to carry the required duties.</p> <p>Develop a hot work permit program. The program must</p>
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The recommendations for Electrical Safety corrective actions are:

Immediate (3 to 6 Days)	Ensure the Sub-Station clean and free of dirt, debris, and improperly stored materials.
Short Term (3 Weeks)	<p>Ensure proper identification of emergency power switchboards, distribution boards, and circuits.</p> <p>Provide two separate points earthing (grounding) provided for generator.</p>
Mid Term (6 Weeks)	<p>Provide a capacity information label which contains the current carrying capacity and size of main cable, rated capacity of circuit breaker and the busbar (with dimension). Display panel schedules posted on panels' door (inner side).</p> <p>Have a qualified electrical engineer develop an as-built single line diagram, detailing key components and the capacity of the electrical system.</p> <p>Provide electrical insulation mats in front of distribution boards.</p>
Long Term (6 Months)	<p>Complete Thermographic scans at least on a three year cycle. Thermographic scans should be completed in accordance with the Standard for Infrared Inspection of Electrical Systems & Rotating Equipment and NFPA70B or a comparable standard.</p> <p>Develop an Insulation Resistance Measurement Program that ensures deterioration of insulation resistance will be identified quickly. Testing should be in compliance with International Electrical Testing Association (NETA). All transformers, switchgears etc. shall be subject to an insulation resistance measurement test to ground after installation but before any wiring is connected. Insulation tests shall be made between open contacts of circuit breakers, switches etc. and between each phase and earth.</p> <p>Ensure the generator room properly rated and physically separated from the remainder of the building.</p> <p>Have a qualified electrical engineer; design a lightning protection system according to the BNBC requirements. Have a licensed electrician install the designed system. This is a violation of Section 2.9 of BNBC, 2006.</p>