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The Tally Ho building complex and its fire precautions

by Gordon Cooke

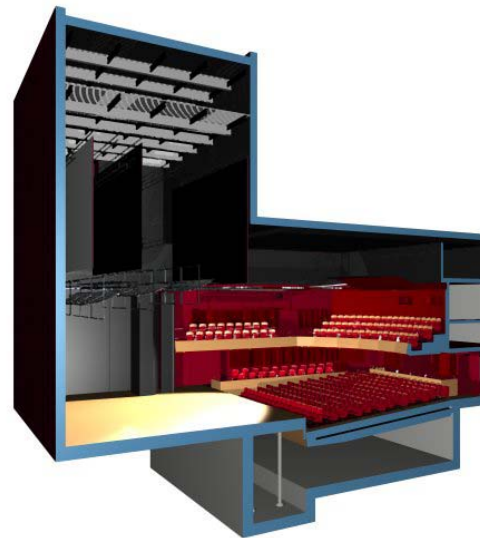
I was fortunate to be asked by Barnet Building Control Department to check, on their behalf, the fire safety design and construction of this £50m fire safety engineered project. I worked closely with the design team, building control and the fire authority and was able to suggest improvements to the fire safety design while relaxing some conventional requirements.

It was especially interesting and demanding because it featured many different occupancies, including one of the best modern arts centres in the country, and required phased handover.

I have prepared this note to give general information on the fire safety strategy and passive and active fire precautions in the complex.



Courtesy Ruddle Wilkinson architects



Courtesy ACT design services

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Site environment

The Tally Ho complex is an island site in a very busy part of North Finchley, North London. It is surrounded on its three sides by two major roads and a minor road and there is good access for external fire fighting on most of the perimeter should this ever be necessary. There are three external hydrants in the roads. There are two external HV supplies of electrical power. The complex is sufficiently far away from nearby buildings to avoid external fire spread from or to the complex. The local fire station is 5 minutes away given good traffic conditions and an attendance time of 5-10 minutes appears likely. The fire safety strategy for the building does not depend on rapid attendance by the fire service or any foreseen external fire fighting, but the assistance of the fire service in fighting a vehicle fire in the unsprinklered basement and in providing search and rescue within the building is still much needed.

Range of occupancies in complex

Tally Ho is a multi-occupancy building. It contains a 12 storey tower block of flats with rooftop penthouses, a leading-edge major theatre (Pentland) with a tilting floor which can accommodate 500 people in flat mode, a studio theatre, an arts centre, an extensive open plan office immediately below the residential flats, a two-story high health and fitness suite including a swimming pool, art galleries and studios, two basement levels of car parking, a bus station at ground floor level, part of a technical college, a self-contained large M&S food store at ground level, three other retail units mostly at ground floor level, and a Community Focus at 2nd floor level where there may be as many as 25 wheelchair users.

The structure

The building has a reinforced concrete frame, reinforced concrete floors and enclosing walls to the three fire fighting stairs and fire fighting shaft. Generally these elements of structure have 2hour fire resistance. The only floor which is not of reinforced concrete is the intermediate floor within the penthouse units which is timber joisted supported by steel beams

The external cladding of the building relies on rock wool for thermal insulation and also for fire stopping at floor/cladding junctions. No plastic foam is present in the cladding.

Portions of the roof have insulation on the upper surface of rigid polyurethane (PUR) foam. Over the accessible roof area used as a terrace at the base of the residential tower, the PUR foam is overlaid with 50mm pebble layer and has timber decking on top. The pebble has been added at my request so as to stop a fire starting (for instance by dropped smoker's materials) and spreading within the cavity formed by the combustible foam and decking

The soffit of the floor slabs in both levels of basement car parking has a composite board of phenolic foam and cementitious board fixed directly to the soffit. This foam is not regarded as a fire hazard as it is protected from fire by the cementitious layer, which is mechanically fastened to the concrete floor (phenolic foam tends to char rather than burn rapidly or produce burning droplets).

The roof to the auditorium is a grid of diagonally-braced steel girders and they are unprotected. Similarly, the technical gallery above the auditorium is also unprotected but has good means of escape. There is a massive, concealed, storey-high steel girder in the Arts centre and this is provided with 2hr fire resistance by enclosing concrete blockwork and with intumescent paint on some exposed small steel areas.

Fire fighting shaft, fire fighting stairs and dry falling/rising mains

In the residential tower there is a fire-fighting shaft (lobby approach stair, lift and dry riser) with openable vents fully in accordance with BS 5588 Part 5. The shaft is on the outside face of the building and has natural ventilation. The one small exception agreed with the fire authority is that in two lower storeys there is no openable lobby window in the external wall of the stair due to planning constraints, but I agreed this was acceptable because there was openable ventilation both below and above the two storeys so that upward ventilation could occur. There are also two well-positioned fire fighting stairs in the rest of the complex which form part of the external wall (these have dry risers and are lobby approach stairs in which the lobbies are unventilated since the stairs are internal). All three dry risers serve all upper levels, and drop to serve the two basement car park levels in which there are no sprinklers.

Basement car park smoke control

The two basement levels are mainly used for car parking by M&S and other users. Roughly 250 car spaces are provided. The two levels are not sprinklered. These two

levels are mechanically ventilated with a combination of approximately 30 jet fans mounted below the ceilings and two powerful extract fans in one corner of the building. Inlet air is via the in- and out-ramps. The fans are arranged to continuously ventilate to prevent build-up of vehicle fumes. In fire mode, which is triggered by smoke detection, many of the jet fans stop and others run in fast mode. The fans are zoned and, at my request, a zone plan is available to assist the fire service to determine the location of any vehicle fire when it is not self evident.

Cold smoke tests have been done in my presence using a smoke-making machine in different areas in the two storey parking area and I was satisfied with the results in terms of direction and rate of smoke clearance. Upon arrival the fire service can control the fans. There are three well-positioned dry risers which serve the car park levels for fire fighting purposes

Heating and ventilation

The main complex is air conditioned using air handling units (AHU's) and a system of uninsulated galvanized steel ductwork to distribute the conditioned air. Fusible-link operated fire dampers are fitted wherever the ductwork crosses a fire compartment wall or floor. The same ductwork does not cross different tenant zones. Fire stopping around the ducts is achieved with intumescent-coated rockwool board and intumescent mastic. As mentioned elsewhere, the AHU's have smoke detectors fitted downstream of the fan motors. The residential tower has individual heating units in each of the flats.

Automatic fire suppression

Automatic fire suppression is achieved with fast response sprinklers to BS 5306 Part 2 life safety specification and LPC Rules to Ordinary Hazard Group 3. These are installed in the complex with the following exceptions: the two-storey basement car park, the tower block of flats, the health and fitness suite (because the fire load is very small), the two theatres and the under-theatre seat store (see below), all staircases, the bus underpass (because it is well ventilated at both ends), toilets and other areas of accepted low fire load and low fire risk, and any areas of high risk involving electrical items. The sprinkler water storage tanks, pumps and motors are in the basement.

There are some deep ceiling voids (i.e. voids greater than 800mm deep) which ideally should have sprinkler protection but do not, but these voids have cavity barriers at the usual spacing of 20m and contain little combustible material. Many of the ceiling voids have smoke detection installed.

Atrium smoke control

The back of the theatre has an atrium which is three storeys high and has open balconies at two levels. Smoke control is based on the recommendations of BS 5588 Part 7: 1997. The atrium has a mechanical smoke clearance system at roof level which can remove 25 m³/s of smoke. Inlet air is provided through the Arts centre main entrance door which is sized at 5m² so that the maximum air flow velocity through the door does not exceed the permissible 5m/s. The fans start on detection of fire or

operation of sprinklers but the air inlet doors have to be initially opened by management, after which they are kept open on hold-open devices

The worst design fire scenario considered has assumed a fast fire growing on the floor on the atrium under the lower balcony so that worst air entrainment conditions are obtained which results in the maximum amount of smoke to be removed. Both storey balconies overlooking the atrium have sprinklers fitted on their soffits. Sprinklers are also fitted to the underside of the atrium roof but it is accepted that these are not likely to be effective as it would require a very large fire on the floor of the atrium for the sprinkler bulbs to break and by this time the sprinklers would not be able to control the fire. Such a fire is unlikely to occur, however, since the combustibles on the floor of the atrium are to be controlled under the Arts Centre license conditions.

In the design study it is assumed that a fire occurs under the lowermost balcony and the sprinklers operate and maintains the fire at a constant rate of heat release output (1MW). At roof level this results in a need for 25m³/s smoke extract (assuming the worst case scenario of a full width line plume (17.5m wide) with maximum single-sided air entrainment), and this has been provided using two fans each rated at 12.5m³/s and capable of operating at 300degC for one hour, with standby fans in a series (in-line) arrangement. In an annex of the Fire Safety Strategy report several design fire scenarios have been examined and the results show that the evacuation time provided is not less than 20 minutes. I have checked these results with a spreadsheet I wrote specifically for the Tally Ho conditions and obtained the same results as the WSP fire consultant, and approved the design on this basis.

The main theatre

The Pentland (main) theatre seats 500 and does not have a fire curtain and it does not have a roof level smoke vent over the stage area: the scenery drops are tightly packed together and there is a steel mesh floor at high level, and this makes venting through the roof of the fly tower impractical. With the agreement of my client I gave these concessions following a review of existing modern theatres, the controls exercised by Licensing regulations over the combustibles in the stage scenery, the beneficially large volume of the auditorium roof space which can act as a large smoke reservoir, and the good means of escape. There may sometimes, very rarely, be wheelchair-bound lighting technicians working on the high level open grid 'floor' above the auditorium, and their means of escape has been considered and regarded as satisfactory.

The main theatre is not compartmented from the seat store below. Attempts were made to have sprinkler coverage in the seat store but this proved very difficult for several reasons, but mainly because the headroom is very small and the hydraulically-powered floor moves up and down and also tilts which makes the sprinkler engineering very difficult. The seat store has, at my suggestion, high sensitivity aspirating detection around three sides of the moving floor, and access to the seat store void is only by authorized personnel using digi-pad entry. I personally conducted a waste paper fire test in the seat store to test the sensitivity of the detection and found the results surprisingly good. Controls are imposed to prevent storage of combustibles in the seat store. Further, all of the plywood flooring used in the construction of the theatre floor (the moving part and also the surround floor at the

same level) has been treated in the factory to give Class O. In this way it is unlikely that a fire will occur in the seat store and, if it does, it will be detected early on, permitting evacuation of occupants of the theatre above at a very early stage in fire development. The edge of the moving floor has nylon brush seals around all four edges to seal against smoke passage. It should be noted that the seat store is only separated from the theatre auditorium above when the floor is in flat mode and thus the floor edge seal will only be fully effective in this mode, but the aspirating smoke detection will be operational for all modes (raising/lowering/tilting) of floor use.

The main theatre has 6m high folding acoustic doors adjacent to the scenery store. These doors will be closed during performance mode and will provide cold smoke resistance. When the acoustic doors are open there will be no performance and the opening will be protected by a detection-triggered fabric roller screen having fire integrity but no insulation, which will have controlled descent. Beyond the acoustic door the corridor is fire protected.

Means of escape

The numbers, positions and widths of escape routes have been defined to achieve safe routes to places of safety outside the building.

Means of escape concessions

Some minor means of escape concessions have been given, notably that the two-storey roof top penthouse units will have single internal staircase access to sleeping accommodation on the upper level. This is not ideal, the fire risk being at the lower level, but is being accepted elsewhere in the country in multi-storey buildings. The stair in each penthouse will be protected by the fire resisting doors at the lower level opening into the small hall, and there will be stand-alone fire detection (smoke and heat) to give early warning of fire in both storeys. Another concession is that the two small bagged-refuse storage rooms in the communal corridors in each storey of the flats will have fire resisting lobbies but they will not be ventilated because of their location away from an external wall. To provide ventilation was impractical and, in my view, not important in this context

Phased evacuation

The fire safety strategy is based on the fact that the building is divided into a number of evacuation zones bounded by compartment walls and floors. The proposed evacuation is phased and would require the immediate evacuation of occupants of the fire zone and, later, evacuation of adjacent zones. This has implications for search, rescue and fire fighting operations by the fire service. The fire service has agreed with the building management how to deal with the different public modes of operation (i.e. with and without Arts Centre activities). On behalf of building control I made it clear that operational matters would have to be resolved to the approval of the fire authority and building control before building approval was given (conditional approval was initially given due to the phasing of occupation). At an early stage I suggested that a fire risk assessment for the whole building should be started without delay since this would help in approvals given by building control, the licensing and the fire authorities.

There are safe refuges for disabled persons sited at different points in the building. At a late stage in the project building control and I learnt that Community Focus, located at second floor level, may have up to 25 wheelchair users at some times. The design team suggested that the first floor room (which has direct access to the outside via an accessible balcony) may be regarded as a safe refuge while individuals are helped down the nearby escape stair using staff from the Arts Centre. Since occupation, this policy has been reconsidered and I and the fire authority have jointly agreed and recommended that two passenger lifts in the Arts Centre lobby and another lift near the studio theatre (where there may occasionally be 12 wheel-chair users) should be given an alternative power supply and improved communication to make them usable as evacuation lifts. This work now has funding and is currently (mid-2008) progressing

Automatic fire detection and alarm

A fully addressable automatic fire detection and alarm system (smoke and heat as appropriate) according to L1 standard of BS 5839: Part 1 is provided throughout the complex (with the exception of the individual flats and penthouses in the residential block which each have their own stand-alone fire detection and alarm systems to BS 5839 Part6) and with the following exceptions: there is no detection in the communal corridors of the flats as this could be a constant source of false alarms, and there is no automatic detection in the M&S food store as M&S argue that manual detection by staff using call points is preferable for their well-managed operations. The M&S store is virtually stand alone, is sprinklered, and is located at ground floor level and has direct access to the outside of the building. It is intended that other retail units will have automatic fire detection installed as they are occupied.

Activation of detection (by detector or call point) shuts down the mechanical plant. At my request a duct detector has been installed downstream of each air handling unit (AHU) fan so that, should a fire occur in a fan motor, the plant will be shut down immediately so as to avoid spreading fire effluent to the occupied areas.

Emergency lighting

Emergency lighting is provided for all internal parts of the complex and to external escape routes necessary for the escape of any plant maintenance workers. External escape lighting is also provided for public assembly areas. The design provides 1lux in defined escape routes and nominally 0.5lux in other areas, in accordance with BS 5266: Part 1. Emergency lighting is by battery-powered luminaires integrated into the normal lighting circuits. In emergency mode the battery backup is intended to provide the required lux level for not less than three hours. Key switches with neon lights allow testing. As the site was under construction and well lit it was not possible to 'walk the building' to check that the emergency lighting levels were adequate in all parts of the building and it was necessary to rely on lux calculations, observe the positioning of emergency luminaires, and rely on the M&E engineers assertion that the system was adequate.

Signage

Fire safety signs are provided in accordance with BS 5499 Part 1. Pictogram running man signs are used where appropriate, care being taken to ensure that the direction of escape is unambiguous. There is a notice recommending that occupants do not use the stopped escalator as an escape route. Most of the signage was checked by a colleague in the building control department.

Power supplies

There are two independent high voltage electrical supplies entering the site and there are 2 sub-stations in the basement. Because independent supplies are available, an alternative power supply (e.g. diesel generator) is not provided. Thus the fire fighting lift and other emergency systems have two independent supplies.

Public address system

This operates in the Arts Centre and Community Focus, the particular areas being shown on the fire safety strategy drawings.

Control Room

The control room houses: fire alarm panel, public address control panel, telephone, 2-way radio, building management system, drawings showing the layout of the centre at every level, sprinkler control panel, atrium and basement car park control equipment, fireman's control panel, and monitors for viewing CCTV cameras

Security

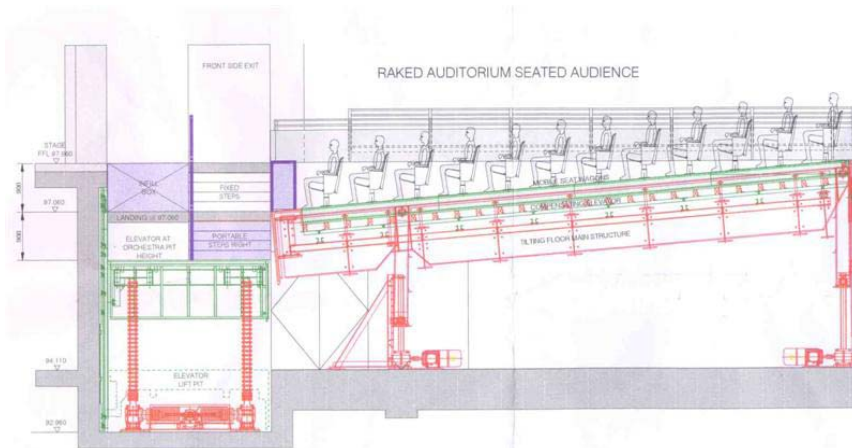
A fire safety control room is provided to monitor and organize evacuation from the building. 2 security staff will be employed 24/7/365 – one will monitor the control room and act as incident controller to hand over to the fire service on its arrival at site, and the other will walk the site and carry out investigation functions. These staff have 2-way radio capable of communicating in all areas of the building. In addition there is a car park attendant (8/10 hr) and a residential caretaker (24 hr)

There is a centre manager who heads a committee representing the Arts Centre, tenants, the security organizer and the insurers.

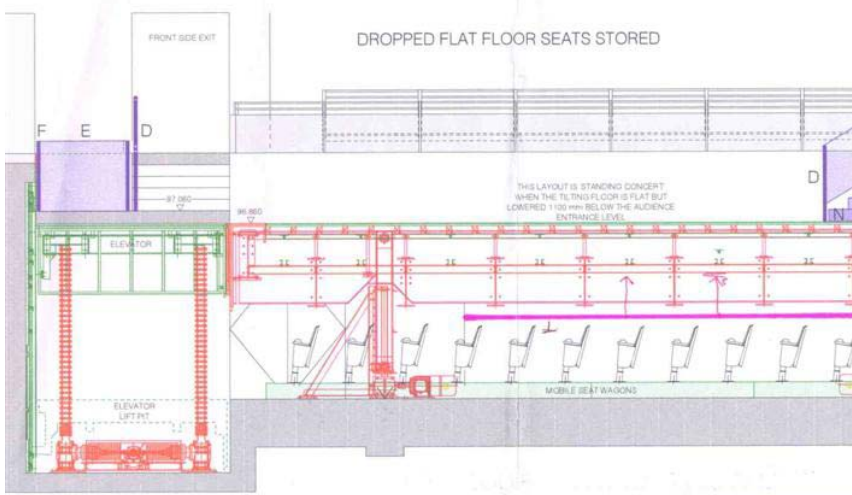
Landlord's fire safety manual

A manual has been prepared. This has had to allow for phased take-up of the accommodation and has required my approval as the building control fire responsibilities were devolved to me.

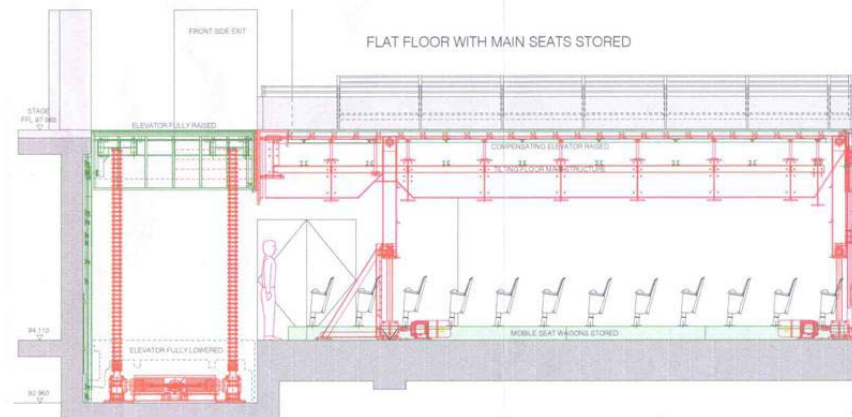
Photos and diagrams



Section through Pentland theatre auditorium and seat store below. The stage is to the left.



Theatre floor in flat mode allowing more general use of facility. Seats can be seen stored below.



Another mode of floor use, facilitated with system of hydraulic jacks.



Seat store with smoke test on VESDA aspirating detection system in progress. Small fire is in bin resting on board on top of seats (centre of picture)



Smoke test in basement car park. Picture shows smoke logging before smoke control fans switched on.



Part of smoke 'corridor' formed by PSB jet fans after they were switched on by detection system.



Top right hand side is red jet fan mounted below ceiling – one of roughly 30 fans used for smoke and vehicle fume removal. System avoids need for ducting.



Typical fire detector and sounder for 2-level basement car park



Life safety
sprinkler pump
installation in
basement plant
room.



Exposed air
handling plant
on soffit in
Community
Focus



Part of
massive
storey-high
steel plate
girder acting as
load transfer
structure in the
Arts Centre



Pentland
theatre lighting
installation



Control room
monitors and
fire control
panels during
commissioning



Cross-corridor
smoke
ventilating
window in
residential
tower block
during
construction



Tally Ho
complex
during
construction



Top of auditorium and fly tower with busy High Road on right hand side, viewed from residential tower