Design Constraints and Approach

Design Objectives

- To incorporate the requirements of Fire Services Department (FSD) as recorded in MTR letter dated 12th June 2009.
- To maximise the reinstatement of Harcourt Garden and the public facilities there-in
- To minimise the adverse impact of above ground station structures
- To create a mutually beneficial balance between the provision of a new MTR station, the requirements of statutory and regulatory bodies, and the usability of Harcourt Garden and associated urban connectivity.

Design Approach

Although the subject of this report is predominantly the impact of accommodation and facilities within Harcourt Garden, it is necessary to explain the design constraints as a whole, thereby providing an understanding of those issues affecting the building mass above ground level.

1. Constraints

Physical Constraints

The extension of Admiralty Station is physically constrained on all sides.

- To the East and South, the existing Harcourt and Rodney underground car parks form a barrier negating additional loading above the car parks, and undermining of the structure below the car parks.
- To the North, the existing Tsuen Wan Line (TWL) and Harcourt Road prevent expansion of the station footprint, and this is further complicated by the geological conditions of the 'soft-ground' resulting from the rock profile towards the harbour. An Existing electrical sub-station sits on top of the TWL tunnel box.
- To the South is the Island Line, and also Queensway and Pacific Place. The existing cylindrical structures within Harcourt Garden provide ventilation and smoke extraction from the Island Line (ISL) track, and this function must be maintained.
- To the West is the existing station, the foundations of which are designed to accommodate Admiralty Centre and United Centre above.

Within the above boundaries, the new South Island Line (East) (SIL(E)) track alignment forms a lower limit for station planning, and the Shatin to Central Line (SCL) alignment (itself threaded between physical constrains within and outside the site) creates outer limits to the provision of passenger circulation and public spaces within the new station.

Design Constraint - Passenger Circulation and Atrium Location

Although Admiralty Station becomes a terminus station for the SIL(E) and the SCL, passenger interchange between the SCL and the ISL forms the main circulation flow. The available space and location for escalators between SCL level and the existing Upper and Lower platform levels, combined with the desire for natural daylight to penetrate the station interior, determines the only location available for the central circulation atrium, and the associated skylight.

Design Constraint - Vertical Service Connection Location

Lift shafts, escape/access stairs and the significant number of vertical service risers and air shafts are therefore pushed to the perimeter of this circulation zone, further contained within the boundaries described above, and are predominantly located to the East of the station plan to facilitate efficient and direct vertical connectivity.

2. Requirements

There are certain components of the station that have to be above ground level, and within Harcourt Garden:

- The new station entrance and associated plant rooms
- The transformer rooms and associated plantrooms (per FSD requirements)
- FS inlets, Fireman's Access and Means of Escape
- Escalators, lifts and stair access to footbridge level
- Vent shafts, cooling towers and water tanks
- Utility provider requirements (i.e. meter cabinets, valve rooms etc)
- Delivery access
- LCSD facilities (re-provided)

Plantroom Requirements

<u>Electrical Transformer Rooms</u>

In response to the requirements of FSD, all electrical traction and power equipment rooms are located at ground floor level. These rooms require specific and large access doors allowing the installation and subsequent replacement of transformers. As generators of significant heat load, ventilation is provided via an intake vent above the landscaped deck, and exhaust vents around the perimeter of the building.

<u>Air Handling / ECS</u>

Also located at Ground Floor are Environmental Control System (ECS) rooms associated with the station entrance. Related chillers, water tanks and cooling towers are located on the landscaped deck.

<u>Tunnel Ventilation Fan Rooms</u>

SCL tunnel ventilation fan rooms, shafts and vent structures have been moved from the northern side of Harcourt Road, to within the station footprint since PD. This is in response to two criteria:

1. The required land for development of the station is reduced by incorporation of the Tunnel Ventilation System (TVS) into the station box, i.e. the acquisition of land north of Harcourt Road is not necessary in this regard, and;
2. To reduce the extent of works within the soft ground conditions to the North of Harcourt Road.

Inevitably, this leads to an increase of accommodation and associated superstructure within the station building. In mitigation, the vent shafts serving the SCL TVS system are reduced through the application of top-venting (see Vent Shafts, below), but the only viable location for the large fan rooms is at ground level, due to the spatial constraints at lower levels – especially headroom where floor-to-floor levels are dictated by track alignment.

Drainage Requirements

In response to HEC code of practice where a water hazard exists above transformer rooms, there must be a double slab arrangement containing a secondary waterproofing system. Similarly, the Landscape Deck drainage and irrigation is in a zone above the station plantrooms such that maintenance can be carried out by LSCD and/or HyD without the necessity of entering station areas.

Vent Shafts

Separation

The vent shafts have to comply with specific statutory separation requirements. In particular, tunnel ventilation (intake and extract) must be separated from all other openings by at least 5m. All exhaust vents must be higher than 3m from a publicly accessibly floor, and not within 5m of any opening.

Additional FSD Requirements for Smoke Extraction Affecting Vent Shaft Design

The above segregation is further affected by Fire Services Department requirement that all smoke zones within the building be provided with separate and independent smoke extraction fans and associated ducts/shafts and vents. This requirement is in excess of normal practice for station design, and has been introduced by FSD in response to their concerns regarding the deep nature of the station. Make up air must also be provided to each zone, independently. The net effect of this is a dramatic increase in ventilation requirements compared to previous station projects.

3. Design Opportunities

Station Entrance (Not to be provided for SIL(E) Day 1 Operation)

The station entrance provides street level access from Rodney Street. It is a reprovision of the existing entrance E, which is demolished to make way for the new station areas. Although the patronage is relatively low, this entrance provides Admiralty Station with identity and presence. It incorporates the atrium skylight, a passenger lift and a pair of RRIW escalators serving footbridge level. The incorporation of RRIW escalators into the station building provides convenient, direct and covered access to the majority of the public who will access the station via this Entrance (70/30 split between footbridge and street access).

The design of the façade is intentionally concave to be protective, but also allow it to face the United Centre and the Rodney Street/Harcourt Road junction. It is orientated and inclined as a result of environmental daylight/shading modelling, and provides the maximum daylight into the station, with least heat gain. The arched form of the entrance echoes the architectural form of the nearby Citic footbridge, and responds to the internal shape of the atrium. It is clad in glass and metal panels to distinguish it from the adjacent terraced landscaping.

In response to the need to increase usability of the Landscape Deck, and control the light and heat entering the station interior, the 'bubble' skylight of the PD scheme has been modified into a the glazed façade described above. A balance has been found between the footprint of a sky-light, and the amount of light which can be brought into the station through an inclined façade. This also assists in resolving pragmatic issues of atrium smoke extraction, sprinkler coverage and maintenance access. The design of the glazed façade allows the public to experience the subtle illumination of the atrium at night, further reinforcing the station presence and architectural identity, even outside station operating hours.

Vent Shafts

Vent Shaft Form and Appearance

In determining the form of the vent shafts, careful consideration has been given to the visual mass. Such structures by their nature are slim at the base (where the air pressure is higher in the shaft) and larger at the top, where the air pressure is reduced prior to discharge to minimise face velocity and noise. The Architects have developed the design aesthetic in to these practical requirements, and this has created a series of stainless steel architectural mesh ventilation boxes which are larger than the solid structures (the air shafts) which support them.

These stainless steel mesh boxes, will reflect the colour and brightness of the sky during the day, and become visually lighter. At night, these boxes will be illuminated, and give the appearance of red lanterns at an appropriate scale for the surrounding civic space.

Vent Shaft Location

The location of the vent shafts is determined by the shafts serving them within the building. While some are transferred below ground level to the perimeter, to try and achieve transfer zones above ground level would increase the mass of the ground floor, and have been avoided where possible, resulting in (most of the) vents shafts being located directly above the vertical ducts within the building.

Vent Shaft Grouping

A unifying feature was considered necessary to tie the southern vent structures together into a grouped arrangement.

To this end, a trellis has been introduced immediately below the ventilation boxes. This trellis will provide shading to seating areas, allow for low level task lighting, and could become a framework for climbing plants.
Viewed from the lower garden, the trellis provides a light canopy to the garden, and reduces the apparent height, and therefore the visual impact of the vent shafts.

It should be noted that efforts were made during the development of the design to unify and unite the vent shafts to achieve a conjoined solution. However, transfer ducts above the ground floor plant rooms locally increased the height of the Landscape Deck and the ventilation shafts. Further, by joining vent shafts together (within the segregation criteria), the available louver faces are reduced. To deviate from the most efficient arrangement of louvers (i.e. on all 4 sides of a vent shaft) inevitably increased the overall size of the vent shafts.

Vent Shaft Louver Area

Where possible, vent shafts have been considered with top-venting, negating the need for louvered sides. However, this increases the penetration of water into the station, and is therefore restricted to the SCL tunnel ventilation system. Similarly, the use of rain-proof louvres is restricted to those vents which intake air. Where possible, discharge (or exhaust) vents are only covered with a mesh and visual screen, thus increasing the 'free-area' of the vent opening and reducing the overall size of the vent shaft.

Vent Shaft Materiality

The vent shafts will be clad in a palette of materials (patterned fair-faced concrete, natural granite stone tiles and natural slate) to break up the massing and provide appropriate scale of finish due to facing outwards, or inwards. Louvers, trellises and screens will be aluminium.

In line with the design objectives, the adopted design solution serves to minimise the volume, visual mass and height of the vent shafts.

Clock Tower

At the interface between the low level garden and the elevated landscape deck, an iconic structure in a form of a slender clock tower is located alongside the grand staircase connecting the two levels.

The clock tower is the highest structure within the garden and will be perceived as the icon of the future Harcourt Garden. It's top is about 18m aboveground so that it stands proud of the other vent structures within the garden. It will display the time for people using the garden and will no doubt become an interesting backdrop for photos. The use of a clock tower (a tall structure) to signify an important public space is quite common, i.e. the old railway clock tower at Tsim Sha Tsui.

The clock tower also serves another function, which is to disguise one of the vent shafts within the garden by giving this shaft a function, while at the same time expressing it as a distinctive architectural feature. The vent outlet will be hidden behind the architectural stainless steel wire mesh facade which integrates with the natural stone massing of the tower, producing sleek lines and a contemporary outlook for the clock tower.

Technical Constraints of Clock Tower

The exhaust vent that is housed within the clock tower is a station exhaust vent with stainless steel wire mesh covering its operable openings. As mentioned above, the vent shaft has to comply with specific statutory separation requirements. This vent outlet requires minimum 5m horizontal separation from other vent shafts opening and minimum 3m vertical separation from an adjacent floor level.

Building Height

The determination of the Landscape Deck Level is a product of:

- Ground level (approx 6mPD) and a 150mm step for flood mitigation.
- Practical headroom requirements within plantrooms (varies between 4.5m – 7.0m).
- Drainage and waterproofing zone (see above) as required by HEC and MTR to facilitate segregated maintenance access.
- Landscape and finishes build-up.

This amounts to a landscape deck height of between 6m – 10m.

The top of the vent shaft structures is a product of:

- Roof deck level plus 3m minimum to the bottom of exhaust opening.
- The necessary louver height at the face of the vent (varies but approx 3.0 – 4.0m).

This amounts to a vent shaft height of at least 6m**.**

The total building height is therefore required to be approximately 12m, or +18mPD.

Connectivity

The resultant Landscape Deck level is similar to the level of the footbridges connecting to the site. This becomes advantageous and allows for direct access to/from footbridges connecting to surrounding property developments, including Citic Tower, the new HK Government Headquarters. Pacific Place will also be connected via a new bridge being developed by Swire Properties. Such immediate and easy access will naturally encourage a greater use of Harcourt Garden, than the current patronage.
To assist in public movement from the lower part of Harcourt Garden (street level) to the Landscape Deck level, the

design of the station incorporates grand staircases on the East façade, at a gradual incline. It also provides new 24-hour lift access and increases the current escalator connection to a pair of escalators within the station entrance.

Landscape Deck

The approach to the reprovision of Harcourt Garden is holistic in nature. The Garden as a whole is divided in to three zones:

- The East Garden, which has a large lawn area and formal arrangement of palm trees, connects the public to Harcourt Road and the walkway serving the HK Academy for Performing Arts.
- The South Garden addresses the main entrance to the park from Queensway, and provides a plaza space.
- The Landscape Deck above the Station connects to the East Garden via a grand staircase. This garden provides many covered seating locations and, through its convenient access, will encourage local office workers to relax outdoors during their break time. The height of this garden, and the screening arrangement of the vent shafts to the North diminish the traffic noise from Harcourt Road.

Natural stone and timber will be prevalent within the material palette of the Landscape Deck, which will be maintained by LCSD. The ground floor structure is considered part building, part terraced landscape. This reduces the visual impact of the structure by effectively raising the ground plane at the base of the wall. These terraces will be filled with a variety of plant, providing different colours, shapes and types (i.e. climbing, ground covering, hanging or vertical).

Appropriate shading is a vital component of the success of any park in this region. The proposed use of trees enhances the shade provided to the public, and will be located along prime routes through the garden, or adjacent to sitting areas - an additional asset currently underprovided in the existing Harcourt Garden.

Conclusion

The size of the station building within Harcourt Garden has been largely driven by the physical constraints**,** safety requirements of FSD, and the mitigation of land take and risk associated with construction in soft ground conditions to the North of Harcourt Road.

Inevitably, there is a requirement for ventilation structures above the station building, and the requirement for these is further exacerbated by smoke exhaust segregation parameters defined by FSD. Notwithstanding this, the design team have sought to minimise the visual impact of these structures, and further utilise them to benefit the character and identity of the Landscape Deck and Harcourt Garden.

The design team have capitalised on the opportunities for connectivity with the footbridges, and provided garden facilities directly accessible to a greater number of public. This has effectively maximised the area, and increased the facilities available to the users of Harcourt Garden.