

CHAPTER 5

Precedents

Elephant Trails of the Smithsonian Zoological Park in Washington D.C., visited by the author, forms the primary influence for creating architecture for elephants and people. Spatial planning to ensure optimal elephant care and management, elephant enrichment, sustainable design, energy efficient technologies and of course, suitable materials were all investigated.

Elephant House, Zoo Zürich | Markus Schietsch Architekten

Location: Zürichbergstrasse 221

Area: 8 440.0 m²

Project completion year: 2014

Client: 57.0 Mio SFr

The most striking feature of the new elephant building is the large wooden roof, with ETFE plastic skylights, that encloses a large space, terminating and merging into the landscape. Despite it being an enclosed indoors space, there are plenty of trees and natural substrate, with selective views to the sky to allow sunlight to filter through, generating changing light patterns and atmospheres. These atmosphere effects are representative of light filtering through tree canopies. The iconographic organic shape of the roof conveys a sense of “Nature-Construction” a symbiosis between architecture and the natural landscape (Archdaily, 2015). Apart from adhering to the unique building requirements for elephants, allowing them to experience a space based on their natural habitats was an important design informant and consid-

eration, for both the elephants and visitors.

The new enclosure provides the ten Asian elephants with six times as much space as they previously had, to roam between changing indoor and outdoor environments. The site was chosen for its open, slightly sloping landscape and thick vegetation for the new elephant building. The overall 11 000 m² enclosure contains numerous watering holes for the elephants to fully submerge themselves in and bathe. Visitors are also able to view the elephants swimming from an underwater vantage point (Frearson, 2015).

In accordance with new AZA requirements, the elephants are cared for in protected contact only within

the new building. The elephants and their handlers therefore are separated from each other and will never cross paths or be in a same space at any given time. This not only establishes better safety for the handlers and staff, but it enables elephants the freedom to develop their own natural social behaviours and bonds with one another (Swiss-Architects Review, 2015).



Elephant House, Copenhagen Zoo | Foster + Partners

Location: Copenhagen Zoo, Denmark

Area: 3 500 m²

Project completion year: 2008

Client: Foundation Realdania for Copenhagen Zoo

Copenhagen Zoo, located within a historic royal park, commissioned a new Elephant House to celebrate these noble, magnificent creatures and provide them with a more natural, healthy and enriching environment. Visitors experiencing the enclosure were also considered from the start of the design process, to create easily accessible spaces, both physical and visual, from which the public can observe the elephants in a naturalised habitat.

An extensive research investigation was conducted regarding elephant social patterns and networks, and other behaviours expressed in the wild, to design a specialised enclosure that addresses all their needs. As male elephants are inclined to separate from their mothers and the matriarchal herd when they reach sexual maturity, the architects structured their design around two separate enclosures for the female and male herds. This formed the primary design informant that influenced the rest of the decisions that followed.

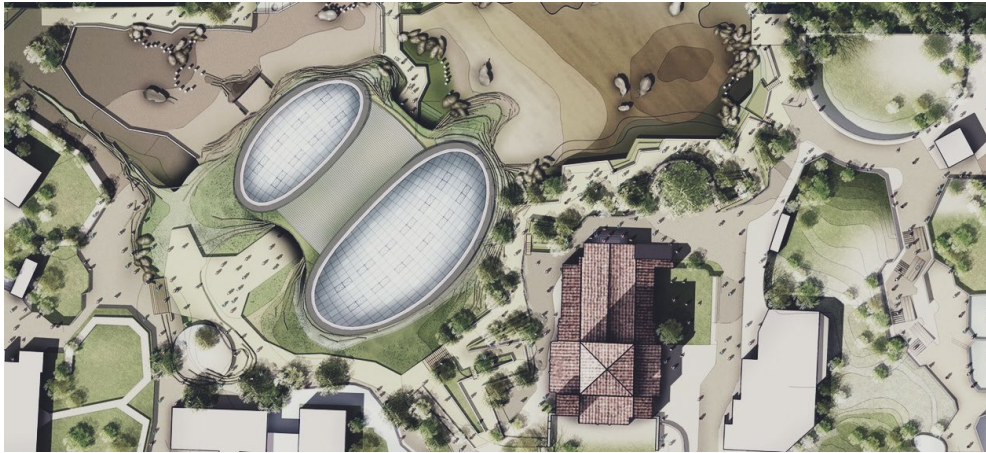
These enclosures provide the benefit of passive thermal mass and heating as they are embedded into the sloping landscape, while also minimising the building's impact on the earth. These enclosed day areas are covered with glazed domes that offer the elephants strong visual connections to the surrounding sky and varying light patterns during the course of the day. Visitors are provided with viewing spaces along these internal enclosures, which then direct them to the various paddocks and yard spaces outside. Discreet barriers are put in place to protect both the elephants and visitors alike (Foster and Partners, 2008).

This new building contributes to new zoological standards concerning elephant management and their mental and physical wellbeing. The larger of the two internal enclosures allows the six female elephants and their calves to socialise and sleep together, a first for elephants in captivity, as they would in the wild. The enclosures are filled with sand with heated slabs



underneath to maintain healthy foot care for the elephants.

Additional elements, as a result of research of elephants' natural habitat, include the surrounding paddocks and yard spaces. The paddocks reinvent a dry riverbed condition, as found at the edges of rainforests (Foster and Partners, 2008). The concrete walls have a warm terracotta-colouring, and the yellow beach-like sand naturally existing on the site, was reused to create the paddocks. These textures and colours are symbolic of the dry riverbed found in the natural habitats of Asian elephants (Fairs, 2008).



Special Features

As a fully grown male Asian elephant weighing 5, 5 tonnes may be prone to aggressive behaviour, and can exert a force of 15 tonnes on a wall, all enclosing walls were constructed from reinforced concrete, 300mm thick. Precast concrete panels were used in the stable walls, with an exposed aggregate finish to allow the elephants to rub and exfoliate their skin against the textured surface.

To prevent direct sunlight and glare entering the large day areas, a 'fritting' pattern on the glazed dome roofs was computer scripted by varying, overlapping leaf designs to provide

naturalistic, dappled light entering the space – similar to that of tree canopies. These glazed sections in the domes have operable windows to optimise natural ventilation, and together with a heat recovery system, fully enhances the energy efficiency of the overall building (Fairs, 2008).

Elephant Trails | Smithsonian National Zoological Park, Washington D.C.

Architects: *pja architects + landscape architects*

Location: *Washington D.C., United States*

Area: *8 943 m²*

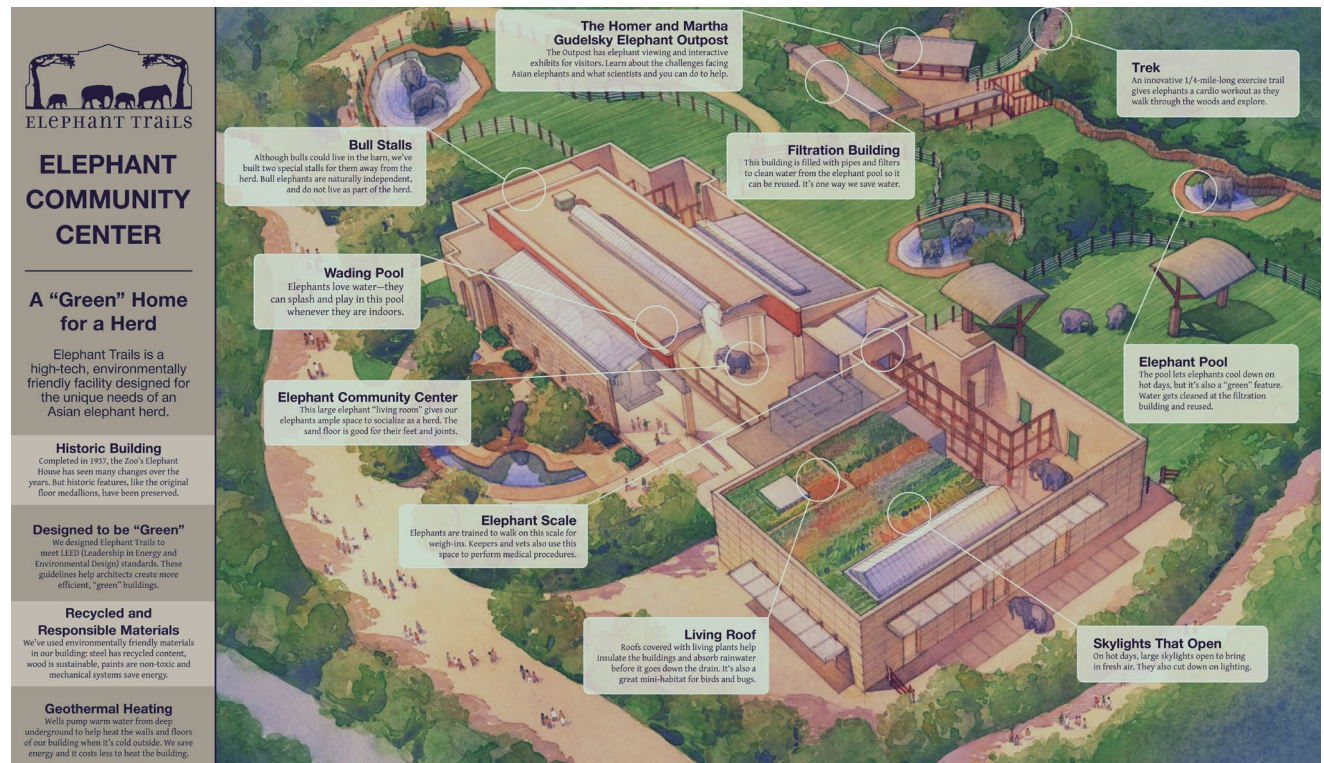
Project completion year: *2012*

Client: *Smithsonian National Zoo*

Introduction

The Elephant Trails facility at the Smithsonian National Zoological Park in Washington D.C was recently renovated and expanded in 2013, now covering a total area of 8, 943 square metres. The site is divided into an indoor exhibit of 1,232 square metres and an outdoor one of 7,711 square metres.

The facility is large enough to be able to accommodate between eight and ten fully grown Asian elephants as well as their young; however the handlers have decided on rather catering to six Asian female elephants, including a small matriarchal herd which they hope will expand (Smithsonian National Zoological Park, n. d). It will require a long time to have a multi-generational herd at the zoo due to long breeding time and limited space. Besides a mother and daughter currently residing at the facility, all the other elephants are unrelated.



History

The large mammal house was completely reconfigured and renovated in 2013, since the opening of the original stone building in 1937. Initially, the large mammal house had smaller enclosures along the periphery with a large, central viewing area for visitors. It now has a large space for the elephants and a much smaller space for the people – prioritising the elephants over the visitors.

Previously, the large mammal house consisted of various species, including giraffes, Asian and African elephants, rhinoceros and hippopotamuses. The decision was made to then only focus on Asian elephants (due to their loss of habitat) and redesign a new facility to cater entirely to them alone.

Recently until six years ago, the handlers worked with the elephants in free contact. The decision was then made to convert to protected contact in keeping with AZA (Association of Zoos and Aquariums) regulations. The facility opted instead for open barriers, as barriers were still needed –

even inside, between handlers and the elephants. Due to an unfortunate event where

an elephant accidentally killed a handler in another zoo, a re-evaluation was prompted and the shift to protected contact. They currently do have their accreditation with the AZA which is evaluated every five years.

After every incident that takes place within the zoo or any cases across the country, the safety and security of the zoo is re-evaluated. The zoo is currently preparing to put in a 4 metre barrier as an additional safety measure (Flinkman, 2016).



Experiencing Elephant Trails

A better, detailed understanding of the facility and the management and care of elephants was achieved through a two hour discussion and private tour on the 8th of July 2016 with one of the senior elephant handlers, Deborah Flinkman. Deborah, who has been working with the elephants for twenty-six years, generously welcomed all questions while showing and explaining each of the rooms and spaces within the elephant building where public access is strictly forbidden.

Features

The objective of the facility is to provide the elephants the freedom to move between various indoor and outdoor spaces on a daily basis, particularly in the evenings when all handlers leave the zoo premises. The new building includes an Elephant Community Centre (which the public are allowed to experience from a safe distance) and an Elephant Barn containing nine indoor living spaces for shared or single use depending on the elephants. The outdoor exhibit consists of seven enclosures, including four exhibit yards and two paddocks. There is also a half kilometre fenced Elephant Trek, unique to the National Zoo, which provides a walking trail for the elephants to encourage outdoor exercise through the elevated terrain and wooded vegetation. Visitors are able to view the elephants on their daily walks from selective raised viewpoints.

The six female elephants have access to several varied

outdoor enclosures containing features such as pools, sand piles and mental and physical stimulation and enrichment devices that aid in stimulating natural behaviours. These outdoor enclosures or yards provide almost a hectare of varied terrain, elevations and opportunities for foraging, exploring, exercising and socialising, and provide the handlers with optimal herd management (Smithsonian National Zoological Park, n. d).

Although not fully functional and efficient, there are a several open structures with roofs in the yards meant to provide protection from the sun during the summer, and provide heat in winter. In reality, they provide very little sun protection due to placement height and small roof areas.

The Elephant Community Centre, a large indoor exhibit with enrichment for the elephants, also provides public viewing of the elephants and an exhibition and information point for educational purposes. This centre exhibits first-class animal husbandry, state-of-the-art elephant care facilities and medical care, while also contributing to the Smithsonian elephant research committed to elephant conservation. This centre provides abundant space for the elephants to socialise, exercise and play. It includes a wading pool with overhead shower sprays that can be activated by the elephants themselves with a foot press. This centre provides visitors with incredible opportunities to view these creatures and learn about elephant physiology and behaviours, both social and cognitive, as well as animal care given to them.

The building also has a separate facility adjacent to the Community Centre which is strong enough to house an adult bull if one were to be brought to the zoo in the future (Flinkman, 2016).

The entire elephant facility is approximately two acres of space. Currently, the facility consists of 6 female Asian elephants – the largest number the zoo has ever had. The young male calf born in the zoo previously was moved to another zoo with a breeding facility when he ‘came of age’. There is only one female elephant at the moment who is suitable for breeding. There is debate as to whether a male elephant will be brought to the zoo for this purpose or if artificial insemination would be an easier and more affordable option. On the other hand, it is not certain if the female elephant will accept the training for the artificial insemination – which is a time-consuming process.

The facility has what is called a restraint device (ERD, also called a ‘squeeze cage’) which allows the elephants to be reinforced positively into this device, which is not a harness. They are given treats and made comfortable while inside. It is used for examinations and minor procedures. The sides of the device are slowly closed in on the elephant in a much smaller space. Training is required to allow elephants to gradually become accustomed to this device as a form of reinforcement. At first they are taught to just walk through it, and slowly they are fed inside it to ultimately allow them to be comfortable being inside. The training thereof becomes part of their daily rituals. The device also has a scale for handlers and veterinarians to monitor the weight of the elephants (Flinkman, 2016).

The facility has never had an adult bull residing at the zoo. Before the renovation in 2013, the facility was not able to house any adult males since only male Asian elephants have tusks which can be problematic and dangerous. Now the prospect is welcomed to contribute to public education, allow for breeding and to provide sanctuary to any bulls in need.

The elephants receive a lot of enrichment, both physically and mentally, throughout the day. The elephant handlers also provide a daily demonstration to the public – if the elephants are willing to be present and respond to simple commands. Food is placed in different containers at different heights to encourage ‘foraging’.





Challenges

- Enormous expense (renovation)
- Geothermal heating is an interesting element in the facility.
- Having multiple and adequate spaces for all the equipment for the handlers' needs – for example a hydraulic lift, connected to a cross beam running through all the barns, to lift an elephant that is down to keep it upright or elevated to prevent injuries or complications. This proves to be a challenge in itself in order to be gentle and yet strong enough to support an elephant. This hydraulic lift is able to lift up to 5, 5 tonnes, the size of an adult Asian elephant.
- Due to the extreme cold in winter (half a metre of snow at the worst), elephants have to be housed indoors for the majority of the time. Therefore it was necessary for reinforced steel and concrete doors. Otherwise, the elephants are free to move between indoors and outdoors as they please. Ice is a bigger concern where elephants will need to be housed permanently for safety reasons.
- Sun protection – adequate coverage is a concern. Several of the single roofed structures scattered throughout the outdoor spaces do not provide the sufficient shade in summer as they were hoping for. Elephants do, however, cover themselves with sand and mud for cooling and skin protection purposes from the sun, yet ample shade is still something that should be present. Indoor spaces need to be kept cool in summer for elephants wishing to remain inside.
- Due to leakage issues, three of the four pools are currently empty, including the biggest pool that is visually accessible to the public. Due to the size, it is the only pool where partial to full submerging of elephants is possible depending on their size. The other pools are merely splash pools. Due to lack of funds, the main pool could not be renovated as hoped and remained as is since being built in 1937.
- On one of the roofs they have solar panels as well as growing plants on the green roof.
- Being an interstate zoo, there is no space for expansion and designers and handlers have to use the limited amount of space provided as best as possible, which is always a challenge.

Education & awareness



Sustainable design

Green Building

The elephant building is LEED (Leadership in Energy & Environmental Design) gold certified for its sustainable and environmentally friendly design (Smithsonian National Zoological Park, n. d).

The building includes several green features including:

- Forty geothermal wells with radiant floor heating and heat pumps are used for heating the barn's floors and walls during winter, and cooling them down during summer months. These wells offer an energy-efficient, renewable source for cooling and heating the building for the elephants.
- Operable skylights run the length of the barn, permitting natural daylight, essential to elephants, while reducing electricity costs. Shade cloths were specifically designed to allow heat the exit through the roof, with fresh air entering through the many doors in the building.
- A green roof with vegetation helps absorb rainwater, reduces storm water runoff, provides insulation to maintain indoor air temperatures, and creates a habitat for wildlife including local birds and other fauna.
- Natural ventilation strategies help improve the building's overall energy performance, which include – operable skylights with retractable shades, and elephant

containment doors with large openings.

- The building's envelope is super-insulated, including the large reinforced steel and concrete elephant doors.
- All elephant pool water is filtered and reused to decrease the amount of wastewater on site.
- Recycled materials were used to meet LEED standards, including stone, sand, wood and demolished concrete.
- The HVAC system was designed to reduce energy use.

Safety and access control

Hydraulic gates are used to separate certain yards to control elephant movement when general maintenance and cleaning needs to be done. As part of Flinkman's suggestion, the operable section of the steel gate was painted yellow to be easily identifiable from a distance as it contrasts the rest of the brown gates and fencing used throughout. This was purposefully done to ensure the handlers' safety while they are working in specific yards, as they can easily identify if the gate is open or closed.

Inside the building, a 'training wall' runs throughout all the barns, parallel to the staff's service wall, that allows the handlers and specialists safe, protected access to the elephants during daily training rituals and

medical procedures.

Between the staff passageway and storage areas, and the elephant barn spaces, runs a 'transfer hall' in which elephants can move between the Elephant Community Centre and the night barns. This transfer hall is comprised of square steel sections with gaps small enough for humans to pass through while securing elephants from escaping into the staff passage. This is what is called the primary containment.

Flooring



To ensure healthy feet and nails, a recurring problem with elephants in captivity, the floor surfaces used contain various substrates. Sand is excellent for drainage but also provides a more comfortable flooring material for the elephants, causing less strain on their feet and legs.

In the Community Centre and one of the barns, 1,2m of sand above a heated concrete slab works well in terms of drainage and maximum comfort. The rest of the barns, used for sleeping, include rubberised floor material above a heated concrete slab which serves a similar purpose.

The outdoor yards offer a variety of natural substrates, including grass, soft sand, earth and pavement.

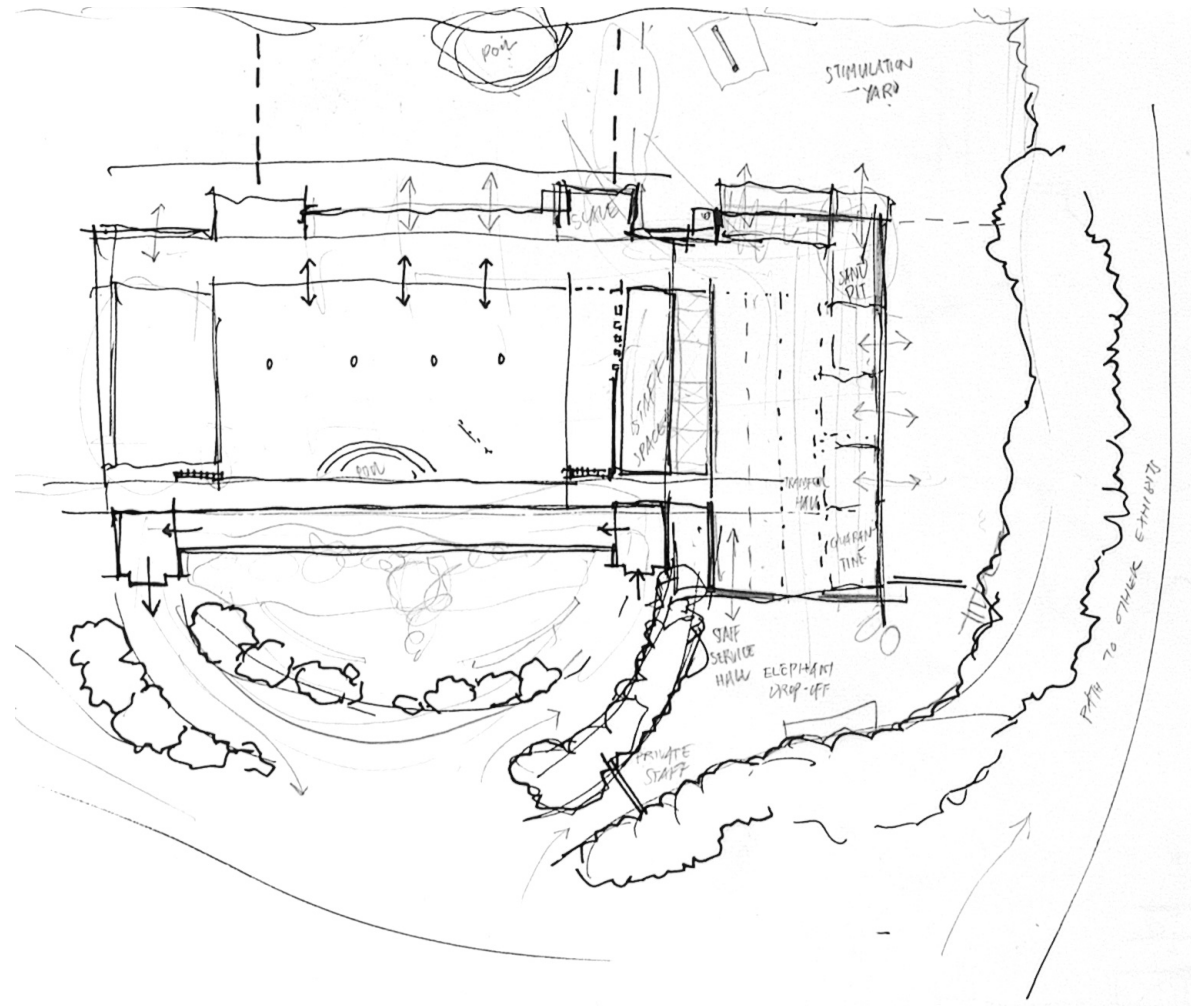
Elephant Care & Management

Enrichment

The National Zoo strives to provide mentally and physically stimulating environments and challenges for the elephants in its care. The stimulation provides various opportunities for the elephants to embrace their natural tendencies and abilities, while being in control over their own decisions in the many different enclosures and environments provided.

The handlers document all enrichment challenges and activities they offer their elephants, to continually improve and expand their research contributions to elephant conservation. The type of enrichment activities they provide aim to encourage thinking, problem solving, curiosity, enhance gross body movements and fine manipulation skills. These active behaviours attempt to fulfil husbandry needs and actions, those typically displayed by elephants living in the wild.





Author's experiential drawing of the building during the visit.

Night Quarters





Health

The handlers incorporate challenging and stimulating training sessions into the daily routines of the elephants. This routine training allows for daily health inspections and treatment, which can be challenging as elephants are only dealt with through protected contact to ensure the staff's safety.

All of the veterinarians available on site have been trained and experienced in providing elephants with medicine, diagnostics and treatment. Handlers and scientists are involved and contribute to field research of elephants, topics which include 'elephant anaesthesia, wound management, infectious disease investigation, pharmacokinetic studies and reproduction' (Smithsonian National Zoological Park, n. d).



Nutrition

Food is a daily source of nutritional enrichment, with a variety of food given to the elephants daily and scattered throughout their enclosures. Food is also placed in specifically designed nooks throughout Elephant Trails, and hung in suspended feeders to encourage trunk use. Grass grows in 2 of the four outdoor yards to allow elephants to graze naturally.

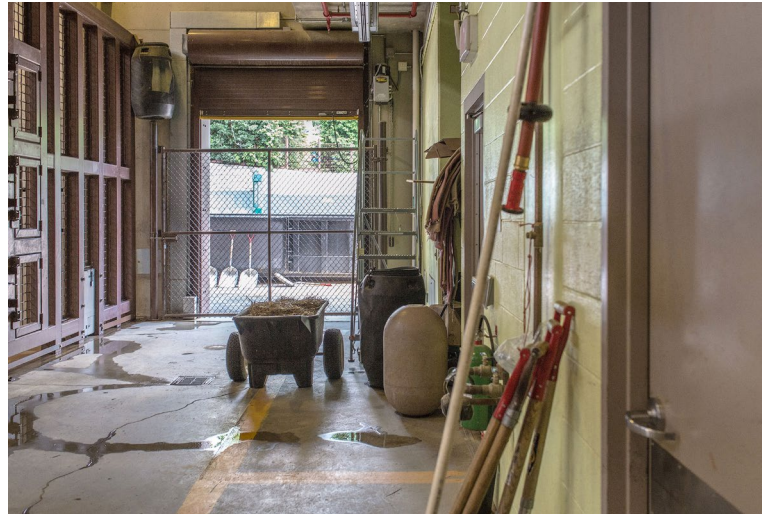
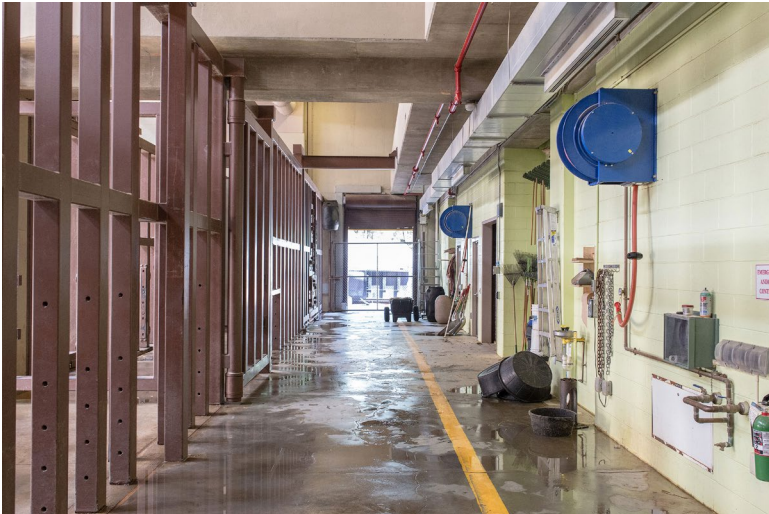
Storage spaces accessed via the service wall are used to store perishable and non perishable foods for the elephants.

The National Zoo's Department of Nutrition, comprising of clinical nutritionists, commissary manager, laboratory manager and food service specialists, have carefully devised individualised diet plans for elephants together with the handlers.

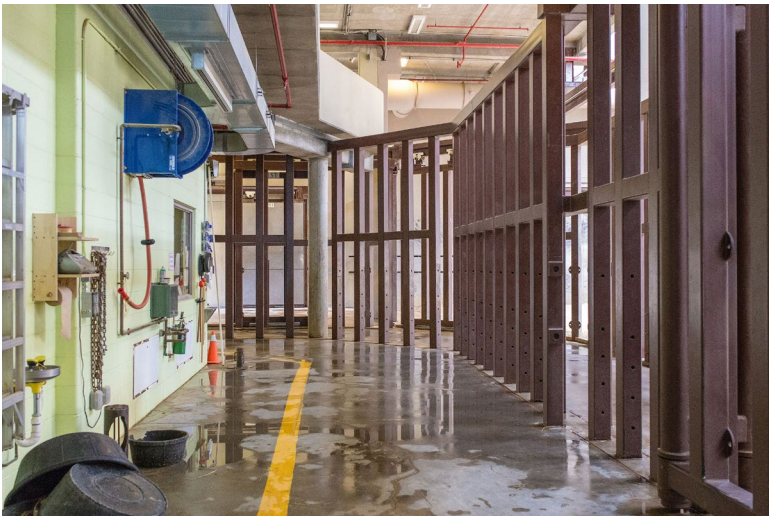




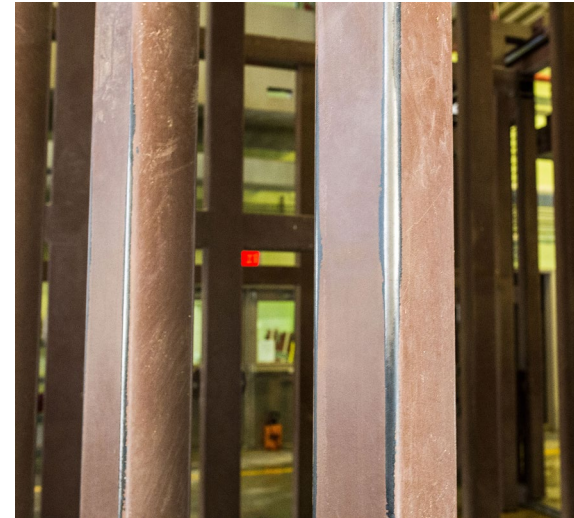
Service spaces and functions



The service wall next to the elephant transfer hall allows staff to service, clean and maintain all surrounding elephant occupied spaces on a daily basis.



Utility storage and service wall



Steel elements comprising the elephant transfer hall allow the staff to pass through, while still containing the elephants for their safety.

Holes in the steel columns allow for cables to be run through when young calves are in the building.



The training wall of the quarantine area allows handlers to safely access the elephant in need of treatment. The wall includes various openings at various heights for their convenience to reach all parts of the sick or injured elephant.



