



Intro on my job role – I am involved in all the animal related projects at the zoo. Act as a link between the client (often curators/Team Managers) and the Capital Development team (Project managers/architects/designers) and also any external consultants (structural engineers/specialist contractors). I am responsible for gathering together the brief at the start of the project and filtering queries / RFI's between the project team and the curator while the design develops.

Started at CZ in 2012 when we were in the detailed design phase of the Islands project. Construction started in Aug 2013, opened to public in July 2015 (although Orangs didn't move until Jan 2016).

## Islands site



Overview of the Islands project. One of the biggest developments in the history of UK zoos. (15 acres)

Chester Zoo is involved with, and supports, a number of conservation projects across SE Asia and it therefore seemed like a natural progression for our next development. We wanted to use the project as an opportunity to showcase the vital field work that Chester Zoo are involved in.

Islands very heavily themed. The vision was, that by throwing a spotlight on threatened species in a more immersive way our visitors develop a deeper connection with the animals - might feel more empowered to become the conservationists of the future.

Today – Focus on Orangutan enclosures specifically (area I have highlighted) and the things we took into account to try and create the most enriching environment possible for the animals.



7 Sumatran Orangs, 3 Javan gibbons: Puluh (29) adult male Emma (29) and Subis (30) adult females Indah (9), Tripa (4), Tuti (4) and Siska (1) Javan gibbons Alven (17), Tilu (9) Eko m(1)

Total area outside = 3126m<sup>2</sup>

Three separate areas all linked via Monsoon forest – arrangement gives large 'diversity of spaces' and allows the animals to choose which space they want to be in. Important for such highly intelligent complex animals.

There are a number of smaller viewing points for visitors – some open, some through glass. Importantly, the animals are not surrounded by public and there are large spaces for the animals to retreat to if they choose.



Monsoon Forest - Largest indoor zoo exhibit in the UK. 4,000m<sup>2</sup>

Three interlinked onshow enclosures and three smaller den areas. Total area inside =  $482m^2$ 

12 steel tunnels linking the internal/external areas – great flexibility for keepers. Drop sections to help with management.

Designed to give free choice and replicate orangutans' natural fission-fusion behaviour. We know that the composition of the group will vary over time and as animals move through their environment. Animals may merge (Fusion – e.g sleeping) and split (Fission – e.g foraging) throughout the day. Designed in this way to give the animals free choice as to which area they wanted to be in.



Built in enrichment feature - small waterfall, stream and pool.

Adds interest for visitors and animals. Shallow water which they can choose to interact with (or not). Play in the shallow water.

Lots of plants in external areas. Animals use these for learning, climbing, nesting material. Also offer seasonal variation within the enclosure, providing shade and privacy in the summer. Physical contact with plants encourages natural behaviours.

Add another dimension to explore in the habitat.



We chose to incorporate 8 large artificial trees in the design of our enclosures.

- 4 trees inside 6m
- 4 trees external up to 12m

Reason – to make the space more 3 dimensional and increase the amount of 'usable' space. Know from previous experiences (RoRA) our Orangs spend lots of time in their artificial climbing trees. Keen to make them even bigger and better in their new home. Natural behaviour for an arboreal animal such as the Orangutan to spend nearly all of it's time up high in trees. Wanted to try and recreate this as much as possible. Lots of wide branching for us to attach other climbing elements to. Rockwork themed afterwards to look more natural.



Incorporated 28 stainless steel hammocks into the design of the trees by welding steel eyelets into position on the branches – half inside, half outside.

Decided to use stainless steel mesh because it is very durable (last a long time) while also being quite flexible/comfortable. Know from RoRA that the Orangutans like to use hammocks to sleep in at night. Another attempt to replicate Orangutans' natural behaviour by providing nesting opportunities to them and a choice of which hammock they want to use. They have a choice to be near other individuals or not.



Another feature designed to make better use of the space is another tried and tested one from RoRA. Telegraph poles. Easily to get hold of, come in a variety of lengths, and are very long lasting.

In Islands, 37 telegraph poles in external enclosures ranging from 7m to 18m tall. Placement of each carefully thought out so they are far away enough not to create a bridge out of the enclosure if the fall over. Also positioned in 'pathways' so that they are leading somewhere.

They provide lots of climbing opportunities in the external enclosures, again links back to replicating natural behaviours in the wild.



An important feature is the webbing that links a lot of our climbing structures and provides routes around them. We used 15,000m of webbing in Islands which the keepers add to and alter on a regular basis.

May look like a simple material to source but we actually rejected about 10 samples before we found the right type of webbing with a thickness, colour and weave that the keepers were happy with. (woven in such a way that if the Orangs manage to get a loose thread, they can't unravel the whole length!)



We have a good relationship with a local forest (Delamere) 10 miles down the road, they routinely thin out areas of their forest for management purposes. Allow us to go and select specific trees. We are restricted by what we can actually transport on the road, so they never look quite as tall or impressive when they arrive on site, but nevertheless, they provide another dimension to the enclosure and another different type of climbing opportunity for the animals.

Nice because natural looking (unlike telegraph poles and sway poles).



Last type of climbing structure I want to mention are sway poles. 18 poles in total  $-14 \times 6m$ ,  $4 \times 8m$ 

Before investing in carbon fibre poles, we trailed 4 poles in our previous Orang exhibit – Realm of the Red Ape. Two students from Uni Birmingham conducted a research study in which they gathered lots of behavioural data about how the Orangutans used the sway poles. Information from this study then helped inform whether it was worth including sway poles in new Islands enclosures and also advise on placement.

Conclusions from the study showed that the sway poles were "making a positive contribution to the orangutans' behavioural repertoire by eliciting some new behaviours not exhibited on other structures".

Mechanical properties of the poles were distinct from rigid wooden poles or highly flexible webbing, that the Orangutans were actually using novel behaviours and movements to move between them - using different combinations of muscle groups. List of behaviours that were observed only when using the sway poles, and very rare or absent on other climbing structures. E.g bridging between poles (pulling one of both supports closer together to safely transfer weight between the two). Requires mush more strength than pulling webbing. Overall conclusions: Sway poles allow the Orangutans to move in a more natural way around their enclosures.

"In the wild they would move through the trees, leaning from tree to tree using the movement of the trees to help them through the canopy. This natural motion especially helps when carrying their young. The new sway poles should allow them to move in a more natural way around their new enclosures".

Positioning: Early indications that poles were being used as part of a route – In Islands we chose to place them along key routes to optimise their usage. Placed some further apart scaled to Puluh's reach so that he would need to bend them to bridge between. (Puluh – 29 yrs, ~100kg).



15m tall netted enclosure outside – Climb netting, artificial trees, sway poles, webbing which allows the animals full 3D use of the entire space.

(SS net expensive - not practical on all areas)

High level keeper platform which can be used for feeding on top of the net – encourage more natural feeding and locomotion.



Move on now to explain how the design developed through the various planning levels.

For Islands, the high level Strategic plan/Masterplan was laid out to us by directors. Series of SE Asian themed Islands in an area outside the existing footprint of the zoo. Key species decided upon in collaboration with curators.

Next – Specific islands and visitor flow around them was decided upon. Location of the boat ride was determined.

Enclosure plan level – Landform, barriers, viewing points were decided upon.

Detailed design – Substrates, furnishings, individual planting plans all agreed upon.



Show how this process happened for the Orang enclosures:

Concept stage – Approximate layout was determined and rough size and shape of orangutan enclosures.

Developed design – Enclosure plans produced and discussed with design team. Animal and keeper access routes determined, visitor viewing areas, landscaping and water features included on plans.

Detailed design – Detailed enclosure plans produced showing final levels, exact positions of all the climbing structures and plants.



Highlight some of the challenges faced during construction

1) Climbable rockwork. Talented rockwork contractors who wanted to form nice craggy rocks, however we needed to be certain that the Orangutans wouldn't be able to climb it. Had to ensure all the ledges were overhangs that couldn't act as footholds for the orangs to climb. Spent hours with keepers checking every inch of the walls highlighting any areas that needed smoothing out.



We are fully aware that Sumatran orangutans are extremely intelligent and highly curious. We knew that when we introduced the group into their new home in Monsoon Forest, they would be incredibly interested in their new environment and will want to explore and test everything around them. Making rockwork 'orangutan proof' is not the easiest task an so, as part of our rigorous safety checks, in June 2015 we invited the North East Wales Mountaineering Club to come over and test out the structure.

Good sense check for us. Although they didn't manage to climb to the top of any of the walls, they did identify one or two areas that we subsequently got 'smoothed out'!



2) Design included a network of animal tunnels above the keeper passageways – complicated hugely by the amount of services running through the same space. Consisted of electrics cables, data cables, water pipes, heating vents. Full extent of the clashes wasn't clear until tunnels and cables were in place on site. Spent lots of time relocating cable trays where possible, or adding steel plate over cables/pipes/vents to protect them from the Orangutans – anything within 1m!

## Behavioural data



Important to analyse the project afterwards - can be difficult to do. For Islands, we had a team who spent time collecting behavioural data from this group of Orangutans both before and after they moved into the new enclosure.

Previous enclosure RORA since May 2007

Reviewed camera trap footage, Go-Pro footage and hours of live observations to gather the data. Recorded data using both continuous and instantaneous methods.

Did behaviour change? Yes....

Group behaviours: Activity up 6%, +ve social interaction up 12%, Human interaction down 11%.

## Behavioural data



Look on the individual level:

Positive Social behaviour: Grooming others, being groomed, maternal behaviour, play with other individuals.

Increased in all, but statistically significant in Subis, Tuti, Tripa.



Data includes public and keeper interaction.

Subis and Emma hand reared, used to spend lots of time sitting in public viewing window. Behaviour decreased significantly after the move.

Encouraging natural behaviour – public may class this as a negative thing but as a zoo we encourage natural behaviour, in actual fact one of the most successful behavioural changes since the move.



Increased, even more than before!

Significance for both adult females and the juveniles.

Important question for zoos, both management and visitors - both want visibility to be high.



Since the move, time spent outside significantly increased for all individuals. (Data points removed where outside access was restricted. Therefore this graph is an accurate representation of choice made by all individuals).

Seasonality could have an influence – initial analysis. Needs to be ongoing analysis to be sure.

