Ali Manço: how to design a data centre

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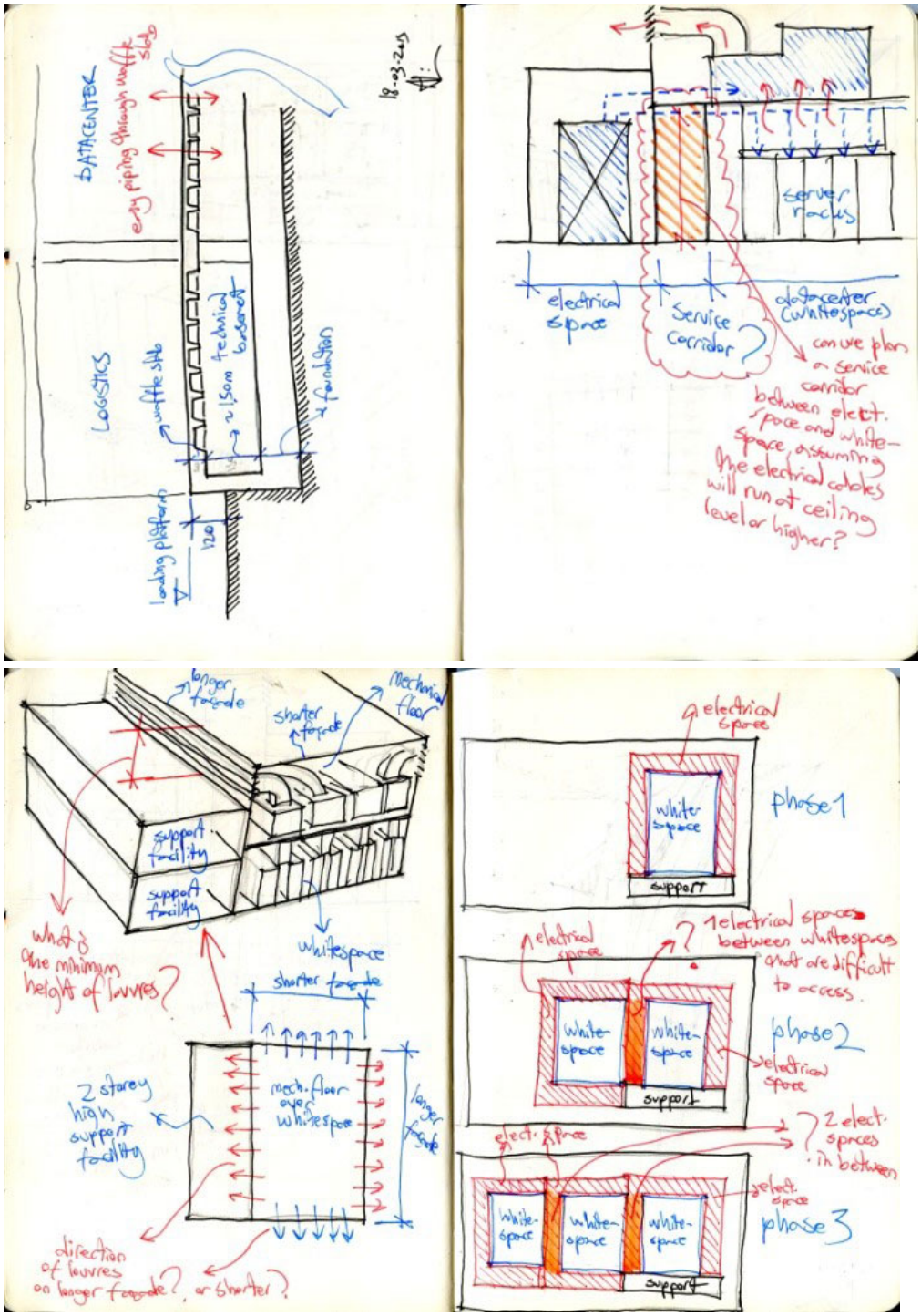
Modern life relies on data and as we move to cloud computing and mobile data consumption, that reliance will only increase. Data storage is now vital for companies, governments, and organisations, making data centres a strong upstarter sector of the construction industry. We spoke to Ali Manço, Managing Partner at Manço Architects, who designed the Anadolu Data Centre Campus in Ankara, Turkey, about his project and what it takes to design a data centre.

With your design, how have you made sure that the servers, equipment, and facility can keep cool enough to function?

The main principles of the mechanical cooling system had already been decided upon before we were invited for the design competition. After winning the contest we immediately started studying how we could maximise the number of servers according to the 'hot aisle / cold aisle' method. This is a layout where cool air is pumped into the space in between groups of server racks, namely the cold aisle, while hot air is sucked from the isolated space lined with the backs of servers facing each other, namely the hot aisle.

Due to technical and seismic concerns, a raised floor for cooling was not preferred. Instead, all HVAC equipment was placed on top of the data hall where the suspended ceiling was used as a plenum for directing cool air toward the servers. Hot air sucked upwards from the data hall to the mechanical floor is released from the air handling units and gets naturally exhaled through the chimneys that open up the roof surface.

As per Uptime Tier IV standards, all mechanical and electrical systems include N+1 substitute equipment to ensure continuous functioning of the data centre 99.99% of the time.



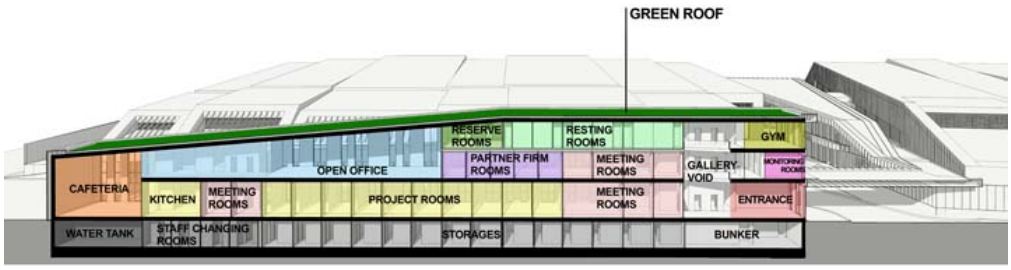
Some early concept sketches of the design.

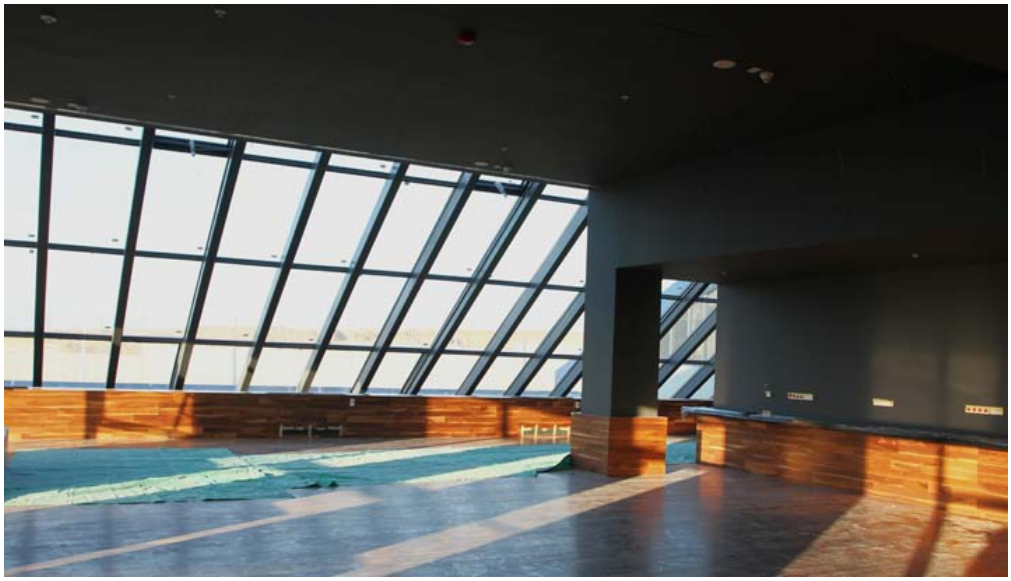
How have you worked energy efficiency into the design?

Passive energy efficiency solutions we applied were limited to the Client Operation Centre and the Support Building. In order to maximise natural lighting and ventilation, we kept the depth of the Client Operation Centre at a minimum. We placed operable windows in each room where we specified low-e glasses minimising excessive heat gain. In the Support Building we placed the circulation corridor along the west façade facing the sun, in order to provide a shading buffer for the offices. The cafeteria of the Support Building has a huge skylight facing north, in order to benefit from diffused sunlight throughout the day without suffering from a greenhouse effect. Energy efficient LED lighting was also used throughout the campus.

Due to the enormous amount of energy consumed by the data hall, benefiting from passive methods here was neither applicable nor meaningful. Therefore, the initial plans to cover the roof with PV panels were later abandoned, although it is still possible to integrate thin film PV onto the roof surface.

Air handling units providing indirect freecooling with outside air were preferred for the cooling of the data centre. The fresh air of the Support Building was supplied from the warm air coming out of the adjacent data centre, and rainwater is collected and used for landscape irrigation.

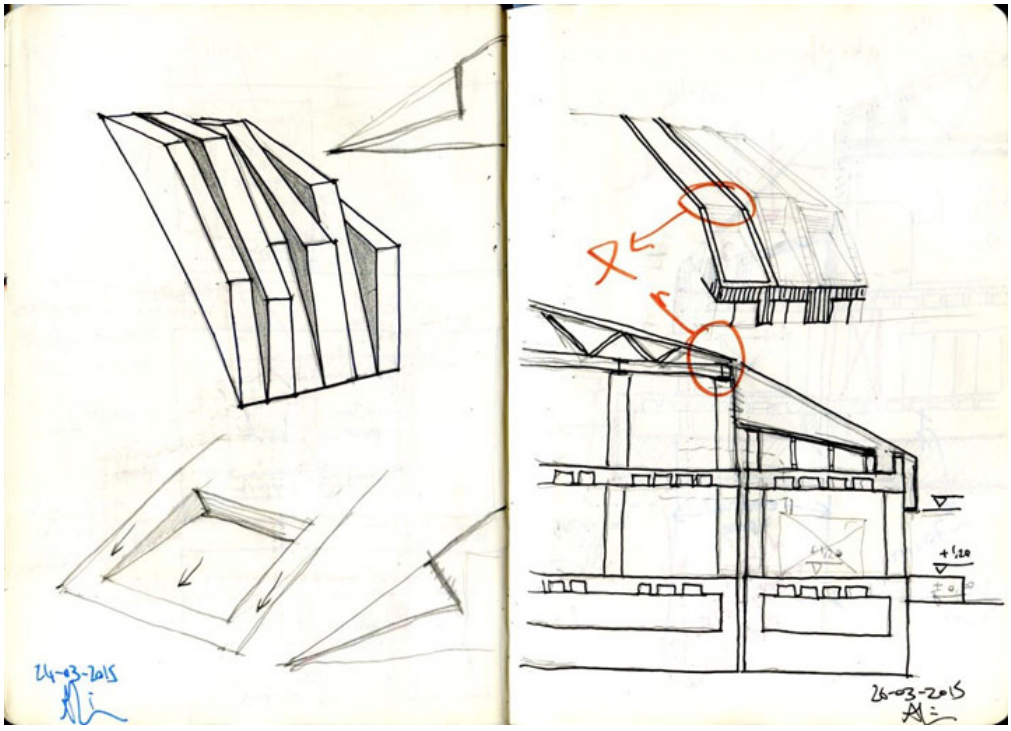


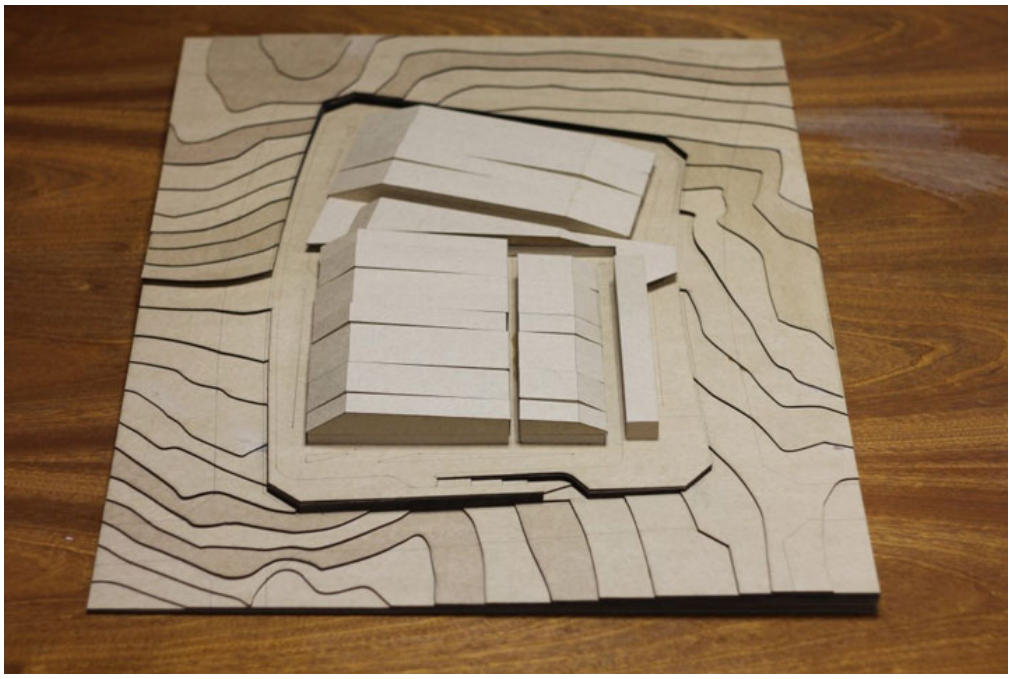


What design language did you aim for when planning the centre? What impression do you want to create?

From the very beginning the design of the roofs has defined the architectural language of the project. In the initial design brief, the foremost concern to be addressed was protecting the data hall from rainwater. Therefore a secondary roof layer on top of the slab above the servers was especially required by the project management consultants. Secondly, benefiting from solar power was one of the initial intentions of the client.

Following up those two requirements, we decided to put a pitched roof over the data centre. In order to prevent a hulk of a building mass, we sliced the roof surface into four parts, which we later reduced to three. By using different angles on each roof slice we wanted to achieve a dynamic ‘roofscape’ mimicking the original topography of the site that we heavily altered.





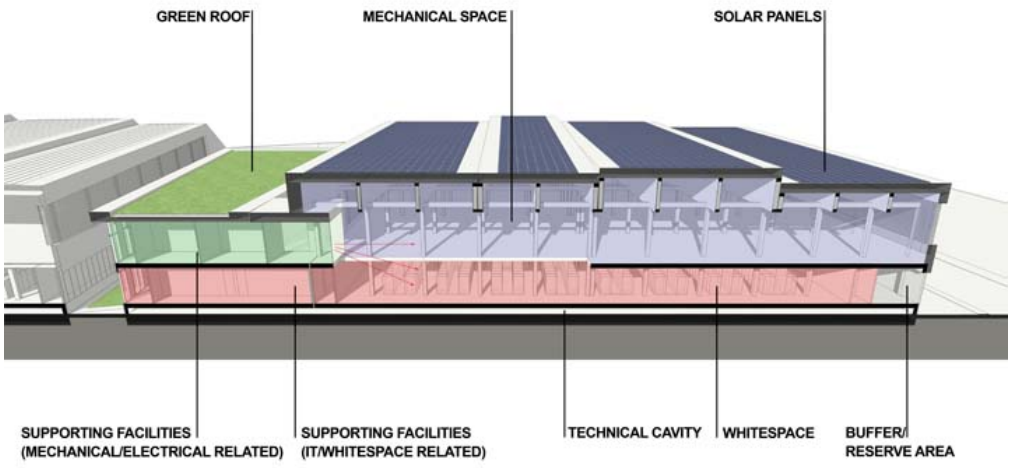
Since we were sheltering only mechanical devices, we aimed for a purely pragmatic ‘machine aesthetic’ while further developing the architecture. We rotated the inclinations of the roof toward the south to maximise exposure to sunrays, whereas we chose navy as the only colour of the roof cladding, so that the PV panels would visually blend in. Furthermore we subtracted huge openings from the envelope of the mechanical floor for fresh air intake, as well as for creating a loading terrace for HVAC maintenance. In the end, each roof slice corresponded to a certain technical purpose, namely fresh air intake, loading and dynamic UPS ventilation. As a 40-year-old car enthusiast, I must say that I am very pleased with the slight resemblance to the legendary Lamborghini Countach.

On the rest of the façades we opted for fibre cement panels with concrete colour, in order to emphasise the contrast with the roof layer, as well as to express the robustness of the structure enclosing the data hall.

We applied the same roof and façade decisions to the Support Building and the Client Operation Centre, in order to have a coherent design language throughout the campus.

By randomly distributing fibre cement panels with smooth and fluted surfaces on the façades of the Support Building and Client Operation Centre we created an ever-changing barcode effect according to the time of the day. In that way we wanted to add a two-dimensional dynamism on top of the three-dimensional one we achieved with the roofs. We also used tinted glass panels on windows, in order to enhance the irregular effect of the opaque façade panels.

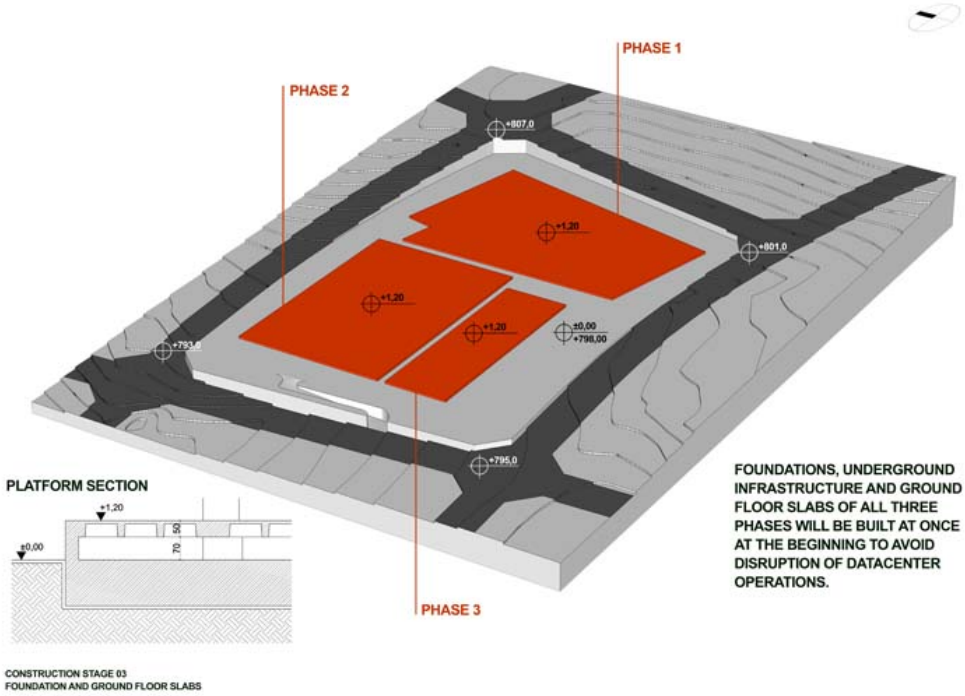
We strived to create contrasting atmospheres in the technical/office and cafeteria areas. While one displays the technological aspect of the building with its futuristic lines and neutral cool colours, the other was designed to be light filled and spacious, yet cosy, refuges for employees with as much wood and planting as possible.

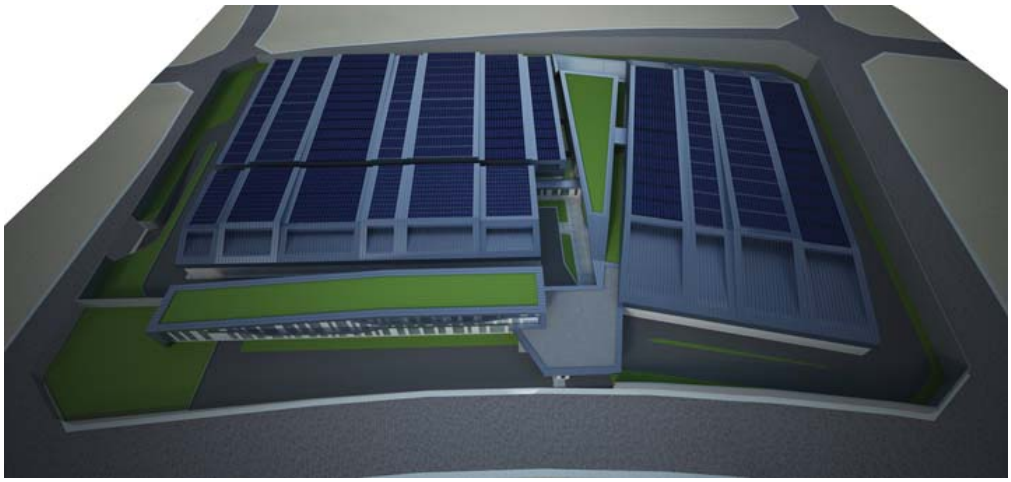


Will all phases of the centre (phases 2 and 3 as well as phase 1) have a single design ethos?

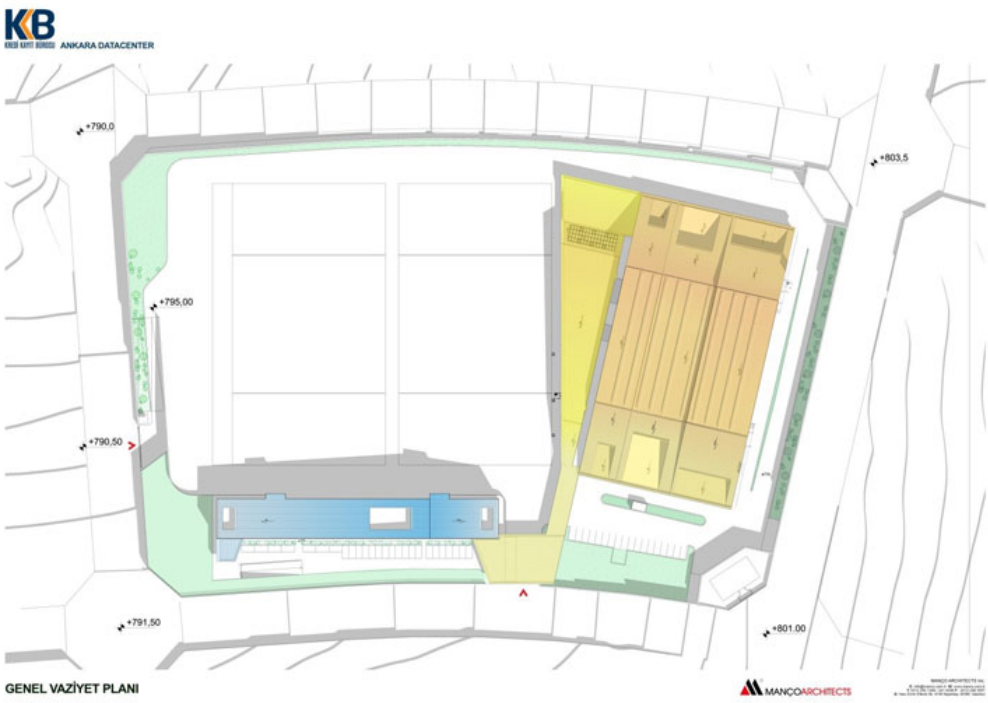
Absolutely. Achieving the consistency of the architectural language throughout all phases has been one of the main aims of the architectural design from the very beginning.

All three stages were taken into consideration in the conceptual design we submitted to the invited competition opened for this project. Although we had initially proposed buildings with differing sizes, phase 2 and 3 will include the same data centre buildings as phase 1, in order to maximise the efficiency of construction. Despite inevitable revisions during the design and construction periods, the architectural concept has remained intact. We are especially proud of this.





Early conceptual design visuals.



The final layout of Phase 1.

What are the particular challenges of designing a data centre?

First of all, it requires a totally different mindset to most other building types. Most of the time we architects work on structures for human activities, but in this case you need to focus on solving the needs of devices first. Accordingly, the usual concerns of architects regarding context, aesthetics and form are considered secondary to the technical ones.

In order to succeed in designing a data centre you need to research a lot and listen to the experts you are cooperating with. You also need to think very hard about aspects such as maintenance and future revisions, which may not be regarded as much in other project types. However, it is as fulfilling as it is challenging to gain an understanding of MEP and security systems unique to data centres and to develop innovative architectural solutions for them.

The greatest difficulties faced when designing data centres are human interaction related ones. Adapting yourself as an architect to the increased role of electrical and mechanical engineers is a challenge in itself. Besides, the huge number of consultants involved throughout the design process can also be quite stressful sometimes.

Completing a data centre with a certain degree of architectural quality requires being a persuasive leader and a collaborative team player at the same time. You need to be sufficiently persistent to be able to execute your design intents by achieving consensus among a large group of people with starkly distinct priorities.

How have you designed to keep the data centre secure from intruders?

Half of the campus site is above street level, whereas the other half is below, due to the sloping roads around. Besides, the Client Operation Centre is positioned longitudinally along the main street leading to the entrance. Both these factors minimise the direct line of sight toward the Data Centre Building.

Although part of the campus, the Client Operation Centre is physically separated from the rest of the campus, so most of the IT operations will be handled by clients without ever setting foot in security sensitive spaces. The Support Building is divided into zones where only authorised personnel will be able to access the data hall or its technical spaces.

State of the art physical and electronic security and surveillance tools have been employed in the design and construction of the campus; however, I can’t comment on those.

How many staff will the centre accommodate when it is fully functioning?

It is around 50, including security and maintenance staff.

When will Phases 2 and 3 of the centre be finished?

The initial targets have changed due to political and economic volatilities. All I can say at the moment is that it will eventually depend on the demand from the market.

Has the data centre market grown in Turkey recently?

It has indeed, especially in the financial sector where Turkish laws prevent storage of banking data abroad. A significant number of major Turkish banks have completed their own data centres. The same goes for the three big telecoms operators. However there have been very few investments for small/mid-sized businesses. Our Anadolu Data Centre project is unique in that sense since it is designed to cater to both banks and non-financial firms.

Are you optimistic about more data centre projects in future? Why are they becoming more common?

Yes I am. Having completed a major Tier IV standard data centre with a stronger than usual focus on architectural design, we are confident that we will be able to build more in the future.

I think that there are four major trends that will drive the increase of data centre projects. Firstly, the amount of data generated and consumed by individuals is growing exponentially, thanks to cloud computing, smartphones, social networks, and streaming media services.

Secondly, the storage and harvesting of big data is getting easier with the advancement of artificial intelligence technologies. At the same time, insight derived from the analysis of big data is becoming a vital tool for corporations' profitability.

Thirdly, innovations in the data centre sector will make buildings of certain age obsolete. This will inevitably lead to older data centres being reconstructed for contemporary mechanical, electrical and IT systems.

Fourthly, globalisation is regressing, politically as well as economically. The growing protectionism will inevitably enforce storing critical data within the political boundaries of countries. That means less consolidation of data in internationals hubs, a bigger number of dispersed, national data centres in different countries. We have been hearing about huge governmental projects under way in Turkey for example.

All images: Manço Architects

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