

Learning from disaster

4 February 2016

Onur Gunduru describes how a development in Izmir has been designed to mitigate earthquake risk and embrace sustainability

On 17 August 1999, an earthquake of momentous magnitude 7.4 occurred on the North Anatolian Fault Zone, with its epicentre near the town of Gölcük in western Turkey. At least 17,118 people were killed and nearly 50,000 injured. In addition, about 500,000 people were left homeless, with nearly 250,000 buildings damaged.

Subsequently, the event marked a milestone in the recent history of the building sector in Turkey. A nationwide renovation programme was introduced and the demand for safer building increased.

The government also introduced new laws and regulations, leading the way for the privatisation of the building control services in 19 pilot cities.

In Izmir, which is located in the same fault zone, the lessons were taken on board in the 35. Sokak (35th Street) development. In view of the earthquake risk, the structure and the foundations gain more importance.

35. Sokak represents the new building understanding in Turkey

To determine soil characteristics, 80 boreholes were drilled, with at least two for each block. After exploration, it was found out that the foundation settlement would be on limestone and two types of soil were defined as Z1-A and Z2-B, according to Turkish [Specification for Buildings to be Built in Seismic Zones](#).

The developer, Aksan Yapi, explains that local soil groups are defined as A, B, C and D (in Table 6.1 of the specification) and Z1, Z2, Z3 and Z4 (in Table 6.2), depending on the thickness of upper soil layer (h_1). Type A soil is determined as at a depth of up to 15m and type B soil at depths below 15m.

Type A indicates that the soil has shear wave velocity equal or greater than 700m/s and B type indicates a shear wave velocity between 300m/s and 700m/s. Under each block, bearing capacity is calculated at between 15.5tonf/m² and 44.4tonf/m². As a result, foundation design is based on the weaker result Z2-B at 35th Street.

Resistant design

The design takes account of the sloping topography and the foundations have a graded structure. Earthquake resistance is also improved by selecting a lightweight steel-frame structure, which imposes less loading than concrete. Factory production minimises the margin of error in building components, making assembly easier.

35th Street aims to connect city and countryside. Houses open on to large shared yards instead of small gardens. Six types of houses offer one, two or three bedrooms plus a living room, and the complex has a secure pedestrian area, a walking trail and a cycle path. Car parks are located underground to eliminate vehicle pollution.

Seref Gunduru, Chief Executive at Avrasya Building Controlling and Consultancy, states: ?We wish to increase the number of such sustainable projects to minimise the effect of earthquakes and offer a higher living standard for a better future. 35. Sokak represents the new building understanding in Turkey.?

Based on the energy performance certification, the low environmental impact of the project was a priority. Currently, the online [BEP-TR tool](#) is used to handle all stages of the certification. However, the limitations of this software result in a lower performance for green buildings, and a new version is being developed.

BREEAM certificate

35th Street is the first residential project to receive a BREEAM Very Good certificate in Turkey. The photovoltaic solar electricity system generates 400,000kWh energy annually, reducing carbon emissions by 290 tonnes each year. In addition, use of low or zero carbon technologies such as an air-source heat pump replace 376,000kWh of energy from other sources annually, sparing 272 trees.

Energy-efficient white goods also contribute to savings. To ensure the health and wellbeing of building users, access to daylight is maximised.

Prefabricated panels address the common problem of poor thermal performance due to bad craftsmanship. This results in predictable thermal behaviour and a better customer experience.

The complex has 9.5ha of green space, with facilities including basketball and tennis courts, Olympic-sized pools, a sauna, a Turkish bath, a day nursery, a library and organic vegetable and fruit gardens.

Onur Gunduru is Building Control Services Manager at [Avrasya Building Controlling and Consultancy](#)

Further information

- Related competencies include [Construction, technology and environmental](#)

- [services](#)
This feature is taken from the RICS *Building Control Journal* November/December 2015.