

## Project Summary

### Organization

Al Ain City Municipality

### Solution

Water, Wastewater and Stormwater Networks

### Location

Al Ain, Abu Dhabi, United Arab Emirates

### Project Objectives

- To design a gully cover using a composite material that make the covers less desirable to theft.
- To create a lighter design with the capacity to bear a load of 25 tons.

### Products Used

AssetWise®, OpenFlows™, STAAD®

## Fast Facts

- The Al Ain City Municipality is responsible for managing tens of thousands of iron-covered gullies used to drain rainwater in the city.
- As part of an AED 10 million project to replace the covers stolen to be sold as recyclable material, Al Ain sought to develop new curb-side entry gully covers.
- STAAD, OpenFlows, and AssetWise helped model the proposed design and analyze whether the design could handle the stresses.

## ROI

- By analyzing the design using STAAD, the team developed an optimal design for the gully covers.
- In the past four to five years, the city installed thousands of new gully covers that have worn well in the extreme heat.
- The municipality gained a net savings of 8% by turning to the new material composite.
- The weight of the new gully-curb covers prevents them from remaining open when they are being cleaned, which limits the amount of debris entering the sewer system, lowering maintenance costs.



# The City of Al Ain Pioneers Solution to Replace Stolen Gully Covers

STAAD and OpenFlows Helped Design a Light, 5-centimeter-thick Cover with a Load Bearing Capacity of 25 Tons

## Creating Innovative Gully Cover Design

Located in Abu Dhabi in the United Arab Emirates, the city of Al Ain is the largest inland city and the fourth-largest city in the Emirates, as well as the second-largest city in Abu Dhabi. The Al Ain City Municipality is responsible for managing tens of thousands of iron-covered gullies used to drain rainwater in the city, some of which were installed in the 1960s. However, by 2012, many of the covers had been stolen and sold to recycling centers.

As part of an AED 10 million project to replace the stolen covers, the government agency sought to develop new curb-side entry gully covers made of material that is not as easy to recycle, preventing further theft. The covers, made of a mix of composite material, also needed to comply with BS EN 124 standards for load and deflection, as well as safely withstand a minimum loading bearing capacity of 25 tons.

## Overcoming Challenges with Modeling and Analysis

This type of solution had not been developed before in the Emirate, and the team faced many challenges on this extensive project. With so many gully covers needing to be replaced, the project team realized that it needed a single location to house all the necessary information. The thickness of the cover had to be less than 5 centimeters and weigh less than the previous gully covers. Also, the structure needed to withstand the harsh, extremely hot and dry climate of the region while preventing catastrophic failure. The structures needed to be stiff, but somewhat malleable so that they would be able to constrict and expand without breaking. The new covers also needed to withstand near-constant direct sunlight, with temperatures over 60 degrees Celsius (140 degrees Fahrenheit), and the harsh UV light.

To achieve these requirements, the project team used Bentley's structural modeling and analysis applications to overcome the most critical challenges. All information was housed in AssetWise, creating a single repository where project participants could access always-accurate information in real time. The team developed a model of the proposed

design using STAAD and OpenFlows. STAAD made it easy to analyze the design, automatically converting the design model into an analytical model to streamline the workflow. With OpenFlows, the team could better visualize the water system that included the new gully covers.

Once the proposed designs were completed, the team used OpenFlows, in combination with the AssetWise data, to test the designs by developing simulations of various environmental situations. The STAAD models allowed team members to run design alternatives in parallel, analyzing which ones could better handle the stresses in clear, graphical side-by-side comparisons. These simulations helped the team determine an optimal design.

## Improving Shareability for Increased Load-bearing Capacity

By analyzing the simulations in STAAD and OpenFlows, the project team created the ideal mixture of reinforced polymers, fillers, catalysts, and stabilizers. However, while the mixture could withstand the climate, it could only reach a bearing capacity of up to 13 tons. Therefore, the team needed to consult a team of mechanical engineering designers.



*The municipality created a product that other cities in the region can use for future projects.*

*For the city, an important benefit was having the technology to support creative thinking, allowing team members to develop an entirely new solution in the Emirate.*

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The Al Ain City Municipality worked with a group of engineering designers based out of the University of Toronto. The interoperability of Bentley applications made it easy to share the model and data with the third-party design team. The mechanical engineering designers reviewed the models and analysis, proposing that the city reposition the shear reinforcement or plates in the reinforcement matrix, which brought the load bearing capacity to the required amount. The design complied with all standards – including BS EN 124, ISO 1083, and ASTM A536 – and even increased the ductility of the cover while still maintaining the required stiffness.

### **Developing an Innovative Solution**

The Al Ain City Municipality was able to produce a 5-centimeter-thick gully cover with a minimum load bearing

capacity of 25 tons. This new type of cover can withstand the extreme temperatures with the added benefit of being made of material that is not easily recyclable, which will help prevent them from being stolen and sold. The project is now complete, with the city's tens of thousands of gullies covered with this new product.

For the city, however, the most important benefit was having the technology and platform that supported creative thinking, allowing team members to develop an entirely new solution in the Emirate.

By using Bentley applications to test the gully cover design and review the analysis, the Al Ain City Municipality created a product that other cities in the region can learn from and use for future projects.