IKT-tested: adapter ring makes old manholes HGV-proof

On test: Six different manhole variants, with and without compensation ring and with and without an adapter ring.

Sewer manholes in roads have a lot to put up with. They are exposed not only to vertical, but also to horizontal loads. For this reason, newer types of manhole cover are secured against lateral displacement. However, older types of manhole, with no such security, are still predominantly found in roads. For these, there is now an adapter ring available that is claimed to prevent displacement. IKT has tested this new solution.

HGVs: a burden on manholes

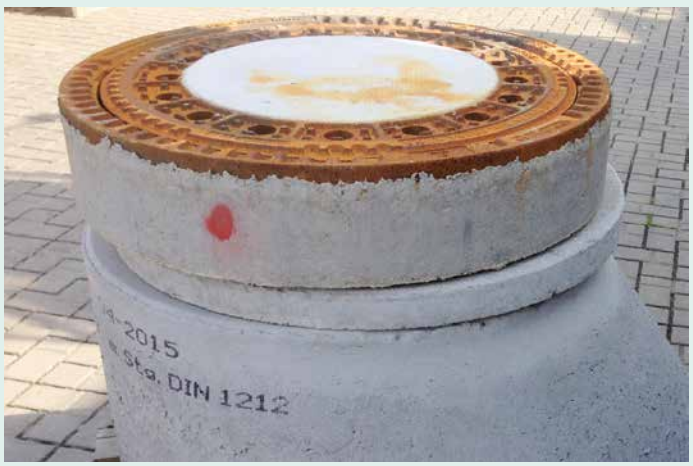
Vehicles passing over manhole shafts exert vertical loads on the structure. However, powerful horizontal forces are also generated if a heavy goods vehicle (HGV) brakes in front of or on the manhole cover. Horizontal loads even act on the manhole when a vehicle simply passes by, due to spreading of the load.

For this reason, new types of manhole cover installed since 1990 are equipped with anti-displacement fixtures. However, such design provision is lacking in the older systems. Up to now, it has not been possible to implement the anti-displacement requirement for the manhole top area in DIN EN 1917 and DIN V 4034, Part 1 when such a manhole is rehabilitated.

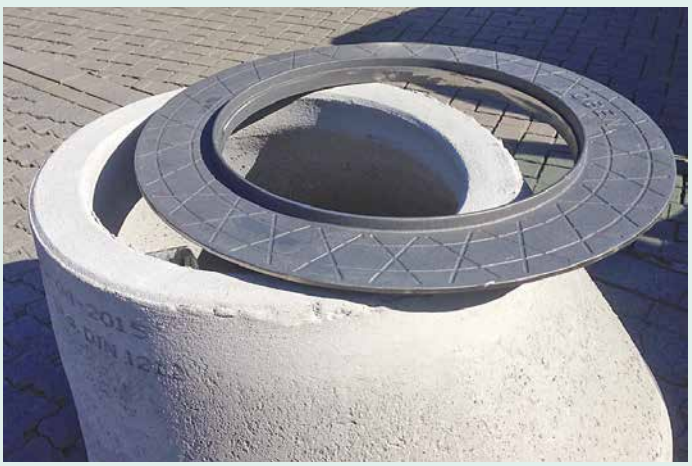
Adapter ring: retrofitted for security against displacement

The AdapTEC adapter ring, which prevents horizontal shift in the manhole top area and is intended to absorb larger vertical loads, has been developed by zarmuTEC GmbH & Co. KG. The cast-iron adapter ring connects the old smooth-surfaced manhole cone (in accordance with DIN 4034, Part 2) to the newer compensation rings (in accordance with DIN V 4034, Part 1), or directly to the manhole-shaft frame – force-locked and secure against displacement. AdapTEC reliably absorbs the vertical and horizontal loads acting on the manhole structure and diverts them away, protecting the manhole.

This ring, which looks like a giant washer, is installed in a bed of mortar on the older-type manhole cone. New-type compensation rings with anti-displacement fittings can then be mounted on this, an important benefit since older-type compensation rings are not quality controlled. However, the frame of the manhole cover can also be positioned directly on to the adapter ring. The cast-iron ring features on its inner side an upward and downward projecting collar which is intended to prevent horizontal movement of the adjoining elements relative to each other.



The problem: the individual parts of an older-type manhole cover can move relative to each other with time.



The remedy: the AdapTEC adapter ring creates a stable connection between an old manhole cone with no anti-displacement securement and new-pattern compensation rings.

IKT test programme: tested comparatively

IKT has tested the functionality of this innovative adapter ring in comparative tests performed on manhole components with and without an adapter ring. Manhole structures – consisting of the manhole cone, compensation rings and manhole-shaft frame with lid – were exposed in their upper areas to vertical and horizontal loads, and the maximum absorbable forces were determined. For reference: the relevant codes of practice assume that a brake application by a heavy truck can exert a horizontal load of around 72 kN on a manhole cover.

Concrete, mortar and iron guinea pigs:
a total of twelve test samples were used.

The tests investigated two load situations. First a vertical dynamic load in conjunction with a horizontal braking load on the cover. A horizontal load was then applied to the first structural element above the manhole cone/above the adapter ring, in order to determine the anti-displacement fitting's maximum load-bearing capability.

Two manhole frame set-ups were used - directly on the manhole cone and on two installed compensation rings, in order to cover different installation situations. Arrangements with and without an adapter ring, and with and without anti-displacement securement were tested. Two tests were performed on each arrangement. The forces and consequent displacement distances were recorded.

Results

All the test set-ups passed the tests involving combined wheel and braking loads without suffering damage. The shear-load only tests then separated the wheat from the chaff. The arrangements incorporating anti-displacement fittings, and the test set-ups with a built-in adapter ring, in particular, performed better.

In the case of the system with no anti-displacement fitting, shear failure occurred on average at 55 kN with a directly mounted manhole frame and at around 80 kN when compensation rings with no anti-displacement fitting were used.
The newer-type system with anti-displacement fittings failed at an average of up to 90 kN with a directly mounted manhole frame. Here, the concrete edge provided as the anti-displacement fitting was broken out. When compensation rings with anti-displacement fittings were used, everything remained in place even at the maximum shear force applied of 132 kN.

Stable system with adapter ring

The system with the adapter ring performed convincingly, both with a directly mounted manhole frame and with the use of compensation rings for anti-displacement by absorbing the maximum shear force of 132 kN. The zarmuTEC adapter ring makes it possible to install, when refurbishing a manhole, a system which conforms to the requirements of current standards and codes of practice for anti-displacement fittings and also possesses reserves of performance above and beyond these requirements. Thus the service-life of the manhole structure and the refurbishing intervals are thus both prolonged. So, bring on your heavy trucks!

Prospects: load calculation

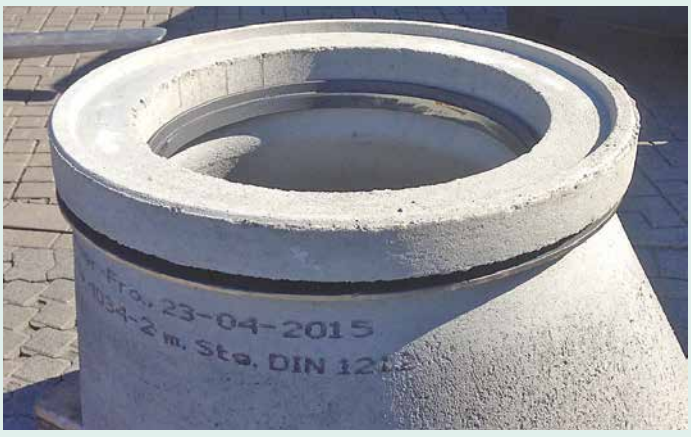
These IKT tests exposed the test samples to horizontal and vertical forces up to either the point of failure or up to the load limits of the test apparatus. Prof. Dr.-Ing. Martin Radenberg (Chair of the Institute of Road, Railway and Airfield Construction of the Ruhr University Bochum) intends to investigate in detail how temperature differences may affect the loads acting on manholes and what other processes, such as fatigue and superimposed loads have an influence. This will provide even better understanding of the manhole top system and the stresses occurring. The manufacturer is confident that the adapter-ring system will continue to perform well in further tests.

Download test report (German version only):
www.ikt.de/downloads/pruefberichte

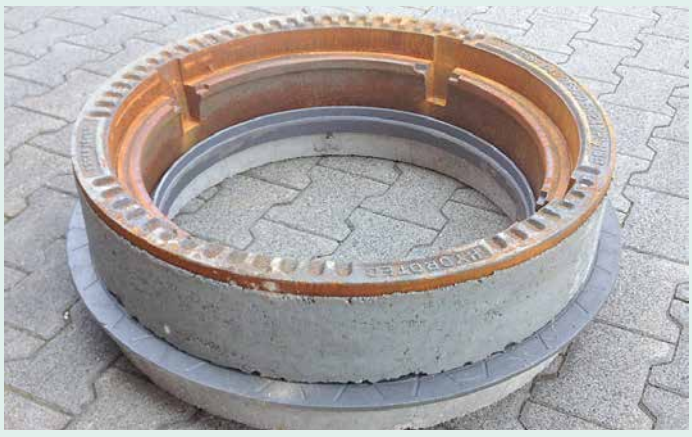
AdapTEC website: zarmutec.de

Contact

Dipl.-Ing. Martin Liebscher
IKT- Institute for Underground Infrastructure



Flexiblity: either compensation rings with anti-displacement securement or...



…the frame of the manhole cover can be installed on the adapter ring.

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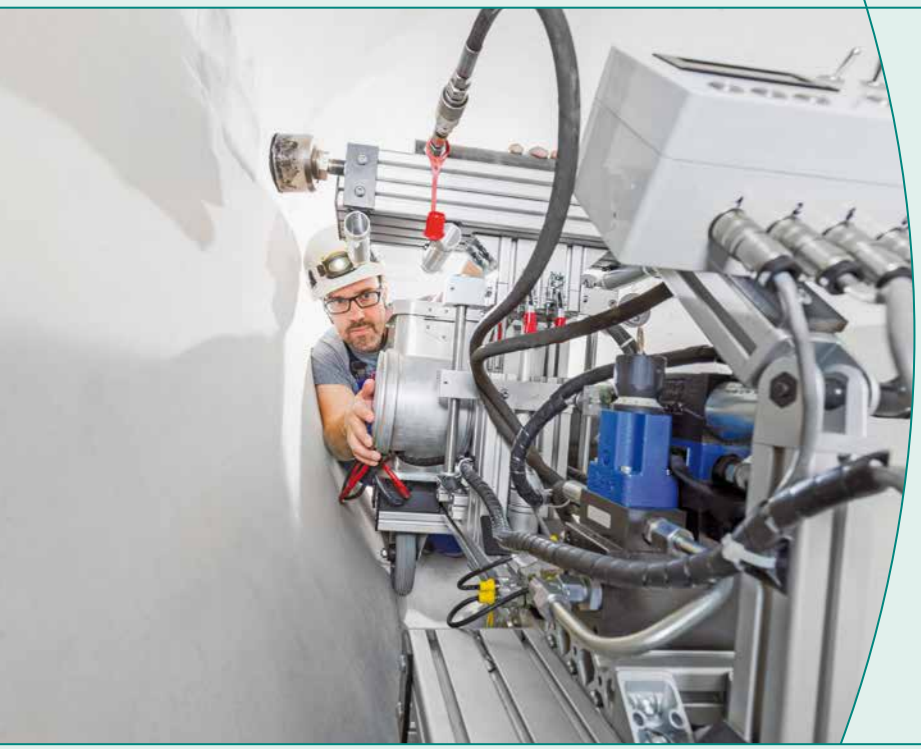

IKT - Institute for Underground Infrastructure is a research, consultancy and testing institute specialized in the field of sewers. It is neutral and independent and operates on a non-profit basis. It is oriented towards practical applications and works on issues surrounding underground pipe construction. Its key focus is centred on sewage systems. IKT provides scientifically backed analysis and advice.

IKT has been established in 1994 as a spin-off from Bochum University, Germany.

The initial funding for setting up the institute has been provided by the Ministry for the Environment of the State of North-Rhine Westphalia, Germany's largest federal state.

However, IKT is not owned by the Government. Its owners are two associations which are again non-profit organizations of their own:

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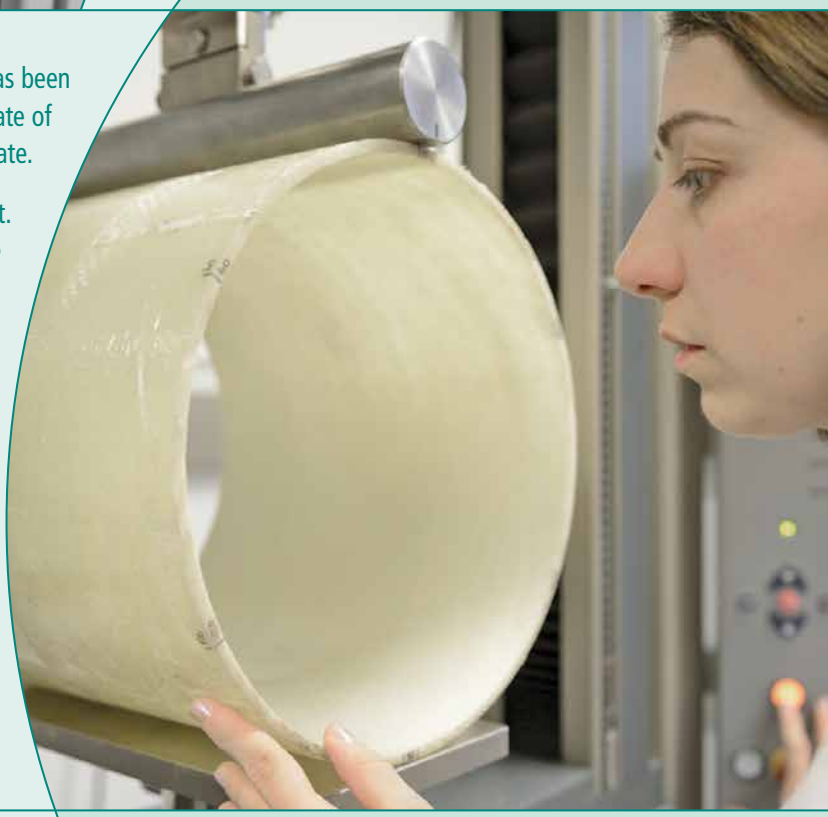

IKT – Institute for Underground Infrastructure

Exterbruch 1
45886 Gelsenkirchen
Germany

phone: +49 209 178060
fax: +49 209 17806-88
email: info@ikt.de

IKT is located ca. 30 min. off Düsseldorf International Airport.

Published: May 2016
Circulation: 1.500 copies
Protective charge: 19,95 €