Zeitschrift:	IABSE reports = Rapports AIPC = IVBH Berichte
Band:	55 (1987)
Artikel:	Unbonded steel tube concrete
Autor:	Sato, Takanori / Tanaka, Nobuyuki / Orito, Yoshihiro
DOI:	https://doi.org/10.5169/seals-42816

Nutzungsbedingungen

Die ETH-Bibliothek ist die Anbieterin der digitalisierten Zeitschriften auf E-Periodica. Sie besitzt keine Urheberrechte an den Zeitschriften und ist nicht verantwortlich für deren Inhalte. Die Rechte liegen in der Regel bei den Herausgebern beziehungsweise den externen Rechteinhabern. Das Veröffentlichen von Bildern in Print- und Online-Publikationen sowie auf Social Media-Kanälen oder Webseiten ist nur mit vorheriger Genehmigung der Rechteinhaber erlaubt. <u>Mehr erfahren</u>

Conditions d'utilisation

L'ETH Library est le fournisseur des revues numérisées. Elle ne détient aucun droit d'auteur sur les revues et n'est pas responsable de leur contenu. En règle générale, les droits sont détenus par les éditeurs ou les détenteurs de droits externes. La reproduction d'images dans des publications imprimées ou en ligne ainsi que sur des canaux de médias sociaux ou des sites web n'est autorisée qu'avec l'accord préalable des détenteurs des droits. <u>En savoir plus</u>

Terms of use

The ETH Library is the provider of the digitised journals. It does not own any copyrights to the journals and is not responsible for their content. The rights usually lie with the publishers or the external rights holders. Publishing images in print and online publications, as well as on social media channels or websites, is only permitted with the prior consent of the rights holders. <u>Find out more</u>

Download PDF: 10.08.2025

ETH-Bibliothek Zürich, E-Periodica, https://www.e-periodica.ch



Unbonded Steel Tube Concrete

Tubes en acier remplis de béton

Stahlrohre mit Betonfüllung ohne Verbund

Takanori SATO Research Engineer Res. Inst. of Shimizu Construction Co., Ltd. Tokyo, Japan **Yoshihiro ORITO Research Engineer** Nuclear Dep. of Shimizu Construction Co., Ltd. Tokyo, Japan

Nobuyuki TANAKA Research Engineer Res. Inst. of Shimizu Construction Co., Ltd. Tokyo, Japan Yasushi WATANABE **Design Engineer** Design Dep. of Shimizu Construction Co., Ltd. Tokyo, Japan

1. INTRODUCTION

The structure has been developed to apply to structural members subjected to large axial force such as the columns of highrise buildings, the columns of multistoried large span structures, the main poles of suspension bridges or the supports of underground structures. This is a new structural form, which is different in axial force supporting mechanism from conventional reinforced concrete (RC) or from steel reinforced concrete (SRC). The structure is constructed in such a way that a thin frictionless material (asphalt layer of 0.2mm thick) is applied to the inner surface of the cylindrical steel tube in The structure is named as "Unbonded Steel Tube which concrete is filled. Concrete" (UTC). This paper describes the principle and composition of the UTC and the outline of results of various tests.

2. PRINCIPLE OF UTC

In the UTC, axial force (N) is supported only by the filled concrete sections, and at the time axial stress soz is generated in the steel tube as less as possible thanks to the frictionless material and only the restraining effect by circumferential stress soe is ex-Bending moment (M) and pected. shearing force (Q) are supported by both sections of the steel tube and filled concrete, similar to other structural forms. The comparison on the supporting mechanism axial force (N) is shown in of The stress conditions Figure-1. under combined force, when compared with that of bonded steel tube concrete (BTC) as a representative of other structural forms, are On the shown in Figure-2. assupmtion that the filled concrete is not failed as far as the steel tube is not failed, the design strength depends on the local yield or buckling of the steel tube. It is apparent from Figure-2 that the UTC has larger strength in bending moment (M) than the BTC, as axial force N becomes larger.







Fig.-2 Stress Condition under Combined Force

3. BEAM-COLUMN JOINT

The 3 types shown in Figure-3 are considered as a joint of the UTC column with beam in building structures. Type A is expected to improve the strength of N, M, Q, type B and C improve only N. Type A (for



e A (for Highrise Buildings) Type B (for Mediumrise Buildings) Fig.-3 Detail of Beam-Column Joint

4. OUTLINE OF RESULTS OF VARIOUS TESTS

4.1 Concentric compression test

A concentric compression test is carried out for 3 kinds of specimens U, B and R of which the ¹²⁰ UTC, the BTC and the positioning between the 2 are simulated respectively (ϕ 114x600mm). In $\hat{\underline{g}}_{80}$ specimen R a frictionless material is not $\frac{1}{2}$ ^(a) applied but force is loaded only to filled concrete section. As shown in Figure-4, specimen ⁴⁰ U has yielding strength Ny approximately 30% higher than specimen B, and having sufficient toughness. Specimen R is between them. The ⁰ frictionless material effect is cofirmed.

4.2 Bending test

To compare the UTC and the BTC ($\phi 216 \times 1500$ mm), \tilde{b} load is added to bend at constant axial force N. \tilde{g} As shown in Figure-5, yielding bending strength Py of the UTC is approximately twice that of the 40 BTC. The difference depends on the intensity of constant axial force N. This is also understood from Figure-2. However, maximum bending 0 strength Pu is almost equal, and has sufficient of toughness.

4.3 Shear test

Even if the steel pipe and filled concrete are not bonded as in UTC, it is made clear experimentally (ϕ 216x2800mm) and analytically that shear transfer occurs between them by side pressure distribution, as shown in Figure-6.

5. SUMMARY

"Unbonded Steel Tube Concrete" (UTC) which is different from other structural forms (RC and SRC) is proposed and in order to apply it to actual structures, various tests are carried out and described the outline of them.

ACKNOWLEDGMENT

The authors would like to acknowledge their helps and advices of Professor Kazuo Suzuki of Osaka University and Professor Hiroyuki Aoyama of Tokyo University.

REFERENCES

(1) Y. Orito et al; "Study on Unbonded Steel Tube Concrete", Conference on Composite Construction by Engineering Foundation 1987.6 New Hampshire



Fig.-4 Concentric Compression Test



