MLF Experimental Report

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課題番号 Project No.
2016A0066

実験課題名 Title of experiment
Verification of Truss-and-Arch Model for shear failure on reinforced concrete structure

実験責任者名 Name of principal investigator
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装置名 Name of Instrument/（BL No.）
TAKUMI/ BL19

実施日 Date of Experiment
Nov 6th – Nov 15th, 2016

試料、実験方法、利用の結果得られた主なデータ、考察、結論等を、記述して下さい。（適宜、図表添付のこと）
Please report your samples, experimental method and results, discussion and conclusions. Please add figures and tables for better explanation.

1. 試料 Name of sample(s) and chemical formula, or compositions including physical form.

The rectangular shape of the reinforced concrete (RC) specimen with a size of 60 mm in width, 250 mm in height and 370 mm in length was prepared. The deformed main rebars with a diameter of 10 mm and the stirrups with a diameter of 6 mm are embedded in the concrete as shown in Fig. 1.

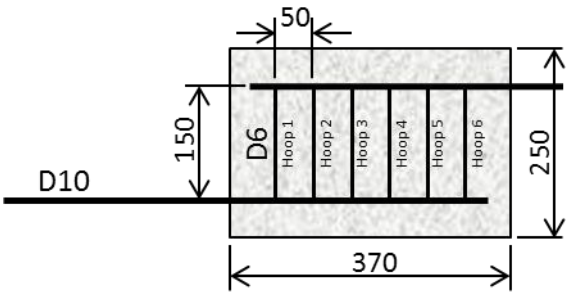

Fig. 1 RC Specimen.

2. 実験方法及び結果（実験がうまくいかなかった場合、その理由を記述してください。）

Experimental method and results. If you failed to conduct experiment as planned, please describe reasons.

The engineering diffractometer, TAKUMI, installed at BL19 in MLF (Materials and life Science Experimental Facility) of J-PARC (Japan Proton Accelerator Research Complex) was utilized. The reinforced concrete specimen mounted on the loading device was set up on the XYZθ positioner, oriented 45° to the incident beam, as shown in Fig. 2. The gauge volume was 5×5×10 mm^3, defined by the incident gauge definition slit and the radial collimators. The medium resolution mode was selected to reduce the background noise, and diffraction patterns from the embedded rebar over the range of *d*-spacing from 0.5 to 2.7 Å were measured using both detector banks installed at ±90^o. The average lattice constants in these directions were

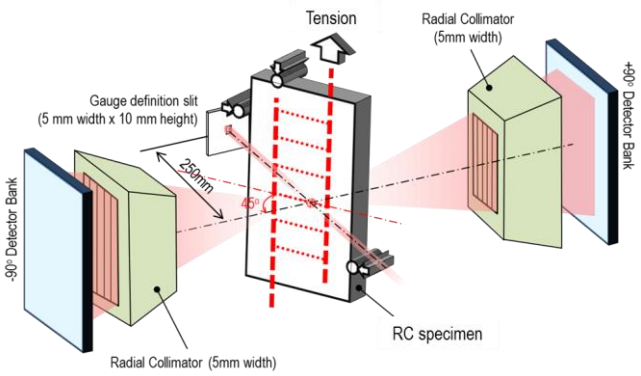

Fig. 2 Measurement configuration.

determined by multi-fitting procedure using Z-Rietveld. The axial and transverse strains for the stirrups and the transverse strains for the main rebar were measured along the embedded rebar under different bending moments applied by the mechanism schematically shown in Fig. 2. The axial strain for the rebar can be estimated from the transverse strains measured in assumption of the simple uniaxial loading condition, meaning negligible transverse restriction of the main rebar from surrounding concrete.

Figure 3 (a) shows the axial stress distributions along the embedded main rebar on the loading side under different loading conditions. The stress distributions were drastically changed at 275 MPa of 1st applied loading due to crack generation around Hoop 3. Figure 3 (b) shows a change in the axial stress of the Hoop 3 stirrup as a function of applied stress, measured at 10 mm and 75 mm away from the main rebar of the loading side. The compressive stress measured at the initial loading condition tends to be constant until 195 MPa of 1st applied loading, and then it obviously decreases to approximately zero at 275 MPa. As shown in Figure 3, the stress distributions along the main rebar and the stirrups with orthogonal relation were successfully measured at the fixed measurement configuration without any changes.

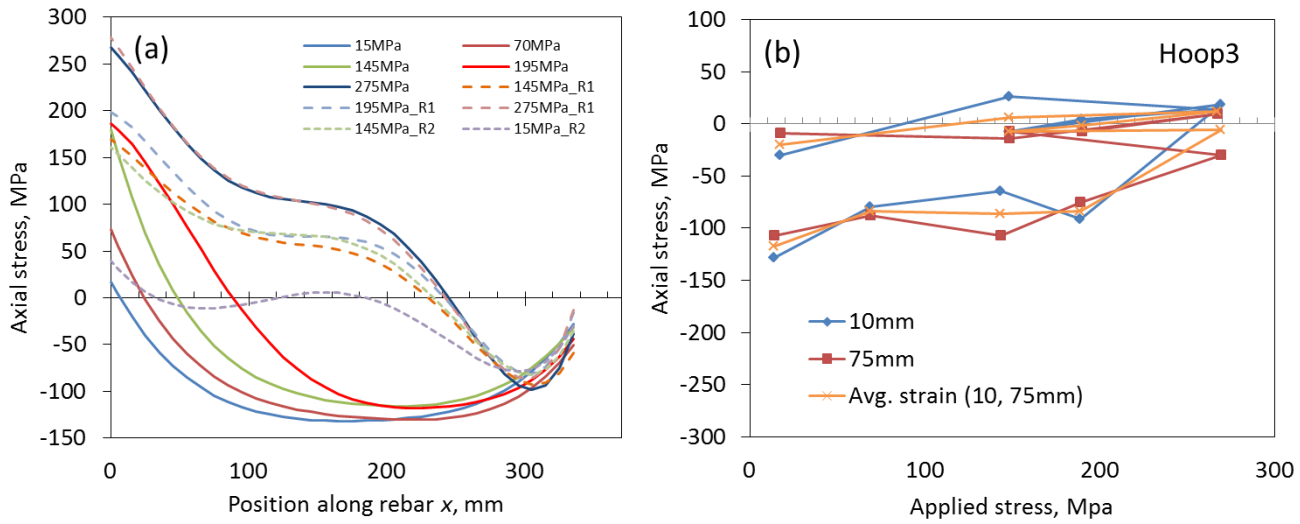

Fig. 3 (a) Stress distributions along the embedded main rebar under different loading conditions, and (b) changes in axial stress for the Hoop 3 stirrup as a function of the applied stress.