Shear Strength Evaluation of the Wave Perfobond Rib Shear Connector

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Summary

Recently, steel and concrete composite structures are widely used due to the efficiency. In composite structures shear connection should guarantee the composite behavior of two materal. This should be ensured by the capacity of shear connector in the composite structures. In this study, a modified perfobond rib shear connector (wave perfobond rib), is proposed. Push-out tests have been performed to evaluate the shear strength of the proposed wave perfobond rib shear connectors based on Eurocode-4. Various shapes of wave perfobond have been examined to evaluate the effectiveness of some important parameters according to the sensitivity of structural behavior. The parameters considered in this study includes the existence of the holes, the diameter of the holes, the existence of transverse rebar, the diameter of transverse rebar, and the diameter of wave rib curvature.

Keywords: shear strength; perfobond rib shear connector; wave perfobond rib shear connector; push-out test.

1. Introduction

This study proposes the improved perfobond rib shear connector. The proposed perfobond rib shear connector manufactures rib as a wave form. The concrete dowel effects among these waves increase the shear resistance. Since the stiffness of wave form is smaller than that of other perfobond rib shear connectors, the proposed connector has advantage to gain more flexibility. In this study, in order to confirm shear capacity and ductility effect of the wave perfobond continuously arranged, we have prepared specimens which have the variables of wave wave rib curvature, rib hole and transverse rebars. Then push-out test were carried out to examine the shear capacity of wave perfobond rib shear connector. Figure 1 shows the shear resistance characteristics of wave perfobond rib shear connector.

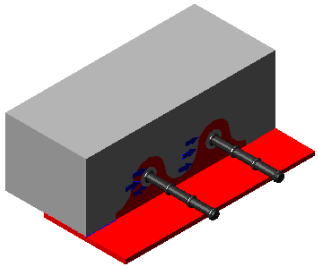

Fig. 1: Wave perfobond rib shear connector

2. PUSH-OUT TEST

2.1 Push-out test specimens

A total of 11 push specimens were fabricated by embedding the shear connector to a concrete slab of 480 mm in width, 650 mm in length, and 190 mm in height. A wave perfobond rib is a type of shear connectors suggested to gain larger effects in continuous ribs. Therefore, the specimen with perfobond rib offset concrete end-bearing resistance by installing styrofoam at the front of rib to

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represent the continuous rib. SP-H13-2 and SP-H50-2 specimens utilized perfobond rib shear connectors; SP-H13-2 has two transverse rebars and SP-H50-2 has rebars in 50 mm rib holes. WP series of specimens have wave perfobond ribs. WP50-H00-0, WP50-H50-0, WP50-H60-0, and WP50-H50-2 specimens were designed for the evaluation of the shear strength according to the existence of holes, the diameter of holes, and the existence of transverse rebars. In WP50-H13-1 and WP50-H13-2 specimens, the number of transverse rebar had variations. WP45-H13-2 and WP55-H13-2 were designed to compare the shear strength of the concrete dowel effect according to the diameter of wave rib curvature. Lastly, WP50-H16-2 was used to evaluate the shear strength according to the diameter of transverse rebar.

3. SHEAR STRENGTH TEST RESULTS

Table1: Push-out test results: Ultimate load, relative slip, and cracking load

Spicmen	Type	Ultimate value		Characteristic value		Cracking Load [kN]	Ductility ratio δ_{Rk}/δ_u	Cracking / Ultimate
		p_u [kN]	δ_u [mm]	p_{Rk} [kN]	δ_{Rk} [mm]			
SP-H13-2	Perfobond	547.0	4.75	490.0	10.46	475.0	2.20	0.87
SP-H50-2		619.5	3.57	557.5	18.39	514.5	5.15	0.83
WP50-H00-0	Wave perfobond	545.5	2.68	488.5	3.50	488.5	1.31	0.90
WP50-H50-0		642.5	1.19	588.0	1.41	517.0	1.18	0.80
WP50-H60-0		637.5	2.18	574.0	3.42	528.5	1.57	0.83
WP50-H50-2		660.0	11.73	594.0	44.67	521.5	3.81	0.79
WP50-H13-1		718.5	1.63	650.0	2.67	553.5	1.64	0.77
WP50-H13-2		825.0	6.63	742.0	20.98	679.5	3.16	0.82
WP45-H13-2		776.5	3.85	698.5	14.34	595.5	3.72	0.77
WP55-H13-2		893.0	9.18	804.0	34.94	650.5	3.81	0.73
WP50-H16-2		974.5	18.84	878.0	33.99	685.5	1.80	0.70

4. CONCLUSIONS

To compare the shear strength of wave perfobond rib shear connector with that of the existing perfobond rib, this specimens had identical height ribs with two 13 mm diameter transverse rebar at the same spacing. The ultimate strength of wave perfobond rib shear specimen under a failure mode reveals that its shear strength increased by about 51% compared with perfobond rib specimen. The diameter of hole, existence of rib hole, diameter of wave rib increased the shear strength less than 18% and showed relatively small effect for the shear strength except the specimens with the transverse rebar. In case of specimen with two transverse rebar, shear strength increased by about 51% compared with specimen without transverse rebar.

Acknowledgement

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References

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