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Failures of Half-Gouted Sleeve in Precast Concrete

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ABSTRACT:

A structural feature known for its versatility and effectiveness, a half grouted sleeve gives concrete columns or beams more strength and stability. Equitable load distribution, enhanced structural performance, and enhanced design and construction flexibility are all facilitated by it. Bar diameter, sleeve dimensions, and rebar offsets are the three primary variables in this experimental study. Precast concrete construction dangers will significantly increase due to the various sorts of flaws of half grouting sleeves. The failure modes of the half grout sleeves are demonstrated in this research.

Keywords: column to column connection, half grouted sleeve, precast concrete, failures.

INTRODUCTION:

Columns in prefabricated structures are joined together using a sort of connection called a half grouted sleeve. A steel sleeve is inserted into the ends of the columns for this kind of connection, and it is partially filled with concrete or grout. The diameters of the rebar are 14 mm, 16 mm, 18 mm, 22 mm, and 25 mm, respectively, for the sizes of half grout sleeves that are employed. The particular structural design and load capability of the connecting columns are taken into consideration while choosing the sleeve's size. To optimise the strength and stability of the connection, it's critical to make sure the half-grouted sleeve's size is suitable for the planned use. A building's or other structure's structural integrity may suffer significantly if a half-grouted sleeve in a column-to-column connection is compromised. There may be greater load on the columns and perhaps possible collapse if a partially grouted sleeve breaks. The failure modes of the half grout sleeves are demonstrated in this research.

LITERATURE REVIEW:

Wang xi Zhang et.al (2018) The paper investigates the tensile behavior of half grouted sleeve connections at elevated temperatures. It examines the compressive behavior of cementitious grout and how it changes with temperature. The bonding length of the rebar may become insufficient at high temperatures. The elastic modulus of both the half grouted sleeve connection and the single rebar decreases rapidly with increasing temperature, with the connection showing a faster decreasing trend. The test results can be used in the design and analysis of half grouted sleeve connections at elevated temperatures.

Wang xi Zhang et.al (2020) The paper investigates an experimental study on the post-fire tensile behavior of half grouted sleeve connections (HGSC) with construction defects. An analysis is conducted on the impact of construction faults and peak temperature on the properties of HGSC. Tested and compared to single rebars under identical conditions is the tensile behavior of sixty-six post-fire HGSCs with construction flaws. The investigation and discussion focuses on the yield strength, ultimate strength, yield elongation, ultimate elongation, and ductile factor of post-fire HGSC with construction faults.

Huang Yuan et.al (2017) The paper investigates an experimental study on the tensile behavior of half grouted sleeve connections, including failure modes such as rebar tension fracture, bond failure, and thread sliding failure. The tensile capacity of the connections is determined using an analytical model, and good agreement between the test results and predictions is obtained. Strength, yield, and ductility ratios are used to assess the connections' performance. The accuracy of the suggested formula for failure mode prediction is also covered in the study, and it is recommended that more experimental research be done in order to produce a more trustworthy regression formula. The Fundamental Research Funds for the Central Universities and the National Natural Science Foundation of China are funding this research.

Jianwei Chen et.al (2022) This paper investigates two sorts of failure modes were noted. Rebar failure happened when the SR was 50% or less, which happened after the splice rebar reached its maximum strength. Rebar pull-out happened shortly after the splice rebar gave for a 100% SR, demonstrating the effect of rebar strip off ribs on splice. According to the study's failure modes, the ultimate tensile load of a splice is determined by two main factors: the bond strength at the rebar-grout interface and the rebar's ultimate strength, the latter of which would determine the splice's tensile capacity. The splice

performance was unaffected by lengthening the rebar strip off ribs of the elastic part of the rebar. On the other hand, when the length of the inelastic portion of the rebar was increased, the splice's ultimate bearing capacity and ductility decreased.

Linlin Xie et.al (2022) This paper investigates a defect-detectable and repairable half-grouted sleeve (DDRHGS) .To address the identification and restoration of inadequate grouting of GSCs, DDRHGS was created. In order to verify the repair method's dependability and examine the impact of inadequate grouting on GSC connection performance, a total of 52 DDRHGS specimens were subjected to two cyclic loading protocols. Analysis was done on the effects of rebar diameter, defect ratio, repair material, and loading procedures, with a focus on the tested specimens' failure mode, load-bearing ability, and deformation capacity.

Feng Xu et.al (2018) This paper investigates a experimental bond behavior of deformed rebars in half-grouted sleeve connections with insufficient grouting defect. The risk of PC infrastructures failing too soon can be greatly increased by inadequate grouting of the sleeve connections between RC components. Twenty-one sets of sleeve connection specimens under tensile load were used in a systemic experimental examination to better understand the bond behavior of the sleeve connection with inadequate grouting. In order to simulate potential inadequate grouting in practice, four types of configurations—uniform, longitudinal, axial, and inclined—have been created for this study. The volume-ratio of the insufficient grouting is meant to range from 0% to 50%. Taking into account the impact of inadequate grouting, the failure mechanism and the bond stress-slip relation of the specimens have been analyzed.

CONCLUSION:

The tensile behaviour of half grouted sleeve connections at elevated temperatures, emphasizing changes in the compressive behaviour of cementitious grout and the potential insufficiency of rebar bonding at high temperatures. The post-fire tensile behaviour of half grouted sleeve connections with construction defects, analysing the impact of faults and peak temperature on properties such as yield strength, ultimate strength, yield elongation, ultimate elongation, and ductile factor in comparison to single rebars. The tensile behaviour of half grouted sleeve connections, identifying failure modes and determining tensile capacity using an analytical model. The study emphasizes the assessment of performance through strength, yield, and ductility ratios, suggesting the need for further experimental research. The failure modes in splice connections, highlighting rebar failure and pull-out. It emphasizes the role of rebar strip off ribs, the bond strength at the rebar-grout interface, and rebar ultimate strength in determining the splice's ultimate tensile load and capacity. Lengthening the inelastic portion of the rebar decreases ultimate bearing capacity and ductility. A defect-detectable and repairable half-grouted sleeve (DDRHGS) to address inadequate grouting in GSCs. The study includes 52 specimens subjected to cyclic loading, analysing the effects of rebar diameter, defect ratio, repair material, and loading procedures on failure mode, load-bearing ability, and deformation capacity.

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