



## Development of extremely thin prefabricated concrete façade elements

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### Abstract

Story-high, prefabricated concrete façade elements with 6-8 cm thick outer layers were frequently used in building construction in the 1960/70s. In current construction and rehabilitation, they are much thicker (12-15 cm) or economically non-competitive, due to significantly increased concrete cover or the required use of stainless steel reinforcement, respectively, for durability. Additionally, these elements are placed further away from the support structure, owing to significantly increased requirement in thermal insulation. The outer shell of a façade element of the late 1960s was 4-8 cm away from the support structure while today, it is placed at a distance of 16-32 cm. The potential of replacing steel bars in prefabricated concrete façade elements by non-metallic glass-fiber reinforced polymer (GFRP) reinforcement was explored experimentally in a collaborative research project, targeting 5 cm thin elements and also requiring to test an associated new anchor system.

**Keywords:** façade elements; reinforced concrete; composites; prefabrication; conceptual design; full-scale testing; wind loads; deflection limits; anchor systems; failure mode.

### 1 Introduction

Prefabricated story-high façade elements made of reinforced concrete with 6-8 cm thin outer layers were used quite frequently in building construction in the 1960/70s. Applying the same constructional concept today in new façades and rehabilitation of existing results in substantially increased element thickness (12-15 cm), due to significantly increased concrete cover of the reinforcement required for durability. These elements also have to be placed further away

from the support structure, due to current thermal insulation requirements. In the late 1960s, the outer shell of a concrete façade element was horizontally 4-8 cm away from the support structure while today, it is positioned at 16-32 cm. To decrease element thickness and weight and consequently, loading of the anchors (i.e. connection between façade element and support structure), stainless steel reinforcement needs to be used for durability, resulting in economically non-competitive elements.