

# UWS2 Test Report

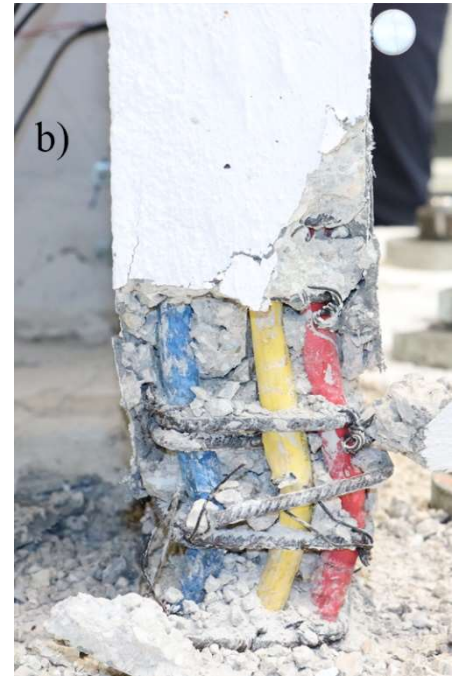
This document summarizes the observed behavior and overall test results of the second wall unit, UWS2.

Similar to the first wall unit (UWS1), the second unit (UWS2) exhibited minor hairline cracking during the initial ground motion stages. In particular, vertical splitting cracks developed at the base of the north and south flange boundary ends after GM1, likely due to a combination of horizontal flexural cracking followed by crushing of the unconfined concrete cover. As observed in UWS1, cracks also formed along the wall-foundation interface after GM2. However, unlike UWS1, which experienced flexural cracks near its base under these initial ground motions, UWS2 developed near-horizontal flexural cracks approximately 500 mm above the foundation—most notably on the outside surface of the Flange One.

At this stage, some cracking was also observed in the foundation. However, a laboratory technician confirmed that these cracks were limited to the mortar layer applied to smooth the surface after the concrete had set. The cracks in UWS2 worsened under GM5 (i.e., 75% uniaxial west-east loading), which induced a maximum west-east drift ( $\delta_{WE}$ ) of 1.73%—almost identical to UWS1. However, unlike UWS1, this level of loading caused the unconfined concrete cover at the flange boundary ends of UWS2 to crush.

Under bi-directional ground motions from GM6 (75% west-east and north-south), additional flexural cracks formed on the inner surfaces of the wall and the outer south face of Flange One. Compared to UWS1, the spacing between these cracks was noticeably larger, likely due to (partial) debonding of the FeSMA rebars and the minor pre-compression applied through temperature inducement. Interestingly, under these ground motions, UWS2 experienced less north-south displacement and rotation than UWS1. The recorded maximum values for west-east drift ( $\delta_{WE}$ ), north-south drift ( $\delta_{NS}$ ), and rotation ( $\theta_{max}$ ) were 1.80%, 0.39%, and 15.8 mrad, respectively. Furthermore, UWS2 exhibited minimal horizontal sliding, differing from the behavior observed in UWS1.

Further concrete crushing at both flange boundary ends was observed during GM7, exposing the longitudinal FeSMA bars (encased in two layers of plastic heat shrink, to promote debonding as discussed above, and guarantee electrical insulation) in these regions (Figure 1). During GM7, UWS2 reached its highest recorded in-plane west-east drift ( $\delta_{WE} = 2.39\%$ ), which was approximately 13% lower than that of UWS1. As with UWS1, the subsequent bi-directional accelerations of GM8 caused severe crushing of the north-east flange boundary end (Figure 8). The attained maximum drifts of  $\delta_{WE} = 1.97\%$  and  $\delta_{NS} = 0.56\%$ , along with a rotation of  $\theta_{max} = 24.8$  mrad, also led to noticeable buckling of the longitudinal rebars in this boundary end (Figure 8). The buckling behavior observed in UWS2 was consistent with the trends seen in UWS1.



**Figure 1 Failure locations of unit UWS2 at the base of Flange Two after GM8. The longitudinal rebars were wrapped in colored heat shrink plastic for the purpose of electrical insulation with the rebar cage, and to promote debonding.**