Calculation of Long-Term Cracked Deflection and Deflection Due to Live Load

**Deflection Due to Live Load**

1 – Calculate the instantaneous deflection of the member due to sustained dead load, with due consideration to cracking (\( d_{DL} \))

2 – Calculate the instantaneous deflection of the member due to sustained dead load and the design live load with due allowance for cracking. Loads are not factored. The applicable load combination is: (1.0*DL + 1.0* LL).

\[
\text{Deflection due to dead and live load} = d_{DL} + d_{LL}
\]

3 – Calculate the deflection due to live load by subtracting the values from the previous two load combinations.

\[
\text{Instantaneous deflection due to live load} = (d_{DL} + d_{LL}) - d_{DL}
\]

Note that the above relationship is the simple difference between two solutions, each of which was obtained based on cracking of concrete. The above procedure recognizes that when live load is applied, the section may have already been cracked. Application of live load will increase the cracking.

**Long-Term Deflection**

1 – Calculate the instantaneous deflection of the member due to sustained dead load and sustained live load with due allowance for cracking. Generally the sustained live load is taken as 0.30 of design live load (not factored).

\[
d_{DL} + 0.3 \ d_{LL}
\]

3 – Calculate the long-term creep deflection of the structure due to sustained dead load and sustained live load, using a suitable creep coefficient. For non-cracked sections the creep coefficient generally used for post-tensioned floor systems is 2. The creep coefficient of cracked sections, however, is less. The more extensive is the cracking, the less is the creep coefficient. Conservatively, assume the same creep coefficient as uncracked section (2).

\[
\text{Creep deflection} = 2* (d_{DL} + 0.3 \ d_{LL})
\]

4 – Total long-term deflection is the sum of the instantaneous and creep deflection

\[
\text{Long-term deflection} = (d_{DL} + 0.3 \ d_{LL}) + 2* (d_{DL} + 0.3 \ d_{LL})
\]

It is important to note that in the above relationship, the allowance for cracking is limited to the load combination for (\( d_{DL} + 0.3 \ d_{LL} \)). The long-term combination is the simple algebraic sum of the instantaneous and creep values.