CONCRETE TYPE CLASSIFICATION BASED ON UNIT DENSITY

The modification factor, λ, is determined based on ACI 318-14, Table 19.2.4.2 for five concrete types based on the composition of aggregates namely:

- All-lightweight λ = 0.75
- Lightweight, fine blend λ = 0.75 to 0.85
- Sand-lightweight λ = 0.85
- Sand-lightweight, coarse blend λ = 0.85 to 1.00
- Normalweight λ = 1.00

As specified in the definition of certain concrete types per ACI 318-14, clause 2.3, there is a correlation between the concrete types and the unit densities. The unit densities are specified explicitly for lightweight concrete as between 90 and 115 lb/ft^3 and normalweight concrete as between 135 and 160 lb/ft^3. The unit density information for the other three types of concrete is not provided in ACI 318-14.

To determine λ, with limited guidance in standards and literature, spSlab utilizes three concrete types with following unit densities namely: All-lightweight; Sand-lightweight; and Normalweight as shown in the table below. These values were implemented beginning with ACI 318-08 codes to update and revise values used in earlier codes from 1999 to 2005.

- All-lightweight λ = 0.75
- Sand-lightweight λ = 0.85
- Normalweight λ = 1.00

Type	ACI 318-14 ACI 318-11 ACI 318-08		ACI 318-05 ACI 318-02 ACI 318-99	
	w_c		w_c	
	pcf	kg/m^3	pcf	kg/m^3
Normal	$135 \le w_c$	$2155 \le w_c$	$130 \le w_c$	$2000 \le w_c$
Sand-Lightweight	$115<w_c<135$	$1840<w_c<2155$	$105<w_c<130$	$1700<w_c<2000$
All-Lightweight	$w_c \le 115$	$w_c \le 1840$	$w_c \le 105$	$w_c \le 1700$

Table 1. Concrete Type Classification based on Unit Density

Conclusions

spSlab Program updated the unit density values for concrete types used historically to better correlate with the more detailed definitions introduced in ACI 318-08 while maintaining the unit density values pertaining to previous editions of ACI 318.

References

[1] Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14), American Concrete Institute, 2014
[2] Building Code Requirements for Structural Concrete (ACI 318-08) and Commentary (ACI 318R-08), American Concrete Institute, 2008
[3] Building Code Requirements for Structural Concrete (ACI 318-05) and Commentary (ACI 318R-05), American Concrete Institute, 2005