

Group 152-07

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ACD

Lines of Code/ Functions

Explanations

<code>import pandas as pd</code>	The statement <code>import pandas as pd</code> imports the pandas library into Python and assigns it the name <code>pd</code> so its data analysis functions can be used throughout the program.
<code>import numpy as np</code>	This line imports the NumPy library, which is used for numerical calculations and working with arrays. The alias “ <code>np</code> ” is assigned so the library can be referenced more easily in the code
<code>cubic_yard_ft3 = 27</code>	This assigns the value 27 to the variable <code>cubic_yard_ft3</code> , representing the number of cubic feet in one cubic yard.
<code>unit_weight_water = 62.4</code>	This assigns the value 62.4 to the variable <code>unit_weight_water</code> , representing the unit weight of water in pounds per cubic foot (lb/ft^3).
<code>def calculate_mix_design(inputs):</code>	Defines a function that calculates the concrete mix design using values stored in the <code>inputs</code> dictionary.
<code>project_no = inputs["project_no"]</code> <code>concrete_class =</code> <code>inputs["concrete_class"]</code> <code>A = inputs["cement"]</code> <code>B = inputs["fly_ash"]</code> <code>C = inputs["silica_fume"]</code> <code>D = inputs["other_scm"]</code> <code>E = inputs["w_c_ratio"]</code> <code>F = inputs["air_percent"]</code> <code>G = inputs["fine_percent"]</code> <code>H = inputs["coarse_percent"]</code> <code>I = inputs["other_agg_percent"]</code>	Each line assigns a value from the <code>inputs</code> dictionary (such as cement content, fly ash, aggregate percentages, and specific gravities) to a shorter variable name (<code>A</code> , <code>B</code> , <code>C</code> , etc.) for easier calculations.

J = inputs["sg_cement"] K = inputs["sg_flyash"] L = inputs["sg_silica"] M = inputs["sg_other_scm"] N = inputs["sg_fine"] O = inputs["sg_coarse"] P = inputs["sg_other_agg"]	
$Q = (A + B + C + D) * E$	Calculates the required water content using the water-cement ratio multiplied by the total cementitious materials.
$R = A / (J * \text{unit_weight_water})$ $S = B / (K * \text{unit_weight_water})$ $T = C / (L * \text{unit_weight_water})$ $U = D / (M * \text{unit_weight_water})$ $V = (F / 100) * \text{cubic_yard_ft3}$ $W = Q / \text{unit_weight_water}$	Convert the weights of cementitious materials into absolute volumes using specific gravity and the unit weight of water.
$X = \text{cubic_yard_ft3} - R - S - T - U - V - W$	Determines the remaining volume available for aggregates by subtracting all other material volumes from one cubic yard (27 ft ³).
$Y = \text{unit_weight_water} * (G / 100) * N * X$ $Z = \text{unit_weight_water} * (H / 100) * O * X$ $AA = \text{unit_weight_water} * (I / 100) * P * X$	Calculate the weights of fine, coarse, and other aggregates using: <ul style="list-style-type: none"> - Their percentage of total aggregate volume - Their specific gravity - The unit weight of water - The remaining aggregate volume (X)
return { "project_no": project_no, "concrete_class": concrete_class, "cement": A, "fly_ash": B, "silica_fume": C,	Returns a dictionary containing: <ul style="list-style-type: none"> - Project information - Concrete class

<pre>"other_scm": D, "water": Q, "fine_agg": Y, "coarse_agg": Z, "other_agg": AA</pre>	<ul style="list-style-type: none"> - Final calculated material weights (cement, fly ash, silica fume, other SCM, water, and aggregates)
<pre>def print_weight_chart(results):</pre>	<p>Defines a function that formats and prints the final mix design weights for one cubic yard.</p>
<pre>print("\n--- CONTRACTOR TARGET MIX DESIGN WEIGHTS FOR 1 CUBIC YARD ---\n")</pre>	<p>Displays a title indicating the contractor target mix design weights.</p>
<pre>print(f"CEMENT: {results['cement']:.2f} lb") print(f"FLY ASH: {results['fly_ash']:.2f} lb") print(f"SILICA FUME: {results['silica_fume']:.2f} lb") print(f"OTHER SCM: {results['other_scm']:.2f} lb") print(f"FINE AGGREGATE: {results['fine_agg']:.2f} lb") print(f"COARSE AGGREGATE: {results['coarse_agg']:.2f} lb") print(f"OTHER AGGREGATE: {results['other_agg']:.2f} lb") print(f"WATER: {results['water']:.2f} lb")</pre>	<p>Each line prints a material weight (cement, fly ash, silica fume, other SCM, aggregates, and water) from the results dictionary.</p> <p>The :.2f formatting rounds each value to two decimal places and displays the units in pounds (lb).</p>
<pre>print("End of Mix Design Summary")</pre>	<p>Prints a closing line indicating the end of the mix design summary.</p>
<pre>def run_mix():</pre>	<p>Defines the main function that runs the full mix design process.</p>
<pre>inputs = collect_user_inputs()</pre>	<p>Collects all required values from the client.</p>
<pre>results = calculate_mix_design(inputs)</pre>	<p>Performs the mix design calculations using the collected inputs.</p>
<pre>print_weight_chart(results)</pre>	<p>Displays the final calculated mix design</p>

	weights.
run_mix()	Calls the function to execute the entire program.