Group 152-07

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# ACD

| Lines of Code/ Functions | Explanations |
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| import pandas as pd | The statement import pandas as pd imports the pandas library into Python and assigns it the name pd so its data analysis functions can be used throughout the program. |
| import numpy as np | This line imports the NumPy library, which is used for numerical calculations and working with arrays. The alias “np” is assigned so the library can be referenced more easily in the code |
| cubic_yard_ft3 = 27 | This assigns the value 27 to the variable cubic_yard_ft3, representing the number of cubic feet in one cubic yard. |
| unit_weight_water = 62.4 | This assigns the value 62.4 to the variable unit_weight_water, representing the unit weight of water in pounds per cubic foot (lb/ft³). |
| def calculate_mix_design(inputs): | Defines a function that calculates the concrete mix design using values stored in the inputs dictionary. |
| project_no = inputs["project_no"]<br>concrete_class = inputs["concrete_class"]<br>A = inputs["cement"]<br>B = inputs["fly_ash"]<br>C = inputs["silica_fume"]<br>D = inputs["other_scm"]<br>E = inputs["w_c_ratio"]<br>F = inputs["air_percent"]<br>G = inputs["fine_percent"]<br>H = inputs["coarse_percent"]<br>I = inputs["other_agg_percent"] | Each line assigns a value from the inputs dictionary (such as cement content, fly ash, aggregate percentages, and specific gravities) to a shorter variable name (A, B, C, etc.) for easier calculations. |

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| J = inputs["sg_cement"]<br>K = inputs["sg_flyash"]<br>L = inputs["sg_silica"]<br>M = inputs["sg_other_scm"]<br>N = inputs["sg_fine"]<br>O = inputs["sg_coarse"]<br>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 * unit_weight_water)<br>S = B / (K * unit_weight_water)<br>T = C / (L * unit_weight_water)<br>U = D / (M * unit_weight_water)<br>V = (F / 100) * cubic_yard_ft3<br>W = Q / unit_weight_water | Convert the weights of cementitious materials into absolute volumes using specific gravity and the unit weight of water. |
| X = 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 = unit_weight_water * (G / 100) * N * X<br>Z = unit_weight_water * (H / 100) * O * X<br>AA = unit_weight_water * (I / 100) * P * X | Calculate the weights of fine, coarse, and other aggregates using:<br>- Their percentage of total aggregate volume<br>- Their specific gravity<br>- The unit weight of water<br>- The remaining aggregate volume (X) |
| return {<br>"project_no": project_no,<br>"concrete_class": concrete_class,<br>"cement": A,<br>"fly_ash": B,<br>"silica_fume": C, | Returns a dictionary containing:<br>- Project information<br>- Concrete class |

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| "other_scm": D,<br>"water": Q,<br>"fine_agg": Y,<br>"coarse_agg": Z,<br>"other_agg": AA | - Final calculated material weights (cement, fly ash, silica fume, other SCM, water, and aggregates) |
| def print_weight_chart(results): | Defines a function that formats and prints the final mix design weights for one cubic yard. |
| print("\n--- CONTRACTOR TARGET MIX DESIGN WEIGHTS FOR 1 CUBIC YARD ---\n") | Displays a title indicating the contractor target mix design weights. |
| print(f"CEMENT: {results['cement']:.2f} lb")<br>print(f"FLY ASH: {results['fly_ash']:.2f} lb")<br>print(f"SILICA FUME: {results['silica_fume']:.2f} lb")<br>print(f"OTHER SCM: {results['other_scm']:.2f} lb")<br>print(f"FINE AGGREGATE: {results['fine_agg']:.2f} lb")<br>print(f"COARSE AGGREGATE: {results['coarse_agg']:.2f} lb")<br>print(f"OTHER AGGREGATE: {results['other_agg']:.2f} lb")<br>print(f"WATER: {results['water']:.2f} lb") | Each line prints a material weight (cement, fly ash, silica fume, other SCM, aggregates, and water) from the results dictionary.<br>The :.2f formatting rounds each value to two decimal places and displays the units in pounds (lb). |
| print("End of Mix Design Summary") | Prints a closing line indicating the end of the mix design summary. |
| def run_mix(): | Defines the main function that runs the full mix design process. |
| inputs = collect_user_inputs() | Collects all required values from the client. |
| results = calculate_mix_design(inputs) | Performs the mix design calculations using the collected inputs. |
| print_weight_chart(results) | Displays the final calculated mix design |

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