**Appendix-A**

Table A1: Pairwise Comparison of three Criteria for High Performance Concrete

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Criteria | Workability | Strength | Durability | Weights |
| Workability | 1 | 1/2 | 2 | 0.2973 |
| Strength | 2 | 1 | 3 | 0.5390 |
| Durability | 1/2 | 1/3 | 1 | 0.1638 |
| **λ max** = 3.0092, CI= 0.0046, CR=0.0079 | | | | |

Table A2: Pairwise Comparison of Sub Criteria (Mix Factors) with Workability Criteria (Performance)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Dimensions | w/c | Density | CA/C | T/C | FA/C | FA/T | Cost | Weights |
| w/c | 1 | 3 | 5 | 7 | 6 | 3 | 5 | 0.3667 |
| Density | 1/3 | 1 | 3 | 3 | 5 | 3 | 3 | 0.1919 |
| CA/C | 1/5 | 1/3 | 1 | 7 | 9 | 5 | 3 | 0.2036 |
| T/C | 1/7 | 1/3 | 1/7 | 1 | 2 | 2 | 1 | 0.0631 |
| FA/C | 1/6 | 1/5 | 1/9 | 1/2 | 1 | 3 | 1/3 | 0.0529 |
| FA/T | 1/3 | 1/3 | 1/5 | 1/2 | 1/3 | 1 | 1 | 0.0548 |
| Cost | 1/5 | 1/3 | 1/3 | 1 | 3 | 1 | 1 | 0.0668 |
| λ max =6.9776, CI= 0.0037, CR=0.028 | | | | | | |  |  |

Table A3: Pairwise Comparison of Alternatives with Respect to Water/Cement (w/c) Ratio

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Criteria | ACI | DOE | FM | E-vectors |
| ACI | 1 | 1 | 1 | 0.3278 |
| DOE | 1 | 1 | 2 | 0.4111 |
| FM | 1 | 1/2 | 1 | 0.2611 |
| λ max = 3.0537, CI= 0.0268, CR=0.0463 | | | | |

Table A4. Priority Weights of Three Alternatives Obtained by AHP with respect to Each Weights of Sub-Criterion

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Alternatives** | **Workability** | | | | | | | **Strength** | | | | | | | **Durability** | | | | | | |
| **w/c** | **Density** | **CA/C** | **T/C** | **FA/C** | **FA/T** | **Cost** | **W/C** | **Density** | **CA/C** | **T/C** | **FA/C** | **FA/T** | **Cost** | **w/c** | **Density** | **CA/C** | **T/C** | **FA/C** | **FA/T** | **Cost** |
| **ACI** | 0.328 | 0.368 | 0.405 | 0.126 | 0.320 | 0.443 | 0.334 | 0.159 | 0.131 | 0.368 | 0.260 | 0.113 | 0.229 | 0.187 | 0.104 | 0.387 | 0.229 | 0.159 | 0.234 | 0.106 | 0.241 |
| **DOE** | 0.411 | 0.493 | 0.480 | 0.458 | 0.557 | 0.387 | 0.525 | 0.589 | 0.677 | 0.493 | 0.633 | 0.719 | 0.601 | 0.715 | 0.665 | 0.443 | 0.601 | 0.589 | 0.688 | 0.633 | 0.548 |
| **FM** | 0.261 | 0.139 | 0.115 | 0.416 | 0.123 | 0.170 | 0.142 | 0.252 | 0.192 | 0.139 | 0.106 | 0.168 | 0.170 | 0.098 | 0.231 | 0.170 | 0.170 | 0.252 | 0.078 | 0.260 | 0.211 |

Table A5. Priority Weights of Three Alternatives Obtained by AHP with respect to Each Weights of Sub-Criterion (Normalized Decision Matrix)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Alternatives** | **Workability** | | | | | | | **Strength** | | | | | | | **Durability** | | | | | | |
| **w/c** | Density | CA/C | T/C | FA/C | FA/T | Cost | **w/c** | Density | CA/C | T/C | FA/C | FA/T | Cost | **w/c** | Density | CA/C | T/C | FA/C | FA/T | Cost |
| ACI | 0.558 | 0.584 | 0.635 | 0.200 | 0.490 | 0.723 | 0.523 | 0.241 | 0.183 | 0.584 | 0.376 | 0.151 | 0.344 | 0.251 | 0.146 | 0.632 | 0.344 | 0.241 | 0.321 | 0.153 | 0.379 |
| DOE | 0.700 | 0.782 | 0.751 | 0.725 | 0.852 | 0.632 | 0.823 | 0.892 | 0.946 | 0.782 | 0.914 | 0.962 | 0.903 | 0.959 | 0.934 | 0.723 | 0.903 | 0.892 | 0.941 | 0.914 | 0.864 |
| FM | 0.445 | 0.220 | 0.180 | 0.659 | 0.187 | 0.277 | 0.222 | 0.382 | 0.269 | 0.220 | 0.153 | 0.225 | 0.256 | 0.131 | 0.325 | 0.277 | 0.256 | 0.382 | 0.107 | 0.376 | 0.332 |

Table A6. Priority Weights of Three Alternatives Obtained by AHP with respect to Each Weights of Sub-Criterion (Weighted Normalized Decision Matrix)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Alternatives** | **Workability** | | | | | | | **Strength** | | | | | | | **Durability** | | | | | | |
| **w/c** | Density | CA/C | T/C | FA/C | FA/T | Cost | **w/c** | Density | CA/C | T/C | FA/C | FA/T | Cost | **w/c** | Density | CA/C | T/C | FA/C | FA/T | Cost |
| ACI | 0.061 | 0.033 | 0.038 | 0.004 | 0.008 | 0.012 | 0.010 | 0.038 | 0.020 | 0.034 | 0.025 | 0.011 | 0.009 | 0.012 | 0.004 | 0.019 | 0.004 | 0.003 | 0.007 | 0.003 | 0.015 |
| DOE | 0.076 | 0.045 | 0.045 | 0.014 | 0.013 | 0.010 | 0.016 | 0.139 | 0.102 | 0.045 | 0.062 | 0.071 | 0.023 | 0.047 | 0.027 | 0.021 | 0.010 | 0.011 | 0.021 | 0.019 | 0.033 |
| FM | 0.048 | 0.013 | 0.011 | 0.012 | 0.003 | 0.005 | 0.004 | 0.060 | 0.029 | 0.013 | 0.010 | 0.017 | 0.007 | 0.006 | 0.009 | 0.008 | 0.003 | 0.005 | 0.002 | 0.008 | 0.013 |

Table A7. Ideal Solution (**A\***) and Negative Ideal Solution **A-**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Criteria | **Workability** | | | | | | | **Strength** | | | | | | | **Durability** | | | | | | |
| **sub-criteria** | **w/c** | Density | CA/C | T/C | FA/C | FA/T | Cost | W/C | Density | CA/C | T/C | FA/C | FA/T | Cost | W/C | Density | CA/C | T/C | FA/C | FA/T | Cost |
| MAX | 0.076 | 0.013 | 0.045 | 0.014 | 0.013 | 0.005 | 0.004 | 0.038 | 0.102 | 0.045 | 0.062 | 0.071 | 0.007 | 0.047 | 0.027 | 0.021 | 0.003 | 0.003 | 0.002 | 0.003 | 0.013 |
| MIN | 0.048 | 0.045 | 0.011 | 0.004 | 0.003 | 0.012 | 0.016 | 0.139 | 0.020 | 0.013 | 0.010 | 0.011 | 0.023 | 0.006 | 0.004 | 0.008 | 0.010 | 0.011 | 0.021 | 0.019 | 0.033 |