Data Appendix

This appendix presents data on corrosion parameters, such as corrosion potential (), corrosion current density (), anodic Tafel slope (), and cathodic Tafel slope () for rebar measured in simulated pore solutions and mortar. In summary, there were six levels of chloride contamination (Table A.0) and two levels of carbonation state for both simulated pore solution and mortar. Additionally, for the mortar samples, four levels of moisture conditions were examined: relative humidity of 65%, 85%, 95% and submerged. Three replicate samples were prepared for each condition level to capture the uncertainty of the test data.

Table A.0 NaCl contamination levels in solution and mortar

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Chloride level | 0 | 1 | 2 | 3 | 4 | 5 |
| wt.% NaCl simulated pore solution  or mortar mixing solution | 0% | 0.5% | 1.0% | 2.0% | 3.0% | 5.0% |
| wt.% Cl by weight of cement | 0% | 0.21% | 0.43% | 0.87% | 1.31% | 2.24% |

Table A.1 Corrosion parameters of rebar in mortar

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Sample | Condition  humidity | Cl level | Repeat |  |  |  |  |
| Rebar in  non-carbonated mortar, w/c=0.7  (Sample label: 7N) | RH 65 | 0 | 1 | -0.054 | 0.015 | 0.472 | -0.135 |
| 2 | -0.053 | 0.014 | 0.312 | -0.138 |
| 3 | -0.057 | 0.017 | 0.334 | -0.139 |
| 1 | 1 | -0.079 | 0.017 | 0.333 | -0.127 |
| 2 | -0.060 | 0.012 | 0.333 | -0.126 |
| 3 | -0.065 | 0.018 | 0.382 | -0.119 |
| 2 | 1 | -0.077 | 0.040 | 0.600 | -0.155 |
| 2 | -0.095 | 0.025 | 0.339 | -0.137 |
| 3 | -0.090 | 0.034 | 0.484 | -0.139 |
| 3 | 1 | -0.128 | 0.052 | 0.559 | -0.156 |
| 2 | -0.130 | 0.071 | 0.675 | -0.161 |
| 3 | -0.136 | 0.052 | 0.604 | -0.164 |
| 4 | 1 | -0.151 | 0.113 | 0.504 | -0.176 |
| 2 | -0.153 | 0.134 | 0.467 | -0.198 |
| 3 | -0.178 | 0.114 | 0.402 | -0.183 |
| 5 | 1 | -0.213 | 0.679 | 0.986 | -0.294 |
| 2 | -0.206 | 0.562 | 0.868 | -0.309 |
| 3 | -0.220 | 0.492 | 0.857 | -0.278 |
| RH 85 | 0 | 1 | -0.061 | 0.017 | 0.253 | -0.127 |
| 2 | -0.032 | 0.022 | 0.231 | -0.135 |
| 3 | -0.032 | 0.022 | 0.245 | -0.147 |
| 1 | 1 | -0.130 | 0.047 | 0.408 | -0.130 |
| 2 | -0.082 | 0.022 | 0.277 | -0.124 |
| 3 | -0.120 | 0.069 | 0.463 | -0.123 |
| 2 | 1 | -0.181 | 0.306 | 0.795 | -0.180 |
| 2 | -0.176 | 0.217 | 0.491 | -0.180 |
| 3 | -0.181 | 0.232 | 0.765 | -0.163 |
| 3 | 1 | -0.239 | 0.427 | 0.708 | -0.209 |
| 2 | -0.208 | 0.273 | 0.453 | -0.168 |
| 3 | -0.249 | 0.302 | 0.409 | -0.155 |
| 4 | 1 | -0.281 | 1.047 | 0.597 | -0.238 |
| 2 | -0.263 | 0.997 | 0.616 | -0.247 |
| 3 | -0.306 | 1.100 | 0.644 | -0.235 |
| 5 | 1 | -0.333 | 3.319 | 0.628 | -0.241 |
| 2 | -0.356 | 3.084 | 0.603 | -0.229 |
| 3 | -0.338 | 2.551 | 0.603 | -0.230 |
| RH 95 | 0 | 1 | -0.099 | 0.029 | 0.333 | -0.113 |
| 2 | -0.071 | 0.033 | 0.288 | -0.134 |
| 3 | -0.069 | 0.032 | 0.286 | -0.148 |
| 1 | 1 | -0.133 | 0.078 | 0.573 | -0.146 |
| 2 | -0.108 | 0.047 | 0.395 | -0.129 |
| 3 | -0.128 | 0.093 | 0.705 | -0.135 |
| 2 | 1 | -0.227 | 0.943 | 1.024 | -0.189 |
| 2 | -0.194 | 0.302 | 0.608 | -0.177 |
| 3 | -0.236 | 0.545 | 0.575 | -0.172 |
| 3 | 1 | -0.321 | 1.547 | 0.701 | -0.227 |
| 2 | -0.298 | 1.177 | 0.639 | -0.193 |
| 3 | -0.344 | 1.737 | 0.765 | -0.240 |
| 4 | 1 | -0.379 | 4.334 | 0.909 | -0.281 |
| 2 | -0.373 | 4.517 | 0.892 | -0.292 |
| 3 | -0.399 | 4.335 | 0.877 | -0.260 |
| 5 | 1 | -0.455 | 15.918 | 0.655 | -0.263 |
| 2 | -0.440 | 11.224 | 0.826 | -0.252 |
| 3 | -0.460 | 11.894 | 0.888 | -0.250 |
| submerged | 0 | 1 | -0.124 | 0.115 | 0.773 | -0.134 |
| 2 | -0.094 | 0.084 | 0.652 | -0.133 |
| 3 | -0.073 | 0.066 | 0.494 | -0.143 |
| 1 | 1 | -0.314 | 0.330 | 0.392 | -0.213 |
| 2 | -0.203 | 0.277 | 0.881 | -0.205 |
| 3 | -0.149 | 0.207 | 0.849 | -0.171 |
| 2 | 1 | -0.541 | 3.067 | 0.827 | -0.423 |
| 2 | -0.488 | 1.637 | 0.560 | -0.362 |
| 3 | -0.556 | 1.773 | 0.728 | -0.298 |
| 3 | 1 | -0.684 | 5.238 | 1.754 | -0.255 |
| 2 | -0.607 | 1.840 | 1.137 | -0.166 |
| 3 | -0.645 | 3.444 | 2.150 | -0.226 |
| 4 | 1 | -0.727 | 11.252 | 1.598 | -0.224 |
| 2 | -0.707 | 10.861 | 1.593 | -0.199 |
| 3 | -0.720 | 10.413 | 1.271 | -0.203 |
| 5 | 1 | -0.750 | 33.796 | 1.372 | -0.129 |
| 2 | -0.756 | 24.400 | 1.013 | -0.147 |
| 3 | -0.752 | 32.951 | 1.084 | -0.262 |
| Rebar in Carbonated Mortar, w/c=0.7  (Sample label: 7C) | RH 65 | 0 | 1 | -0.091 | 0.214 | 0.565 | -0.504 |
| 2 | -0.111 | 0.223 | 0.548 | -0.480 |
| 3 | -0.078 | 0.220 | 0.544 | -0.403 |
| 1 | 1 | -0.378 | 0.409 | 0.468 | -0.319 |
| 2 | -0.356 | 0.374 | 0.489 | -0.357 |
| 3 | -0.353 | 0.448 | 0.479 | -0.339 |
| 2 | 1 | -0.432 | 0.457 | 0.404 | -0.331 |
| 2 | -0.427 | 0.623 | 0.435 | -0.364 |
| 3 | -0.410 | 0.614 | 0.428 | -0.361 |
| 3 | 1 | -0.465 | 1.318 | 0.612 | -0.445 |
| 2 | -0.475 | 1.790 | 0.587 | -0.525 |
| 3 | -0.460 | 1.522 | 0.457 | -0.385 |
| 4 | 1 | -0.473 | 1.904 | 0.504 | -0.441 |
| 2 | -0.485 | 2.394 | 0.479 | -0.482 |
| 3 | -0.479 | 3.056 | 0.496 | -0.543 |
| 5 | 1 | -0.506 | 4.796 | 0.443 | -0.533 |
| 2 | -0.508 | 5.913 | 0.398 | -0.546 |
| 3 | -0.512 | 4.609 | 0.436 | -0.513 |
| RH 85 | 0 | 1 | -0.147 | 0.152 | 0.314 | -0.415 |
| 2 | -0.081 | 0.091 | 0.286 | -0.339 |
| 3 | -0.082 | 0.135 | 0.397 | -0.374 |
| 1 | 1 | -0.327 | 1.536 | 0.426 | -0.547 |
| 2 | -0.348 | 1.024 | 0.354 | -0.363 |
| 3 | -0.382 | 1.060 | 0.455 | -0.393 |
| 2 | 1 | -0.403 | 1.239 | 0.675 | -0.383 |
| 2 | -0.387 | 2.154 | 0.584 | -0.555 |
| 3 | -0.353 | 1.716 | 0.390 | -0.464 |
| 3 | 1 | -0.447 | 2.835 | 0.398 | -0.576 |
| 2 | -0.454 | 3.205 | 0.459 | -0.560 |
| 3 | -0.460 | 3.926 | 0.428 | -0.579 |
| 4 | 1 | -0.471 | 3.831 | 0.620 | -0.403 |
| 2 | -0.481 | 4.808 | 0.543 | -0.439 |
| 3 | -0.489 | 6.468 | 0.462 | -0.556 |
| 5 | 1 | -0.528 | 9.217 | 0.455 | -0.517 |
| 2 | -0.523 | 9.792 | 0.620 | -0.495 |
| 3 | -0.520 | 6.720 | 0.648 | -0.458 |
| RH 95 | 0 | 1 | -0.334 | 0.733 | 0.745 | -0.547 |
| 2 | -0.272 | 0.488 | 0.705 | -0.534 |
| 3 | -0.262 | 0.282 | 0.449 | -0.308 |
| 1 | 1 | -0.391 | 1.387 | 0.328 | -0.278 |
| 2 | -0.377 | 2.723 | 0.733 | -0.406 |
| 3 | -0.428 | 1.804 | 0.868 | -0.331 |
| 2 | 1 | -0.423 | 2.236 | 0.824 | -0.275 |
| 2 | -0.431 | 5.768 | 0.908 | -0.545 |
| 3 | -0.412 | 5.413 | 0.906 | -0.552 |
| 3 | 1 | -0.484 | 10.038 | 0.964 | -0.397 |
| 2 | -0.473 | 6.297 | 0.951 | -0.442 |
| 3 | -0.487 | 7.775 | 0.947 | -0.509 |
| 4 | 1 | -0.494 | 7.822 | 1.028 | -0.404 |
| 2 | -0.505 | 7.420 | 1.157 | -0.315 |
| 3 | -0.502 | 10.029 | 1.074 | -0.388 |
| 5 | 1 | -0.548 | 9.712 | 0.506 | -0.260 |
| 2 | -0.535 | 13.682 | 1.046 | -0.359 |
| 3 | -0.536 | 9.189 | 1.088 | -0.361 |
| submerged | 0 | 1 | -0.568 | 2.008 | 0.777 | -0.408 |
| 2 | -0.570 | 3.180 | 0.783 | -0.534 |
| 3 | -0.569 | 4.468 | 0.799 | -0.527 |
| 1 | 1 | -0.589 | 19.457 | 0.731 | -0.782 |
| 2 | -0.600 | 12.412 | 0.531 | -0.822 |
| 3 | -0.588 | 8.526 | 0.541 | -0.747 |
| 2 | 1 | -0.593 | 12.164 | 0.501 | -0.863 |
| 2 | -0.580 | 15.648 | 0.577 | -0.860 |
| 3 | -0.591 | 20.423 | 0.538 | -0.867 |
| 3 | 1 | -0.584 | 27.441 | 0.888 | -0.921 |
| 2 | -0.582 | 15.908 | 0.678 | -0.742 |
| 3 | -0.592 | 10.545 | 0.353 | -0.341 |
| 4 | 1 | -0.591 | 17.248 | 0.704 | -0.834 |
| 2 | -0.596 | 14.406 | 0.826 | -0.458 |
| 3 | -0.592 | 9.131 | 0.616 | -0.291 |
| 5 | 1 | -0.600 | 14.131 | 0.864 | -0.454 |
| 2 | -0.595 | 7.918 | 0.475 | -0.261 |
| 3 | -0.594 | 7.489 | 0.350 | -0.278 |

Table A.2 Corrosion parameters of rebar in the simulated pore solution

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Sample | Condition  time | Cl level | Repeat |  |  |  |  |
| Rebar in non-carbonated simulated pore solution (SPS)  (Sample label: NP) | 72 h | 0 | 1 | -0.198 | 0.545 | 3.057 | -0.329 |
| 2 | -0.203 | 0.348 | 1.719 | -0.218 |
| 3 | -0.163 | 0.119 | 0.654 | -0.178 |
| 1 | 1 | -0.477 | 5.254 | 1.200 | -0.505 |
| 2 | -0.495 | 3.780 | 1.453 | -0.337 |
| 3 | -0.256 | 0.261 | 1.224 | -0.187 |
| 2 | 1 | -0.400 | 5.593 | 1.266 | -0.745 |
| 2 | -0.538 | 6.448 | 1.320 | -0.477 |
| 3 | -0.526 | 4.615 | 1.624 | -0.420 |
| 3 | 1 | -0.283 | 2.630 | 1.722 | -0.475 |
| 2 | -0.516 | 5.838 | 1.604 | -0.371 |
| 3 | -0.304 | 0.462 | 0.246 | -0.166 |
| 4 | 1 | -0.357 | 5.424 | 0.446 | -0.855 |
| 2 | -0.529 | 10.289 | 1.340 | -0.597 |
| 3 | -0.392 | 1.078 | 0.491 | -0.221 |
| 5 | 1 | -0.578 | 4.913 | 0.693 | -0.360 |
| 2 | -0.560 | 10.292 | 0.339 | -1.315 |
| 3 | -0.560 | 12.060 | 0.429 | -1.314 |
| 20 d | 0 | 1 | -0.218 | 0.235 | 0.167 | -0.242 |
| 2 | -0.252 | 0.320 | 0.504 | -0.239 |
| 3 | -0.299 | 0.551 | 1.071 | -0.234 |
| 1 | 1 | -0.555 | 1.172 | 0.106 | -0.189 |
| 2 | -0.544 | 1.007 | 0.126 | -0.201 |
| 3 | -0.555 | 1.906 | 0.350 | -0.265 |
| 2 | 1 | -0.581 | 3.056 | 0.274 | -0.291 |
| 2 | -0.577 | 2.939 | 0.289 | -0.290 |
| 3 | -0.548 | 2.106 | 0.188 | -0.279 |
| 3 | 1 | -0.620 | 6.081 | 0.321 | -0.375 |
| 2 | -0.591 | 4.935 | 0.285 | -0.401 |
| 3 | -0.628 | 8.081 | 0.321 | -0.419 |
| 4 | 1 | -0.603 | 5.046 | 0.293 | -0.339 |
| 2 | -0.596 | 6.111 | 0.405 | -0.402 |
| 3 | -0.628 | 5.147 | 0.320 | -0.363 |
| 5 | 1 | -0.606 | 6.237 | 0.279 | -0.429 |
| 2 | -0.623 | 2.407 | 0.209 | -0.237 |
| 3 | -0.612 | 3.184 | 0.229 | -0.276 |
| Rebar in carbonated simulated pore solution (CSPS)  (Sample label: CP) | 36 h | 0 | 1 | -0.128 | 0.578 | 1.579 | -0.140 |
| 2 | -0.056 | 0.294 | 2.469 | -0.190 |
| 3 | -0.102 | 0.320 | 0.312 | -0.139 |
| 1 | 1 | -0.381 | 5.459 | 0.142 | -0.399 |
| 2 | -0.362 | 6.144 | 0.131 | -0.371 |
| 3 | -0.368 | 1.929 | 0.122 | -0.212 |
| 2 | 1 | -0.397 | 5.619 | 0.119 | -0.347 |
| 2 | -0.425 | 1.633 | 0.095 | -0.179 |
| 3 | -0.428 | 3.057 | 0.093 | -0.280 |
| 3 | 1 | -0.460 | 5.852 | 0.151 | -0.390 |
| 2 | -0.462 | 10.230 | 0.209 | -0.869 |
| 3 | -0.447 | 6.389 | 0.157 | -0.402 |
| 4 | 1 | -0.459 | 5.401 | 0.145 | -0.410 |
| 2 | -0.452 | 8.136 | 0.194 | -0.635 |
| 3 | -0.442 | 9.304 | 0.233 | -0.616 |
| 5 | 1 | -0.503 | 4.914 | 0.139 | -0.606 |
| 2 | -0.507 | 7.318 | 0.165 | -1.546 |
| 3 | -0.473 | 9.166 | 0.223 | -0.819 |
| 20 d | 0 | 1 | -0.081 | 0.130 | 0.181 | -0.137 |
| 2 | -0.129 | 0.198 | 0.362 | -0.120 |
| 3 | -0.082 | 0.133 | 0.137 | -0.141 |
| 1 | 1 | -0.403 | 8.760 | 0.421 | -0.205 |
| 2 | -0.409 | 9.436 | 0.553 | -0.226 |
| 3 | -0.400 | 8.877 | 0.576 | -0.229 |
| 2 | 1 | -0.465 | 22.156 | 0.548 | -0.311 |
| 2 | -0.507 | 20.808 | 0.375 | -0.259 |
| 3 | -0.463 | 16.333 | 0.398 | -0.257 |
| 3 | 1 | -0.491 | 25.506 | 0.569 | -0.322 |
| 2 | -0.493 | 19.239 | 0.427 | -0.280 |
| 3 | -0.495 | 19.318 | 0.341 | -0.262 |
| 4 | 1 | -0.521 | 20.085 | 0.419 | -0.405 |
| 2 | -0.476 | 18.426 | 0.554 | -0.311 |
| 3 | -0.486 | 19.797 | 0.559 | -0.305 |
| 5 | 1 | -0.548 | 16.673 | 0.328 | -0.597 |
| 2 | -0.544 | 13.280 | 0.311 | -0.623 |
| 3 | -0.505 | 20.828 | 0.544 | -0.363 |