# Appendix A

Table A-1 Database of investigated buildings (Source: Chaimahawan and Pimanmas,2006)

| No. | Code Name | Type of Building | Number of Story | Column size($mm^2$) | Column tributary area ($m^2$) | Bond index (BI) | Column depth/bar diameter | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | B1 | University | 9 | 600x800 | 48.00 | 4.30 | 32 | JL |
| 2 | B2 | University | 9 | 800x800 | 57.00 | 4.81 | 29 | JL |
| 3 | B3 | Office | 21 | 1200x1200 | 40.50 | 3.09 | 40 | JL |
| 4 | B5 | Hospital | 10 | 800x800 | 39.20 | 3.77 | 32 | JL |
| 5 | B5 | Hospital | 12 | 600x600 | 29.50 | 6.19 | 24 | JM |
| 6 | B6 | School | 9 | 500x800 | 24.00 | 4.96 | 32 | JM |
| 7 | B7 | Apartment | 15 | 400x800 | 20.00 | 4.64 | 32 | JM |
| 8 | B8 | Apartment | 15 | 1000x400 | 22.62 | 4.14 | 25 | JM |
| 9 | B9 | School | 6 | 700x500 | 29.00 | 6.45 | 20 | JM |
| 10 | B10 | School | 6 | 600x600 | 27.00 | 4.98 | 24 | JM |
| 11 | B11 | Office | 12 | 400x550 | 17.50 | 5.94 | 25 | JS |
| 12 | B12 | Apartment | 9 | 200x400 | 9.00 | 5.90 | 25 | JS |
| 13 | B13 | Apartment | 9 | 300x500 | 13.70 | 8.57 | 20 | JS |
| 14 | B14 | Apartment | 9 | 400x200 | 10.15 | 6.21 | 17 | JS |
| 15 | B15 | Apartment | 8 | 700x300 | 13.65 | 5.16 | 19 | JS |
| 16 | B16 | Office | 5 | 400x400 | 16.00 | 4.84 | 20 | JS |
| 17 | B17 | Hospital | 10 | 450x450 | 16.70 | 5.74 | 23 | JS |

Table A-2 Database of investigated buildings (Source: Cheejaroen,2004)

| No. | Code Name | Type of Building | Number of Story | Clear Story Height (m) | Clear Span Length (m) | Approximated Tributary Area ( $m^2$) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 9UNI-1 | University | 9 | 4.0 | 8.0 | 48.0 | JL |
| 2 | 9UNI-2 | University | 9 | 4.2 | 7.0 | 57.0 | JL |
| 3 | 21OFF-3 | Office | 21 | 4.5 | 9.0 | 40.5 | JL |
| 4 | 12Hos-4 | Hospital | 12 | 4.5 | 5.0 | 29.5 | JM |
| 5 | 12AP-5 | Apartment | 12 | 3.0 | 8.0 | 32.4 | JM |
| 6 | 9SCL-6 | School | 9 | 4.0 | 7.0 | 24.0 | JM |
| 7 | 15AP-7 | Apartment | 15 | 3.2 | 4.3 | 20.0 | JM |
| 8 | 12OFF-8 | Office | 12 | 4.5 | 6.2 | 17.5 | JS |
| 9 | 9Ap-9 | Apartment | 9 | 2.7 | 3.0 | 9.0 | JS |
| 10 | 9AP-10 | Apartment | 9 | 2.5 | 3.4 | 13.7 | JS |

Table A-3 Structural indices of beam for buildings with large tributary area
(Source: Cheejaroen, 2004)

| No. | Code | Story height (m) | $\frac{a_b}{h_b}$ | $\frac{M_n}{aV_n}$ | $\rho$ | $\rho'$ | $\rho_s\sqrt{\frac{b''}{s}}$ | $\frac{V_a}{b_w d\sqrt{f_c'}}$ |
|---|---|---|---|---|---|---|---|---|
| 1 | 9UNI-1 | 4.0 | 6.67 | 0.207 | 0.0224 | 0.0150 | 0.0123 | 2.09 |
| 2 | 9UNI-2 | 4.2 | 4.38 | 0.275 | 0.0158 | 0.0035 | 0.0081 | 1.76 |
| 3 | 21-OFF-3 | 4.5 | 5.62 | 0.471 | 0.0182 | 0.0140 | 0.0085 | 2.31 |
| Maximum | | 4.5 | 6.67 | 0.471 | 0.0224 | 0.0150 | 0.0123 | 2.31 |
| Minimum | | 4.0 | 4.38 | 0.207 | 0.0158 | 0.0035 | 0.0081 | 1.76 |
| Average | | 4.2 | 5.56 | 0.318 | 0.0188 | 0.0108 | 0.0096 | 2.05 |
| Std. Dev. | | 0.3 | 1.15 | 0.137 | 0.0033 | 0.0064 | 0.0023 | 0.28 |
| Specimen JL | | | 4.33 | 0.615 | 0.0129 | 0.0086 | 0.0081 | 2.15 |

Table A-4 Structural indices of column for buildings with large tributary area
(Source: Cheejaroen, 2004)

| No. | Code | Story height (m) | $\frac{a_c}{h_c}$ | $\frac{M_n}{aV_n}$ | $\frac{\rho}{f'_c A_g}$ | $\rho_t$ | $\rho_s\sqrt{\frac{b''}{s}}$ | $\frac{V_a}{b_w d\sqrt{f_c'}}$ |
|---|---|---|---|---|---|---|---|---|
| 1 | 9UNI-1 | 4.0 | 2.50 | 0.855 | 0.249 | 0.0334 | 0.00403 | 4.49 |
| 2 | 9UNI-2 | 4.2 | 2.63 | 0.880 | 0.240 | 0.0192 | 0.00310 | 3.84 |
| 3 | 21-OFF-3 | 4.5 | 1.88 | 1.458 | 0.269 | 0.0257 | 0.00433 | 4.45 |
| Maximum | | 4.5 | 2.63 | 1.458 | 0.269 | 0.0334 | 0.00433 | 4.49 |
| Minimum | | 4.0 | 1.88 | 0.855 | 0.240 | 0.0192 | 0.00310 | 3.84 |
| Average | | 4.2 | 2.33 | 1.064 | 0.253 | 0.0261 | 0.00382 | 4.26 |
| Std. Dev. | | 0.3 | 0.40 | 0.341 | 0.015 | 0.0071 | 0.00064 | 0.36 |
| Specimen JL | | | 1.88 | 1.314 | 0.217 | 0.0245 | 0.00460 | 4.41 |

Table A-5 Structural indices of joint for buildings with large tributary area
(Source: Cheejaroen, 2004)

| No. | Code | Story height (m) | BI | $\frac{h_c}{d_b}$ | $\frac{b_b}{b_c}$ | $\frac{h_b}{h_c}$ | $\frac{M_{nc}}{M_{nb}}$ | $\frac{V}{V_n}$ | $\frac{\rho_{sv} f_y}{f_c'}$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 9UNI-1 | 4.0 | 4.30 | 32 | 0.417 | 0.750 | 3.442 | 1.126 | 0.0 |
| 2 | 9UNI-2 | 4.2 | 4.81 | 29 | 0.625 | 1.000 | 2.098 | 0.972 | 0.0 |
| 3 | 21-OFF-3 | 4.5 | 3.09 | 48 | 0.417 | 0.667 | 5.047 | 0.911 | 0.0 |
| Maximum | | 4.5 | 4.81 | 48 | 0.625 | 1.000 | 5.047 | 1.126 | 0 .0 |
| Minimum | | 4.0 | 3.09 | 29 | 0.417 | 0.667 | 2.098 | 0.911 | 0 .0 |
| Average | | 4.2 | 4.07 | 36 | 0.486 | 0.806 | 3.529 | 1.003 | 0.0 |
| Std. Dev. | | 0.3 | 0.88 | 10 | 0.120 | 0.173 | 1.477 | 0.111 | 0.0 |
| Specimen JL | | | 4.45 | 33 | 0.667 | 0.750 | 3.049 | 0.903 | 0.0 |

Table A-6 Structural indices of beam for buildings with medium tributary area (Source: Cheejaroen, 2004)

| No. | Code | Story height (m) | $\frac{a_b}{h_b}$ | $\frac{M_n}{aV_n}$ | $\rho$ | $\rho'$ | $\rho_s\sqrt{\frac{b''}{s}}$ | $\frac{V_a}{b_w d\sqrt{f_c'}}$ |
|---|---|---|---|---|---|---|---|---|
| 4 | 12Hos-4 | 4.5 | 3.85 | 0.518 | 0.0115 | 0.0058 | 0.0040 | 1.98 |
| 5 | 12AP-5 | 3 | 5.00 | 0.313 | 0.0150 | 0.0150 | 0.0100 | 2.24 |
| 6 | 9SCL-6 | 4 | 4.38 | 0.673 | 0.0140 | 0.0040 | 0.0016 | 1.85 |
| 7 | 15AP-7 | 3.2 | 4.30 | 0.748 | 0.0150 | 0.0150 | 0.0043 | 2.86 |
| Maximum | | 4.5 | 5.00 | 0.748 | 0.0150 | 0.0150 | 0.0100 | 2.86 |
| Minimum | | 3.0 | 3.85 | 0.313 | 0.0115 | 0.0040 | 0.0016 | 1.85 |
| Average | | 3.7 | 4.38 | 0.563 | 0.0139 | 0.0099 | 0.0050 | 2.23 |
| Std. Dev. | | 0.7 | 0.47 | 0.193 | 0.0016 | 0.0059 | 0.0036 | 0.45 |
| Specimen JM | | | 4.42 | 0.637 | 0.0148 | 0.0098 | 0.0076 | 2.36 |

Table A-7 Structural indices of column for buildings with medium tributary area (Source: Cheejaroen, 2004)

| No. | Code | Story height (m) | $\frac{a_c}{h_c}$ | $\frac{M_n}{aV_n}$ | $\frac{\rho}{f'_c A_g}$ | $\rho_t$ | $\rho_s\sqrt{\frac{b''}{s}}$ | $\frac{V_a}{b_w d\sqrt{f_c'}}$ |
|---|---|---|---|---|---|---|---|---|
| 4 | 12Hos-4 | 4.5 | 3.75 | 0.580 | 0.246 | 0.0273 | 0.00418 | 2.83 |
| 5 | 12AP-5 | 3 | 1.25 | 0.995 | 0.317 | 0.0409 | 0.00761 | 10.18 |
| 6 | 9SCL-6 | 4 | 2.50 | 0.980 | 0.226 | 0.0172 | 0.00151 | 3.48 |
| 7 | 15AP-7 | 3.2 | 2.00 | 0.781 | 0.256 | 0.0118 | 0.00251 | 3.83 |
| Maximum | | 4.5 | 3.75 | 0.995 | 0.317 | 0.0409 | 0.00761 | 10.18 |
| Minimum | | 3.0 | 1.25 | 0.580 | 0.226 | 0.0118 | 0.00151 | 2.83 |
| Average | | 3.7 | 2.38 | 0.834 | 0.261 | 0.0243 | 0.00395 | 5.08 |
| Std. Dev. | | 0.7 | 1.05 | 0.195 | 0.039 | 0.0128 | 0.00268 | 3.43 |
| Specimen JM | | | 2.14 | 1.010 | 0.165 | 0.0291 | 0.00616 | 5.00 |

Table A-8 Structural indices of joint for buildings with medium tributary area (Source: Cheejaroen, 2004)

| No. | Code | Story height (m) | BI | $\frac{h_c}{d_b}$ | $\frac{b_b}{b_c}$ | $\frac{h_b}{h_c}$ | $\frac{M_{nc}}{M_{nb}}$ | $\frac{V}{V_n}$ | $\frac{\rho_{sv} f_y}{f_c'}$ |
|---|---|---|---|---|---|---|---|---|---|
| 4 | 12Hos-4 | 4.5 | 6.19 | 24 | 0.500 | 1.083 | 2.372 | 0.912 | 0.0 |
| 5 | 12AP-5 | 3 | 2.24 | 60 | 0.750 | 0.667 | 3.403 | 1.029 | 0.0 |
| 6 | 9SCL-6 | 4 | 4.96 | 32 | 0.700 | 1.000 | 1.538 | 1.115 | 0.0 |
| 7 | 15AP-7 | 3.2 | 4.64 | 32 | 0.750 | 0.625 | 2.127 | 1.172 | 0.0 |
| Maximum | | 4.5 | 6.19 | 60 | 0.750 | 1.083 | 3.403 | 1.172 | 0.0 |
| Minimum | | 3.0 | 2.24 | 24 | 0.500 | 0.625 | 1.538 | 0.912 | 0.0 |
| Average | | 3.7 | 4.51 | 37 | 0.675 | 0.844 | 2.360 | 1.057 | 0.0 |
| Std. Dev. | | 0.7 | 1.65 | 16 | 0.119 | 0.232 | 0.779 | 0.113 | 0.0 |
| Specimen JM | | | 5.09 | 29 | 0.875 | 0.857 | 1.682 | 1.382 | 0.0 |

Table A-9 Structural indices of beam for buildings with small tributary area
(Source: Cheejaroen, 2004)

| No. | Code | Story height (m) | $\frac{a_b}{h_b}$ | $\frac{M_n}{aV_n}$ | $\rho$ | $\rho'$ | $\rho_s\sqrt{\frac{b''}{s}}$ | $\frac{V_a}{b_w d\sqrt{f_c'}}$ |
|---|---|---|---|---|---|---|---|---|
| 8 | 12OFF-8 | 4.5 | 3.88 | 0.495 | 0.0264 | 0.0176 | 0.0177 | 4.16 |
| 9 | 9Ap-9 | 2.7 | 3.75 | 0.522 | 0.0144 | 0.0086 | 0.0066 | 2.53 |
| 10 | 9AP-10 | 2.5 | 3.78 | 1.041 | 0.0249 | 0.0249 | 0.0064 | 4.52 |
| Maximum | | 4.5 | 3.88 | 1.041 | 0.0264 | 0.0249 | 0.0177 | 4.52 |
| Minimum | | 2.5 | 3.75 | 0.495 | 0.0144 | 0.0086 | 0.0064 | 2.53 |
| Average | | 3.2 | 3.80 | 0.686 | 0.0219 | 0.0170 | 0.0102 | 3.74 |
| Std. Dev. | | 1.1 | 0.07 | 0.308 | 0.0066 | 0.0082 | 0.0065 | 1.06 |
| Specimen JS | | | 4.50 | 0.819 | 0.0197 | 0.0148 | 0.0063 | 3.04 |

Table A-10 Structural indices of column for buildings with small tributary area
(Source: Cheejaroen, 2004)

| No. | Code | Story height (m) | $\frac{a_c}{h_c}$ | $\frac{M_n}{aV_n}$ | $\frac{\rho}{f'_c A_g}$ | $\rho_t$ | $\rho_s\sqrt{\frac{b''}{s}}$ | $\frac{V_a}{b_w d\sqrt{f_c'}}$ |
|---|---|---|---|---|---|---|---|---|
| 8 | 12OFF-8 | 4.5 | 3.21 | 0.574 | 0.201 | 0.0151 | 0.00505 | 2.74 |
| 9 | 9Ap-9 | 2.7 | 3.38 | 1.245 | 0.355 | 0.0982 | 0.00373 | 5.26 |
| 10 | 9AP-10 | 2.5 | 2.50 | 1.223 | 0.260 | 0.0524 | 0.00393 | 5.78 |
| Maximum | | 4.5 | 3.38 | 1.245 | 0.355 | 0.0982 | 0.00505 | 5.78 |
| Minimum | | 2.5 | 2.50 | 0.574 | 0.201 | 0.0151 | 0.00373 | 2.74 |
| Average | | 3.2 | 3.03 | 1.014 | 0.272 | 0.0552 | 0.00424 | 4.59 |
| Std. Dev. | | 1.1 | 0.47 | 0.381 | 0.077 | 0.0416 | 0.00071 | 1.62 |
| Specimen JS | | | 2.50 | 1.104 | 0.217 | 0.0452 | 0.00554 | 5.25 |

Table A-11 Structural indices of joint for buildings with small tributary area
(Source: Cheejaroen, 2004)

| No. | Code | Story height (m) | BI | $\frac{h_c}{d_b}$ | $\frac{b_b}{b_c}$ | $\frac{h_b}{h_c}$ | $\frac{M_{nc}}{M_{nb}}$ | $\frac{V}{V_n}$ | $\frac{\rho_{sv} f_y}{f_c'}$ |
|---|---|---|---|---|---|---|---|---|---|
| 8 | 12OFF-8 | 4.5 | 5.94 | 25 | 0.571 | 1.143 | 0.732 | 2.668 | 0.0 |
| 9 | 9Ap-9 | 2.7 | 5.90 | 25 | 1.000 | 1.000 | 2.331 | 1.677 | 0.0 |
| 10 | 9AP-10 | 2.5 | 8.57 | 20 | 0.833 | 0.900 | 1.473 | 3.504 | 0.0 |
| Maximum | | 4.5 | 8.57 | 25 | 1.000 | 1.143 | 2.331 | 3.504 | 0 .0 |
| Minimum | | 2.5 | 5.90 | 20 | 0.571 | 0.900 | 0.732 | 1.677 | 0 .0 |
| Average | | 3.2 | 6.80 | 23 | 0.802 | 1.014 | 1.512 | 2.616 | 0.0 |
| Std. Dev. | | 1.1 | 1.53 | 3 | 0.216 | 0.122 | 0.800 | 0.915 | 0.0 |
| Specimen JS | | | 5.94 | 25 | 0.875 | 1.000 | 1.187 | 2.282 | 0.0 |