APPENDIX

Appendix A – Technical parameters of each section

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Section |  |  |  | (car) | (car) | (hour) | (hour) |  |
| 1→2 | 2.8 | 3.2 | 3 | 69 | 69,63,47,46 | 4.6 | 8.6 | 170 |
| 1→4 | 2.6 | 3.7 | 3 | 63 | 63,41,64,61 | 9.9 | 13.8 | 129 |
| 2→1 | 2.2 | 3.8 | 3 | 60 | 60,68,40,50 | 4.6 | 9.3 | 143 |
| 2→3 | 2.5 | 3.7 | 4 | 57 | 57,68,42,59,46 | 2.5 | 7.6 | 178 |
| 3→2 | 2.8 | 3.3 | 4 | 61 | 61,68,61,69,69 | 2.5 | 6.3 | 184 |
| 3→4 | 2.4 | 3.4 | 4 | 45 | 45,56,58,49,56 | 7.1 | 11.6 | 116 |
| 3→5 | 2.9 | 4 | 4 | 69 | 69,59,67,41,69 | 5.8 | 11.3 | 100 |
| 3→8 | 2.6 | 3.3 | 2 | 42 | 42,42,44 | 4.7 | 6.9 | 112 |
| 4→1 | 2.5 | 3.8 | 3 | 58 | 58,42,52,47 | 9.9 | 14.2 | 120 |
| 4→3 | 2.5 | 3.5 | 4 | 42 | 42,64,49,49,58 | 7.1 | 13.9 | 92 |
| 4→10 | 2.3 | 3.7 | 5 | 68 | 68,50,46,47,57,46 | 6.2 | 13 | 141 |
| 5→3 | 2.8 | 3.3 | 4 | 40 | 40,62,68,59,66 | 5.8 | 9 | 191 |
| 5→6 | 2.6 | 3.3 | 5 | 43 | 43,64,44,46,49,54 | 3.8 | 8.5 | 177 |
| 6→5 | 3 | 3.7 | 5 | 45 | 45,68,48,48,69,68 | 3.8 | 12.1 | 139 |
| 6→7 | 3 | 3.7 | 2 | 64 | 64,48,68 | 2.3 | 4 | 134 |
| 6→11 | 2.3 | 3.9 | 4 | 56 | 56,59,56,52,41 | 3 | 8.8 | 95 |
| 7→6 | 2.8 | 3.3 | 2 | 48 | 48,60,68 | 2.3 | 5.9 | 84 |
| 7→8 | 2.8 | 3.7 | 3 | 51 | 51,59,60,60 | 4.4 | 8.9 | 121 |
| 7→11 | 2.7 | 3.7 | 3 | 50 | 50,49,40,52 | 3.1 | 7 | 115 |
| 8→3 | 2.5 | 4 | 2 | 51 | 51,61,47 | 4.7 | 7.8 | 189 |
| 8→7 | 2 | 3.5 | 3 | 48 | 48,52,70,54 | 4.4 | 8.8 | 113 |
| 8→9 | 2.3 | 3.3 | 5 | 50 | 50,49,68,60,59,47 | 2.9 | 10.9 | 128 |
| 8→14 | 2.4 | 3.4 | 3 | 65 | 65,70,57,54 | 2.3 | 6.3 | 159 |
| 9→8 | 2.7 | 3.6 | 5 | 44 | 44,48,58,56,70,67 | 2.9 | 8.1 | 159 |
| 9→10 | 2.2 | 3.7 | 2 | 61 | 61,62,61 | 7.3 | 9.6 | 151 |
| 9→15 | 2.7 | 3.8 | 4 | 52 | 52,67,55,54,52 | 4.7 | 9.8 | 102 |
| 10→4 | 2.9 | 3.9 | 5 | 50 | 50,52,67,56,51,57 | 6.2 | 10.7 | 88 |
| 10→9 | 2.8 | 3.5 | 2 | 65 | 65,66,40 | 7.3 | 10 | 108 |
| 11→6 | 2.4 | 4 | 4 | 52 | 52,48,46,69,41 | 3 | 9.5 | 108 |
| 11→7 | 2.6 | 4.1 | 3 | 48 | 48,49,65,46 | 3.1 | 7 | 195 |
| 11→12 | 2.3 | 3.8 | 4 | 42 | 42,44,64,42,45 | 2.4 | 9.3 | 131 |
| 11→13 | 2.2 | 3.8 | 3 | 62 | 62,61,70,66 | 2.2 | 5.6 | 120 |
| 12→11 | 2.4 | 3.9 | 4 | 66 | 66,63,52,45,53 | 2.4 | 6.8 | 86 |
| 12→13 | 2.9 | 3.7 | 3 | 57 | 57,62,46,67 | 2.3 | 6.8 | 158 |
| 12→18 | 2 | 4.2 | 3 | 44 | 44,54,59,45 | 7 | 10.4 | 149 |
| 13→11 | 2.2 | 3.5 | 3 | 56 | 56,54,62,51 | 2.2 | 6.2 | 192 |
| 13→12 | 2.8 | 3.3 | 3 | 48 | 48,41,55,49 | 2.3 | 5.6 | 137 |
| 13→14 | 2.2 | 3.4 | 2 | 55 | 55,54,55 | 1.9 | 5.5 | 188 |
| 14→8 | 2.6 | 3.8 | 3 | 57 | 57,40,41,67 | 2.3 | 4.9 | 191 |
| 14→13 | 2.8 | 3.2 | 2 | 61 | 61,60,43 | 1.9 | 4.7 | 141 |
| 14→15 | 2 | 3.2 | 3 | 67 | 67,68,68,54 | 3.1 | 6.4 | 147 |
| 14→17 | 2.7 | 4 | 4 | 56 | 56,56,57,64,58 | 4.3 | 10.5 | 131 |
| 15→9 | 2.6 | 3.6 | 4 | 47 | 47,67,60,61,52 | 4.7 | 9.8 | 143 |
| 15→14 | 3 | 3.4 | 3 | 59 | 59,54,52,53 | 3.1 | 8.2 | 114 |
| 15→16 | 2.5 | 4.1 | 3 | 48 | 48,66,40,56 | 2.6 | 7.1 | 94 |
| 15→17 | 2.4 | 3.4 | 4 | 67 | 67,69,58,58,62 | 4.9 | 8.7 | 179 |
| 16→15 | 2.5 | 3.9 | 3 | 70 | 70,68,68,67 | 2.6 | 7.6 | 92 |
| 17→14 | 2.2 | 3.7 | 4 | 46 | 46,62,48,54,67 | 4.3 | 7.5 | 96 |
| 17→15 | 2.3 | 4.1 | 4 | 58 | 58,45,60,40,53 | 4.9 | 8.7 | 147 |
| 17→19 | 2.7 | 3.3 | 5 | 45 | 45,58,60,64,69,53 | 4.4 | 10.4 | 123 |
| 17→20 | 2.9 | 4.1 | 5 | 61 | 61,44,52,58,44,48 | 1.2 | 7 | 185 |
| 17→21 | 2.5 | 3.6 | 4 | 40 | 40,53,51,64,59 | 1.4 | 5.5 | 181 |
| 18→12 | 2.3 | 3.8 | 3 | 52 | 52,40,48,67 | 7 | 10.3 | 194 |
| 18→19 | 3 | 4 | 5 | 50 | 50,58,67,63,42,48 | 7.4 | 13.7 | 153 |
| 19→17 | 2 | 3.6 | 5 | 47 | 47,62,43,46,45,50 | 4.4 | 10.2 | 179 |
| 19→18 | 2.2 | 3.4 | 5 | 50 | 50,67,52,50,56,45 | 7.4 | 11.5 | 121 |
| 19→20 | 2.9 | 3.4 | 4 | 59 | 59,53,47,66,45 | 4.4 | 8.5 | 150 |
| 20→17 | 2.1 | 4.1 | 5 | 66 | 66,58,48,59,69,57 | 1.2 | 5.8 | 160 |
| 20→19 | 2.6 | 4 | 4 | 44 | 44,54,53,53,42 | 4.4 | 8.1 | 84 |
| 20→21 | 2.4 | 4 | 4 | 43 | 43,63,68,67,51 | 1.7 | 7.6 | 182 |
| 21→17 | 2.5 | 4 | 4 | 54 | 54,67,66,53,42 | 1.4 | 5 | 194 |
| 21→20 | 2.1 | 3.7 | 4 | 40 | 40,68,53,40,62 | 1.7 | 8.8 | 184 |

Appendix B – Blocks built in the 21-yard network

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| O-D |  | O-D |  | O-D |  |
| 1→2 | 41 | 8→12 | 302 | 14→16 | 159 |
| 1→3 | 144 | 8→14 | 150 | 14→17 | 193 |
| 1→4 | 59 | 8→15 | 103 | 14→19 | 192 |
| 1→8 | 151 | 8→17 | 80 | 14→20 | 199 |
| 1→14 | 88 | 8→21 | 173 | 15→3 | 137 |
| 2→1 | 11 | 9→8 | 247 | 15→9 | 273 |
| 2→3 | 177 | 9→10 | 136 | 15→10 | 244 |
| 2→8 | 126 | 9→14 | 66 | 15→13 | 138 |
| 2→14 | 131 | 9→15 | 115 | 15→14 | 161 |
| 3→1 | 385 | 10→3 | 84 | 15→16 | 321 |
| 3→2 | 568 | 10→4 | 119 | 15→17 | 160 |
| 3→4 | 429 | 10→8 | 143 | 15→19 | 118 |
| 3→5 | 301 | 10→9 | 68 | 15→20 | 122 |
| 3→8 | 164 | 10→15 | 216 | 16→14 | 172 |
| 3→17 | 162 | 11→5 | 121 | 16→15 | 294 |
| 4→1 | 40 | 11→6 | 68 | 17→8 | 73 |
| 4→3 | 102 | 11→7 | 187 | 17→14 | 222 |
| 4→8 | 110 | 11→8 | 87 | 17→15 | 113 |
| 4→10 | 196 | 11→12 | 224 | 17→19 | 226 |
| 4→14 | 84 | 11→13 | 137 | 17→20 | 137 |
| 5→3 | 148 | 11→14 | 46 | 17→21 | 224 |
| 5→6 | 174 | 11→17 | 110 | 18→11 | 93 |
| 5→11 | 198 | 12→3 | 193 | 18→12 | 159 |
| 5→14 | 165 | 12→11 | 87 | 18→15 | 112 |
| 6→3 | 75 | 12→13 | 54 | 18→19 | 94 |
| 6→5 | 37 | 12→14 | 169 | 19→14 | 302 |
| 6→7 | 66 | 12→15 | 118 | 19→15 | 93 |
| 6→8 | 73 | 12→18 | 399 | 19→17 | 73 |
| 6→11 | 118 | 13→3 | 130 | 19→18 | 85 |
| 6→14 | 102 | 13→11 | 119 | 19→20 | 53 |
| 6→17 | 79 | 13→12 | 248 | 20→14 | 283 |
| 7→3 | 226 | 13→14 | 176 | 20→15 | 84 |
| 7→6 | 101 | 14→3 | 398 | 20→17 | 61 |
| 7→8 | 101 | 14→5 | 217 | 20→19 | 60 |
| 7→11 | 74 | 14→6 | 171 | 20→21 | 14 |
| 7→14 | 155 | 14→7 | 158 | 21→3 | 116 |
| 8→3 | 222 | 14→8 | 200 | 21→14 | 176 |
| 8→5 | 67 | 14→11 | 234 | 21→15 | 97 |
| 8→7 | 226 | 14→13 | 320 | 21→17 | 58 |
| 8→9 | 256 | 14→15 | 194 | 21→20 | 28 |

Appendix C – Fixed train operation cost

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Section |  | Section |  | Section |  | Section |  | Section |  | Section |  |
| 1→2 | 365 | 4→12 | 441 | 8→1 | 362 | 11→12 | 411 | 15→1 | 302 | 18→11 | 409 |
| 1→3 | 365 | 4→13 | 432 | 8→2 | 424 | 11→13 | 424 | 15→2 | 367 | 18→12 | 416 |
| 1→4 | 383 | 4→14 | 449 | 8→3 | 382 | 11→14 | 445 | 15→3 | 380 | 18→13 | 317 |
| 1→5 | 366 | 4→15 | 317 | 8→4 | 309 | 11→15 | 408 | 15→4 | 355 | 18→14 | 315 |
| 1→6 | 329 | 4→16 | 387 | 8→5 | 439 | 11→16 | 401 | 15→5 | 333 | 18→15 | 347 |
| 1→7 | 379 | 4→17 | 416 | 8→6 | 342 | 11→17 | 373 | 15→6 | 412 | 18→16 | 334 |
| 1→8 | 396 | 4→18 | 401 | 8→7 | 435 | 11→18 | 405 | 15→7 | 352 | 18→17 | 308 |
| 1→9 | 379 | 4→19 | 413 | 8→9 | 406 | 11→19 | 435 | 15→8 | 370 | 18→19 | 368 |
| 1→10 | 414 | 4→20 | 378 | 8→10 | 434 | 11→20 | 323 | 15→9 | 331 | 18→20 | 442 |
| 1→11 | 304 | 4→21 | 340 | 8→11 | 338 | 11→21 | 354 | 15→10 | 381 | 18→21 | 343 |
| 1→12 | 372 | 5→1 | 432 | 8→12 | 361 | 12→1 | 382 | 15→11 | 394 | 19→1 | 345 |
| 1→13 | 331 | 5→2 | 343 | 8→13 | 432 | 12→2 | 433 | 15→12 | 408 | 19→2 | 320 |
| 1→14 | 311 | 5→3 | 340 | 8→14 | 424 | 12→3 | 305 | 15→13 | 321 | 19→3 | 303 |
| 1→15 | 323 | 5→4 | 331 | 8→15 | 320 | 12→4 | 356 | 15→14 | 377 | 19→4 | 333 |
| 1→16 | 350 | 5→6 | 353 | 8→16 | 373 | 12→5 | 428 | 15→16 | 305 | 19→5 | 423 |
| 1→17 | 377 | 5→7 | 395 | 8→17 | 317 | 12→6 | 310 | 15→17 | 424 | 19→6 | 441 |
| 1→18 | 329 | 5→8 | 348 | 8→18 | 322 | 12→7 | 323 | 15→18 | 352 | 19→7 | 400 |
| 1→19 | 316 | 5→9 | 375 | 8→19 | 390 | 12→8 | 362 | 15→19 | 370 | 19→8 | 329 |
| 1→20 | 352 | 5→10 | 434 | 8→20 | 399 | 12→9 | 443 | 15→20 | 335 | 19→9 | 392 |
| 1→21 | 322 | 5→11 | 382 | 8→21 | 355 | 12→10 | 418 | 15→21 | 328 | 19→10 | 376 |
| 2→1 | 395 | 5→12 | 445 | 9→1 | 424 | 12→11 | 340 | 16→1 | 330 | 19→11 | 409 |
| 2→3 | 409 | 5→13 | 316 | 9→2 | 362 | 12→13 | 393 | 16→2 | 410 | 19→12 | 308 |
| 2→4 | 409 | 5→14 | 352 | 9→3 | 321 | 12→14 | 316 | 16→3 | 322 | 19→13 | 348 |
| 2→5 | 400 | 5→15 | 354 | 9→4 | 446 | 12→15 | 441 | 16→4 | 368 | 19→14 | 390 |
| 2→6 | 383 | 5→16 | 322 | 9→5 | 343 | 12→16 | 423 | 16→5 | 376 | 19→15 | 348 |
| 2→7 | 317 | 5→17 | 395 | 9→6 | 376 | 12→17 | 303 | 16→6 | 321 | 19→16 | 394 |
| 2→8 | 404 | 5→18 | 351 | 9→7 | 418 | 12→18 | 371 | 16→7 | 342 | 19→17 | 390 |
| 2→9 | 433 | 5→19 | 351 | 9→8 | 347 | 12→19 | 400 | 16→8 | 437 | 19→18 | 305 |
| 2→10 | 333 | 5→20 | 327 | 9→10 | 327 | 12→20 | 306 | 16→9 | 360 | 19→20 | 396 |
| 2→11 | 321 | 5→21 | 408 | 9→11 | 392 | 12→21 | 332 | 16→10 | 413 | 19→21 | 303 |
| 2→12 | 376 | 6→1 | 449 | 9→12 | 387 | 13→1 | 337 | 16→11 | 426 | 20→1 | 391 |
| 2→13 | 401 | 6→2 | 450 | 9→13 | 322 | 13→2 | 396 | 16→12 | 368 | 20→2 | 366 |
| 2→14 | 318 | 6→3 | 324 | 9→14 | 443 | 13→3 | 313 | 16→13 | 416 | 20→3 | 348 |
| 2→15 | 387 | 6→4 | 316 | 9→15 | 429 | 13→4 | 313 | 16→14 | 348 | 20→4 | 416 |
| 2→16 | 375 | 6→5 | 421 | 9→16 | 310 | 13→5 | 375 | 16→15 | 326 | 20→5 | 376 |
| 2→17 | 332 | 6→7 | 338 | 9→17 | 315 | 13→6 | 313 | 16→17 | 449 | 20→6 | 419 |
| 2→18 | 392 | 6→8 | 393 | 9→18 | 412 | 13→7 | 389 | 16→18 | 423 | 20→7 | 393 |
| 2→19 | 379 | 6→9 | 435 | 9→19 | 403 | 13→8 | 362 | 16→19 | 350 | 20→8 | 430 |
| 2→20 | 329 | 6→10 | 389 | 9→20 | 336 | 13→9 | 394 | 16→20 | 449 | 20→9 | 367 |
| 2→21 | 330 | 6→11 | 359 | 9→21 | 373 | 13→10 | 432 | 16→21 | 346 | 20→10 | 448 |
| 3→1 | 345 | 6→12 | 305 | 10→1 | 324 | 13→11 | 421 | 17→1 | 315 | 20→11 | 418 |
| 3→2 | 349 | 6→13 | 386 | 10→2 | 339 | 13→12 | 351 | 17→2 | 408 | 20→12 | 318 |
| 3→4 | 392 | 6→14 | 436 | 10→3 | 378 | 13→14 | 371 | 17→3 | 371 | 20→13 | 447 |
| 3→5 | 330 | 6→15 | 339 | 10→4 | 440 | 13→15 | 412 | 17→4 | 348 | 20→14 | 352 |
| 3→6 | 410 | 6→16 | 336 | 10→5 | 440 | 13→16 | 363 | 17→5 | 423 | 20→15 | 369 |
| 3→7 | 366 | 6→17 | 443 | 10→6 | 420 | 13→17 | 319 | 17→6 | 324 | 20→16 | 392 |
| 3→8 | 373 | 6→18 | 313 | 10→7 | 375 | 13→18 | 427 | 17→7 | 388 | 20→17 | 345 |
| 3→9 | 423 | 6→19 | 384 | 10→8 | 365 | 13→19 | 341 | 17→8 | 332 | 20→18 | 326 |
| 3→10 | 341 | 6→20 | 330 | 10→9 | 358 | 13→20 | 405 | 17→9 | 401 | 20→19 | 320 |
| 3→11 | 441 | 6→21 | 445 | 10→11 | 341 | 13→21 | 401 | 17→10 | 390 | 20→21 | 363 |
| 3→12 | 321 | 7→1 | 370 | 10→12 | 374 | 14→1 | 378 | 17→11 | 417 | 21→1 | 407 |
| 3→13 | 383 | 7→2 | 435 | 10→13 | 408 | 14→2 | 361 | 17→12 | 368 | 21→2 | 393 |
| 3→14 | 413 | 7→3 | 383 | 10→14 | 408 | 14→3 | 404 | 17→13 | 367 | 21→3 | 395 |
| 3→15 | 323 | 7→4 | 322 | 10→15 | 433 | 14→4 | 336 | 17→14 | 447 | 21→4 | 351 |
| 3→16 | 357 | 7→5 | 419 | 10→16 | 392 | 14→5 | 304 | 17→15 | 377 | 21→5 | 407 |
| 3→17 | 322 | 7→6 | 432 | 10→17 | 304 | 14→6 | 404 | 17→16 | 354 | 21→6 | 369 |
| 3→18 | 320 | 7→8 | 445 | 10→18 | 431 | 14→7 | 302 | 17→18 | 339 | 21→7 | 374 |
| 3→19 | 356 | 7→9 | 325 | 10→19 | 374 | 14→8 | 443 | 17→19 | 301 | 21→8 | 360 |
| 3→20 | 346 | 7→10 | 443 | 10→20 | 418 | 14→9 | 351 | 17→20 | 330 | 21→9 | 440 |
| 3→21 | 336 | 7→11 | 355 | 10→21 | 351 | 14→10 | 322 | 17→21 | 363 | 21→10 | 356 |
| 4→1 | 448 | 7→12 | 406 | 11→1 | 403 | 14→11 | 359 | 18→1 | 394 | 21→11 | 436 |
| 4→2 | 310 | 7→13 | 409 | 11→2 | 410 | 14→12 | 385 | 18→2 | 402 | 21→12 | 395 |
| 4→3 | 432 | 7→14 | 423 | 11→3 | 322 | 14→13 | 444 | 18→3 | 313 | 21→13 | 354 |
| 4→5 | 385 | 7→15 | 321 | 11→4 | 421 | 14→15 | 307 | 18→4 | 364 | 21→14 | 367 |
| 4→6 | 361 | 7→16 | 332 | 11→5 | 397 | 14→16 | 382 | 18→5 | 390 | 21→15 | 380 |
| 4→7 | 326 | 7→17 | 330 | 11→6 | 368 | 14→17 | 448 | 18→6 | 447 | 21→16 | 393 |
| 4→8 | 354 | 7→18 | 330 | 11→7 | 377 | 14→18 | 307 | 18→7 | 366 | 21→17 | 360 |
| 4→9 | 410 | 7→19 | 369 | 11→8 | 343 | 14→19 | 315 | 18→8 | 379 | 21→18 | 355 |
| 4→10 | 415 | 7→20 | 442 | 11→9 | 320 | 14→20 | 330 | 18→9 | 310 | 21→19 | 360 |
| 4→11 | 333 | 7→21 | 375 | 11→10 | 343 | 14→21 | 414 | 18→10 | 431 | 21→20 | 443 |

Appendix D – Technical parameters of each yard

| Yard |  | (hour) | (hour) | (hour) |
| --- | --- | --- | --- | --- |
| 1 | 10.8 | 3.9 | 0.6 | 3.9 |
| 2 | 11.3 | 3.5 | 0.7 | 4.2 |
| 3 | 11.2 | 3.7 | 0.8 | 4.1 |
| 4 | 11.8 | 3.8 | 0.6 | 3.8 |
| 5 | 11.1 | 4.1 | 0.8 | 4.2 |
| 6 | 11.5 | 4.3 | 1.1 | 3.7 |
| 7 | 11.2 | 4.5 | 0.6 | 4.0 |
| 8 | 11.7 | 3.7 | 1.2 | 3.4 |
| 9 | 11.3 | 3.8 | 1.4 | 3.5 |
| 10 | 10.8 | 3.9 | 1.3 | 4.3 |
| 11 | 10.9 | 3.5 | 0.6 | 4.3 |
| 12 | 11.4 | 3.7 | 1.5 | 3.8 |
| 13 | 11.5 | 4.1 | 1.4 | 4.6 |
| 14 | 10.7 | 4.3 | 0.7 | 3.7 |
| 15 | 10.5 | 4.5 | 0.9 | 3.9 |
| 16 | 11.4 | 3.9 | 0.6 | 3.8 |
| 17 | 11.4 | 3.5 | 1.4 | 4.0 |
| 18 | 10.8 | 3.7 | 1.5 | 4.0 |
| 19 | 11.9 | 4.1 | 1.4 | 3.9 |
| 20 | 10.9 | 4.2 | 1.3 | 4.1 |
| 21 | 10.7 | 4.1 | 0.6 | 3.9 |

Appendix E – Dispatched two-block train services

|  |  |  |  |
| --- | --- | --- | --- |
|  | Type | Number of cars | Frequency |
| (1,5,3) | Linking FRTT | 144 | 2.6182 |
| (1,9,8) | Linking VRTT | 151 | 2.7455 |
| (2,14,8) | Union VRTT | 257 | 4.6727 |
| (2,17,3) | Linking FRTT | 162 | 2.9455 |
| (3,15,8) | Linking FRTT | 103 | 1.8727 |
| (4,7,8) | Linking VRTT | 110 | 2 |
| (4,9,10) | Linking FRTT | 68 | 1.2364 |
| (5,8,6) | Linking FRTT | 73 | 1.3273 |
| (5,12,11) | Linking VRTT | 198 | 3.6 |
| (5,20,14) | Linking VRTT | 165 | 3 |
| (6,3,5) | Union VRTT | 112 | 2.0364 |
| (6,13,11) | Linking VRTT | 118 | 2.1455 |
| (6,15,14) | Linking VRTT | 102 | 1.8545 |
| (6,19,17) | Linking VRTT | 79 | 1.4364 |
| (7,1,3) | Linking VRTT | 226 | 4.1091 |
| (7,16,14) | Linking VRTT | 155 | 2.8182 |
| (9,12,8) | Linking VRTT | 247 | 4.4909 |
| (9,20,15) | Linking VRTT | 115 | 2.0909 |
| (10,3,4) | Union FRTT | 186 | 3.3818 |
| (10,19,15) | Linking FRTT | 118 | 2.1455 |
| (10,21,8) | Linking VRTT | 143 | 2.6 |
| (11,8,7) | Union FRTT | 188 | 3.4182 |
| (11,20,17) | Linking VRTT | 110 | 2 |
| (12,6,11) | Linking FRTT | 68 | 1.2364 |
| (12,16,15) | Linking VRTT | 118 | 2.1455 |
| (12,17,14) | Linking VRTT | 169 | 3.0727 |
| (13,18,12) | Linking VRTT | 248 | 4.5091 |
| (13,19,14) | Linking VRTT | 176 | 3.2 |
| (14,4,3) | Linking VRTT | 398 | 7.2364 |
| (15,7,14) | Linking FRTT | 158 | 2.8727 |
| (15,11,13) | Linking FRTT | 119 | 2.1636 |
| (15,21,17) | Linking VRTT | 160 | 2.9091 |
| (16,3,15) | Linking FRTT | 137 | 2.4909 |
| (16,6,14) | Linking FRTT | 171 | 3.1091 |
| (17,8,14) | Union FRTT | 273 | 4.9636 |
| (18,3,12) | Linking VRTT | 159 | 2.8909 |
| (18,5,11) | Linking VRTT | 93 | 1.6909 |
| (18,9,15) | Linking VRTT | 112 | 2.0364 |
| (18,17,19) | Linking FRTT | 73 | 1.3273 |
| (19,13,14) | Linking VRTT | 302 | 5.4909 |
| (20,11,14) | Linking FRTT | 234 | 4.2545 |
| (20,15,17) | Union VRTT | 145 | 2.6364 |
| (20,18,19) | Linking VRTT | 60 | 1.0909 |
| (21,2,3) | Linking VRTT | 116 | 2.1091 |
| (21,5,14) | Linking VRTT | 176 | 3.2 |
| (21,10,15) | Linking VRTT | 97 | 1.7636 |

Appendix F – Travel plan of shipments between two adjacent yards

|  |  |  |  |
| --- | --- | --- | --- |
| Section | Number of cars | Frequency of shuttle train service | Frequency of local train service |
| 1→2 | 41 | 0 | 2.75 |
| 1→4 | 59 | 0 | 3.08 |
| 2→1 | 11 | 0 | 1.98 |
| 2→3 | 15 | 0.27 | 1.7 |
| 3→2 | 452 | 8.22 | 1.73 |
| 3→4 | 31 | 0.56 | 1.45 |
| 3→5 | 157 | 2.85 | 1.73 |
| 3→8 | 61 | 1.11 | 1.1 |
| 4→1 | 40 | 0 | 2.45 |
| 4→3 | 0 | 0 | 1.6 |
| 4→10 | 128 | 2.33 | 1.7 |
| 5→3 | 111 | 2.02 | 1.7 |
| 5→6 | 101 | 1.84 | 1.6 |
| 6→5 | 0 | 0 | 1.73 |
| 6→7 | 66 | 0 | 3.35 |
| 6→11 | 0 | 0 | 1.48 |
| 7→6 | 101 | 1.84 | 1.7 |
| 7→8 | 0 | 0 | 1.5 |
| 7→11 | 74 | 1.35 | 1.3 |
| 8→3 | 222 | 4.04 | 1.53 |
| 8→7 | 116 | 2.11 | 1.75 |
| 8→9 | 105 | 1.91 | 1.7 |
| 8→14 | 24 | 0 | 2.35 |
| 9→8 | 0 | 0 | 1.75 |
| 9→10 | 136 | 2.47 | 1.55 |
| 9→15 | 0 | 0 | 1.68 |
| 10→4 | 17 | 0 | 2.1 |
| 10→9 | 0 | 0 | 1.65 |
| 11→6 | 0 | 0 | 1.73 |
| 11→7 | 86 | 1.56 | 1.63 |
| 11→12 | 26 | 0.47 | 1.6 |
| 11→13 | 19 | 0.35 | 1.75 |
| 12→11 | 19 | 0.35 | 1.65 |
| 12→13 | 54 | 0 | 3.03 |
| 12→18 | 151 | 2.75 | 1.48 |
| 13→11 | 0 | 0 | 1.55 |
| 13→12 | 0 | 0 | 1.38 |
| 13→14 | 0 | 0 | 1.38 |
| 14→8 | 0 | 0 | 1.68 |
| 14→13 | 18 | 0.33 | 1.53 |
| 14→15 | 92 | 1.67 | 1.7 |
| 14→17 | 24 | 0.44 | 1.6 |
| 15→9 | 161 | 2.93 | 1.68 |
| 15→14 | 3 | 0 | 1.53 |
| 15→16 | 203 | 3.69 | 1.65 |
| 15→17 | 0 | 0 | 1.73 |
| 16→15 | 157 | 2.85 | 1.75 |
| 17→14 | 22 | 0.4 | 1.68 |
| 17→15 | 52 | 0 | 2.8 |
| 17→19 | 147 | 2.67 | 1.73 |
| 17→20 | 27 | 0.49 | 1.53 |
| 17→21 | 64 | 1.16 | 1.6 |
| 18→12 | 0 | 0 | 1.68 |
| 18→19 | 21 | 0.38 | 1.68 |
| 19→17 | 0 | 0 | 1.55 |
| 19→18 | 25 | 0.45 | 1.68 |
| 19→20 | 53 | 0 | 2.98 |
| 20→17 | 0 | 0 | 1.73 |
| 20→19 | 0 | 0 | 1.35 |
| 20→21 | 14 | 0 | 2.05 |
| 21→17 | 58 | 0 | 3.13 |
| 21→20 | 28 | 0 | 2.4 |