





Table 4.1.1.16(1) Results in Cruising(Departure) by Ship Type in Year 2000

| Port                           | Number of Voyages | Liquid Bulk           |                   |                   |                       |                   |                   |                       |                   |                   | Solid Bulk            |                   |                   |                       |                   |                   |                       |                   |                   |       |
|--------------------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-------|
|                                |                   | Main Diesel           |                   |                   | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   | Main Diesel           |                   |                   | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   |       |
|                                |                   | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) |       |
| Bangkok                        | 394               | 197,465               | 12,472            | 6,714             | 38,746                | 697               | 1,317             | 103,183               | 7,223             | 3,506             | 551                   | 299,915           | 18,861            | 10,197                | 67,726            | 1,219             | 2,303                 | 53,386            | 3,737             | 1,815 |
| Klong Toey Wharf               |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 16                    | 8,686             | 546               | 295                   | 1,962             | 35                | 67                    | 1,546             | 106               | 53    |
| Klong Toey Pole                |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 20                    | 10,858            | 683               | 369                   | 2,452             | 44                | 83                    | 1,933             | 135               | 66    |
| Bang Hae Suer Pole             |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 14                    | 4,188             | 262               | 142                   | 980               | 18                | 33                    | 773               | 54                | 26    |
| Sathupradit Buay               |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 141                   | 99,795            | 6,285             | 3,393                 | 72,304            | 401               | 758                   | 17,581            | 1,231             | 598   |
| Tran Wharf                     |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 4                     | 2,452             | 154               | 83                    | 551               | 10                | 19                    | 434               | 30                | 15    |
| Private Wharves                | 366               | 193,012               | 12,190            | 6,562             | 37,676                | 682               | 1,288             | 100,867               | 7,061             | 3,429             | 350                   | 170,679           | 10,726            | 5,803                 | 38,741            | 697               | 1,317                 | 30,538            | 2,138             | 1,038 |
| Others                         | 8                 | 4,453                 | 281               | 151               | 870                   | 16                | 30                | 2,316                 | 162               | 79                | 6                     | 3,257             | 205               | 111                   | 736               | 13                | 25                    | 580               | 41                | 20    |
| Provincial Area                | 3,213             | 378,737               | 23,362            | 12,877            | 86,229                | 1,552             | 2,932             | 229,634               | 16,074            | 7,808             | 1,266                 | 145,538           | 8,932             | 4,948                 | 38,327            | 690               | 1,303                 | 30,212            | 2,115             | 1,027 |
| Chachoengsao                   | 176               | 20,746                | 1,280             | 705               | 4,723                 | 85                | 161               | 12,579                | 881               | 428               |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Chanthaburi                    |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Chon Buri                      |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Ko Sichang                     | 17                | 2,004                 | 124               | 68                | 456                   | 8                 | 16                | 1,215                 | 85                | 41                | 309                   | 35,522            | 2,180             | 1,208                 | 9,355             | 168               | 318                   | 7,374             | 516               | 251   |
| Leem Chabang                   | 47                | 5,540                 | 342               | 188               | 1,261                 | 23                | 43                | 3,359                 | 235               | 114               | 59                    | 6,783             | 416               | 231                   | 1,786             | 32                | 61                    | 1,408             | 99                | 48    |
| Sattahip                       | 1                 | 118                   | 7                 | 4                 | 27                    | 0                 | 1                 | 71                    | 5                 | 2                 | 3                     | 345               | 21                | 12                    | 91                | 2                 | 3                     | 72                | 5                 | 2     |
| Sri Racha                      | 625               | 73,673                | 4,544             | 2,505             | 16,773                | 302               | 570               | 44,669                | 3,127             | 1,519             | 149                   | 17,129            | 1,051             | 582                   | 4,511             | 81                | 153                   | 3,556             | 249               | 121   |
| Others                         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Chumpom                        |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Krabi                          | 3                 | 354                   | 22                | 12                | 81                    | 1                 | 3                 | 214                   | 15                | 7                 | 64                    | 7,357             | 452               | 250                   | 1,938             | 35                | 66                    | 1,527             | 107               | 52    |
| Nakhon Si Thammarat            |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Khanom                         | 41                | 4,833                 | 298               | 164               | 1,100                 | 20                | 37                | 2,930                 | 205               | 100               | 10                    | 1,150             | 71                | 39                    | 303               | 5                 | 10                    | 239               | 17                | 8     |
| Pakparang                      |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| The Sala                       |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Others                         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 18                    | 2,069             | 127               | 70                    | 545               | 10                | 19                    | 430               | 30                | 15    |
| Phatchaburi                    |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Cha-ani                        |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Others                         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Phuket                         | 138               | 16,267                | 1,003             | 553               | 3,704                 | 67                | 126               | 9,863                 | 690               | 335               | 16                    | 1,839             | 113               | 63                    | 484               | 9                 | 16                    | 362               | 27                | 13    |
| Prachuap Khiri Khan            |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Bang Saphan                    |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 22                    | 2,529             | 155               | 86                    | 666               | 12                | 23                    | 525               | 37                | 18    |
| Thap Sakae                     |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Others                         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 13                    | 1,494             | 92                | 51                    | 394               | 7                 | 13                    | 310               | 22                | 11    |
| Rayong                         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Maptaphut                      | 1,390             | 163,848               | 10,107            | 5,571             | 37,304                | 671               | 1,268             | 99,344                | 6,954             | 3,378             | 142                   | 16,324            | 1,002             | 555                   | 4,299             | 77                | 146                   | 3,389             | 237               | 115   |
| Others                         | 429               | 50,569                | 3,119             | 1,719             | 11,513                | 207               | 391               | 30,661                | 2,146             | 1,042             | 45                    | 5,173             | 318               | 176                   | 1,362             | 25                | 46                    | 1,074             | 75                | 37    |
| Samut Sakhon                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Mahachulalongkornrajavidyalaya | 1                 | 118                   | 7                 | 4                 | 27                    | 0                 | 1                 | 71                    | 5                 | 2                 | 35                    | 4,024             | 247               | 137                   | 1,060             | 19                | 36                    | 835               | 58                | 28    |
| Thachin                        |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Others                         | 7                 | 825                   | 51                | 28                | 188                   | 3                 | 6                 | 500                   | 35                | 17                | 5                     | 575               | 35                | 20                    | 151               | 3                 | 5                     | 119               | 8                 | 4     |
| Samut Songkhram                |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Maeklong                       |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Salut                          |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Songkhla                       | 337               | 39,724                | 2,450             | 1,351             | 9,044                 | 163               | 308               | 24,086                | 1,686             | 819               | 232                   | 26,670            | 1,637             | 907                   | 7,024             | 126               | 239                   | 5,536             | 388               | 188   |
| Surat Thani                    |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Trang                          |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Katang                         | 1                 | 118                   | 7                 | 4                 | 27                    | 0                 | 1                 | 71                    | 5                 | 2                 | 144                   | 16,554            | 1,016             | 563                   | 4,359             | 78                | 148                   | 3,436             | 241               | 117   |
| Total                          | 3,607             | 576,202               | 35,833            | 19,591            | 124,975               | 2,249             | 4,249             | 332,817               | 23,297            | 11,316            | 1,817                 | 445,453           | 27,794            | 15,145                | 106,053           | 1,909             | 3,606                 | 83,597            | 5,852             | 2,842 |



Table 4.1.1.16(2) Results in Cruising (Departure) by Ship Type in Year 2000

| Port                           | Number of Voyager | Fully Cellular Container |                   |                   |                       |                   |                   |                       |                   |                   | Number of Voyager | Semi-Container        |                   |                   |                       |                   |                   |                       |                   |                   |
|--------------------------------|-------------------|--------------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|
|                                |                   | Main Diesel              |                   |                   | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   |                   | Main Diesel           |                   |                   | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   |
|                                |                   | Fuel Consumption (kg)    | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) |                   | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) |
| Bangkok                        | 1,769             | 2,333,723                | 176,358           | 79,347            | 455,980               | 8,207             | 15,503            | 211,741               | 14,822            | 7,199             | 173               | 81,415                | 5,014             | 2,768             | 19,127                | 344               | 650               | 14,393                | 1,008             | 489               |
| Klong Toey Wharf               | 1,222             | 1,663,983                | 125,772           | 56,575            | 324,656               | 5,843             | 11,038            | 150,758               | 10,553            | 5,126             | 113               | 55,335                | 3,409             | 1,881             | 12,977                | 234               | 441               | 9,765                 | 684               | 332               |
| Klong Toey Pole                |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Bang Hua Saer Pole             |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Sathupradit Buoy               |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   | 3                 | 809                   | 50                | 28                | 197                   | 4                 | 7                 | 148                   | 10                | 5                 |
| Tma Wharf                      |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Private Wharves                | 542               | 662,931                  | 50,071            | 22,540            | 129,996               | 2,340             | 4,420             | 60,366                | 4,226             | 2,052             | 53                | 23,312                | 1,435             | 793               | 5,495                 | 99                | 187               | 4,135                 | 289               | 141               |
| Others                         | 5                 | 6,808                    | 515               | 231               | 1,328                 | 24                | 45                | 617                   | 43                | 21                | 4                 | 1,959                 | 121               | 67                | 459                   | 8                 | 16                | 346                   | 24                | 12                |
| Provincial Area                | 1,003             | 289,202                  | 21,334            | 9,833             | 65,796                | 1,184             | 2,237             | 30,553                | 2,139             | 1,039             | 185               | 19,183                | 1,153             | 652               | 5,246                 | 94                | 178               | 3,947                 | 276               | 134               |
| Chachoengsao                   | 4                 | 1,153                    | 85                | 39                | 262                   | 5                 | 9                 | 122                   | 9                 | 4                 | 1                 | 104                   | 6                 | 4                 | 28                    | 1                 | 1                 | 21                    | 1                 | 1                 |
| Chanthaburi                    |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Chon Buri                      |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Ko Sichang                     | 6                 | 1,730                    | 128               | 59                | 394                   | 7                 | 13                | 183                   | 13                | 6                 | 14                | 1,452                 | 87                | 49                | 397                   | 7                 | 13                | 299                   | 21                | 10                |
| Laem Chabang                   | 620               | 178,769                  | 13,187            | 6,078             | 40,671                | 732               | 1,383             | 18,886                | 1,322             | 642               | 85                | 8,814                 | 530               | 300               | 2,410                 | 43                | 82                | 1,814                 | 127               | 62                |
| Sattahip                       | 1                 | 288                      | 21                | 10                | 66                    | 1                 | 2                 | 30                    | 2                 | 1                 |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Sri Racha                      | 7                 | 2,018                    | 149               | 69                | 459                   | 8                 | 16                | 213                   | 15                | 7                 | 28                | 2,903                 | 175               | 99                | 794                   | 14                | 27                | 597                   | 42                | 20                |
| Others                         |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Chumporn                       |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Krabi                          |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Nakhon Si Thammarat            |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Khanom                         |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Pakpanang                      |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Tha Sala                       |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   | 1                 | 104                   | 6                 | 4                 | 28                    | 1                 | 1                 | 21                    | 1                 | 1                 |
| Phetchaburi                    |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Che-am                         |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Others                         |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Phuket                         | 12                | 3,460                    | 255               | 118               | 787                   | 14                | 27                | 366                   | 26                | 12                |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Prachuap Khiri Khan            |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Bang Saphan                    |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Thap Sakae                     |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Others                         |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Rayong                         |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Maptaphut                      | 2                 | 577                      | 43                | 20                | 131                   | 2                 | 4                 | 61                    | 4                 | 2                 | 2                 | 207                   | 12                | 7                 | 57                    | 1                 | 2                 | 43                    | 3                 | 1                 |
| Others                         | 19                | 5,478                    | 404               | 186               | 1,246                 | 22                | 42                | 579                   | 41                | 20                | 17                | 1,763                 | 106               | 60                | 482                   | 9                 | 16                | 363                   | 25                | 12                |
| Samut Sakhon                   |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Mahachulalongkornrajavidyalaya |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Thachalorn                     |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Thachin                        |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Others                         |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Samut Songkhram                |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Maeklong                       |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Satun                          |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Songkhla                       | 332               | 95,728                   | 7,062             | 3,255             | 21,779                | 392               | 740               | 10,113                | 708               | 344               | 37                | 3,837                 | 231               | 130               | 1,049                 | 19                | 36                | 789                   | 55                | 27                |
| Surat Thani                    |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Trang                          |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Katang                         |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Total                          | 2,772             | 2,622,925                | 197,691           | 89,179            | 521,776               | 9,391             | 17,740            | 242,294               | 16,961            | 8,238             | 358               | 100,598               | 6,167             | 3,420             | 24,373                | 439               | 829               | 18,341                | 1,284             | 624               |



Table 4.1.1.16(3) Results in Cruising (Departure) by Ship Type in Year 2000

| Port                           | Number of Voyager | Ro-Ro                 |                   |                   |                       |                   |                   |                       |                   |                   | Conventional          |                   |                   |                       |                   |                   |                       |                   |                   |       |
|--------------------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-------|
|                                |                   | Main Diesel           |                   |                   | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   | Main Diesel           |                   |                   | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   |       |
|                                |                   | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) |       |
| Bangkok                        | 57                | 58,893                | 4,231             | 2,002             | 10,436                | 188               | 355               | 11,108                | 778               | 378               | 1,147                 | 668,248           | 42,913            | 22,720                | 145,433           | 2,618             | 4,945                 | 120,230           | 8,416             | 4,088 |
| Klong Toey Wharf               | 44                | 46,541                | 3,345             | 1,582             | 8,239                 | 148               | 280               | 8,769                 | 614               | 298               | 363                   | 219,057           | 14,070            | 7,448                 | 47,598            | 857               | 1,618                 | 39,349            | 2,754             | 1,338 |
| Klong Toey Pole                |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 114                   | 68,795            | 4,419             | 2,339                 | 14,948            | 269               | 508                   | 12,358            | 865               | 420   |
| Bang Hua Suet Pier             |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 47                    | 15,627            | 998               | 531                   | 3,519             | 63                | 120                   | 2,909             | 204               | 99    |
| Sathupradit Bury               |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 103                   | 81,032            | 5,213             | 2,755                 | 17,424            | 314               | 592                   | 14,405            | 1,008             | 490   |
| Tran Wharf                     |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 9                     | 6,133             | 394               | 209                   | 1,326             | 24                | 45                    | 1,096             | 77                | 37    |
| Private Wharves                | 13                | 12,352                | 887               | 420               | 2,198                 | 40                | 75                | 2,339                 | 164               | 80                | 501                   | 271,569           | 17,431            | 9,233                 | 59,307            | 1,067             | 2,016                 | 49,029            | 3,432             | 1,667 |
| Others                         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 10                    | 6,035             | 388               | 205                   | 1,311             | 24                | 45                    | 1,084             | 76                | 37    |
| Provincial Area                | 194               | 43,452                | 3,047             | 1,477             | 8,969                 | 161               | 305               | 9,546                 | 668               | 325               | 2,206                 | 281,890           | 17,671            | 9,584                 | 71,422            | 1,286             | 2,428                 | 59,045            | 4,133             | 2,008 |
| Chachoengsao                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 86                    | 10,989            | 689               | 374                   | 2,784             | 50                | 95                    | 2,302             | 161               | 78    |
| Chanthaburi                    |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Chon Buri                      |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Ko Sichang                     | 4                 | 896                   | 63                | 30                | 185                   | 3                 | 6                 | 197                   | 14                | 7                 | 717                   | 91,621            | 5,743             | 3,115                 | 23,214            | 418               | 789                   | 19,191            | 1,343             | 652   |
| Laem Chabang                   | 145               | 32,477                | 2,278             | 1,104             | 6,704                 | 121               | 228               | 7,135                 | 499               | 243               | 394                   | 50,347            | 3,156             | 1,712                 | 12,756            | 230               | 434                   | 10,546            | 738               | 359   |
| Sattahip                       | 1                 | 224                   | 16                | 8                 | 46                    | 1                 | 2                 | 49                    | 3                 | 2                 | 14                    | 1,789             | 112               | 61                    | 453               | 8                 | 15                    | 375               | 26                | 13    |
| Sri Racha                      | 6                 | 1,344                 | 94                | 46                | 277                   | 5                 | 9                 | 295                   | 21                | 10                | 159                   | 20,318            | 1,274             | 691                   | 5,148             | 93                | 175                   | 4,256             | 298               | 145   |
| Others                         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 2                     | 256               | 16                | 9                     | 65                | 1                 | 2                     | 54                | 4                 | 2     |
| Chumphon                       |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 1                     | 128               | 8                 | 4                     | 32                | 1                 | 1                     | 27                | 2                 | 1     |
| Krabi                          | 6                 | 1,344                 | 94                | 46                | 277                   | 5                 | 9                 | 295                   | 21                | 10                | 103                   | 13,162            | 825               | 447                   | 3,335             | 60                | 113                   | 2,757             | 193               | 94    |
| Nakhon Si Thammarat            |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Khanom                         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 39                    | 4,984             | 312               | 169                   | 1,263             | 23                | 43                    | 1,044             | 73                | 35    |
| Pakpanang                      |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 2                     | 256               | 16                | 9                     | 65                | 1                 | 2                     | 54                | 4                 | 2     |
| Tha Sala                       |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 14                    | 1,789             | 112               | 61                    | 453               | 8                 | 15                    | 375               | 26                | 13    |
| Petchaburi                     |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Cha-am                         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Others                         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Phuket                         | 20                | 4,480                 | 314               | 152               | 925                   | 17                | 31                | 984                   | 69                | 33                | 49                    | 6,261             | 393               | 213                   | 1,586             | 29                | 54                    | 1,312             | 92                | 45    |
| Prachuap Khiri Khan            |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Bang Saphan                    |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 65                    | 8,306             | 521               | 282                   | 2,104             | 38                | 72                    | 1,740             | 122               | 59    |
| Thap Sakao                     |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Others                         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 63                    | 8,050             | 505               | 274                   | 2,040             | 37                | 69                    | 1,686             | 118               | 57    |
| Rayong                         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Maeplaphu                      | 2                 | 448                   | 31                | 15                | 92                    | 2                 | 3                 | 98                    | 7                 | 3                 | 314                   | 40,124            | 2,515             | 1,364                 | 10,166            | 183               | 346                   | 8,404             | 588               | 286   |
| Others                         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 32                    | 4,089             | 256               | 139                   | 1,036             | 19                | 35                    | 856               | 60                | 29    |
| Samut Sakhon                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Mahachulalongkornrajavidyalaya |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 5                     | 639               | 40                | 22                    | 162               | 3                 | 6                     | 134               | 9                 | 5     |
| Thechalong                     |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 1                     | 128               | 8                 | 4                     | 32                | 1                 | 1                     | 27                | 2                 | 1     |
| Thachin                        |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Others                         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 7                     | 894               | 56                | 30                    | 227               | 4                 | 8                     | 187               | 13                | 6     |
| Samut Songkhram                |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Maeklong                       |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Satun                          |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 10                    | 1,278             | 80                | 43                    | 324               | 6                 | 11                    | 268               | 19                | 9     |
| Songkhla                       | 10                | 2,240                 | 157               | 76                | 462                   | 8                 | 16                | 492                   | 34                | 17                | 102                   | 13,034            | 817               | 443                   | 3,302             | 59                | 112                   | 2,730             | 191               | 93    |
| Surat Thani                    |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 1                     | 128               | 8                 | 4                     | 32                | 1                 | 1                     | 27                | 2                 | 1     |
| Trang                          |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |       |
| Katang                         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 26                    | 3,322             | 208               | 113                   | 842               | 15                | 29                    | 696               | 49                | 24    |
| Total                          | 251               | 102,345               | 7,279             | 3,480             | 19,406                | 349               | 660               | 20,654                | 1,446             | 702               | 3,353                 | 990,138           | 60,584            | 32,305                | 216,856           | 3,903             | 7,373                 | 179,274           | 12,549            | 6,095 |



Table 4.1.1.17 Number of boat and SOx, NOx emission of Fishing Boats in Year 2000

| Province            | Number of Boat | Working hours (/year) | Rated Power (PS) | Fuel Consumption (ktons) | SOx (ton/y) | NOx (ton/y) |
|---------------------|----------------|-----------------------|------------------|--------------------------|-------------|-------------|
| Krabi               | 92             | 785                   | 41               | 0.2                      | 0.1         | 4           |
| Chanthaburi         | 521            | 785                   | 101              | 2.3                      | 1.6         | 66          |
| Chachoengsao        | 84             | 785                   | 85               | 0.3                      | 0.2         | 9           |
| Chon Buri           | 751            | 785                   | 61               | 2.1                      | 1.4         | 53          |
| Chumporn            | 925            | 785                   | 97               | 4.0                      | 2.8         | 111         |
| Trang               | 321            | 785                   | 142              | 2.0                      | 1.4         | 60          |
| Trat                | 1,342          | 785                   | 83               | 5.0                      | 3.5         | 135         |
| Nakhon Si Thammarat | 873            | 785                   | 84               | 3.3                      | 2.3         | 89          |
| Narathiwat          | 48             | 785                   | 61               | 0.1                      | 0.1         | 3           |
| Prachuap Khiri Khan | 682            | 785                   | 66               | 2.0                      | 1.4         | 53          |
| Pattani             | 577            | 785                   | 96               | 2.5                      | 1.7         | 69          |
| Bangkok             | 0              | 785                   | 0                | 0.0                      | 0.0         | 0           |
| Phangnga            | 141            | 785                   | 126              | 0.8                      | 0.5         | 23          |
| Phetchaburi         | 589            | 785                   | 99               | 2.6                      | 1.8         | 72          |
| Phuket              | 244            | 785                   | 47               | 0.5                      | 0.4         | 13          |
| Ranong              | 225            | 785                   | 87               | 0.9                      | 0.6         | 24          |
| Rayong              | 986            | 785                   | 66               | 2.9                      | 2.0         | 76          |
| Songkhla            | 1,375          | 785                   | 74               | 4.6                      | 3.2         | 121         |
| Satun               | 717            | 785                   | 37               | 1.3                      | 0.9         | 29          |
| Samut Prakan        | 830            | 785                   | 215              | 7.6                      | 5.3         | 249         |
| Samut Songkhram     | 662            | 785                   | 147              | 4.2                      | 2.9         | 128         |
| Samut Sakhon        | 897            | 785                   | 165              | 6.4                      | 4.4         | 198         |
| Surat Thani         | 381            | 785                   | 142              | 2.4                      | 1.6         | 71          |
| Total               | 13,263         |                       |                  | 58                       | 40          | 1,657       |

Note: work hours 5 hours/day based on interview with Officer of Fishery Department, Working day:157days/year based on " The 2000 Intercensal Survey of Marine Fishery".

Table 4.1.1.18 Number of trips and SOx, NOx emission of Express Boat in Chao Phraya River in Year 2000

| Kind of Boat        | destination                                 | Length (km) | Time (hr) | Trips (/day) | Trips (day/week) | Trips (/year) | GRT | Rated Power(PS) | Fuel Consumption (ktons) | NOx Emission (ton) | SOx Emission (ton) |
|---------------------|---|-------------|-----------|--------------|------------------|---------------|-----|-----------------|--------------------------|--------------------|--------------------|
| Rapid Express Boat  | Nonthaburi-BigC (A)                         | 23.3        | 1.00      | 13           | 5                | 3,389         | 30  | 263             | 0.05                     | 2                  | 2                  |
| Normal Express Boat | Nonthaburi-Wat Rajsingkorn(Orange Flag) (B) | 20.1        | 1.00      | 108          | 5                | 28,157        | 30  | 263             | 0.40                     | 13                 | 14                 |
|                     | Nonthaburi-Satorn(Yellow Flag) (C)          | 17.8        | 0.75      | 76           | 5                | 19,814        | 30  | 263             | 0.21                     | 7                  | 7                  |
|                     | Nonthaburi-Wat Rajsingkorn(No Flag) (D)     | 20.1        | 1.00      | 78           | 7                | 28,470        | 30  | 263             | 0.40                     | 14                 | 14                 |
| Total               |   |             |           | 275          |                  |               |     |                 | 1.06                     | 35.83              | 36.02              |

Source: Harbor Department

Note: Time and GRT of boat is based on interview with express boat company.

**Table 4.1.1.19 Number of trips and SO<sub>x</sub>, NO<sub>x</sub> emission of Ferry Boat in Chao Phraya River in Year 2000**

| No. | Pier   | Time(hr) | Trips (/day) | Trips (/week) | Trips (/year) | GRT | Rated Power (PS) | Fuel Consumption (ktons) | NO <sub>x</sub> Emission (ton) | SO <sub>x</sub> Emission (ton) |
|-----|--|----------|--------------|---------------|---------------|-----|------------------|--------------------------|--------------------------------|--------------------------------|
| 1   | Pak Kret - Wat Bang Tay                      | 0.08     | 182          | 908           | 66,284        | 40  | 313              | 0.1                      | 3.2                            | 3.1                            |
| 2   | Pak Kret - Watchareewong                     | 0.08     | 213          | 1,063         | 77,599        | 40  | 313              | 0.1                      | 3.8                            | 3.7                            |
| 3   | Nonthaburi - Bang Sri Muang                  | 0.08     | 303          | 1,515         | 110,595       | 40  | 313              | 0.2                      | 5.4                            | 5.2                            |
| 4   | Wat Khama - Dan Pong Suwan                   | 0.08     | 93           | 467           | 34,091        | 40  | 313              | 0.0                      | 1.7                            | 1.6                            |
| 5   | Wat Khama - Wat Kang Khoa                    | 0.08     | 112          | 561           | 40,953        | 40  | 313              | 0.1                      | 2.0                            | 1.9                            |
| 6   | Keat Kay - Wat Chat Kaew                     | 0.08     | 62           | 310           | 22,630        | 40  | 313              | 0.0                      | 1.1                            | 1.1                            |
| 7   | Phayap - Wat Arwut                           | 0.08     | 79           | 397           | 28,981        | 40  | 313              | 0.0                      | 1.4                            | 1.4                            |
| 8   | Thawet - Wat Borwornmongkol                  | 0.08     | 102          | 511           | 37,303        | 40  | 313              | 0.1                      | 1.8                            | 1.8                            |
| 9   | Thawet - Wat Kharuhabudee                    | 0.08     | 117          | 584           | 42,632        | 40  | 313              | 0.1                      | 2.1                            | 2.0                            |
| 10  | Wisukasat - Ban Pun                          | 0.08     | 45           | 227           | 16,571        | 40  | 313              | 0.0                      | 0.8                            | 0.8                            |
| 11  | Banglumpoo - Bang Yee Khun                   | 0.08     | 42           | 210           | 15,330        | 40  | 313              | 0.0                      | 0.7                            | 0.7                            |
| 12  | Pra Arthit - Wat Daowadeng                   | 0.08     | 119          | 596           | 43,508        | 40  | 313              | 0.1                      | 2.1                            | 2.1                            |
| 13  | Pra Arthit - Pin Khoa                        | 0.08     | 98           | 492           | 35,916        | 40  | 313              | 0.1                      | 1.7                            | 1.7                            |
|     | Sub Total                                    | 0.08     | 1,568        | 7,841         | 572,393       | 40  | 313              | 0.8                      | 27.9                           | 27.1                           |
| 14  | North Phrachan - Pin Khoa                    | 0.08     | 80           | 398           | 29,054        | 40  | 313              | 0.0                      | 1.4                            | 1.4                            |
| 15  | North Phrachan - Thonburi Station            | 0.08     | 153          | 764           | 55,772        | 40  | 313              | 0.1                      | 2.7                            | 2.6                            |
| 16  | North Phrachan - Wang Lang                   | 0.08     | 176          | 880           | 64,240        | 40  | 313              | 0.1                      | 3.1                            | 3.0                            |
| 17  | Tha Chang - Wang Lang                        | 0.08     | 175          | 873           | 63,729        | 40  | 313              | 0.1                      | 3.1                            | 3.0                            |
| 18  | Tha Chang - Wat Rakhang                      | 0.08     | 94           | 470           | 34,310        | 40  | 313              | 0.0                      | 1.7                            | 1.6                            |
| 19  | Tha Tain - Wat Arun                          | 0.08     | 129          | 645           | 47,085        | 40  | 313              | 0.1                      | 2.3                            | 2.2                            |
| 20  | Pak Klong Talad - Wat Kurechan               | 0.08     | 96           | 480           | 35,040        | 40  | 313              | 0.0                      | 1.7                            | 1.7                            |
| 21  | Pak Klong Talad - Wat Kalayamit              | 0.08     | 97           | 485           | 35,405        | 40  | 313              | 0.0                      | 1.7                            | 1.7                            |
| 22  | Rama I Bridge (Bangkok Side - Thonburi Side) | 0.08     | 77           | 384           | 28,032        | 40  | 313              | 0.0                      | 1.4                            | 1.3                            |
| 23  | Ratchawong - Tha Dindaeng                    | 0.08     | 167          | 833           | 60,809        | 40  | 313              | 0.1                      | 3.0                            | 2.9                            |
| 24  | Thong Sewad - Wat Thong Thamachat            | 0.08     | 107          | 537           | 39,201        | 40  | 313              | 0.1                      | 1.9                            | 1.9                            |
|     | Sub Total                                    | 0.08     | 1,350        | 6,749         | 492,677       | 40  | 313              | 0.7                      | 24.0                           | 23.3                           |
| 25  | Si Phraya - Klong San                        | 0.08     | 292          | 1,462         | 106,726       | 40  | 313              | 0.1                      | 5.2                            | 5.1                            |
| 26  | Oriental Hotel - Wat Suwan                   | 0.08     | 159          | 793           | 57,889        | 40  | 313              | 0.1                      | 2.8                            | 2.7                            |
| 27  | Saun Phu - Dumax                             | 0.08     | 116          | 582           | 42,486        | 40  | 313              | 0.1                      | 2.1                            | 2.0                            |
| 28  | Sathon Bridge - Taksin                       | 0.08     | 106          | 528           | 38,544        | 40  | 313              | 0.1                      | 1.9                            | 1.8                            |
| 29  | Se Ta - Wat Sawachchat                       | 0.08     | 73           | 364           | 26,572        | 40  | 313              | 0.0                      | 1.3                            | 1.3                            |
| 30  | Klong Tay - General                          | 0.08     | 91           | 456           | 33,288        | 40  | 313              | 0.0                      | 1.6                            | 1.6                            |
| 31  | Bang Na - Num pung Nok                       | 0.08     | 70           | 352           | 25,696        | 40  | 313              | 0.0                      | 1.3                            | 1.2                            |
| 32  | Bang NA - Kamnutee                           | 0.08     | 53           | 263           | 19,199        | 40  | 313              | 0.0                      | 0.9                            | 0.9                            |
| 33  | Phratra - Prapadang                          | 0.08     | 27           | 137           | 10,001        | 40  | 313              | 0.0                      | 0.5                            | 0.5                            |
| 34  | Wibunsri - Phrasumutthadee                   | 0.08     | 205          | 1,023         | 74,679        | 40  | 313              | 0.1                      | 3.6                            | 3.5                            |
|     | Sub Total                                    | 0.08     | 1,192        | 5,960         | 435,080       | 40  | 313              | 0.6                      | 21.2                           | 20.6                           |
|     | Grand Total                                  | 0.08     | 4,110        | 20,550        | 1,500,150     | 40  | 313              | 2.1                      | 73.1                           | 71.0                           |

Source: Harbor Department

Note: Time and GRT of boat is based on interview with ferry boat company.

**Table 4.1.1.20 Number of trips and SO<sub>x</sub>, NO<sub>x</sub> emission of Long-tailed Boat in Chao Phraya River in Year 2000**

| No. | Pier                                | Trip (/day) | time/trip (min) | Distance (km) | kW  | Rated Power(PS) | Fuel Consumption(ktons) | NO <sub>x</sub> Emission (ton) | SO <sub>x</sub> Emission (ton) |
|-----|-------------------------------------|-------------|-----------------|---------------|-----|-----------------|-------------------------|--------------------------------|--------------------------------|
| 201 | Pak Kret - Bang Khuwad              | 42          | 10              | 1.49          | 108 | 202             | 0.03                    | 0.91                           | 0.02                           |
| 202 | Pak Kret - Tha It                   | 234         | 10              | 2.77          | 108 | 202             | 0.16                    | 5.06                           | 0.11                           |
| 203 | Pak Kret - Pak Klong Bang Bua Thong | 97          | 20              | 4.24          | 108 | 202             | 0.13                    | 4.19                           | 0.09                           |
| 204 | Pak Kret - Bang Bua Thong           | 44          | 20              | 3.98          | 108 | 202             | 0.06                    | 1.90                           | 0.04                           |
| 205 | Pak Kret - Phra Udom                | 77          | 10              | 2.96          | 108 | 202             | 0.05                    | 1.66                           | 0.04                           |
| 206 | Nonthaburi - Bang Yai (1)           | 146         | 40              | 11.58         | 108 | 202             | 0.39                    | 12.59                          | 0.27                           |
| 207 | Nonthaburi - Bang Yai (1)           | 76          | 40              | 11.59         | 108 | 202             | 0.20                    | 6.59                           | 0.14                           |
| 208 | Nonthaburi - Bang Yai (1)           | 18          | 30              | 8.33          | 108 | 202             | 0.04                    | 1.15                           | 0.02                           |
| 209 | Khun Koi - Chimplee                 | 30          | 10              | 0.44          | 108 | 202             | 0.02                    | 0.66                           | 0.01                           |
| 210 | Tha Chang - Bang Yai                | 127         | 60              | 16.31         | 108 | 202             | 0.51                    | 16.42                          | 0.36                           |
| 211 | Tha Chang - Bang Chak Nung          | 26          | 30              | 8.86          | 108 | 202             | 0.05                    | 1.71                           | 0.04                           |
| 212 | Tha Bang Noi                        | 9           | 30              | 7.59          | 108 | 202             | 0.02                    | 0.60                           | 0.01                           |
| 213 | Rachini - Bang Wak                  | 71          | 30              | 7.33          | 108 | 202             | 0.14                    | 4.59                           | 0.10                           |
| 214 | Rama I Bridge - Bang Wak            | 56          | 30              | 7.33          | 108 | 202             | 0.11                    | 3.66                           | 0.08                           |
| 215 | Sathupradit - Phra Phra Daeng       | 135         | 10              | 1.07          | 108 | 202             | 0.09                    | 2.92                           | 0.06                           |
| 217 | Klong Tay - Ladtanong               | 16          | 10              | 0.96          | 108 | 202             | 0.01                    | 0.35                           | 0.01                           |
| 216 | Klong Tay - Bang Ko Bua             | 98          | 10              | 1.85          | 108 | 202             | 0.07                    | 2.11                           | 0.05                           |
| 218 | Bang Kae - Klong Bang Wak           | 112         | 20              | 4.32          | 108 | 202             | 0.15                    | 4.85                           | 0.10                           |
|     | Total                               | 1,415       |                 |               |     |                 | 2.24                    | 71.93                          | 1.56                           |

Source: Harbor Department

Note: Time and Kw of boat is based on interview with long-tailed boat company.

## **2) Parameter for Emission Calculation**

The parameters like average GRT, load factor, number of operating engine, mooring time and so on, which are used for emission calculation of vessels in mooring, are shown in Table 4.1.1.21 - 4.1.1.22.

The parameters like load factor, number of operating engine, cruising time and so on, which are used for emission calculation of vessels in cruising, are shown in Table 4.1.1.23 - 4.1.1.24.

The parameters like average PS, load factor and number of operating engine used for emission calculation of fishing boat are shown in Table 4.1.1.25 - 4.1.1.26.

The parameters like load factor and number of operating engine used for emission calculation of small boats are shown in Table 4.1.1.27 - 4.1.1.28.





Table 4.1.1.21 Parameter in Mooring(Arrival) by Ship Type in Year 2000

|                             |               | Liquid Bulk |            | Solid Bulk |            | Fully Cellular Container |            | Semi-Container |            | Ro-Ro      |            | Conventional |            | Others     |            |
|-----------------------------|---------------|-------------|------------|------------|------------|--------------------------|------------|----------------|------------|------------|------------|--------------|------------|------------|------------|
|                             |               | Sub Diesel  | Sub Boiler | Sub Diesel | Sub Boiler | Sub Diesel               | Sub Boiler | Sub Diesel     | Sub Boiler | Sub Diesel | Sub Boiler | Sub Diesel   | Sub Boiler | Sub Diesel | Sub Boiler |
| Load factor                 | Unloading     | 0.37        | 0.19       | 0.42       | 0.48       | 0.42                     | 0.48       | 0.42           | 0.48       | 0.42       | 0.48       | 0.42         | 0.48       | 0.42       | 0.48       |
|                             | Loading       | 0.45        | 0.76       | 0.46       | 0.56       | 0.00                     | 0.00       | 0.46           | 0.56       | 0.46       | 0.56       | 0.46         | 0.56       | 0.46       | 0.56       |
| Number of operating engines | Unloading     | 1           |            | 1          |            | 1                        |            | 1              |            | 1          |            | 1            |            | 1          |            |
|                             | Loading       | 1           |            | 2          |            | 0                        |            | 2              |            | 2          |            | 2            |            | 2          |            |
| Rate of loading/mooring     | International | 0.23        |            | 0.23       |            | 0.00                     |            | 0.23           |            | 0.23       |            | 0.23         |            | 0.00       |            |
|                             | Domestic      | 1.00        |            | 1.00       |            | 0.00                     |            | 1.00           |            | 1.00       |            | 1.00         |            | 0.00       |            |
| Mooring time(hr)            | 0             | 500         | 12         |            |            | 12                       |            | 12             |            | 12         |            | 12           |            | 12         |            |
|                             | 500           | 3,000       | 12         |            |            | 16                       |            | 16             |            | 24         |            | 16           |            | 12         |            |
|                             | 3,000         | 6,000       | 12         |            |            | 16                       |            | 16             |            | 34         |            | 16           |            | 12         |            |
|                             | 6,000         | 10,000      | 20         |            |            | 20                       |            | 20             |            | 36         |            | 20           |            | 12         |            |
|                             | 10,000        | 100,000     | 24         |            |            | 40                       |            | 40             |            | 36         |            | 40           |            | 12         |            |
|                             |               |             |            |            |            |                          | 16         |                | 40         |            | 36         |              | 40         |            | 12         |
| Equation(A*GRT^B)           | A             | 20          | 0.29       | 15.4       | 0.27       | 4.4                      | 0.27       | 15.4           | 0.27       | 15.4       | 0.27       | 15.4         | 0.27       | 0.178      | 0.27       |
|                             | B             | 0.37        | 0.88       | 0.4        | 0.67       | 0.6                      | 0.67       | 0.4            | 0.67       | 0.4        | 0.67       | 0.4          | 0.67       | 1          | 0.67       |
| Sulfur Contents             | (%,wt)        | 1.70%       | 1.70%      | 1.70%      | 1.70%      | 1.70%                    | 1.70%      | 1.70%          | 1.70%      | 1.70%      | 1.70%      | 1.70%        | 1.70%      | 1.70%      | 1.70%      |
| NOx Emission                | (kg/kg)       |             | 0.0700     |            | 0.0700     |                          | 0.0700     |                | 0.0700     |            | 0.0700     |              | 0.0700     |            | 0.0700     |
| Spec Gravity                |               |             | 0.9487     |            | 0.9487     |                          | 0.9487     |                | 0.9487     |            | 0.9487     |              | 0.9487     |            | 0.9487     |

Source:NOx emission is based on IPCC/OECD(1996).  
Sulfur contents and spec gravity : DCR,2000

|                          | GRT    | Mooring Time(s) | Sub Diesel              |                              |                          | Sub Boiler                    |                              |
|--------------------------|--------|-----------------|-------------------------|------------------------------|--------------------------|-------------------------------|------------------------------|
|                          |        |                 | Rated Power (PS/engine) | Fuel Consumption (kg/vessel) | NOx Emission (kg/vessel) | Fuel Consumption Rate (kg/hr) | Fuel Consumption (kg/vessel) |
| Liquid Bulk              | 9,500  | 20              | 1,114                   | 1,303                        | 62                       | 871                           | 5,592                        |
| Solid Bulk               | 9,100  | 20              | 1,110                   | 1,784                        | 86                       | 115                           | 1,147                        |
| Fully Cellular Container | 13,100 | 16              | 2,443                   | 2,430                        | 133                      | 147                           | 1,128                        |
| Semi-Container           | 7,700  | 20              | 1,038                   | 1,671                        | 80                       | 103                           | 1,026                        |
| Ro-Ro                    | 26,800 | 36              | 1,710                   | 4,905                        | 254                      | 237                           | 4,258                        |
| Conventional             | 10,800 | 40              | 1,189                   | 3,816                        | 187                      | 129                           | 2,574                        |
| Others                   | 2,900  | 12              | 970                     | 737                          | 35                       | 53                            | 308                          |



Table 4.1.1.22 Parameter in Mooring(Departure) by Ship Type in Year 2000

|                             |               | Liquid Bulk |            | Solid Bulk |            | Fully Cellular Container |            | Semi-Container |            | Ro-Ro      |            | Conventional |            | Others     |            |
|-----------------------------|---------------|-------------|------------|------------|------------|--------------------------|------------|----------------|------------|------------|------------|--------------|------------|------------|------------|
|                             |               | Sub Diesel  | Sub Boiler | Sub Diesel | Sub Boiler | Sub Diesel               | Sub Boiler | Sub Diesel     | Sub Boiler | Sub Diesel | Sub Boiler | Sub Diesel   | Sub Boiler | Sub Diesel | Sub Boiler |
| Load factor                 | Unloading     | 0.37        | 0.19       | 0.42       | 0.48       | 0.42                     | 0.48       | 0.42           | 0.48       | 0.42       | 0.48       | 0.42         | 0.48       | 0.42       | 0.48       |
|                             | Loading       | 0.45        | 0.76       | 0.46       | 0.56       |                          |            | 0.46           | 0.56       | 0.46       | 0.56       | 0.46         | 0.56       | 0.46       | 0.56       |
| Number of operating engines | Unloading     | 1           |            | 1          |            | 1                        |            | 1              |            | 1          |            | 1            |            | 1          |            |
|                             | Loading       | 1           |            | 2          |            | 2                        |            | 2              |            | 2          |            | 2            |            | 2          |            |
| Rate of loading/mooring     | International | 0.23        |            | 0.23       |            |                          |            | 0.23           |            | 0.23       |            | 0.23         |            |            |            |
|                             | Domestic      | 1.00        |            | 1.00       |            |                          |            | 1.00           |            | 1.00       |            | 1.00         |            |            |            |
| Mooring time(hr)            | 500           | 12          |            | 12         |            | 12                       |            | 12             |            | 24         |            | 12           |            | 12         |            |
|                             | 3,000         | 12          |            | 16         |            | 12                       |            | 16             |            | 24         |            | 16           |            | 12         |            |
|                             | 6,000         | 12          |            | 16         |            | 12                       |            | 16             |            | 34         |            | 16           |            | 12         |            |
|                             | 10,000        | 20          |            | 20         |            | 16                       |            | 20             |            | 36         |            | 20           |            | 12         |            |
|                             | 100,000       | 24          |            | 40         |            | 16                       |            | 40             |            | 36         |            | 40           |            | 12         |            |
| Equation(A#GRT^B)           | A             | 20          | 0.29       | 15.4       | 0.27       | 4.4                      | 0.27       | 15.4           | 0.27       | 15.4       | 0.27       | 15.4         | 0.27       | 0.178      | 0.27       |
|                             | B             | 0.37        | 0.88       | 0.4        | 0.67       | 0.6                      | 0.67       | 0.4            | 0.67       | 0.4        | 0.67       | 0.4          | 0.67       | 1          | 0.67       |
| Sulfur Contents             | (%,wt)        | 1.70%       | 1.70%      | 1.70%      | 1.70%      | 1.70%                    | 1.70%      | 1.70%          | 1.70%      | 1.70%      | 1.70%      | 1.70%        | 1.70%      | 1.70%      | 1.70%      |
| NOx Emission                | (kg/kg)       |             | 0.0700     |            | 0.0700     |                          | 0.0700     |                | 0.0700     |            | 0.0700     |              | 0.0700     |            | 0.0700     |
| Spec Gravity                |               |             | 0.9487     |            | 0.9487     |                          | 0.9487     |                | 0.9487     |            | 0.9487     |              | 0.9487     |            | 0.9487     |

Source:NOx emission is based on IPCC/OECD(1996).  
Sulfur contents and specific gravity : DCR,2000

|                          | GRT    | Mooring Time(s) | Sub Diesel              |                              |                          | Sub Boiler                    |                              |
|--------------------------|--------|-----------------|-------------------------|------------------------------|--------------------------|-------------------------------|------------------------------|
|                          |        |                 | Rated Power (PS/engine) | Fuel Consumption (kg/vessel) | NOx Emission (kg/vessel) | Fuel Consumption Rate (kg/hr) | Fuel Consumption (kg/vessel) |
| Liquid Bulk              | 9,800  | 20              | 1,127                   | 1,318                        | 63                       | 895                           | 5,747                        |
| Solid Bulk               | 9,100  | 20              | 1,110                   | 1,784                        | 86                       | 115                           | 1,147                        |
| Fully Cellular Container | 13,200 | 16              | 2,454                   | 2,441                        | 133                      | 148                           | 1,134                        |
| Semi-Container           | 10,300 | 40              | 1,166                   | 3,746                        | 183                      | 125                           | 2,493                        |
| Ro-Ro                    | 27,400 | 36              | 1,725                   | 4,947                        | 257                      | 241                           | 4,322                        |
| Conventional             | 10,900 | 40              | 1,193                   | 3,830                        | 187                      | 130                           | 2,589                        |
| Others                   | 2,900  | 12              | 970                     | 737                          | 35                       | 53                            | 308                          |



Table 4.1.1.23 Parameter in Cruising(Arrival) by Ship Type in Year 2000

|                             | Liquid Bulk   |            |            | Solid Bulk  |            |            | Fully Cellular Container |            |            | Semi-Container |            |            | Ro-Ro       |            |            | Conventional |            |            | Others      |            |            |        |
|-----------------------------|---------------|------------|------------|-------------|------------|------------|--------------------------|------------|------------|----------------|------------|------------|-------------|------------|------------|--------------|------------|------------|-------------|------------|------------|--------|
|                             | Main Diesel   | Sub Diesel | Sub Bioler | Main Diesel | Sub Diesel | Sub Bioler | Main Diesel              | Sub Diesel | Sub Bioler | Main Diesel    | Sub Diesel | Sub Bioler | Main Diesel | Sub Diesel | Sub Bioler | Main Diesel  | Sub Diesel | Sub Bioler | Main Diesel | Sub Diesel | Sub Bioler |        |
| Load factor                 | Half          | 0.32       | 0.37       | 0.19        | 0.32       | 0.42       | 0.48                     | 0.32       | 0.42       | 0.48           | 0.32       | 0.42       | 0.48        | 0.32       | 0.42       | 0.48         | 0.32       | 0.42       | 0.48        | 0.32       | 0.42       | 0.48   |
|                             | Slow          | 0.37       | 0.37       | 0.19        | 0.17       | 0.42       | 0.48                     | 0.17       | 0.42       | 0.48           | 0.17       | 0.42       | 0.48        | 0.17       | 0.42       | 0.48         | 0.17       | 0.42       | 0.48        | 0.17       | 0.42       | 0.48   |
| Number of operating engines | Unloading     |            |            |             | 1          |            |                          | 1          |            |                | 1          |            |             | 1          |            |              | 1          |            |             | 1          |            |        |
|                             | Loading       |            |            |             | 2          |            |                          | 2          |            |                | 2          |            |             | 2          |            |              | 2          |            |             | 2          |            |        |
| Rate of loading/mooring     | International |            | 0.23       |             |            | 0.23       |                          |            |            | 0.23           |            |            |             | 0.23       |            |              | 0.23       |            |             |            |            | 2      |
|                             | Domestic      |            | 1.00       |             |            | 1.00       |                          |            |            | 1.00           |            |            |             | 1.00       |            |              | 1.00       |            |             |            |            |        |
| Mooring time(hr)            | 500           |            | 12         |             |            | 12         |                          |            | 12         |                |            |            | 12          |            |            |              | 12         |            |             |            |            | 12     |
|                             | 3,000         | 3,000      | 12         |             |            | 16         |                          |            | 12         |                |            |            | 16          |            |            |              | 16         |            |             |            |            | 12     |
|                             | 6,000         | 6,000      | 12         |             |            | 16         |                          |            | 12         |                |            |            | 16          |            |            |              | 16         |            |             |            |            | 12     |
|                             | 10,000        | 10,000     | 20         |             |            | 20         |                          |            | 16         |                |            |            | 20          |            |            |              | 20         |            |             |            |            | 12     |
|                             | 10,000        | 100,000    | 24         |             |            | 40         |                          |            | 16         |                |            |            | 20          |            |            |              | 24         |            |             |            |            | 12     |
| Equation(A+GRT B)           | A             | 12         | 20         | 0.29        | 19         | 15.4       | 0.27                     | 1.9        | 4.4        | 0.27           | 19         | 15.4       | 0.27        | 19         | 15.4       | 0.27         | 19         | 15.4       | 0.27        | 33         | 0.178      | 0.27   |
|                             | B             | 0.7        | 0.37       | 0.88        | 0.65       | 0.4        | 0.67                     | 0.97       | 0.6        | 0.67           | 0.65       | 0.4        | 0.67        | 0.65       | 0.4        | 0.67         | 0.65       | 0.4        | 0.67        | 0.61       | 1          | 0.67   |
| Sulfur Contents (K,wt)      |               | 1.70%      | 1.70%      | 1.70%       | 1.70%      | 1.70%      | 1.70%                    | 1.70%      | 1.70%      | 1.70%          | 1.70%      | 1.70%      | 1.70%       | 1.70%      | 1.70%      | 1.70%        | 1.70%      | 1.70%      | 1.70%       | 1.70%      | 1.70%      | 1.70%  |
| NOx Emission (kg/kg)        |               |            |            | 0.0700      |            |            | 0.0700                   |            |            | 0.0700         |            |            | 0.0700      |            |            | 0.0700       |            |            | 0.0700      |            |            | 0.0700 |
| Spec Gravity                |               |            |            | 0.9487      |            |            | 0.9487                   |            |            | 0.9487         |            |            | 0.9487      |            |            | 0.9487       |            |            | 0.9487      |            |            | 0.9487 |

Source:NOx emission is based on IPCC/OECD(1996).  
Sulfur contents and specific gravity : DCR,2000

| Port               | Time(hr)  |           |
|--------------------|-----------|-----------|
|                    | Half Mode | Slow Mode |
| Bangkok            |           |           |
| Klong Toey Wharf   | 1.6       | 0.2       |
| Klong Toey Pole    | 1.6       | 0.2       |
| Bang Hua Suer Pole | 0.8       | 0.2       |
| Sathupradit Buoy   | 2.1       | 0.2       |
| Tmn Wharf          | 1.8       | 0.2       |
| Private Wharves    | 1.4       | 0.2       |
| Others             | 1.6       | 0.2       |
| Local Port         | 0.3       | 0.2       |



Table 4.1.1.24 Parameter in Cruising (Departure) by Ship Type in Year 2000

|                                | Liquid Bulk   |            |            | Solid Bulk  |            |            | Fully Cellular Container |            |            | Semi-Container |            |            | Ro-Ro       |            |            | Conventional |            |            | Others      |            |            |        |
|--------------------------------|---------------|------------|------------|-------------|------------|------------|--------------------------|------------|------------|----------------|------------|------------|-------------|------------|------------|--------------|------------|------------|-------------|------------|------------|--------|
|                                | Main Diesel   | Sub Diesel | Sub Bioler | Main Diesel | Sub Diesel | Sub Bioler | Main Diesel              | Sub Diesel | Sub Bioler | Main Diesel    | Sub Diesel | Sub Bioler | Main Diesel | Sub Diesel | Sub Bioler | Main Diesel  | Sub Diesel | Sub Bioler | Main Diesel | Sub Diesel | Sub Bioler |        |
| Load factor                    | Half<br>0.32  | 0.37       | 0.19       | 0.32        | 0.42       | 0.48       | 0.32                     | 0.42       | 0.48       | 0.32           | 0.42       | 0.48       | 0.32        | 0.42       | 0.48       | 0.32         | 0.42       | 0.48       | 0.32        | 0.42       | 0.48       |        |
|                                | Slow<br>0.17  | 0.37       | 0.19       | 0.17        | 0.42       | 0.48       | 0.17                     | 0.42       | 0.48       | 0.17           | 0.42       | 0.48       | 0.17        | 0.42       | 0.48       | 0.17         | 0.42       | 0.48       | 0.17        | 0.42       | 0.48       |        |
| Number of operating engines    | Unloading     | 1          |            |             | 1          |            |                          | 1          |            |                | 1          |            |             | 1          |            |              | 1          |            |             | 1          |            |        |
|                                | Loading       | 1          |            |             | 2          |            |                          | 2          |            |                | 2          |            |             | 2          |            |              | 2          |            |             | 2          |            |        |
| Rate of loading/mooring        | International | 0.23       |            |             | 0.23       |            |                          | 0.23       |            |                | 0.23       |            |             | 0.23       |            |              | 0.23       |            |             | 0.23       |            |        |
|                                | Domestic      | 1.00       |            |             | 1.00       |            |                          | 1.00       |            |                | 1.00       |            |             | 1.00       |            |              | 1.00       |            |             | 1.00       |            |        |
| Mooring time(hr)               | 500           | 12         |            |             | 12         |            |                          | 12         |            |                | 12         |            |             | 12         |            |              | 12         |            |             | 12         |            |        |
|                                | 3,000         | 12         |            |             | 16         |            |                          | 12         |            |                | 16         |            |             | 12         |            |              | 16         |            |             | 12         |            |        |
|                                | 6,000         | 12         |            |             | 16         |            |                          | 12         |            |                | 16         |            |             | 12         |            |              | 16         |            |             | 12         |            |        |
|                                | 10,000        | 20         |            |             | 20         |            |                          | 16         |            |                | 20         |            |             | 16         |            |              | 20         |            |             | 12         |            |        |
|                                | 100,000       | 24         |            |             | 40         |            |                          | 16         |            |                | 40         |            |             | 16         |            |              | 40         |            |             | 12         |            |        |
| Equation (A+GRT <sup>B</sup> ) | A             | 12         | 20         | 0.29        | 19         | 15.4       | 0.27                     | 1.9        | 4.4        | 0.27           | 19         | 15.4       | 0.27        | 19         | 15.4       | 0.27         | 19         | 15.4       | 0.27        | 33         | 0.178      | 0.27   |
|                                | B             | 0.7        | 0.37       | 0.88        | 0.65       | 0.4        | 0.67                     | 0.97       | 0.6        | 0.67           | 0.65       | 0.4        | 0.67        | 0.65       | 0.4        | 0.67         | 0.65       | 0.4        | 0.67        | 0.61       | 1          | 0.67   |
| Sulfur Contents (%,wt)         |               | 1.70%      | 1.70%      | 1.70%       | 1.70%      | 1.70%      | 1.70%                    | 1.70%      | 1.70%      | 1.70%          | 1.70%      | 1.70%      | 1.70%       | 1.70%      | 1.70%      | 1.70%        | 1.70%      | 1.70%      | 1.70%       | 1.70%      | 1.70%      | 1.70%  |
| NOx Emission (kg/kg)           |               |            |            | 0.0700      |            |            | 0.0700                   |            |            | 0.0700         |            |            | 0.0700      |            |            | 0.0700       |            |            | 0.0700      |            |            | 0.0700 |
| Spec Gravity                   |               |            | 0.9487     |             |            |            | 0.9487                   |            |            | 0.9487         |            |            | 0.9487      |            |            | 0.9487       |            |            | 0.9487      |            |            | 0.9487 |

Source:NOx emission is based on IPCC/OECD(1996).  
Sulfur contents and specific gravity : DCR,2000

| Port               | Time(hr)  |           |
|--------------------|-----------|-----------|
|                    | Half Mode | Slow Mode |
| Bangkok            |           |           |
| Klong Toey Wharf   | 1.6       | 0.2       |
| Klong Toey Pole    | 1.6       | 0.2       |
| Bang Hua Suer Pole | 0.8       | 0.2       |
| Sathupradit Buoy   | 2.1       | 0.2       |
| Tmn Wharf          | 1.8       | 0.2       |
| Private Wharves    | 1.4       | 0.2       |
| Others             | 1.6       | 0.2       |
| Local Port         | 0.3       | 0.2       |



Table 4.1.1.25 Number and Average PS of Fishing Boats in Year 2000

| Province            | Truck Engine                 |           |            | Boat Engine                  |          |            | Number of Boats | Average HP | Average PS |
|---------------------|------------------------------|-----------|------------|------------------------------|----------|------------|-----------------|------------|------------|
|                     | No. of inboard powered boats | Total Hp  | Average HP | No. of inboard powered boats | Total Hp | Average HP |                 |            |            |
| Trat                | 840                          | 108,557   | 129        | 502                          | 1,341    | 3          | 1,342           | 82         | 83         |
| Chanthaburi         | 402                          | 50,739    | 126        | 119                          | 1,209    | 10         | 521             | 100        | 101        |
| Rayong              | 502                          | 60,519    | 121        | 484                          | 3,722    | 8          | 986             | 65         | 66         |
| Chon Buri           | 239                          | 42,166    | 176        | 512                          | 2,973    | 6          | 751             | 60         | 61         |
| Chachoengsao        | 39                           | 5,648     | 145        | 45                           | 1,413    | 31         | 84              | 84         | 85         |
| Samut Prakan        | 392                          | 151,325   | 386        | 438                          | 25,693   | 59         | 830             | 213        | 215        |
| Bangkok             | 0                            | 0         | 0          | 0                            | 0        | 0          | 0               | 0          | 0          |
| Samut Sakhon        | 390                          | 78,457    | 201        | 507                          | 67,760   | 134        | 897             | 163        | 165        |
| Samut Songkhram     | 225                          | 60,580    | 269        | 437                          | 35,817   | 82         | 662             | 146        | 147        |
| Phetchaburi         | 298                          | 52,394    | 176        | 291                          | 5,158    | 18         | 589             | 98         | 99         |
| Prachuap Khiri Khan | 329                          | 41,858    | 127        | 353                          | 2,687    | 8          | 682             | 65         | 66         |
| Chumphon            | 719                          | 83,643    | 116        | 206                          | 5,108    | 25         | 925             | 96         | 97         |
| Surat Thani         | 348                          | 53,092    | 153        | 33                           | 540      | 16         | 381             | 141        | 142        |
| Nakhon Si Thammarat | 420                          | 64,212    | 153        | 453                          | 8,292    | 18         | 873             | 83         | 84         |
| Songkhla            | 364                          | 82,564    | 227        | 1,011                        | 17,606   | 17         | 1,375           | 73         | 74         |
| Pattani             | 191                          | 39,002    | 204        | 386                          | 15,836   | 41         | 577             | 95         | 96         |
| Narathiwat          | 11                           | 2,001     | 182        | 37                           | 904      | 24         | 48              | 61         | 61         |
| Ranong              | 57                           | 11,706    | 205        | 168                          | 7,770    | 46         | 225             | 87         | 87         |
| Phangnga            | 79                           | 15,953    | 202        | 62                           | 1,656    | 27         | 141             | 125        | 126        |
| Phuket              | 0                            | 0         | 0          | 244                          | 11,439   | 0          | 244             | 47         | 47         |
| Krabi               | 17                           | 2,514     | 148        | 75                           | 1,237    | 16         | 92              | 41         | 41         |
| Trang               | 169                          | 39,368    | 233        | 152                          | 5,876    | 39         | 321             | 141        | 142        |
| Satun               | 93                           | 16,234    | 175        | 624                          | 10,382   | 17         | 717             | 37         | 37         |
| Total               | 6,124                        | 1,062,532 | 174        | 7,139                        | 234,419  | 33         | 13,263          | 98         | 99         |

Source: "The 2000 Intercensal Survey of Marine Fishery" (2000, Department of Fisheries Ministry of Agriculture and Cooperatives)

Note: PS = HS \* 1.01

Table 4.1.1.26 Parameter of Fishing Boats in Year 2000

|                             |        |      |
|-----------------------------|--------|------|
| Load factor                 | Half   | 0.32 |
| Number of Operating engines |        | 1    |
| Sulfur Contents             | (%,wt) | 1.7  |
| NOx                         | kg/kg  | 0.07 |

Note: NOx emission based on IPCC/OECD(1996)

Table 4.1.1.27 Parameter of Express Boats and Ferry Boats in Year 2000

|                             |        |      |
|-----------------------------|--------|------|
| Load factor                 | Half   | 0.32 |
| Number of Operating engines |        | 1    |
| Equation(A * GRT^B)         | A      | 33   |
|                             | B      | 0.61 |
| Sulfur Contents             | (%,wt) | 1.7  |

Note: NOx emission based on method of NOx Manual

Table 4.1.1.28 Parameter of Long-tailed Boats in Year 2000

|                 |        |        |
|-----------------|--------|--------|
| Load factor     | Half   | 0.32   |
| Sulfur Contents | (%,wt) | 0.0348 |
| NOx             | kg/kg  | 0.07   |

Note: NOx emission based on IPCC/OECD(1996)

### 3) Sample Calculation

A sample calculation is provided below;

#### (1) Emission from Vessels in loading at port

##### Emission for Sub Diesel Engines

###### **Liquid Bulk at Private Wharf in Bangkok(in loading for arrival):**

$$P \text{ ( Rated Power )} = 1.88 * 2 * 10 * \text{GRT}^{0.37}$$

$$= 1.88 * 2 * 10 * 9500^{0.37} = 1,114.155(\text{PS/engine})$$

$$W \text{ (Fuel Consumption)} = 0.17 * P^{0.98} * (A_1^{0.98} * T_1 * d_1 + A_2^{0.98} * T_2 * d_2)$$

$$= 0.17 * 1114.155^{0.98} * (0.45^{0.98} * 20 * 0.23 * 1 + 0.37^{0.98} * 20 * (1-0.23) * 1)$$

$$= 1,303.012(\text{kg/vessel})$$

$$S \text{ (SOx emission)} = W * s * 1/100 * 64/32$$

$$= 1,303.012 * 1.7 / 100 * 64 / 32$$

$$= 44.302(\text{kg/vessel})$$

$$\text{Calls of vessel (in arrival)} = 571 \text{ (vessels/year)}$$

$$\text{Fuel Consumption(of total vessels per year in loading for arrival at Private Wharf)}$$

$$= 571 * 1,303.012 = 744,020 \text{ (kg/year)}$$

$$\text{SOx emission(of total vessels per year in loading for arrival at Private Wharf)}$$

$$= 571 * 44.302 = 25,297 \text{ (kg/year)}$$

##### Emission for Main & Sub Boiler

###### **Liquid Bulk at Private Wharf in Bangkok( in loading for arrival):**

$$F \text{ ( Rated Fuel Consumption )} = 0.29 * \text{GRT}^{0.88} * \text{Specific Gravity}$$

$$= 0.29 * 9500^{0.88} * 0.9487 = 870.811 \text{ (kg/vessel/hr)}$$

$$W \text{ (Fuel Consumption)} = F * (A_1 * T_1 + A_2 * T_2)$$

$$= 870.811 * (0.75 * 20 * 0.23 + 0.19 * 20 * (1-0.23))$$

$$= 5,592.354(\text{kg/vessel})$$

$$S \text{ (SOx emission)} = W * s * 1/100 * 64/32$$

$$= 5,592.354 * 1.7 / 100 * 64 / 32$$

$$= 190.140 \text{ (kg/vessel)}$$

$$\text{Calls of vessel ( in arrival)} = 571 \text{ (calls/year)}$$

$$\text{Fuel Consumption(of total vessels per year in loading for arrival at Private Wharf)}$$

$$= 571 * 5,592.354 = 3,193,229(\text{kg/year})$$



$$\begin{aligned} \text{SOx emission (of total vessels per year in loading for arrival at Private Wharf)} \\ = 571 * 190.140 = 108,570(\text{kg/year}) \end{aligned}$$

**Emission from Vessel in loading at port**

**Liquid Bulk in Bangkok port (in loading for arrival and departure):**

Fuel Consumption (of total vessels per year in loading for arrival and departure at all wharf in Bangkok Port)

$$= 3,992,412 + 2,783,707 = 6,776,119 (\text{kg/year})$$

$$\begin{aligned} \text{F.C. in loading for arrival} &= 744,020(\text{at Private Wharf by Sub Diesel}) \\ &+ 10,424(\text{at Others by Sub Diesel}) + 3,193,229(\text{at Private Wharf by Sub Boiler}) \\ &+ 44,739(\text{at Others by Sub Boiler}) = 3,992,412(\text{kg/year}) \end{aligned}$$

$$\begin{aligned} \text{F.C. in loading for departure} &= 508,665 (\text{at Private Wharf by Sub Diesel}) \\ &+ 10,542 (\text{at Others by Sub Diesel}) + 2,218,521 (\text{at Private Wharf by Sub Boiler}) \\ &+ 45,980 (\text{at Others by Sub Boiler}) = 2,783,707(\text{kg/year}) \end{aligned}$$

SOx emission (of total vessels per year in loading for arrival and departure at all wharf in Bangkok Port)

$$= 135,742 + 94,646 = 230,388 (\text{kg/year})$$

$$\begin{aligned} \text{SOx E. in loading for arrival} &= 25,297(\text{at Private Wharf by Sub Diesel}) \\ &+ 354(\text{at Others by Sub Diesel}) + 108,570(\text{at Private Wharf by Sub Boiler}) \\ &+ 1,521(\text{at Others by Sub Boiler}) = 135,742 (\text{kg/year}) \end{aligned}$$

$$\begin{aligned} \text{SOx E. in loading for departure} &= 17,295 (\text{at Private Wharf by Sub Diesel}) \\ &+ 358 (\text{at Others by Sub Diesel}) + 75,430 (\text{at Private Wharf by Sub Boiler}) \\ &+ 1,563 (\text{at Others by Sub Boiler}) = 94,646 (\text{kg/year}) \end{aligned}$$

**(2) Emission from Vessels in arrival and departure at port**

**Emission for Main Diesel Engines**

**Liquid Bulk at Private Wharf in Bangkok(in cruising for arrival):**

$$\begin{aligned} P (\text{ Rated Power }) &= 12 * \text{GRT}^{0.70} \\ &= 12 * 9500^{0.70} = 7,304.454 (\text{PS/engine}) \\ W (\text{Fuel Consumption}) &= 0.21 * ( P * A )^{0.95} * T \\ &= 0.21 * ( (7,304.454 * 0.32)^{0.95} * 1.4 + (7,304.454 * 0.17)^{0.95} * 0.2 ) \\ &= 500.030(\text{kg/vessel}) \\ S (\text{SOx emission}) &= W * s * 1/100 * 64/32 \\ &= 500.030 * 1.7 / 100 * 64 / 32 \\ &= 17.001(\text{kg/vessel}) \end{aligned}$$

$$\text{Calls of vessel (in arrival)} = 571 (\text{vessels/year})$$

$$\text{Fuel Consumption (of total vessels per year)} = 571 * 500.030 = 285,517 (\text{kg/year})$$



$$\text{SOx emission(of total vessels per year)} = 571 * 17.001 = 9,708 \text{ (kg/year)}$$

### **Emission for Sub Diesel Engines**

#### **Liquid Bulk at Private Wharf in Bangkok(in cruising for arrival):**

$$P \text{ ( Rated Power )} = 1.88 * 2 * 10 * \text{GRT}^{0.37}$$

$$= 1.88 * 2 * 10 * 9500^{0.37} = 1,114.155 \text{ (PS/engine)}$$

$$W \text{ (Fuel Consumption)} = 0.17 * (P * A)^{0.98} * T * d$$

$$= 0.17 * (1,114.155 * 0.37)^{0.98} * 1.4 * 1 + (1,114.155 * 0.37)^{0.98} * 0.2 * 1$$

$$= 98.125 \text{ (kg/vessel)}$$

$$S \text{ (SOx emission)} = W * s * 1/100 * 64/32$$

$$= 98.125 * 1.7 / 100 * 64 / 32$$

$$= 3.336 \text{ (kg/vessel)}$$

$$\text{Calls of vessel (in arrival)} = 571 \text{ (vessels/year)}$$

$$\text{Fuel Consumption(of total vessels per year)} = 571 * 98.125 = 56,092 \text{ (kg/year)}$$

$$\text{SOx emission(of total vessels per year)} = 571 * 3.336 = 1,905 \text{ (kg/year)}$$

### **Emission for Main & Sub Boiler**

#### **Liquid Bulk at Private Wharf in Bangkok(in cruising for arrival):**

$$W = F * A * T$$

$$F \text{ ( Rated Fuel Consumption )} = 0.29 * \text{GRT}^{0.88} * \text{Specific Gravity}$$

$$= 0.29 * 9500^{0.88} * 0.9487 = 870.811 \text{ (kg/vessel/hr)}$$

$$W \text{ (Fuel Consumption)} = F * A * T$$

$$= 870.811 * (0.19 * 1.4 + 0.19 * 0.2)$$

$$= 261.314 \text{ (kg/vessel)}$$

$$S \text{ (SOx emission)} = W * s * 1/100 * 64/32$$

$$= 261.314 * 1.7 / 100 * 64 / 32$$

$$= 8.885 \text{ (kg/vessel)}$$

$$\text{Calls of vessel ( in arrival)} = 571 \text{ (calls/year)}$$

$$\text{Fuel Consumption(of total vessels per year)}$$

$$= 571 * 261.314 = 149,210 \text{ (kg/year)}$$

$$\text{SOx emission(of total vessels per year) (kg/year)}$$

$$= 571 * 8.885 = 5,073 \text{ (kg/year)}$$

### **Emission from Vessel in arrival and departure at port**

#### **Liquid Bulk in Bangkok port (in cruising for arrival and departure):**

Fuel Consumption (of total vessels per year in cruising for arrival and departure at all wharf in Bangkok Port)

$$= 498,395 + 339,393 = 837,788 \text{ (kg/year)}$$





F.C. in cruising for arrival = 285,517(at Private Wharf by Main Diesel)  
 + 4,453(at Others by Main Diesel) + 56,029(at Private Wharf by Sub Diesel)  
 + 870(at Others by Sub Diesel) + 149,210(at Private Wharf by Sub Boiler)  
 + 2,316(at Others by Sub Boiler) = 498,395 (kg/year)

F.C. in cruising for departure = 193,012(at Private Wharf by Main Diesel)  
 + 4,453(at Others by Main Diesel) + 37,876(at Private Wharf by Sub Diesel)  
 + 870(at Others by Sub Diesel) + 100,867(at Private Wharf by Sub Boiler)  
 + 2,316(at Others by Sub Boiler) = 339,393 (kg/year)

SOx emission (of total vessels per year in cruising for arrival and departure at all wharf in Bangkok Port)

$$=16,945 + 11,539 =28,484 \text{ (kg/year)}$$

SOx E. in cruising for arrival = 9,708(at Private Wharf by Main Diesel)  
 + 151(at Others by Main Diesel) + 1,905(at Private Wharf by Sub Diesel)  
 + 30(at Others by Sub Diesel) + 5,073(at Private Wharf by Sub Boiler)  
 + 79(at Others by Sub Boiler) = 16,945 (kg/year)

SOx E. in cruising for departure = 6,562(at Private Wharf by Main Diesel)  
 + 151(at Others by Main Diesel) + 1,288 (at Private Wharf by Sub Diesel)  
 + 30(at Others by Sub Diesel)+ 3,429(at Private Wharf by Sub Boiler)  
 + 79(at Others by Sub Boiler) = 11,539 (kg/year)

### (3) Total Emission from Vessels at Bangkok port

#### Liquid Bulk in Bangkok port (in loading and cruising):

Fuel Consumption (of total vessels per year in loading and cruising at all wharf in Bangkok Port) = 6,776,119 + 837,788 = 7,613,907 (kg/year) = 8 (kton/year)

SOx Emission (of total vessels per year in loading and cruising at all wharf in Bangkok Port) = 230,388 + 28,484 = 258,872 (kg/year) = 259 (ton/year)

### (4) Fishing Boat

#### Fishing boat in Samut Sakhon:

$$\begin{aligned} P \text{ ( Rated Power )} &= 165 \text{ (PS/engine)} \\ W \text{ (Fuel Consumption)} &= 0.21 * ( P*A)^{0.95} * T \\ &= 0.21 * (165 * 0.32)^{0.95} * 785 = 7,123.311 \text{ (kg/boat)} \\ S \text{ (SOx emission)} &= W * s * 1/100 * 64/32 \\ &= 7,123.311 * 0.0348 / 100 * 64 / 32 \\ &= 4.958 \text{ (kg/vessel)} \end{aligned}$$

Number of boats = 897 (boats/year)

$$\text{Fuel Consumption} = 897 * 7,123.311 = 6,389,610 \text{ (kg/year)} = 6.4 \text{ (kton/year)}$$

$$\text{SOx emission} = 897 * 4.958 = 4,447 \text{ (kg/year)} = 4.4 \text{ (ton/year)}$$

### (5) Small Boat ( Express Boat, Ferry Boat, Long-Tailed Boat )

#### Express boat

##### **Rapid Express Boat (Nonthaburi-BigC):**

$$P \text{ ( Rated Power )} = 33 * \text{GRT}^{0.61}$$

$$= 33 * 30^{0.61} = 262.759 \text{ (PS/engine)}$$

$$W \text{ (Fuel Consumption)} = 0.21 * ( P * A )^{0.95} * T$$

$$= 0.21 * (262.759 * 0.32)^{0.95} * 1 = 14.2 \text{ (kg/boat)}$$

$$S \text{ (SOx emission)} = W * s * 1/100 * 64/32$$

$$= 14.2 * 1.7 / 100 * 64 / 32$$

$$= 0.481 \text{ (kg/boat)}$$

$$\text{Number of trips} = 3,389 \text{ (trips/year)}$$

$$\text{Fuel Consumption} = 3,389 * 14.2 = 48,124 \text{ (kg/year)} = 0.05 \text{ (kton/year)}$$

$$\text{SOx emission} = 3,389 * 0.481 = 1636 \text{ (kg/year)} = 2 \text{ (ton/year)}$$

##### **Total Express Boat (Rapid Express + Normal Express):**

$$\text{Fuel Consumption} = 0.05 + 0.40 + 0.21 + 0.40 = 1 \text{ (kton/year)}$$

$$\text{SOx emission} = 2 + 14 + 7 + 14 = 37 \text{ (ton/year)}$$

#### Ferry boat

$$P \text{ ( Rated Power )} = 33 * \text{GRT}^{0.61}$$

$$= 33 * 40^{0.61} = 313.163 \text{ (PS/engine)}$$

$$W \text{ (Fuel Consumption)} = 0.21 * ( P * A )^{0.95} * T$$

$$= 0.21 * (313.163 * 0.32)^{0.95} * 0.08 = 1.393 \text{ (kg/boat)}$$

$$S \text{ (SOx emission)} = W * s * 1/100 * 64/32$$

$$= 1.393 * 1.7 / 100 * 64 / 32$$

$$= 0.047358 \text{ (kg/boat)}$$

$$\text{Number of trips} = 1,500,150 \text{ (trips/year)}$$

$$\text{Fuel Consumption} = 1,500,150 * 1.393 = 2,089,709 \text{ (kg/year)} = 2.1 \text{ (kton/year)}$$

$$\text{SOx emission} = 1,500,150 * 0.047358 = 71,044 \text{ (kg/year)} = 71 \text{ (ton/year)}$$

#### Long-Tailed boat

##### **Long-tailed Boat (Pak Kret - Bang Khuwad):**

$$P \text{ ( Rated Power )} = 1.88 * 108 = 202.413 \text{ (PS/engine)}$$

$$W \text{ (Fuel Consumption)} = 0.21 * ( P * A )^{0.95} * T$$

$$= 0.21 * (202.413 * 0.32)^{0.95} * 10/60 = 1.84030 \text{ (kg/boat)}$$

$$S \text{ (SOx emission)} = W * s * 1/100 * 64/32$$

$$= 1.84 * 0.034 / 100 * 64 / 32$$

$$= 0.00128 \text{ (kg/boat)}$$



Number of trips =  $42 * 365 = 15,330$  (trips/year)

Fuel Consumption =  $15,330 * 1.84030 = 28,212$  (kg/year) = 0.03 (kton/year)

SOx emission =  $15,330 * 0.00128 = 19.6$  (kg/year) = 0.02 (ton/year)

**Total Long-tailed Boat (1,415 trips/day):**

Fuel Consumption =  $0.03 + 0.16 + 0.13 + 0.06 + 0.05 + 0.39 + 0.20 + 0.04 + 0.02 + 0.51 + 0.05 + 0.02 + 0.14 + 0.11 + 0.09 + 0.01 + 0.07 + 0.15 = 2.24$  (kton/year)

SOx emission =  $0.02 + 0.11 + 0.09 + 0.04 + 0.04 + 0.27 + 0.14 + 0.02 + 0.01 + 0.36 + 0.04 + 0.01 + 0.10 + 0.08 + 0.06 + 0.01 + 0.05 + 0.10 = 1.56$  (ton/year)

#### 4.1.1.4 Aircraft

##### 1) Traffic Data and Estimated Emission

The annual aircraft movement and the estimated NO<sub>x</sub> and SO<sub>x</sub> emission of aircraft of the international airport in the Year 2000 are shown in Table 4.1.1.29.

Table 4.1.1.29(1) Annual Aircraft Movement in Year 2000 and NO<sub>x</sub>,SO<sub>x</sub> Emission

##### Bangkok International Airport

| Type of Aircraft | Year 2000(flights) |          |         | Emission Nox(tons) |                |          | Emission Sox(tons) |                |          |
|------------------|--------------------|----------|---------|--------------------|----------------|----------|--------------------|----------------|----------|
|                  | International      | Domestic | Total   | LTO cycle          | Takeoff+ Climb | Approach | LTO cycle          | Takeoff+ Climb | Approach |
| A-300            | 14,394             | 15,472   | 29,866  | 7,414.42           | 6,320.25       | 959.57   | 217.32             | 137.86         | 58.99    |
| A-310            | 4,210              | 4        | 4,214   | 1,138.00           | 952.39         | 162.29   | 28.96              | 17.97          | 8.17     |
| A-319            | 26                 |          | 26      | 7.02               | 5.88           | 1.00     | 0.18               | 0.11           | 0.05     |
| A-320            | 3,505              |          | 3,505   | 325.47             | 269.63         | 47.00    | 11.71              | 7.34           | 3.17     |
| A-321            | 196                |          | 196     | 18.20              | 15.08          | 2.63     | 0.65               | 0.41           | 0.18     |
| A-330            | 11,031             | 3,718    | 14,749  | 1,369.58           | 1,134.59       | 197.77   | 49.28              | 30.90          | 13.35    |
| A-340            | 6,827              |          | 6,827   | 633.95             | 525.18         | 91.55    | 22.81              | 14.30          | 6.18     |
| B-707            | 117                |          | 117     | 34.00              | 19.67          | 4.48     | 1.78               | 1.06           | 0.50     |
| B-717            | 315                |          | 315     | 91.54              | 52.95          | 12.05    | 4.79               | 2.86           | 1.36     |
| B-727            | 6                  |          | 6       | 0.57               | 0.46           | 0.08     | 0.03               | 0.02           | 0.01     |
| B-737            | 8,437              | 17,207   | 25,644  | 2,054.52           | 1,637.68       | 344.10   | 92.85              | 56.14          | 25.45    |
| B-747            | 8,506              | 44       | 8,550   | 9,429.60           | 8,268.40       | 1,013.41 | 242.69             | 151.03         | 66.74    |
| B-747SP          | 253                |          | 253     | 279.03             | 244.67         | 29.99    | 7.18               | 4.47           | 1.97     |
| B-747-400        | 23,886             | 809      | 24,695  | 27,235.56          | 23,881.65      | 2,927.03 | 700.95             | 436.23         | 192.76   |
| B-757            | 2,037              |          | 2,037   | 446.36             | 386.37         | 51.11    | 11.01              | 6.87           | 3.03     |
| B-767            | 7,491              |          | 7,491   | 1,966.87           | 1,651.20       | 282.60   | 55.97              | 35.43          | 15.77    |
| B-777            | 16,988             | 1,027    | 18,015  | 4,730.09           | 3,970.94       | 679.63   | 134.60             | 85.20          | 37.92    |
| Beech350         |                    | 399      | 399     | 1.24               | 0.63           | 0.52     | 0.10               | 0.05           | 0.03     |
| F-28             | 702                | 1,160    | 1,862   | 89.78              | 73.24          | 14.10    | 4.67               | 2.67           | 1.29     |
| MD-11            | 7,734              | 99       | 7,833   | 4,699.35           | 4,006.50       | 610.94   | 136.23             | 88.58          | 36.02    |
| L-1011           | 483                |          | 483     | 281.81             | 245.21         | 31.53    | 7.10               | 4.30           | 1.96     |
| DC-10            | 1,337              |          | 1,337   | 806.80             | 699.25         | 93.95    | 19.97              | 12.51          | 5.45     |
| BAE-146          | 376                |          | 376     | 28.75              | 21.39          | 5.91     | 1.77               | 1.08           | 0.48     |
| TU-154           | 18                 |          | 18      | 1.70               | 1.38           | 0.25     | 0.09               | 0.05           | 0.02     |
| IL-62            | 70                 |          | 70      | 77.20              | 67.69          | 8.30     | 1.99               | 1.24           | 0.55     |
| IL-76            | 9                  |          | 9       | 0.69               | 0.51           | 0.14     | 0.04               | 0.03           | 0.01     |
| IL-86            | 20                 |          | 20      | 22.06              | 19.34          | 2.37     | 0.57               | 0.35           | 0.16     |
| IL-96            | 88                 |          | 88      | 97.05              | 85.10          | 10.43    | 2.50               | 1.55           | 0.69     |
| ATR-42           | 677                | 864      | 1,541   | 101.37             | 83.73          | 14.81    | 2.53               | 1.53           | 0.71     |
| ATR-72           | 3,906              | 12,338   | 16,244  | 1,068.51           | 882.59         | 156.07   | 26.71              | 16.15          | 7.44     |
| DO-328           |                    | 18       | 18      | 0.06               | 0.03           | 0.02     | 0.00               | 0.00           | 0.00     |
| AN-26/M          | 79                 |          | 79      | 5.20               | 4.29           | 0.76     | 0.13               | 0.08           | 0.04     |
| AN-12/M          | 263                |          | 263     | 17.30              | 14.29          | 2.53     | 0.43               | 0.26           | 0.12     |
| Others           | 746                | 2324     | 3070    | 9.56               | 4.87           | 4.01     | 0.78               | 0.37           | 0.26     |
| Total            | 124,733            | 55,483   | 180,216 | 64,483             | 55,547         | 7,763    | 1,788              | 1,119          | 491      |

Note: For ATMOS2, height of Climb-out and Approach is 6000m.

Table 4.1.1.29(2) Annual Aircraft Movement in Year 2000 and NOx,SOx Emission

Chiang mai International Airport

| Type of Aircraft | Year 2000(flights) |          |        | Emission Nox(tons) |                |          | Emission Sox(tons) |                |          |
|------------------|--------------------|----------|--------|--------------------|----------------|----------|--------------------|----------------|----------|
|                  | Internati-onal     | Domestic | Total  | LTO cycle          | Takeoff+ Climb | Approach | LTO cycle          | Takeoff+ Climb | Approach |
| A-300            | 424                | 4,371    | 4,795  | 1,190.39           | 1,014.72       | 154.06   | 34.89              | 22.13          | 9.47     |
| A-310            | 2                  |          | 2      | 0.54               | 0.45           | 0.08     | 0.01               | 0.01           | 0.00     |
| A-319            | 297                |          | 297    | 80.21              | 67.12          | 11.44    | 2.04               | 1.27           | 0.58     |
| A-320            | 91                 |          | 91     | 8.45               | 7.00           | 1.22     | 0.30               | 0.19           | 0.08     |
| A-330            |                    | 2,354    | 2,354  | 218.59             | 181.08         | 31.57    | 7.86               | 4.93           | 2.13     |
| ATR-42           | 446                | 10       | 456    | 30.00              | 24.78          | 4.38     | 0.75               | 0.45           | 0.21     |
| ATR-72           |                    | 1,529    | 1,529  | 100.58             | 83.08          | 14.69    | 2.51               | 1.52           | 0.70     |
| B-737            | 464                | 4,559    | 5,023  | 402.43             | 320.78         | 67.40    | 18.19              | 11.00          | 4.98     |
| B-744            | 4                  | 130      | 134    | 147.79             | 129.59         | 15.88    | 3.80               | 2.37           | 1.05     |
| B-747            | 6                  | 8        | 14     | 15.44              | 13.54          | 1.66     | 0.40               | 0.25           | 0.11     |
| B-747SP          | 2                  |          | 2      | 2.21               | 1.93           | 0.24     | 0.06               | 0.04           | 0.02     |
| B-767            | 68                 |          | 68     | 17.85              | 14.99          | 2.57     | 0.51               | 0.32           | 0.14     |
| B-777            |                    | 391      | 391    | 102.66             | 86.19          | 14.75    | 2.92               | 1.85           | 0.82     |
| F-28             |                    | 86       | 86     | 4.15               | 3.38           | 0.65     | 0.22               | 0.12           | 0.06     |
| F-70             | 30                 |          | 30     | 1.72               | 1.44           | 0.23     | 0.08               | 0.05           | 0.02     |
| MD-11            | 4                  | 56       | 60     | 36.00              | 30.69          | 4.68     | 1.04               | 0.68           | 0.28     |
| L-1011           | 26                 |          | 26     | 15.17              | 13.20          | 1.70     | 0.38               | 0.23           | 0.11     |
| L-1011           | 2                  |          | 2      | 1.17               | 1.02           | 0.13     | 0.03               | 0.02           | 0.01     |
| Others           | 105                | 528      | 633    | 1.97               | 1.00           | 0.83     | 0.16               | 0.08           | 0.05     |
| Total            | 1,971              | 14,022   | 15,993 | 2,377              | 1,996          | 328      | 76                 | 47             | 21       |

Note: For ATMOS2, height of Climb-out and Approach is 6000m.

Hat Yai International Airport

| Type of Aircraft | Year 2000(flights) |          |        | Emission Nox(tons) |                |          | Emission Sox(tons) |                |          |
|------------------|--------------------|----------|--------|--------------------|----------------|----------|--------------------|----------------|----------|
|                  | Internati-onal     | Domestic | Total  | LTO cycle          | Takeoff+ Climb | Approach | LTO cycle          | Takeoff+ Climb | Approach |
| A-300            | 1,502              | 1,262    | 2,764  | 686.18             | 584.92         | 88.80    | 20.11              | 12.76          | 5.46     |
| A-319            | 108                |          | 108    | 29.17              | 24.41          | 4.16     | 0.74               | 0.46           | 0.21     |
| A-320            | 10                 |          | 10     | 0.93               | 0.77           | 0.13     | 0.03               | 0.02           | 0.01     |
| A-330            |                    | 2        | 2      | 0.19               | 0.15           | 0.03     | 0.01               | 0.00           | 0.00     |
| ATR-42           |                    | 2        | 2      | 0.13               | 0.11           | 0.02     | 0.00               | 0.00           | 0.00     |
| B-737            | 346                | 3,317    | 3,663  | 293.47             | 233.93         | 49.15    | 13.26              | 8.02           | 3.64     |
| B-747            |                    | 4        | 4      | 4.41               | 3.87           | 0.47     | 0.11               | 0.07           | 0.03     |
| DC-10            | 6                  |          | 6      | 3.62               | 3.14           | 0.42     | 0.09               | 0.06           | 0.02     |
| F-70             | 102                |          | 102    | 5.86               | 4.91           | 0.77     | 0.27               | 0.16           | 0.07     |
| MD-11            | 36                 |          | 36     | 21.60              | 18.41          | 2.81     | 0.63               | 0.41           | 0.17     |
| Lear Jet         | 3,620              |          | 3,620  | 174.55             | 142.39         | 27.40    | 9.09               | 5.18           | 2.50     |
| F-28             | 190                |          | 190    | 9.16               | 7.47           | 1.44     | 0.48               | 0.27           | 0.13     |
| L-1011           | 8                  |          | 8      | 4.67               | 4.06           | 0.52     | 0.12               | 0.07           | 0.03     |
| Others           | 96                 | 329      | 425    | 1.32               | 0.67           | 0.56     | 0.11               | 0.05           | 0.04     |
| Total            | 6,024              | 4,916    | 10,940 | 1,235              | 1,029          | 177      | 45                 | 28             | 12       |

Note: For ATMOS2, height of Climb-out and Approach is 6000m.

Table 4.1.1.29(3) Annual Aircraft Movement in Year 2000 and NOx,SOx Emission

**Phuket International Airport**

| Type of Aircraft | Year 2000(flights) |          |        | Emission Nox(tons) |                |          | Emission Sox(tons) |                |          |
|------------------|--------------------|----------|--------|--------------------|----------------|----------|--------------------|----------------|----------|
|                  | International      | Domestic | Total  | LTO cycle          | Takeoff+ Climb | Approach | LTO cycle          | Takeoff+ Climb | Approach |
| A-300            | 3,187              | 5,124    | 8,311  | 2,063.26           | 1,758.78       | 267.02   | 60.48              | 38.36          | 16.42    |
| A-310            | 12                 |          | 12     | 3.24               | 2.71           | 0.46     | 0.08               | 0.05           | 0.02     |
| A-319            | 371                |          | 371    | 100.19             | 83.85          | 14.29    | 2.55               | 1.58           | 0.72     |
| A-320            | 1,350              |          | 1,350  | 125.36             | 103.85         | 18.10    | 4.51               | 2.83           | 1.22     |
| A-321            | 276                |          | 276    | 25.63              | 21.23          | 3.70     | 0.92               | 0.58           | 0.25     |
| A-330            | 1,251              | 924      | 2,175  | 201.97             | 167.31         | 29.17    | 7.27               | 4.56           | 1.97     |
| ATR-42           | 42                 | 77       | 119    | 7.83               | 6.47           | 1.14     | 0.20               | 0.12           | 0.05     |
| ATR-72           | 53                 | 1,519    | 1,572  | 103.40             | 85.41          | 15.10    | 2.58               | 1.56           | 0.72     |
| B-737            | 1,866              | 2,406    | 4,272  | 342.26             | 272.82         | 57.32    | 15.47              | 9.35           | 4.24     |
| B-747            | 73                 | 655      | 728    | 802.89             | 704.02         | 86.29    | 20.66              | 12.86          | 5.68     |
| B-757            | 386                |          | 386    | 84.58              | 73.21          | 9.68     | 2.09               | 1.30           | 0.57     |
| B-767            | 870                |          | 870    | 228.43             | 191.77         | 32.82    | 6.50               | 4.11           | 1.83     |
| B-777            | 895                | 604      | 1,499  | 393.58             | 330.42         | 56.55    | 11.20              | 7.09           | 3.16     |
| DC-10            | 136                |          | 136    | 82.07              | 71.13          | 9.56     | 2.03               | 1.27           | 0.55     |
| F-28             | 106                |          | 106    | 5.11               | 4.17           | 0.80     | 0.27               | 0.15           | 0.07     |
| F-70             | 75                 |          | 75     | 4.31               | 3.61           | 0.57     | 0.20               | 0.11           | 0.05     |
| IL-62            | 10                 |          | 10     | 11.03              | 9.67           | 1.19     | 0.28               | 0.18           | 0.08     |
| IL-86            | 5                  |          | 5      | 5.51               | 4.84           | 0.59     | 0.14               | 0.09           | 0.04     |
| MD-11            | 4                  | 20       | 24     | 14.40              | 12.28          | 1.87     | 0.42               | 0.27           | 0.11     |
| MD-90            | 188                |          | 188    | 112.79             | 96.16          | 14.66    | 3.27               | 2.13           | 0.86     |
| Others           | 316                | 521      | 837    | 2.61               | 1.33           | 1.09     | 0.21               | 0.10           | 0.07     |
| Total            | 11,472             | 11,850   | 23,322 | 4,720              | 4,005          | 622      | 141                | 89             | 39       |

Note: For ATMOS2, height of Climb-out and Approach is 6000m.

**Chiang Rai International Airport**

| Type of Aircraft | Year 2000(flights) |          |       | Emission Nox(tons) |                |          | Emission Sox(tons) |                |          |
|------------------|--------------------|----------|-------|--------------------|----------------|----------|--------------------|----------------|----------|
|                  | International      | Domestic | Total | LTO cycle          | Takeoff+ Climb | Approach | LTO cycle          | Takeoff+ Climb | Approach |
| A-300            |                    | 1,328    | 1,328 | 329.68             | 281.03         | 42.67    | 9.66               | 6.13           | 2.62     |
| A-330            |                    | 390      | 390   | 36.22              | 30.00          | 5.23     | 1.30               | 0.82           | 0.35     |
| B-737            | 85                 | 3,207    | 3,292 | 263.75             | 210.23         | 44.17    | 11.92              | 7.21           | 3.27     |
| B-747            |                    | 4        | 4     | 4.41               | 3.87           | 0.47     | 0.11               | 0.07           | 0.03     |
| B-747-400        |                    | 2        | 2     | 2.21               | 1.93           | 0.24     | 0.06               | 0.04           | 0.02     |
| B-757            | 6                  |          | 6     | 1.31               | 1.14           | 0.15     | 0.03               | 0.02           | 0.01     |
| B-777            |                    | 4        | 4     | 1.05               | 0.88           | 0.15     | 0.03               | 0.02           | 0.01     |
| F-28             | 76                 |          | 76    | 3.66               | 2.99           | 0.58     | 0.19               | 0.11           | 0.05     |
| MD-11            | 2                  |          | 2     | 1.20               | 1.02           | 0.16     | 0.03               | 0.02           | 0.01     |
| Others           | 0                  | 93       | 93    | 0.29               | 0.15           | 0.12     | 0.02               | 0.01           | 0.01     |
| Total            | 169                | 5,028    | 5,197 | 644                | 533            | 94       | 23                 | 14             | 6        |

Note: For ATMOS2, height of Climb-out and Approach is 6000m.



The annual aircraft movement and the estimated NOx and SOx emission of aircraft of the local airport in the Year 2000 are shown in Table 4.1.1.30.

Table 4.1.1.30 Annual Aircraft Movement in Year 2000 and NOx,SOx Emission

Local Airport

| Airport             | Annual Aircraft Movement in Year 2000 |           |            |        |        | Emission Nox(LTO Cycle) (tons) |           |            |        |       | Emission Sox(LTO Cycle) (tons) |           |            |        |       |
|---------------------|---------------------------------------|-----------|------------|--------|--------|--------------------------------|-----------|------------|--------|-------|--------------------------------|-----------|------------|--------|-------|
|                     | Medium Jet                            | Small Jet | Turbo Prop | Stol   | Total  | Medium Jet                     | Small Jet | Turbo Prop | Stol   | Total | Medium Jet                     | Small Jet | Turbo Prop | Stol   | Total |
|                     | A-300                                 | B-737     | ATR-72     | DO-328 |        | A-300                          | B-737     | ATR-72     | DO-328 |       | A-300                          | B-737     | ATR-72     | DO-328 |       |
| Buri Ram            |                                       |           | 664        |        | 664    |                                |           | 44         |        | 44    |                                |           | 1.1        |        | 1.1   |
| Chumphon            |                                       |           |            | 446    | 446    |                                |           |            | 1      | 1     |                                |           |            | 0.1    | 0.1   |
| Hua Hin             |                                       |           | 16,163     | 92     | 16,255 |                                |           | 1,063      | 0      | 1,063 |                                |           | 26.6       | 0.0    | 26.6  |
| Khon Kaen           |                                       | 3,946     |            |        | 3,946  |                                | 316       |            |        | 316   |                                | 14.3      |            |        | 14.3  |
| Krabi               |                                       |           | 2,752      |        | 2,752  |                                |           | 181        |        | 181   |                                |           | 4.5        |        | 4.5   |
| Korat               | 1,324                                 | 378       |            |        | 1,702  | 329                            | 30        |            |        | 359   | 9.6                            | 1.4       |            |        | 11.0  |
| Lampang             |                                       | 1,885     |            |        | 1,885  |                                | 151       |            |        | 151   |                                | 6.8       |            |        | 6.8   |
| Mae Hong Son        |                                       | 325       | 2,439      |        | 2,764  |                                | 26        | 160        |        | 186   |                                | 1.2       | 4.0        |        | 5.2   |
| Mae Sot             |                                       |           | 1,082      |        | 1,082  |                                |           | 71         |        | 71    |                                |           | 1.8        |        | 1.8   |
| Nakhon Phanom       |                                       | 776       |            |        | 776    |                                | 62        |            |        | 62    |                                | 2.8       |            |        | 2.8   |
| Nakhon Si Thammarat |                                       | 87        | 819        |        | 906    |                                | 7         | 54         |        | 61    |                                | 0.3       | 1.3        |        | 1.7   |
| Nan                 |                                       | 104       | 1,250      |        | 1,354  |                                | 8         | 82         |        | 91    |                                | 0.4       | 2.1        |        | 2.4   |
| Narathiwat          |                                       | 94        | 1,567      |        | 1,661  |                                | 7         | 103        |        | 111   |                                | 0.3       | 2.6        |        | 2.9   |
| Pattani             |                                       |           | 24         |        | 24     |                                |           | 2          |        | 2     |                                |           | 0.0        |        | 0.0   |
| Pechabun            |                                       |           | 516        |        | 516    |                                |           | 34         |        | 34    |                                |           | 0.8        |        | 0.8   |
| Phitsanulok         |                                       | 6,535     | 483        |        | 7,018  |                                | 524       | 32         |        | 555   |                                | 23.7      | 0.8        |        | 24.5  |
| Phrae               |                                       | 215       | 1,627      |        | 1,842  |                                | 17        | 107        |        | 124   |                                | 0.8       | 2.7        |        | 3.5   |
| Ranong              |                                       |           | 1,054      |        | 1,054  |                                |           | 69         |        | 69    |                                |           | 1.7        |        | 1.7   |
| Roi Et              |                                       | 656       |            |        | 656    |                                | 53        |            |        | 53    |                                | 2.4       |            |        | 2.4   |
| Sakhon Nakhon       |                                       | 884       |            |        | 884    |                                | 71        |            |        | 71    |                                | 3.2       |            |        | 3.2   |
| Surat Thani         | 271                                   | 1,417     | 396        |        | 2,084  | 67                             | 114       | 26         |        | 207   | 2.0                            | 5.1       | 0.7        |        | 7.8   |
| Sukhothai           |                                       | 1,602     |            |        | 1,602  |                                | 128       |            |        | 128   |                                | 5.8       |            |        | 5.8   |
| Samui               |                                       | 12,306    |            |        | 12,306 |                                | 986       |            |        | 986   |                                | 44.6      |            |        | 44.6  |
| Tak                 |                                       |           | 15         |        | 15     |                                |           | 1          |        | 1     |                                |           | 0.0        |        | 0.0   |
| Trang               |                                       | 190       | 2,394      |        | 2,584  |                                | 15        | 157        |        | 173   |                                | 0.7       | 3.9        |        | 4.6   |
| Ubon Ratchathani    | 1,962                                 | 480       |            |        | 2,442  | 487                            | 38        |            |        | 526   | 14.3                           | 1.7       |            |        | 16.0  |
| Udon Thani          | 1,819                                 | 537       |            |        | 2,356  | 452                            | 43        |            |        | 495   | 13.2                           | 1.9       |            |        | 15.2  |
| Utapao              |                                       | 2,740     |            |        | 2,740  |                                | 220       |            |        | 220   |                                | 9.9       |            |        | 9.9   |
| Total               | 5,376                                 | 35,156    | 33,246     | 538    | 74,316 | 1,335                          | 2,817     | 2,187      | 2      | 6,340 | 39.1                           | 127.3     | 54.7       | 0.1    | 221.2 |

Note: For ATMOS2, height of Climb-out and Approach is 6000m.

Source: Annual Aircraft Movement in Year 2000: Department of Aviation, Ministry of Transportation and Communication

## 2) Parameter for Emission Calculation

The share of aircraft type in local airport used for annual aircraft movement definition are shown in Table 4.1.1.31, which are based on the report of Department of Aviation “the study on Airport Development Master Plan in The Kingdom of Thailand”.

Table 4.1.1.31 Share of Aircraft Type in Local Airport

| Local airport           | Medium Jet | Small Jet | Turbo Prop | Stol |
|-------------------------|------------|-----------|------------|------|
| Lampang                 | 0%         | 100%      | 0%         | 0%   |
| Mae Hong Son            | 0%         | 12%       | 88%        | 0%   |
| Mae Sot                 | 0%         | 0%        | 100%       | 0%   |
| Nan                     | 0%         | 8%        | 92%        | 0%   |
| Phitsanulok             | 0%         | 93%       | 7%         | 0%   |
| Phrae                   | 0%         | 12%       | 88%        | 0%   |
| Tak                     | 0%         | 0%        | 100%       | 0%   |
| Khon Kaen               | 0%         | 100%      | 0%         | 0%   |
| Loei                    | 0%         | 0%        | 0%         | 100% |
| Nakhon Panom            | 0%         | 100%      | 0%         | 0%   |
| Nakon Ratchasima(korat) | 78%        | 22%       | 0%         | 0%   |
| Sakon Nakhon            | 0%         | 100%      | 0%         | 0%   |
| Ubon Ratchathani        | 80%        | 20%       | 0%         | 0%   |
| Udon Thani              | 77%        | 23%       | 0%         | 0%   |
| Hua Hin                 | 0%         | 0%        | 99%        | 1%   |
| Nakhon Si Thammarat     | 0%         | 10%       | 90%        | 0%   |
| Narathiwat              | 0%         | 6%        | 94%        | 0%   |
| Pattani                 | 0%         | 0%        | 100%       | 0%   |
| Ranong                  | 0%         | 0%        | 100%       | 0%   |
| Surat Thani             | 13%        | 68%       | 19%        | 0%   |
| Trang                   | 0%         | 7%        | 93%        | 0%   |

Source : The study on Airport Development Master Plan in The Kingdom of Thailand (1995, JICA, Department of Aviation)





The equivalent type of aircraft is shown in Table 4.1.1.32, which is used in order to define the emission factor of aircraft.

Table 4.1.1.32 Equivalent Type of Aircraft

| Type of Aircraft | Equivalent type of aircraft | Type of Aircraft | Equivalent type of aircraft |
|------------------|-----------------------------|------------------|-----------------------------|
| A-300            | A-300                       | MD-11            | MD-11                       |
| A-310            | A-310                       | L-1011           | L-1011                      |
| A-319            | A-310                       | DC-10            | DC-10                       |
| A-320            | A-320                       | BAE-146          | BAE-146                     |
| A-321            | A-320                       | TU-154           | B-727                       |
| A-330            | A-320                       | IL-62            | B-747                       |
| A-340            | A-320                       | IL-76            | BAE-146                     |
| B-707            | B-707                       | IL-86            | B-747                       |
| B-717            | B-717                       | IL-96            | B-747                       |
| B-727            | B-727                       | ATR-42           | DHC-6                       |
| B-737            | B-737                       | ATR-72           | DHC-6                       |
| B-747            | B-747                       | DO-328           | Beech350                    |
| B-747SP          | B-747                       | AN-26/M          | DHC-6                       |
| B-747-400        | B-747                       | AN-12/M          | DHC-6                       |
| B-757            | B-757                       | F-70             | F-100                       |
| B-767            | B-767                       | Lear Jet         | F-28                        |
| B-777            | B-767                       | MD-90            | MD-11                       |
| Beech350         | Beech350                    | B-744            | B-747                       |
| F-28             | F-28                        | Others           | Beech350                    |

Note: JICA Study Team

### 3) Sample Calculation

A sample calculation is provided below;

#### **SOx emission of A-300 in LTO cycle in Bangkok International Airport :**

Emission Factor of LTO cycle(kg/LTO cycle)

$$\begin{aligned}
 &= \text{TIM}_{jk} (\text{Time in mode}) \times \text{EF}_{ijk} (\text{Emission Load in mode}) \times \text{Number of Engine} \\
 &= (0.7 * 0.1530 + 17.9 * 0.1231 + 24 * 0.0412 + (19+7) * 0.0132) * 2 \\
 &= 7.2766(\text{kg/LTO cycle})
 \end{aligned}$$

Number of Flights = 29,866 (flights/year)

$$\begin{aligned}
 \text{SOx Emission of A-300 in LTO cycle} &= 7.2766 * 29,866 = 217,323(\text{kg/year}) = \\
 &217.32(\text{ton/year})
 \end{aligned}$$

#### **Total SOx emission in LTO cycle in Bangkok International Airport :**

Total SOx Emission in LTO cycle

$$\begin{aligned}
 &= 217.32 + 28.96(\text{for A-310}) + 0.18(\text{for A-319}) + \dots + 0.43(\text{for AN-12/M}) \\
 &\quad + 0.78(\text{for others}) \\
 &= 1,788 (\text{ton/year})
 \end{aligned}$$

## **4.1.2 Mobile Source Inventory of the Year 2000 in BMR**

### **4.1.2.1 Vehicle**

#### **1) Traffic Data**

Traffic volumes of Year 2000 by link in BMR, which are estimated using the Airviro database updated based on the traffic assignment data in URMAL report of OCMLT, are shown in Figure 4.1.2.1.

Share of bus and heavy truck of Year 2000 by link in BMR is shown in Figure 4.1.2.2.

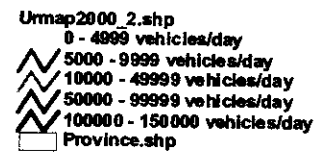
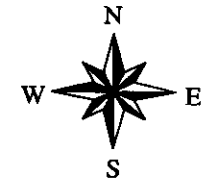


Figure 4.1.2.1 Traffic Volume Distribution Map in BMR in Year 2000

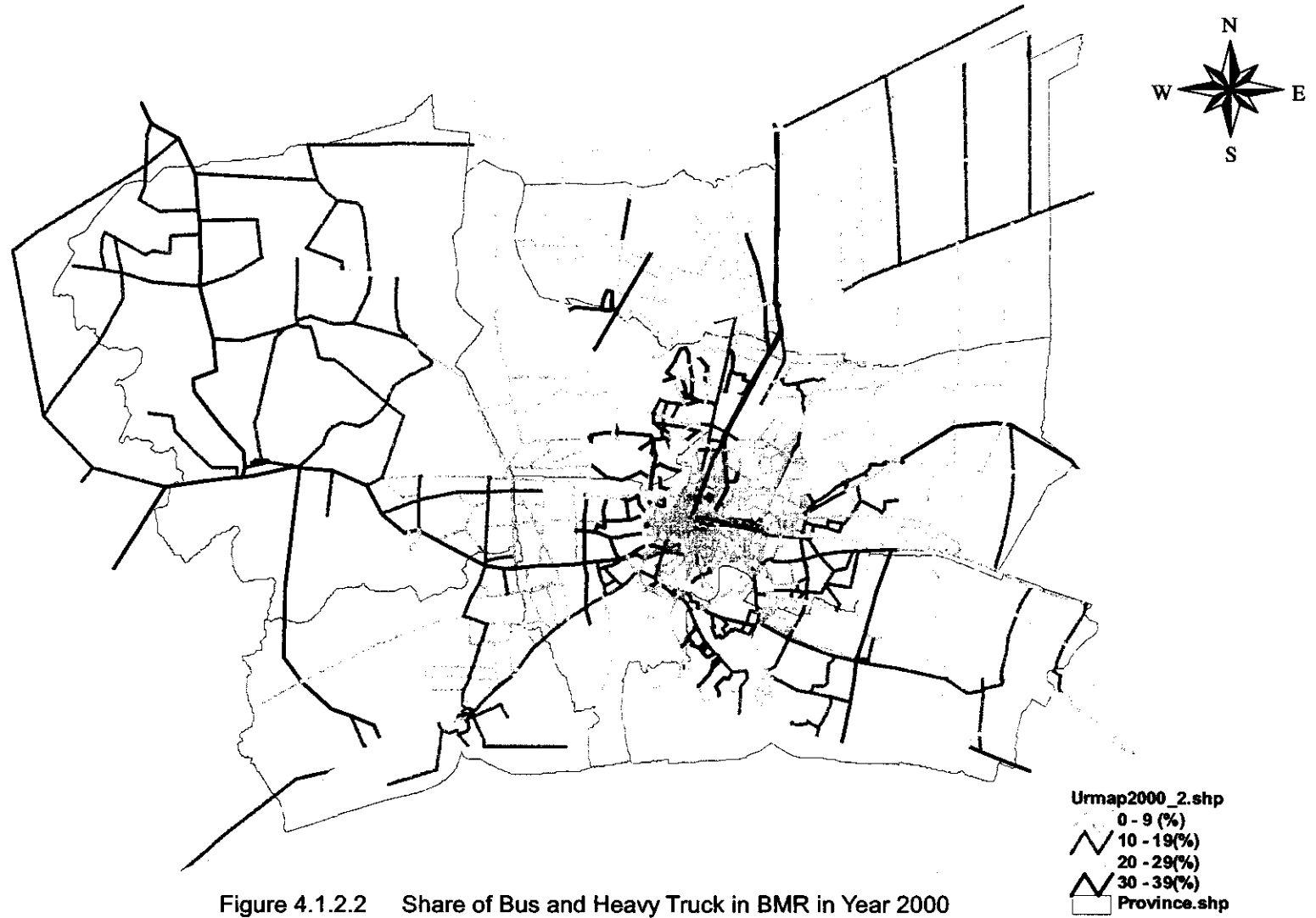


Figure 4.1.2.2 Share of Bus and Heavy Truck in BMR in Year 2000

## 2) Emission Factor

The NO<sub>x</sub> emission factors were calculated from the quadratics approximated to the calculation results of MOBILE 5a, as shown in Table 4.1.2.1 and Figure 4.1.2.3.

Table 4.1.2.1 Coefficients of NO<sub>x</sub> Emission Factor Formulas of the vehicles at 2000

EF = a V<sup>2</sup> + b V + c  
 EF : NO<sub>x</sub> Emission Factor (g/km)    V : Vehicle Speed (km/h)

|   | LDGV    | Taxi(G) | Taxi(L) | LDDV    | LDDT    | H-Truck | Bus     | MC       |
|---|---------|---------|---------|---------|---------|---------|---------|----------|
| a | 0.0003  | 0.0003  | 8E-05   | 0.0004  | 0.0005  | 0.01    | 0.01    | 0.000008 |
| b | -0.0259 | -0.0236 | -0.0072 | -0.0471 | -0.0555 | -1.0915 | -1.0915 | -0.0002  |
| c | +2.1152 | +2.0828 | 0.632   | +2.4154 | +2.8445 | 55.992  | 55.992  | 0.0633   |

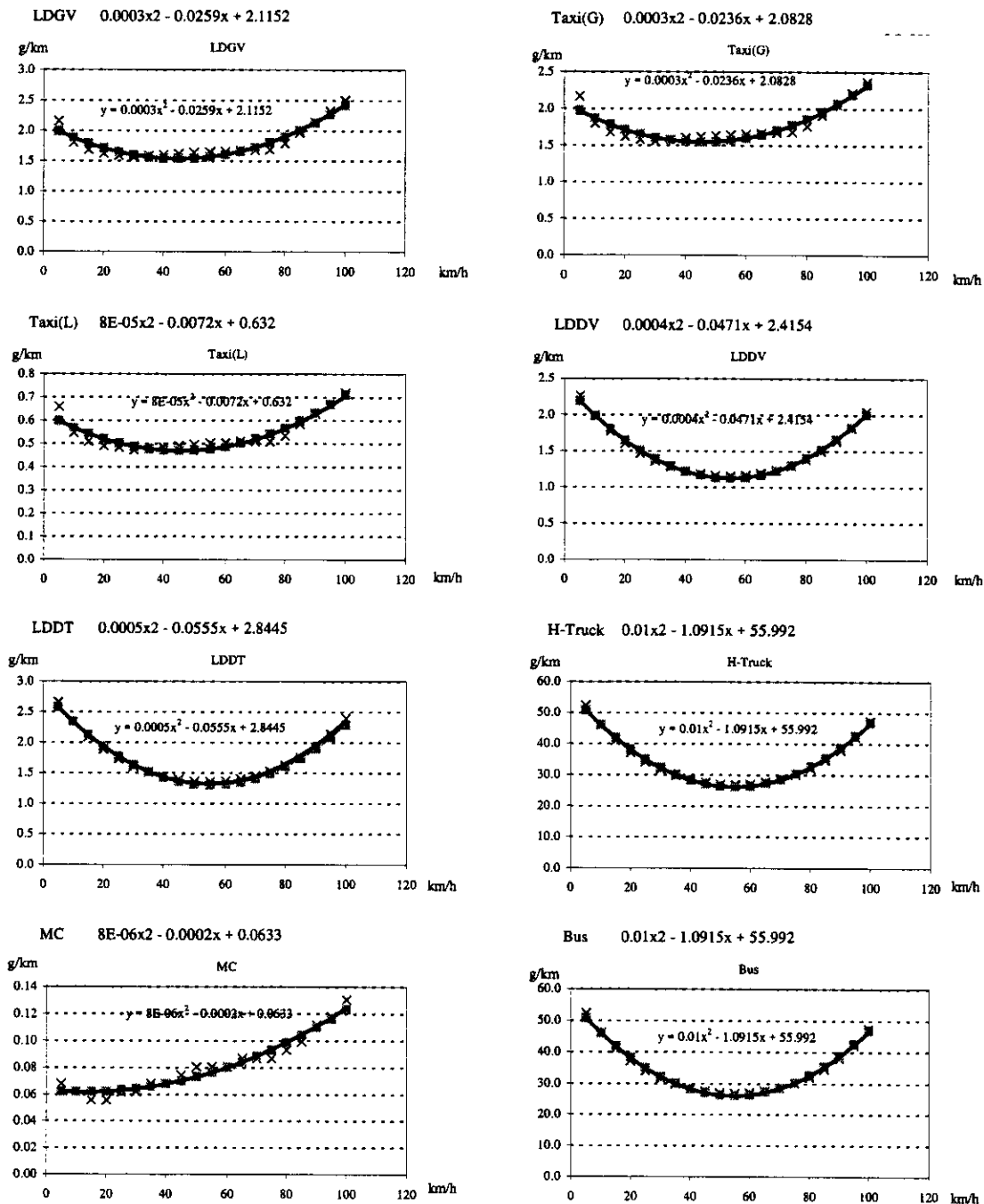


Figure 4.1.2.3 NO<sub>x</sub> Emission Factor of the vehicles at 2000

### 3) Estimated Emission

The estimated NOx and SOx emission of vehicle of the Year 2000 in BMR are shown in Table 4.1.2.2 – 4.1.2.3.

**Table 4.1.2.2 NOx Emission of Vehicle in BMR in Year 2000**

| Province      | NOx Emission (ton/year) |            |            |              |               |                |                |            |            |                |
|---------------|-------------------------|------------|------------|--------------|---------------|----------------|----------------|------------|------------|----------------|
|               | PS(G)                   | Taxi (G)   | Taxi (LPG) | PS(D)        | Light Truck   | Bus            | Heavy Truck    | MC         | Tuk-Tuk    | total          |
| Bangkok       | 18,467                  | 526        | 112        | 2,430        | 5,180         | 48,249         | 69,778         | 223        | 86         | 145,052        |
| Nonthaburi    | 2,411                   | 70         | 15         | 401          | 725           | 8,211          | 11,476         | 30         | 11         | 23,350         |
| Pathum Thani  | 4,943                   | 146        | 30         | 809          | 1,194         | 15,540         | 20,487         | 64         | 21         | 43,234         |
| Samut Prakan  | 3,795                   | 111        | 23         | 499          | 1,062         | 10,843         | 15,842         | 53         | 19         | 32,248         |
| Nakhon Pathom | 2,923                   | 84         | 18         | 593          | 2,288         | 13,670         | 26,169         | 83         | 32         | 45,859         |
| Samut Sakhon  | 1,777                   | 52         | 11         | 306          | 689           | 5,566          | 8,301          | 35         | 12         | 16,749         |
| <b>Total</b>  | <b>34,315</b>           | <b>990</b> | <b>208</b> | <b>5,039</b> | <b>11,138</b> | <b>102,080</b> | <b>152,053</b> | <b>488</b> | <b>181</b> | <b>306,492</b> |

**Table 4.1.2.3 SOx Emission of Vehicle in BMR in Year 2000**

| Province      | SOx Emission (ton/year) |           |            |             |            |             |            |              |
|---------------|-------------------------|-----------|------------|-------------|------------|-------------|------------|--------------|
|               | PS(G)                   | Taxi (G)  | PS(D)      | Light Truck | Bus        | Heavy Truck | MC         | total        |
| Bangkok       | 733                     | 20        | 66         | 181         | 233        | 390         | 68         | 1,691        |
| Nonthaburi    | 85                      | 2         | 10         | 24          | 38         | 63          | 9          | 232          |
| Pathum Thani  | 143                     | 4         | 20         | 37          | 64         | 103         | 16         | 388          |
| Samut Prakan  | 122                     | 3         | 13         | 35          | 47         | 83          | 15         | 318          |
| Nakhon Pathom | 111                     | 3         | 16         | 80          | 69         | 150         | 24         | 454          |
| Samut Sakhon  | 55                      | 2         | 8          | 23          | 24         | 44          | 9          | 165          |
| <b>Total</b>  | <b>1,250</b>            | <b>35</b> | <b>132</b> | <b>380</b>  | <b>476</b> | <b>833</b>  | <b>140</b> | <b>3,247</b> |

#### 4.1.2.2 Railway

##### 1) Sample Calculation

A sample calculation is provided below;

##### Section N1: Bangkok-Bang Sue Junction in Northern Line

$$\begin{aligned} \text{NOx Emission (ton/year)} &= \text{NOx emission factor (kg/km/operation)} \\ &\quad * \text{distance (km)} * \text{operation (operation/year)/1000} \\ &= 0.35 * 7.47 * 169 (\text{operation/day}) * 365 (\text{day})/1000 \\ &= 161 (\text{ton/year}) \end{aligned}$$

#### 4.1.2.3 Ship

##### 1) Traffic Data

The number of calls of vessel of the Year 2000 by port in BMR is shown in Table 4.1.2.4.

Table 4.1.2.4 Number of Calls of Vessel in Arrival & Departure in BMR in Year 2000

Unit: calls of vessel/year

| Port         |                    | Liquid Bulk | Solid Bulk | Fully Cellular Container | Semi-Container | Ro-Ro | Conventional | Others | Total |
|--------------|--------------------|-------------|------------|--------------------------|----------------|-------|--------------|--------|-------|
| Bangkok      | Klong Toey Wharf   | 0           | 37         | 2,447                    | 246            | 92    | 862          | 10     | 3,694 |
|              | Klong Toey Pole    | 0           | 52         | 0                        | 1              | 0     | 208          | 0      | 261   |
|              | Bang Hua Suer Pole | 0           | 38         | 0                        | 8              | 0     | 129          | 3      | 178   |
|              | Sathupradit Buoy   | 0           | 277        | 0                        | 0              | 0     | 197          | 18     | 492   |
|              | Tmn Wharf          | 0           | 13         | 0                        | 0              | 0     | 20           | 25     | 58    |
|              | Private Wharves    | 957         | 750        | 1,110                    | 116            | 26    | 1,116        | 290    | 4,365 |
|              | Others             | 16          | 19         | 13                       | 5              | 0     | 21           | 12     | 86    |
| Samut Sakhon | Mahachai           | 3           | 61         | 0                        | 0              | 0     | 9            | 97     | 170   |
|              | Thachalom          | 0           | 0          | 0                        | 0              | 0     | 1            | 0      | 1     |
|              | Others             | 9           | 12         | 0                        | 0              | 0     | 12           | 137    | 170   |
|              | Total              | 985         | 1259       | 3,570                    | 376            | 118   | 2,575        | 592    | 9,475 |

Source: "Thailand Shipping Statistics 2000 Ship Movement Series" (June 2001, Office of the Maritime Promotion Commission, Ministry of Transport and Communications)

Note: The number of calls shows the total sum of calls in arrival and departure.

Vessels in Samut prakan are included in Bangkok.

Ro-Ro : cargo ship for vehicles.

## 2) Estimated Emission

The estimated NOx and SOx emissions of vessel by port of the Year 2000 in BMR are shown in Table 4.1.2.5 - 4.1.2.6.

Table 4.1.2.5 NOx emission of Vessel in BMR in Year 2000

Unit: ton/year

| Port         |                    | Liquid Bulk | Solid Bulk | Fully Cellular Container | Semi-Container | Ro-Ro | Conventional | Others | Total |
|--------------|--------------------|-------------|------------|--------------------------|----------------|-------|--------------|--------|-------|
| Bangkok      | Klong Toey Wharf   |             | 8          | 804                      | 70             | 60    | 359          | 1      | 1,301 |
|              | Klong Toey Pole    |             | 11         |                          | 0              |       | 87           |        | 98    |
|              | Bang Hua Suer Pole |             | 7          |                          | 2              |       | 51           | 0      | 60    |
|              | Sathupradit Buoy   |             | 62         |                          |                |       | 85           | 2      | 148   |
|              | Tmn Wharf          |             | 3          |                          |                |       | 8            | 2      | 13    |
|              | Private Wharves    | 488         | 154        | 351                      | 32             | 17    | 459          | 23     | 1,524 |
|              | Others             | 8           | 4          | 4                        | 2              |       | 9            | 1      | 28    |
| Samut Sakhon | Mahachai           | 1           | 11         |                          |                |       | 3            | 6      | 22    |
|              | Thachalom          |             |            |                          |                |       | 0            |        | 0     |
|              | Others             | 4           | 2          |                          |                |       | 5            | 8      | 19    |
| Total        |                    | 502         | 261        | 1,160                    | 106            | 76    | 1,066        | 43     | 3,214 |

Table 4.1.2.6 SOx emission of Vessel in BMR in Year 2000

Unit: ton/year

| Port         |                    | Liquid Bulk | Solid Bulk | Fully Cellular Container | Semi-Container | Ro-Ro | Conventional | Others | Total |
|--------------|--------------------|-------------|------------|--------------------------|----------------|-------|--------------|--------|-------|
| Bangkok      | Klong Toey Wharf   |             | 5          | 442                      | 42             | 33    | 212          | 1      | 735   |
|              | Klong Toey Pole    |             | 7          |                          | 0              |       | 51           |        | 58    |
|              | Bang Hua Suer Pole |             | 4          |                          | 1              |       | 30           | 0      | 36    |
|              | Sathupradit Buoy   |             | 37         |                          |                |       | 50           | 1      | 88    |
|              | Tmn Wharf          |             | 2          |                          |                |       | 5            | 1      | 8     |
|              | Private Wharves    | 255         | 92         | 194                      | 19             | 9     | 272          | 15     | 856   |
|              | Others             | 4           | 2          | 2                        | 1              |       | 5            | 1      | 16    |
| Samut Sakhon | Mahachai           | 1           | 6          |                          |                |       | 2            | 4      | 13    |
|              | Thachalom          |             |            |                          |                |       | 0            |        | 0     |
|              | Others             | 2           | 1          |                          |                |       | 3            | 5      | 12    |
| Total        |                    | 262         | 156        | 639                      | 64             | 43    | 631          | 27     | 1,822 |



### 3) Sample Calculation

A sample calculation is provided below;

#### (1) **Emission from Vessels in loading at port**

##### **Emission for Sub Diesel Engines**

###### **Liquid Bulk at Private Wharf in Bangkok(in loading for arrival):**

$$\begin{aligned}
 P \text{ ( Rated Power )} &= 1.88 * 2 * 10 * \text{GRT}^{0.37} \\
 &= 1.88 * 2 * 10 * 9500^{0.37} = 1,114.155(\text{PS/engine}) \\
 N \text{ (NOx emission)} &= 1.49 * P^{1.14} * (A_1^{1.14} * T_1 * d_1 + A_2^{1.14} * T_2 * d_2) / 1000 * 46 / 22.4 \\
 &= 1.49 * 1114.155^{1.14} * (0.45^{1.14} * 20 * 0.23 * 1 + 0.37^{1.14} * 20 * (1-0.23) * 1) / 1000 * \\
 &46 / 22.4 \\
 &= 61.983(\text{kg/vessel})
 \end{aligned}$$

$$\text{Calls of vessel (in arrival)} = 571 \text{ (vessels/year)}$$

$$\begin{aligned}
 \text{NOx emission(of total vessels per year in loading for arrival at Private Wharf)} \\
 &= 571 * 61.983 = 35,392 \text{ (kg/year)}
 \end{aligned}$$

##### **Emission for Main & Sub Boiler**

###### **Liquid Bulk at Private Wharf in Bangkok( in loading for arrival):**

$$\begin{aligned}
 F \text{ ( Rated Fuel Consumption )} &= 0.29 * \text{GRT}^{0.88} * \text{Specific Gravity} \\
 &= 0.29 * 9500^{0.88} * 0.9487 = 870.811 \text{ (kg/vessel/hr)} \\
 W \text{ (Fuel Consumption)} &= F * (A_1 * T_1 + A_2 * T_2) \\
 &= 870.811 * (0.75 * 20 * 0.23 + 0.19 * 20 * (1-0.23)) \\
 &= 5,592.345(\text{kg/vessel}) \\
 N \text{ (NOx emission)} &= W * n \\
 &= 5,592.345 * 0.07 = 391.464 \text{ (kg/vessel)}
 \end{aligned}$$

$$\text{Calls of vessel ( in arrival)} = 571 \text{ (calls/year)}$$

$$\begin{aligned}
 \text{NOx emission(of total vessels per year in loading for arrival at Private Wharf)} \\
 &= 571 * 391.464 = 223,526(\text{kg/year})
 \end{aligned}$$

##### **Emission from Vessel in loading at port**

###### **Liquid Bulk in Bangkok port (in loading for arrival and departure):**

NOx emission (of total vessels per year in loading for arrival and departure at all wharf in Bangkok Port)

$$= 262,546 + 183,259 = 445,805 \text{ (kg/year)}$$

NOx E. in loading for arrival = 35,392(at Private Wharf by Sub Diesel)

+ 496(at Others by Sub Diesel) + 223,526(at Private Wharf by Sub Boiler)

+ 3,132(at Others by Sub Boiler) = 262,546 (kg/year)



NOx E. in loading for departure = 24,241 (at Private Wharf by Sub Diesel)  
 + 502 (at Others by Sub Diesel) + 155,296 (at Private Wharf by Sub Boiler)  
 + 3,219 (at Others by Sub Boiler) = 183,259 (kg/year)

**(2) Emission from Vessels in arrival and departure at port**

**Emission for Main Diesel Engines**

**Liquid Bulk at Private Wharf in Bangkok(in cruising for arrival):**

$$\begin{aligned}
 P \text{ ( Rated Power )} &= 12 * GRT^{0.70} \\
 &= 12 * 9500^{0.70} = 7,304.454 \text{ (PS/engine)} \\
 N \text{ (NOx emission)} &= 1.49 * (P * A)^{1.14} * T / 1000 * 46 / 22.4 \\
 &= 1.49 * ( (7,304.454 * 0.32)^{1.14} * 1.4 + (7,304.454 * 0.17)^{1.14} * 0.2 ) / 1000 * 46 / 22.4 \\
 &= 31.580 \text{ (kg/vessel)}
 \end{aligned}$$

Calls of vessel (in arrival) = 571 (vessels/year)

NOx emission(of total vessels per year) = 571 \* 31.580 = 18,032 (kg/year)

**Emission for Sub Diesel Engines**

**Liquid Bulk at Private Wharf in Bangkok(in cruising for arrival):**

$$\begin{aligned}
 P \text{ ( Rated Power )} &= 1.88 * 2 * 10 * GRT^{0.37} \\
 &= 1.88 * 2 * 10 * 9500^{0.37} = 1,114.155 \text{ (PS/engine)} \\
 N \text{ (NOx emission)} &= 1.49 * (P * A)^{1.14} * T * d / 1000 * 46 / 22.4 \\
 &= 1.49 * ( (1,114.155 * 0.37)^{1.14} * 1.4 + (1,114.155 * 0.37)^{1.14} * 0.2 ) / 1000 * 46 / 22.4 \\
 &= 1.766 \text{ (kg/vessel)}
 \end{aligned}$$

Calls of vessel (in arrival) = 571 (vessels/year)

NOx emission(of total vessels per year) = 571 \* 1.766 = 1,008 (kg/year)

**Emission for Main & Sub Boiler**

**Liquid Bulk at Private Wharf in Bangkok(in cruising for arrival):**

$$\begin{aligned}
 F \text{ ( Rated Fuel Consumption )} &= 0.29 * GRT^{0.88} * \text{Specific Gravity} \\
 &= 0.29 * 9500^{0.88} * 0.9487 = 870.811 \text{ (kg/vessel/hr)} \\
 W \text{ (Fuel Consumption)} &= F * A * T \\
 &= 870.811 * ( 0.19 * 1.4 + 0.19 * 0.2 ) \\
 &= 261.314 \text{ (kg/vessel)} \\
 N \text{ (NOx emission)} &= W * n \\
 &= 261.314 * 0.07 = 18.292 \text{ (kg/vessel)}
 \end{aligned}$$

Calls of vessel ( in arrival) = 571 (calls/year)

NOx emission(of total vessels per year) (kg/year)  
 = 571 \* 18.292 = 10,445(kg/year)



### **Emission from Vessel in arrival and departure at port**

#### **Liquid Bulk in Bangkok port (in cruising for arrival and departure):**

NOx emission (of total vessels per year in cruising for arrival and departure at all wharf in Bangkok Port)

$$= 29,945 + 20,392 = 50,337 \text{ (kg/year)}$$

$$\begin{aligned} \text{NOx E. in cruising for arrival} &= 18,032(\text{at Private Wharf by Main Diesel}) \\ &+ 281(\text{at Others by Main Diesel}) + 1,008(\text{at Private Wharf by Sub Diesel}) \\ &+ 16(\text{at Others by Sub Diesel}) + 10,445(\text{at Private Wharf by Sub Boiler}) \\ &+ 162(\text{at Others by Sub Boiler}) = 29,945 \text{ (kg/year)} \end{aligned}$$

$$\begin{aligned} \text{NOx E. in cruising for departure} &= 12,190(\text{at Private Wharf by Main Diesel}) \\ &+ 281(\text{at Others by Main Diesel}) + 682(\text{at Private Wharf by Sub Diesel}) \\ &+ 16(\text{at Others by Sub Diesel}) + 7,061(\text{at Private Wharf by Sub Boiler}) \\ &+ 162(\text{at Others by Sub Boiler}) = 20,392 \text{ (kg/year)} \end{aligned}$$

### **(3) Total Emission from Vessels at Bangkok port**

#### **Liquid Bulk in Bangkok port (in loading and cruising):**

NOx Emission (of total vessels per year in loading and cruising at all wharf in Bangkok Port) = 445,805 + 50,337 = 496,142 (kg/year) = 496 (ton/year)

### **(4) Fishing Boat**

#### **Fishing boat in Samut Sakhon:**

$$P \text{ ( Rated Power )} = 165 \text{ (PS/engine)}$$

$$\begin{aligned} W \text{ (Fuel Consumption)} &= 0.21 * (P * A)^{0.95} * T \\ &= 0.21 * (165 * 0.32)^{0.95} * 785 = 7,123.311 \text{ (kg/boat)} \end{aligned}$$

$$\begin{aligned} N \text{ (NOx emission)} &= 1.49 * (P * A)^{1.14} * T / 1000 * 46 / 22.4 \\ &= 1.49 * (165 * 0.32)^{1.14} * 785 / 1000 * 46 / 22.4 \\ &= 220.433 \text{ (kg/vessel)} \end{aligned}$$

$$\text{Number of boats} = 897 \text{ (boats/year)}$$

$$\text{NOx emission} = 897 * 220.433 = 197,729 \text{ (kg/year)} = 198 \text{ (ton/year)}$$

### **(5) Small Boat ( Express Boat, Ferry Boat, Long-Tailed Boat )**

#### **Express boat**

##### **Rapid Express Boat (Nonthaburi-BigC):**

$$\begin{aligned} P \text{ ( Rated Power )} &= 33 * \text{GRT}^{0.61} \\ &= 33 * 30^{0.61} = 262.759 \text{ (PS/engine)} \end{aligned}$$

$$\begin{aligned} W \text{ (Fuel Consumption)} &= 0.21 * (P * A)^{0.95} * T \\ &= 0.21 * (262.759 * 0.32)^{0.95} * 1 = 14.2 \text{ (kg/boat)} \end{aligned}$$

$$\begin{aligned} N \text{ (NOx emission)} &= 1.49 * (P * A)^{1.14} * T / 1000 * 46 / 22.4 \\ &= 1.49 * (263 * 0.32)^{1.14} * 1 / 1000 * 46 / 22.4 \\ &= 0.47848 \text{ (kg/vessel)} \end{aligned}$$

$$\text{Number of trips} = 3,389 \text{ (trips/year)}$$

$$\text{NOx emission} = 3,389 * 0.47848 = 1,621 \text{ (kg/year)} = 2 \text{ (ton/year)}$$

**Total Express Boat (Rapid Express + Normal Express):**

$$\text{NOx emission} = 2 + 13 + 7 + 14 = 36 \text{ (ton/year)}$$

**Ferry boat**

$$P \text{ ( Rated Power )} = 33 * \text{GRT}^{0.61}$$

$$= 33 * 40^{0.61} = 313.163 \text{ (PS/engine)}$$

$$W \text{ (Fuel Consumption)} = 0.21 * (P * A)^{0.95} * T$$

$$= 0.21 * (313.163 * 0.32)^{0.95} * 0.08 = 1.393 \text{ (kg/boat)}$$

$$N \text{ (NOx emission)} = 1.49 * (P * A)^{1.14} * T / 1000 * 46 / 22.4$$

$$= 1.49 * (313 * 0.32)^{1.14} * 1 / 1000 * 46 / 22.4$$

$$= 0.048704 \text{ (kg/vessel)}$$

$$\text{Number of trips} = 1,500,150 \text{ (trips/year)}$$

$$\text{NOx emission} = 1,500,150 * 0.048704 = 73,063 \text{ (kg/year)} = 73.1 \text{ (ton/year)}$$

**Long-Tailed boat**

**Long-tailed Boat (Pak Kret - Bang Khuwad):**

$$P \text{ ( Rated Power )} = 1.88 * 108 = 202.413 \text{ (PS/engine)}$$

$$W \text{ (Fuel Consumption)} = 0.21 * (P * A)^{0.95} * T$$

$$= 0.21 * (202.413 * 0.32)^{0.95} * 10 / 60 = 1.84030 \text{ (kg/boat)}$$

$$N \text{ (NOx emission)} = 1.49 * (P * A)^{1.14} * T / 1000 * 46 / 22.4$$

$$= 1.49 * (202.413 * 0.32)^{1.14} * 1 / 1000 * 46 / 22.4$$

$$= 0.05923 \text{ (kg/vessel)}$$

$$\text{Number of trips} = 42 * 365 = 15,330 \text{ (trips/year)}$$

$$\text{NOx emission} = 15,330 * 0.05923 = 908 \text{ (kg/year)} = 0.91 \text{ (ton/year)}$$

**Total Long-tailed Boat (1,415 trips/day):**

$$\begin{aligned} \text{NOx emission} &= 0.91 + 5.06 + 4.19 + 1.90 + 1.66 + 12.59 + 6.59 + 1.15 + 0.66 + 16.42 + \\ &1.71 + 0.60 + 4.59 + 3.66 + 2.92 + 0.35 + 2.11 + 4.85 = 71.93 \text{ (ton/year)} \end{aligned}$$



#### 4.1.2.4 Aircraft

##### 1) Sample Calculation

A sample calculation is provided below;

##### **NOx emission of A-300 in LTO cycle in Bangkok International Airport :**

Emission Factor of LTO cycle(kg/LTO cycle)

$$\begin{aligned}
 &= \text{TIM}_{jk} \text{ (Time in mode) } \times \text{EF}_{ijk} \text{ (Emission Load in mode) } \times \text{Number of Engine} \\
 &= ( 0.7 * 9.1521 + 2.2 * 5.5533 + 4 * 0.6694 + (19+7) * 0.0867 ) * 2 \\
 &= 47.109 \text{ (kg/LTO cycle)}
 \end{aligned}$$

Number of Flights = 29,866 (flights/year)

$$\begin{aligned}
 \text{NOx Emission of A-300 in LTO cycle} &= 47.109 * 29,866 \\
 &= 1,460,957 \text{ (kg/year)} = 1,460.96 \text{ (ton/year)}
 \end{aligned}$$

##### **Total NOx emission in LTO cycle in Bangkok International Airport :**

Total NOx Emission in LTO cycle

$$\begin{aligned}
 &= 1,460.96 + 212.96 \text{ (for A-310)} + 1.31 \text{ (for A-319)} + \dots + 3.32 \text{ (for AN-12/M)} \\
 &\quad + 2.13 \text{ (for others)} \\
 &= 12,127 \text{ (ton/year)}
 \end{aligned}$$

## 4.2 Mobile Source Inventory of the Year 2011

### 4.2.1 Mobile Source Inventory of the Year 2011 in Whole Thailand

#### 4.2.1.1 Vehicle

##### 1) Traffic Data

The vehicle kilometers of the Year 2011 by province by vehicle type in BMR are shown in Table 4.2.1.1, which are estimated using Airviro database updated based on the traffic assignment data in URMAR report of OCMLT.

The vehicle kilometers by province by vehicle type in the area except BMR in Thailand are shown in Table 4.2.1.2, which are estimated using the vehicle kilometers of the Year 2000 and the growth rate of vehicle kilometer by region based on LTP-2 report of DOH and others.

Table 4.2.1.1 Vehicle Kilometers in BMR in Year 2011

| Province      | Vehicle Kilometers by vehicle type (Million Vehicle-Kilometers/year) |          |            |       |             |       |             |        |         |        |
|---------------|--|----------|------------|-------|-------------|-------|-------------|--------|---------|--------|
|               | PS(G)  | Taxi (G) | Taxi (LPG) | PS(D) | Light Truck | Bus   | Heavy Truck | MC     | Tuk-Tuk | total  |
| Bangkok       | 16,183   | 503      | 352        | 1,290 | 4,650       | 2,098 | 3,054       | 4,491  | 187     | 32,809 |
| Nonthaburi    | 2,916  | 91       | 64         | 286   | 862         | 523   | 741         | 791    | 33      | 6,307  |
| Pathum Thani  | 4,505  | 140      | 98         | 544   | 1,243       | 769   | 1,007       | 1,132  | 47      | 9,485  |
| Samut Prakan  | 3,680  | 114      | 80         | 334   | 1,105       | 571   | 832         | 1,078  | 45      | 7,840  |
| Nakhon Pathom | 2,805  | 87       | 61         | 384   | 2,349       | 641   | 1,268       | 1,940  | 81      | 9,616  |
| Samut Sakhon  | 1,738  | 54       | 38         | 220   | 777         | 293   | 440         | 755    | 31      | 4,347  |
| Total         | 31,827   | 989      | 693        | 3,058 | 10,987      | 4,896 | 7,341       | 10,187 | 424     | 70,403 |



Table 4.2.1.2 Vehicle Kilometers in the area except BMR in Thailand in Year 2011

| Province            | ID | Vehicle Kilometers by vehicle type (Million Vehicle-Kilometers/year) |           |           |             |             |             |            |         |
|---------------------|----|--|-----------|-----------|-------------|-------------|-------------|------------|---------|
|                     |    | Car, taxi  | light bus | heavy bus | light truck | medium truc | heavy truck | motorcycle | total   |
| Central             |    | 8,687  | 852       | 713       | 4,238       | 1,332       | 2,179       | 2,281      | 20,283  |
| Chai Nat            | 9  | 1,164  | 70        | 57        | 579         | 141         | 283         | 351        | 2,647   |
| Lop Buri            | 49 | 1,543  | 107       | 96        | 732         | 218         | 199         | 610        | 3,506   |
| Saraburi            | 60 | 2,178  | 256       | 128       | 1,325       | 357         | 634         | 409        | 5,286   |
| Sing Buri           | 61 | 350  | 19        | 10        | 66          | 34          | 25          | 223        | 727     |
| Ayutthaya           | 33 | 2,751  | 323       | 361       | 1,023       | 484         | 881         | 510        | 6,332   |
| Ang Thong           | 67 | 702  | 77        | 60        | 512         | 98          | 157         | 179        | 1,785   |
| Northern Region     |    | 18,207   | 1,500     | 763       | 12,703      | 2,171       | 2,096       | 12,555     | 49,996  |
| upper part          |    | 10,144   | 914       | 355       | 7,284       | 1,147       | 834         | 7,326      | 28,003  |
| Chiang Rai          | 12 | 1,376  | 165       | 79        | 1,457       | 207         | 138         | 1,310      | 4,733   |
| Chiang Mai          | 13 | 3,666  | 333       | 112       | 2,582       | 332         | 164         | 2,348      | 9,537   |
| Nan                 | 26 | 1,339  | 45        | 18        | 285         | 125         | 81          | 845        | 2,737   |
| Phayao              | 72 | 647  | 69        | 39        | 724         | 106         | 67          | 808        | 2,460   |
| Phrae               | 40 | 721  | 67        | 22        | 431         | 80          | 78          | 357        | 1,755   |
| Mae Hong Son        | 43 | 291  | 39        | 8         | 88          | 37          | 22          | 245        | 731     |
| Lampang             | 50 | 1,463  | 128       | 55        | 902         | 143         | 194         | 774        | 3,660   |
| Lamphun             | 51 | 641  | 68        | 23        | 815         | 116         | 89          | 638        | 2,389   |
| lower part          |    | 8,063  | 586       | 407       | 5,420       | 1,024       | 1,263       | 5,230      | 21,993  |
| Kamphaeng Phet      | 4  | 1,036  | 79        | 36        | 835         | 139         | 219         | 842        | 3,187   |
| Tak                 | 16 | 852  | 74        | 28        | 482         | 109         | 148         | 419        | 2,111   |
| Nakhon Sawan        | 23 | 1,475  | 93        | 79        | 1,120       | 183         | 311         | 654        | 3,914   |
| Phichit             | 36 | 724  | 28        | 42        | 652         | 100         | 134         | 503        | 2,182   |
| Phitsanulok         | 37 | 1,078  | 63        | 55        | 510         | 107         | 101         | 547        | 2,461   |
| Phetchabun          | 39 | 987  | 120       | 69        | 767         | 152         | 131         | 771        | 2,996   |
| Sukhothai           | 62 | 974  | 48        | 43        | 403         | 92          | 84          | 638        | 2,283   |
| Uttaradit           | 69 | 550  | 64        | 42        | 438         | 82          | 90          | 528        | 1,793   |
| Uthai Thani         | 70 | 387  | 18        | 14        | 213         | 60          | 45          | 328        | 1,064   |
| Northeastern Region |    | 22,526   | 1,468     | 1,364     | 10,545      | 2,745       | 2,229       | 14,429     | 55,305  |
| upper part          |    | 11,403   | 849       | 722       | 4,954       | 1,326       | 1,003       | 7,639      | 27,896  |
| Kalasin             | 3  | 970  | 60        | 47        | 376         | 115         | 71          | 381        | 2,219   |
| Khon Kaen           | 5  | 2,513  | 195       | 203       | 971         | 300         | 259         | 1,154      | 5,596   |
| Nakhon Phanom       | 20 | 348  | 42        | 27        | 375         | 60          | 35          | 474        | 1,360   |
| Maha Sarakham       | 42 | 1,496  | 108       | 93        | 467         | 168         | 105         | 954        | 3,392   |
| Mukdahan            | 73 | 522  | 57        | 35        | 191         | 60          | 47          | 439        | 1,351   |
| Roi Et              | 45 | 1,418  | 81        | 65        | 253         | 149         | 112         | 563        | 2,641   |
| Loei                | 52 | 846  | 61        | 44        | 426         | 107         | 62          | 764        | 2,309   |
| Sakon Nakhon        | 54 | 707  | 72        | 62        | 614         | 109         | 71          | 776        | 2,411   |
| Nong Khai           | 66 | 539  | 26        | 27        | 398         | 61          | 50          | 790        | 1,892   |
| Nong Bua Lam Phu    | 75 | 304  | 36        | 27        | 231         | 44          | 46          | 269        | 956     |
| Udon Thani          | 68 | 1,740  | 111       | 91        | 653         | 153         | 146         | 874        | 3,768   |
| lower part          |    | 11,122   | 619       | 642       | 5,592       | 1,419       | 1,226       | 6,790      | 27,409  |
| Chaiyaphum          | 10 | 512  | 30        | 44        | 611         | 124         | 86          | 537        | 1,943   |
| Nakhon Ratchasima   | 21 | 4,395  | 220       | 276       | 1,980       | 564         | 618         | 1,493      | 9,546   |
| Buri Ram            | 27 | 839  | 70        | 72        | 807         | 166         | 131         | 875        | 2,961   |
| Yasothon            | 17 | 876  | 48        | 38        | 269         | 73          | 48          | 515        | 1,868   |
| Si Sa Ket           | 53 | 975  | 46        | 42        | 275         | 106         | 71          | 670        | 2,185   |
| Surin               | 65 | 831  | 57        | 43        | 443         | 132         | 113         | 755        | 2,375   |
| Amnat Charoen       | 76 | 260  | 14        | 15        | 222         | 36          | 22          | 254        | 823     |
| Ubon Ratchathani    | 71 | 2,435  | 134       | 111       | 984         | 216         | 137         | 1,491      | 5,709   |
| Southern Region     |    | 14,283   | 1,939     | 614       | 6,853       | 1,790       | 2,138       | 9,782      | 37,399  |
| upper part          |    | 8,410  | 1,164     | 400       | 4,221       | 1,195       | 1,446       | 4,931      | 21,767  |
| Krabi               | 1  | 640  | 158       | 60        | 676         | 159         | 141         | 747        | 2,581   |
| Chumphon            | 11 | 988  | 62        | 42        | 755         | 162         | 294         | 437        | 2,740   |
| Nakhon Si Thammarat | 22 | 2,829  | 441       | 103       | 856         | 407         | 426         | 1,505      | 6,567   |
| Phangnga            | 34 | 385  | 71        | 42        | 334         | 58          | 77          | 395        | 1,361   |
| Phuket              | 41 | 677  | 168       | 45        | 377         | 40          | 37          | 468        | 1,813   |
| Ranong              | 46 | 298  | 42        | 12        | 301         | 44          | 31          | 246        | 974     |
| Surat Thani         | 64 | 2,592  | 222       | 96        | 922         | 325         | 440         | 1,133      | 5,731   |
| lower part          |    | 5,873  | 775       | 214       | 2,632       | 595         | 692         | 4,851      | 15,632  |
| Trang               | 14 | 782  | 139       | 46        | 407         | 106         | 104         | 880        | 2,464   |
| Narathiwat          | 25 | 640  | 50        | 9         | 154         | 44          | 47          | 780        | 1,724   |
| Pattani             | 31 | 838  | 84        | 24        | 298         | 62          | 82          | 670        | 2,058   |
| Phthalung           | 35 | 603  | 70        | 28        | 354         | 100         | 128         | 486        | 1,768   |
| Yala                | 44 | 447  | 56        | 11        | 139         | 32          | 25          | 527        | 1,236   |
| Songkhla            | 55 | 2,225  | 316       | 87        | 1,094       | 218         | 286         | 1,060      | 5,286   |
| Satun               | 56 | 339  | 59        | 9         | 186         | 33          | 20          | 449        | 1,094   |
| Eastern Region      |    | 9,449  | 1,131     | 727       | 7,155       | 1,710       | 2,127       | 3,878      | 26,177  |
| Chanthaburi         | 6  | 613  | 89        | 28        | 1,262       | 85          | 74          | 526        | 2,677   |
| Chachoengsao        | 7  | 2,355  | 262       | 196       | 1,295       | 465         | 581         | 324        | 5,478   |
| Chon Buri           | 8  | 2,818  | 320       | 237       | 1,782       | 533         | 802         | 680        | 7,172   |
| Trat                | 15 | 241  | 55        | 7         | 383         | 31          | 23          | 341        | 1,081   |
| Nakhon Nayok        | 18 | 352  | 22        | 15        | 88          | 54          | 87          | 97         | 715     |
| Prachin Buri        | 30 | 924  | 112       | 78        | 784         | 213         | 214         | 556        | 2,881   |
| Rayong              | 47 | 1,456  | 227       | 129       | 1,227       | 210         | 257         | 803        | 4,308   |
| Sa Kaeo             | 74 | 690  | 43        | 37        | 334         | 119         | 90          | 551        | 1,864   |
| Western Region      |    | 7,098  | 485       | 436       | 5,572       | 1,133       | 1,617       | 3,994      | 20,336  |
| Kanchanaburi        | 2  | 1,420  | 100       | 72        | 1,331       | 133         | 247         | 1,105      | 4,408   |
| Prachuap Khiri Khan | 29 | 1,288  | 60        | 74        | 821         | 317         | 321         | 540        | 3,421   |
| Phetchaburi         | 38 | 1,356  | 103       | 89        | 640         | 216         | 291         | 487        | 3,183   |
| Ratchaburi          | 48 | 1,022  | 76        | 65        | 1,459       | 171         | 350         | 856        | 3,999   |
| Samut Songkhram     | 58 | 388  | 27        | 36        | 172         | 60          | 136         | 84         | 903     |
| Suphan Buri         | 63 | 1,625  | 119       | 99        | 1,149       | 235         | 271         | 922        | 4,422   |
| Total               |    | 80,251   | 7,375     | 4,617     | 47,067      | 10,881      | 12,386      | 46,919     | 209,496 |

## 2) Emission Factor

### (1) Age Distribution

Age distributions at 2011 were calculated on the number of vehicles for new registration, which needed the values after 2000 to be estimated, as shown in Table 4.2.1.3, in the same way as the age distribution at 2000 with the regression model provided there. The future numbers of vehicles for new registration were estimated by them.

Table 4.2.1.3 Key Factors and Calculation Result of Age Distribution at 2011

Private Consumption Expenditure for Vehicle Purchase in the Domestic Market (mil.B) unit: Thousand

| 2011    | 2010    | 2009    | 2008    | 2007    | 2006    | 2005    | 2004   | 2003   | 2002   | 2001   | 2000   | 1999   | 1998   | 1997   | 1996    | 1995    | 1994   | 1993   | 1992   | 1991   | 1990   | 1989   | 1988   | 1987   |
|---------|---------|---------|---------|---------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|
| 184,773 | 166,802 | 150,579 | 135,934 | 122,714 | 110,779 | 100,005 | 90,364 | 81,653 | 73,781 | 66,668 | 62,490 | 49,352 | 35,649 | 79,614 | 108,701 | 110,153 | 94,127 | 88,405 | 71,493 | 50,421 | 53,797 | 40,033 | 31,356 | 21,844 |

#### Number of Vehicle for New Registration by Type

|      | 2011    | 2010    | 2009    | 2008    | 2007    | 2006    | 2005    | 2004    | 2003  | 2002  | 2001  | 2000  | 1999  | 1998  | 1997  | 1996    | 1995    | 1994    | 1993  | 1992  | 1991  | 1990  | 1989  | 1988  | 1987  |
|------|---------|---------|---------|---------|---------|---------|---------|---------|-------|-------|-------|-------|-------|-------|-------|---------|---------|---------|-------|-------|-------|-------|-------|-------|-------|
| LDGV | 321.2   | 289.8   | 261.6   | 236.1   | 213.0   | 192.2   | 173.5   | 156.7   | 141.5 | 127.8 | 115.4 | 103.0 | 75.7  | 55.0  | 172.5 | 182.1   | 169.9   | 173.5   | 157.2 | 123.8 | 87.1  | 92.9  | 69.0  | 53.8  | 37.3  |
| Taxi | 9.0     | 8.1     | 7.4     | 6.7     | 6.1     | 5.5     | 5.0     | 4.6     | 4.2   | 3.8   | 3.5   | 3.4   | -     | -     | -     | -       | -       | -       | -     | -     | -     | -     | -     | -     | -     |
| LDDV | 99.4    | 69.4    | 50.2    | 37.4    | 28.7    | 22.6    | 18.2    | 15.0    | 12.6  | 10.8  | 9.4   | 10.0  | 6.1   | 5.3   | 17.5  | 22.0    | 23.3    | 26.1    | 35.9  | 10.3  | 6.8   | 7.2   | 5.5   | 4.6   | 3.8   |
| LDDT | 564.7   | 504.5   | 450.2   | 401.1   | 356.8   | 316.8   | 280.7   | 248.4   | 219.2 | 192.9 | 169.0 | 133.3 | 106.6 | 83.6  | 239.7 | 338.1   | 312.9   | 251.7   | 205.3 | 185.2 | 114.6 | 125.9 | 79.8  | 50.7  | 18.9  |
| HDDV | 257.4   | 179.7   | 129.9   | 96.9    | 74.4    | 58.6    | 47.2    | 39.0    | 32.7  | 28.0  | 24.3  | 20.5  | 13.6  | 19.0  | 55.5  | 77.0    | 68.4    | 52.3    | 44.8  | 25.9  | 17.2  | 18.4  | 13.9  | 11.5  | 9.2   |
| MC   | 2,089.2 | 1,888.8 | 1,707.9 | 1,544.6 | 1,397.2 | 1,264.1 | 1,143.9 | 1,036.4 | 939.3 | 851.5 | 772.2 | 682.9 | 497.4 | 533.8 | 987.3 | 1,247.9 | 1,339.1 | 1,091.2 | 859.2 | 826.0 | 591.0 | 628.7 | 475.2 | 376.4 | 272.4 |

Source: LTD

Note: The values from 1976 to 1992, except Taxi, were estimated by the correlation between Private Consumption Expenditure for Vehicle Purchase in the Domestic Market and Number of Vehicle for New Registration from 1993 to 2000.

#### Age Distribution by Vehicle Type

|      | 2011  | 2010  | 2009  | 2008  | 2007 | 2006 | 2005 | 2004 | 2003 | 2002 | 2001 | 2000 | 1999 | 1998 | 1997 | 1996 | 1995 | 1994 | 1993 | 1992 | 1991 | 1990 | 1989 | 1988 | 1987 | Total |
|------|-------|-------|-------|-------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| LDGV | 8.5%  | 7.7%  | 6.9%  | 6.2%  | 5.6% | 5.1% | 4.6% | 4.1% | 3.7% | 3.4% | 3.1% | 2.7% | 2.0% | 1.5% | 4.6% | 4.8% | 4.5% | 4.6% | 4.2% | 3.3% | 2.3% | 2.5% | 1.8% | 1.4% | 1.0% | 100%  |
| Taxi | 13.3% | 12.1% | 11.0% | 10.0% | 9.0% | 8.2% | 7.5% | 6.8% | 6.2% | 5.6% | 5.2% | 5.1% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 100%  |
| LDDV | 17.6% | 12.4% | 9.0%  | 6.7%  | 5.1% | 4.1% | 3.3% | 2.7% | 2.3% | 1.9% | 1.7% | 1.8% | 1.1% | 0.9% | 3.1% | 3.9% | 4.2% | 4.7% | 6.4% | 1.8% | 1.2% | 1.3% | 1.0% | 0.8% | 0.7% | 100%  |
| LDDT | 9.5%  | 8.5%  | 7.6%  | 6.7%  | 6.0% | 5.3% | 4.7% | 4.2% | 3.7% | 3.2% | 2.8% | 2.2% | 1.8% | 1.4% | 4.0% | 5.7% | 5.3% | 4.2% | 3.5% | 3.1% | 1.9% | 2.1% | 1.3% | 0.9% | 0.3% | 100%  |
| HDDV | 18.2% | 12.7% | 9.2%  | 6.8%  | 5.3% | 4.1% | 3.3% | 2.8% | 2.3% | 2.0% | 1.7% | 1.4% | 1.0% | 1.3% | 3.9% | 5.4% | 4.8% | 3.7% | 3.2% | 1.8% | 1.2% | 1.3% | 1.0% | 0.8% | 0.7% | 100%  |
| MC   | 8.3%  | 7.5%  | 6.8%  | 6.2%  | 5.6% | 5.0% | 4.6% | 4.1% | 3.8% | 3.4% | 3.1% | 2.7% | 2.0% | 2.1% | 3.9% | 5.0% | 5.3% | 4.4% | 3.4% | 3.3% | 2.4% | 2.5% | 1.9% | 1.5% | 1.1% | 100%  |



## (2) Emission Factor

The SO<sub>x</sub> emission factors were calculated from the fuel consumption rates as shown in Table 4.2.1.4. The graphs of SO<sub>x</sub> emission factors are shown in Figure 4.2.1.1.

Table 4.2.1.4 Fuel Consumption Rate and SO<sub>x</sub> Emission Factor at 2011

$$EF = a V^2 + b V + c$$

EF :SO<sub>x</sub> Emission Factor (g/km)

V :Vehicle Speed (km/h)

| Vehicle Speed |   | PS(G)   | Taxi(G) | Taxi(LPG) | PS(D)   | L-Truck | Bus     | H-Truck | MC      | Tuk-Tuk |
|---------------|---|---------|---------|-----------|---------|---------|---------|---------|---------|---------|
| <40km/h       | a | 0.0908  | 0.09    | 0.0024    | 0.0125  | 0.0207  | 0.253   | 0.2317  | 0.0019  | 0       |
|               | b | -7.2427 | -7.1814 | -0.3134   | -1.8595 | -2.5988 | -19.947 | -18.606 | -0.1241 | 0       |
|               | c | 217.28  | 215.71  | 64.293    | 110.57  | 139.82  | 582.48  | 600.11  | 26.262  | 53.5    |
| >40km/h       | a | 0.0129  | 0.0129  | 0.0024    | 0.0125  | 0.0207  | 0.0308  | 0.0433  | 0.0002  | 0       |
|               | b | -1.9323 | -1.9329 | -0.3134   | -1.8595 | -2.5988 | -4.5138 | -5.8203 | 0.0599  | 0       |
|               | c | 127.67  | 127.4   | 64.293    | 110.57  | 139.82  | 316.19  | 385.81  | 21.475  | 53.5    |

$$EF = a V^2 + b V + c$$

EF :SO<sub>x</sub> Emission Factor (g/km)

V :Vehicle Speed (km/h)

| Vehicle Speed |   | PS(G)     | Taxi(G)   | Taxi(LPG) | PS(D)    | L-Truck | Bus      | H-Truck  | MC        | Tuk-Tuk |
|---------------|---|-----------|-----------|-----------|----------|---------|----------|----------|-----------|---------|
| <40km/h       | a | 0.05902   | 0.0585    | -         | 0.01875  | 0.03105 | 0.3795   | 0.34755  | 0.001235  | -       |
|               | b | -4.707755 | -4.66791  | -         | -2.78925 | -3.8982 | -29.9205 | -27.909  | -0.080665 | -       |
|               | c | 141.232   | 140.2115  | -         | 165.855  | 209.73  | 873.72   | 900.165  | 17.0703   | -       |
| >40km/h       | a | 0.008385  | 0.008385  | -         | 0.01875  | 0.03105 | 0.0462   | 0.06495  | 0.00013   | -       |
|               | b | -1.255995 | -1.256385 | -         | -2.78925 | -3.8982 | -6.7707  | -8.73045 | 0.038935  | -       |
|               | c | 82.9855   | 82.81     | -         | 165.855  | 209.73  | 474.285  | 578.715  | 13.95875  | -       |

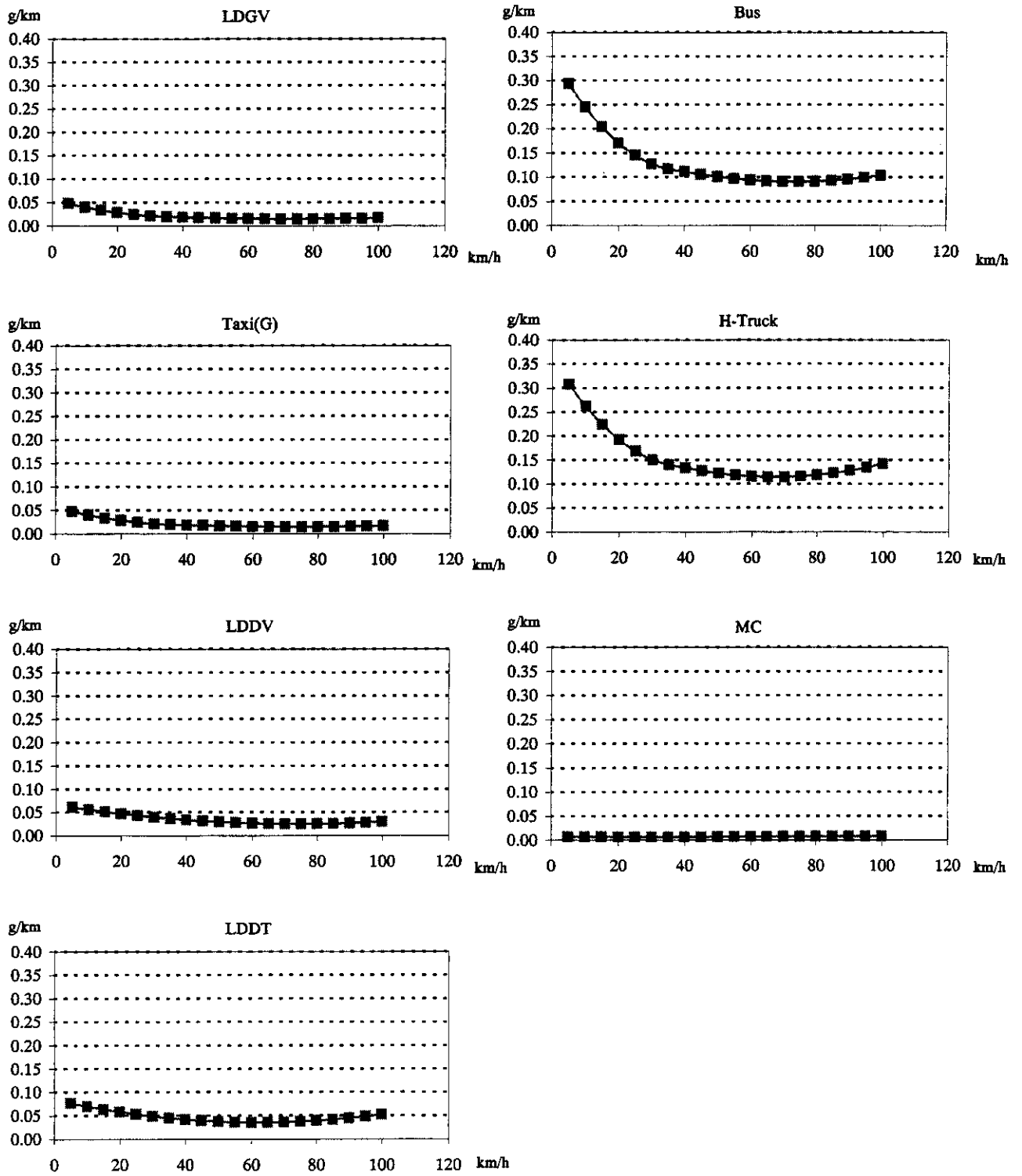


Figure 4.2.1.1 SOx Emission Factor at 2011



### 3) **Estimated Emission**

The estimated fuel consumption and SO<sub>x</sub> emission of vehicle by province of the Year 2011 in BMR are shown in Table 4.2.1.5 - 4.2.1.6.

The estimated fuel consumption and SO<sub>x</sub> emission of vehicle by province of the Year 2011 in the area except BMR in Thailand are shown in Table 4.2.1.7 - 4.2.1.8.

**Table 4.2.1.5 Fuel Consumption of Vehicle in BMR in Year 2011**

| Province      | Fuel Consumption (kton/year) |           |            |             |              |              |            | total        |
|---------------|------------------------------|-----------|------------|-------------|--------------|--------------|------------|--------------|
|               | PS(G)                        | Taxi (G)  | PS(D)      | Light Truck | Bus          | Heavy Truck  | MC         |              |
| Bangkok       | 1,359                        | 40        | 82         | 380         | 501          | 838          | 166        | 3,366        |
| Nonthaburi    | 218                          | 6         | 17         | 65          | 116          | 192          | 25         | 640          |
| Pathum Thani  | 268                          | 8         | 27         | 76          | 135          | 214          | 30         | 759          |
| Samut Prakan  | 259                          | 8         | 19         | 81          | 119          | 204          | 35         | 724          |
| Nakhon Pathom | 212                          | 6         | 22         | 175         | 153          | 341          | 62         | 972          |
| Samut Sakhon  | 119                          | 4         | 12         | 52          | 58           | 102          | 22         | 369          |
| <b>Total</b>  | <b>2,435</b>                 | <b>72</b> | <b>180</b> | <b>830</b>  | <b>1,081</b> | <b>1,890</b> | <b>341</b> | <b>6,829</b> |

**Table 4.2.1.6 SO<sub>x</sub> Emission of Vehicle in BMR in Year 2011**

| Province      | SO <sub>x</sub> Emission (ton/year) |           |            |             |            |              |           | total        |
|---------------|-------------------------------------|-----------|------------|-------------|------------|--------------|-----------|--------------|
|               | PS(G)                               | Taxi (G)  | PS(D)      | Light Truck | Bus        | Heavy Truck  | MC        |              |
| Bangkok       | 353                                 | 10        | 49         | 228         | 301        | 503          | 43        | 1,488        |
| Nonthaburi    | 57                                  | 2         | 10         | 39          | 70         | 115          | 7         | 299          |
| Pathum Thani  | 70                                  | 2         | 16         | 46          | 81         | 128          | 8         | 351          |
| Samut Prakan  | 67                                  | 2         | 11         | 49          | 71         | 122          | 9         | 332          |
| Nakhon Pathom | 55                                  | 2         | 13         | 105         | 92         | 205          | 16        | 488          |
| Samut Sakhon  | 31                                  | 1         | 7          | 31          | 35         | 61           | 6         | 172          |
| <b>Total</b>  | <b>633</b>                          | <b>19</b> | <b>108</b> | <b>498</b>  | <b>649</b> | <b>1,134</b> | <b>89</b> | <b>3,129</b> |

Table 4.2.1.7 Fuel Consumption of Vehicle in the area except BMR in Thailand in Year 2011

| Province            | ID | Fuel Consumption (ktons/year) |           |           |             |              |             |            | total  |
|---------------------|----|-------------------------------|-----------|-----------|-------------|--------------|-------------|------------|--------|
|                     |    | Car, taxi                     | light bus | heavy bus | light truck | medium truck | heavy truck | motorcycle |        |
| Central             |    | 404                           | 104       | 143       | 272         | 217          | 583         | 67         | 1,791  |
| Chai Nat            | 9  | 54                            | 9         | 12        | 37          | 23           | 76          | 10         | 221    |
| Lop Buri            | 49 | 72                            | 13        | 19        | 47          | 36           | 53          | 18         | 258    |
| Saraburi            | 60 | 101                           | 31        | 26        | 85          | 58           | 170         | 12         | 483    |
| Sing Buri           | 61 | 16                            | 2         | 2         | 4           | 6            | 7           | 7          | 44     |
| Ayutthaya           | 33 | 128                           | 40        | 73        | 66          | 79           | 236         | 15         | 635    |
| Ang Thong           | 67 | 33                            | 9         | 12        | 33          | 16           | 42          | 5          | 150    |
| Northern Region     |    | 847                           | 184       | 153       | 815         | 354          | 561         | 368        | 3,282  |
| upper part          |    | 472                           | 112       | 71        | 467         | 187          | 223         | 215        | 1,748  |
| Chiang Rai          | 12 | 64                            | 20        | 16        | 93          | 34           | 37          | 38         | 303    |
| Chiang Mai          | 13 | 171                           | 41        | 22        | 166         | 54           | 44          | 69         | 566    |
| Nan                 | 26 | 62                            | 6         | 4         | 18          | 20           | 22          | 25         | 157    |
| Phayao              | 72 | 30                            | 8         | 8         | 46          | 17           | 18          | 24         | 152    |
| Phrae               | 40 | 34                            | 8         | 4         | 28          | 13           | 21          | 10         | 118    |
| Mae Hong Son        | 43 | 14                            | 5         | 2         | 6           | 6            | 6           | 7          | 45     |
| Lampang             | 50 | 68                            | 16        | 11        | 58          | 23           | 52          | 23         | 251    |
| Lamphun             | 51 | 30                            | 8         | 5         | 52          | 19           | 24          | 19         | 156    |
| lower part          |    | 375                           | 72        | 82        | 348         | 167          | 338         | 153        | 1,535  |
| Kamphaeng Phet      | 4  | 48                            | 10        | 7         | 54          | 23           | 59          | 25         | 225    |
| Tak                 | 16 | 40                            | 9         | 6         | 31          | 18           | 40          | 12         | 155    |
| Nakhon Sawan        | 23 | 69                            | 11        | 16        | 72          | 30           | 83          | 19         | 300    |
| Phichit             | 36 | 34                            | 3         | 8         | 42          | 16           | 36          | 15         | 154    |
| Phitsanulok         | 37 | 50                            | 8         | 11        | 33          | 18           | 27          | 16         | 162    |
| Phetchabun          | 39 | 46                            | 15        | 14        | 49          | 25           | 35          | 23         | 206    |
| Sukhothai           | 62 | 45                            | 6         | 9         | 26          | 15           | 23          | 19         | 142    |
| Uttaradit           | 69 | 26                            | 8         | 8         | 28          | 13           | 24          | 15         | 123    |
| Uthai Thani         | 70 | 18                            | 2         | 3         | 14          | 10           | 12          | 10         | 68     |
| Northeastern Region |    | 1,036                         | 180       | 274       | 676         | 448          | 597         | 423        | 3,634  |
| upper part          |    | 525                           | 104       | 145       | 318         | 216          | 268         | 224        | 1,800  |
| Kalasin             | 3  | 45                            | 7         | 9         | 24          | 19           | 19          | 17         | 140    |
| Khon Kaen           | 5  | 116                           | 24        | 41        | 62          | 49           | 69          | 34         | 395    |
| Nakhon Phanom       | 20 | 16                            | 5         | 5         | 24          | 10           | 9           | 14         | 83     |
| Maha Sarakham       | 42 | 69                            | 13        | 19        | 30          | 27           | 28          | 28         | 214    |
| Mukdahan            | 73 | 24                            | 7         | 7         | 12          | 10           | 13          | 13         | 86     |
| Roi Et              | 45 | 65                            | 10        | 13        | 16          | 24           | 30          | 16         | 175    |
| Loei                | 52 | 39                            | 7         | 9         | 27          | 17           | 17          | 22         | 139    |
| Sakon Nakhon        | 54 | 33                            | 9         | 13        | 39          | 18           | 19          | 23         | 153    |
| Nong Khai           | 66 | 25                            | 3         | 6         | 26          | 10           | 13          | 23         | 106    |
| Nong Bua Lam Phu    | 75 | 14                            | 4         | 5         | 15          | 7            | 12          | 8          | 66     |
| Udon Thani          | 68 | 80                            | 14        | 18        | 42          | 25           | 39          | 26         | 243    |
| lower part          |    | 512                           | 76        | 129       | 359         | 232          | 328         | 199        | 1,834  |
| Chaiyaphum          | 10 | 24                            | 4         | 9         | 39          | 20           | 23          | 16         | 134    |
| Nakhon Ratchasima   | 21 | 202                           | 27        | 55        | 127         | 92           | 165         | 44         | 713    |
| Buri Ram            | 27 | 39                            | 9         | 15        | 52          | 27           | 35          | 26         | 201    |
| Yasothon            | 17 | 40                            | 6         | 8         | 17          | 12           | 13          | 15         | 111    |
| Si Sa Ket           | 53 | 45                            | 6         | 9         | 18          | 17           | 19          | 20         | 133    |
| Surin               | 65 | 38                            | 7         | 9         | 28          | 22           | 30          | 22         | 156    |
| Amnat Charoen       | 76 | 12                            | 2         | 3         | 14          | 6            | 6           | 7          | 50     |
| Ubon Ratchathani    | 71 | 112                           | 16        | 22        | 63          | 35           | 37          | 50         | 335    |
| Southern Region     |    | 666                           | 238       | 123       | 439         | 292          | 572         | 286        | 2,618  |
| upper part          |    | 392                           | 143       | 80        | 271         | 195          | 387         | 144        | 1,612  |
| Krabi               | 1  | 30                            | 19        | 12        | 43          | 26           | 38          | 22         | 190    |
| Chumphon            | 11 | 46                            | 8         | 8         | 48          | 26           | 79          | 13         | 228    |
| Nakhon Si Thammarat | 22 | 132                           | 54        | 21        | 55          | 66           | 114         | 44         | 486    |
| Phangnga            | 34 | 18                            | 9         | 8         | 21          | 9            | 21          | 12         | 98     |
| Phuket              | 41 | 32                            | 21        | 9         | 24          | 7            | 10          | 14         | 116    |
| Ranong              | 46 | 14                            | 5         | 2         | 19          | 7            | 8           | 7          | 63     |
| Surat Thani         | 64 | 121                           | 27        | 19        | 59          | 53           | 118         | 33         | 431    |
| lower part          |    | 274                           | 95        | 43        | 169         | 97           | 185         | 142        | 1,005  |
| Trang               | 14 | 36                            | 17        | 9         | 26          | 17           | 28          | 26         | 160    |
| Narathiwat          | 25 | 30                            | 6         | 2         | 10          | 7            | 13          | 23         | 90     |
| Pattani             | 31 | 39                            | 10        | 5         | 19          | 10           | 22          | 20         | 125    |
| Phthalung           | 35 | 28                            | 9         | 6         | 23          | 16           | 34          | 14         | 130    |
| Yala                | 44 | 21                            | 7         | 2         | 9           | 5            | 7           | 15         | 66     |
| Songkhla            | 55 | 104                           | 39        | 17        | 70          | 36           | 77          | 31         | 373    |
| Satun               | 56 | 16                            | 7         | 2         | 12          | 5            | 5           | 13         | 61     |
| Eastern Region      |    | 439                           | 139       | 146       | 459         | 279          | 569         | 114        | 2,145  |
| Chanthaburi         | 6  | 29                            | 11        | 6         | 81          | 14           | 20          | 15         | 175    |
| Chachoengsao        | 7  | 110                           | 32        | 39        | 83          | 76           | 156         | 9          | 505    |
| Chon Buri           | 8  | 131                           | 39        | 48        | 114         | 87           | 215         | 20         | 654    |
| Trai                | 15 | 11                            | 7         | 1         | 25          | 5            | 6           | 10         | 65     |
| Nakhon Nayok        | 18 | 16                            | 3         | 3         | 6           | 9            | 23          | 3          | 63     |
| Prachin Buri        | 30 | 43                            | 14        | 16        | 50          | 35           | 57          | 16         | 231    |
| Rayong              | 47 | 68                            | 28        | 26        | 79          | 34           | 69          | 24         | 327    |
| Sa Kaeo             | 74 | 32                            | 5         | 7         | 21          | 19           | 24          | 16         | 126    |
| Western Region      |    | 329                           | 59        | 88        | 357         | 185          | 433         | 117        | 1,568  |
| Kanchanaburi        | 2  | 66                            | 12        | 15        | 85          | 22           | 66          | 32         | 298    |
| Prachuap Khiri Khan | 29 | 60                            | 7         | 15        | 53          | 52           | 86          | 16         | 288    |
| Phetchabun          | 38 | 63                            | 13        | 18        | 41          | 35           | 78          | 14         | 262    |
| Ratchabun           | 48 | 47                            | 9         | 13        | 94          | 28           | 94          | 25         | 310    |
| Sarut Songkhram     | 58 | 18                            | 3         | 7         | 11          | 10           | 36          | 2          | 88     |
| Suphan Buri         | 63 | 75                            | 15        | 20        | 74          | 38           | 73          | 27         | 322    |
| Total               |    | 3,722                         | 904       | 928       | 3,018       | 1,776        | 3,316       | 1,374      | 15,038 |

Table 4.2.1.8 SOx Emission of Vehicle in the area except BMR in Thailand in Year 2011

| Province            | ID | SOx Emission (tons/year) |           |           |             |              |             |            | total |
|---------------------|----|--------------------------|-----------|-----------|-------------|--------------|-------------|------------|-------|
|                     |    | Car, taxi                | light bus | heavy bus | light truck | medium truck | heavy truck | motorcycle |       |
| Central             |    | 125                      | 63        | 86        | 163         | 130          | 350         | 17         | 935   |
| Chai Nat            | 9  | 17                       | 5         | 7         | 22          | 14           | 46          | 3          | 113   |
| Lop Buri            | 49 | 22                       | 8         | 12        | 28          | 21           | 32          | 5          | 128   |
| Saraburi            | 60 | 31                       | 19        | 15        | 51          | 35           | 102         | 3          | 257   |
| Sing Buri           | 61 | 5                        | 1         | 1         | 3           | 3            | 4           | 2          | 19    |
| Ayutthaya           | 33 | 40                       | 24        | 44        | 39          | 47           | 141         | 4          | 339   |
| Ang Thong           | 67 | 10                       | 6         | 7         | 20          | 10           | 25          | 1          | 79    |
| Northern Region     |    | 258                      | 110       | 92        | 489         | 213          | 337         | 96         | 1,594 |
| upper part          |    | 144                      | 67        | 43        | 280         | 112          | 134         | 56         | 836   |
| Chiang Rai          | 12 | 19                       | 12        | 10        | 56          | 20           | 22          | 10         | 150   |
| Chiang Mai          | 13 | 52                       | 24        | 13        | 99          | 33           | 26          | 18         | 266   |
| Nan                 | 26 | 19                       | 3         | 2         | 11          | 12           | 13          | 6          | 67    |
| Phayao              | 72 | 9                        | 5         | 5         | 28          | 10           | 11          | 6          | 74    |
| Phrae               | 40 | 10                       | 5         | 3         | 17          | 8            | 12          | 3          | 57    |
| Mae Hong Son        | 43 | 4                        | 3         | 1         | 3           | 4            | 4           | 2          | 20    |
| Lampang             | 50 | 21                       | 9         | 7         | 35          | 14           | 31          | 6          | 123   |
| Lamphun             | 51 | 9                        | 5         | 3         | 31          | 11           | 14          | 5          | 79    |
| lower part          |    | 114                      | 43        | 49        | 209         | 100          | 203         | 40         | 758   |
| Kamphaeng Phet      | 4  | 15                       | 6         | 4         | 32          | 14           | 35          | 6          | 112   |
| Tak                 | 16 | 12                       | 5         | 3         | 19          | 11           | 24          | 3          | 77    |
| Nakhon Sawan        | 23 | 21                       | 7         | 10        | 43          | 18           | 50          | 5          | 153   |
| Phichit             | 36 | 10                       | 2         | 5         | 25          | 10           | 22          | 4          | 78    |
| Phitsanulok         | 37 | 15                       | 5         | 7         | 20          | 11           | 16          | 4          | 77    |
| Phetchabun          | 39 | 14                       | 9         | 8         | 30          | 15           | 21          | 6          | 102   |
| Sukhothai           | 62 | 14                       | 4         | 5         | 16          | 9            | 14          | 5          | 65    |
| Uttaradit           | 69 | 8                        | 5         | 5         | 17          | 8            | 14          | 4          | 61    |
| Uthai Thani         | 70 | 5                        | 1         | 2         | 8           | 6            | 7           | 2          | 32    |
| Northeastern Region |    | 358                      | 108       | 164       | 406         | 269          | 358         | 110        | 1,773 |
| upper part          |    | 181                      | 62        | 87        | 191         | 130          | 161         | 58         | 871   |
| Kalasin             | 3  | 15                       | 4         | 6         | 14          | 11           | 11          | 4          | 67    |
| Khon Kaen           | 5  | 40                       | 14        | 25        | 37          | 29           | 42          | 9          | 196   |
| Nakhon Phanom       | 20 | 6                        | 3         | 3         | 14          | 6            | 6           | 4          | 41    |
| Maha Sarakham       | 42 | 24                       | 8         | 11        | 18          | 16           | 17          | 7          | 102   |
| Mukdahan            | 73 | 8                        | 4         | 4         | 7           | 6            | 8           | 3          | 41    |
| Roi Et              | 45 | 23                       | 6         | 8         | 10          | 15           | 18          | 4          | 83    |
| Loei                | 52 | 13                       | 4         | 5         | 16          | 10           | 10          | 6          | 66    |
| Sakon Nakhon        | 54 | 11                       | 5         | 8         | 24          | 11           | 11          | 6          | 76    |
| Nong Khai           | 66 | 9                        | 2         | 3         | 15          | 6            | 8           | 6          | 49    |
| Nong Bua Lam Phu    | 75 | 5                        | 3         | 3         | 9           | 4            | 7           | 2          | 33    |
| Udon Thani          | 68 | 28                       | 8         | 11        | 25          | 15           | 23          | 7          | 117   |
| lower part          |    | 177                      | 46        | 77        | 215         | 139          | 197         | 52         | 903   |
| Chaiyaphum          | 10 | 8                        | 2         | 5         | 24          | 12           | 14          | 4          | 69    |
| Nakhon Ratchasima   | 21 | 70                       | 16        | 33        | 76          | 55           | 99          | 11         | 361   |
| Buri Ram            | 27 | 13                       | 5         | 9         | 31          | 16           | 21          | 7          | 102   |
| Yasothon            | 17 | 14                       | 4         | 5         | 10          | 7            | 8           | 4          | 51    |
| Si Sa Ket           | 53 | 16                       | 3         | 5         | 11          | 10           | 11          | 5          | 61    |
| Surin               | 65 | 13                       | 4         | 5         | 17          | 13           | 18          | 6          | 77    |
| Amnat Charoen       | 76 | 4                        | 1         | 2         | 9           | 4            | 4           | 2          | 25    |
| Ubon Ratchathani    | 71 | 39                       | 10        | 13        | 38          | 21           | 22          | 13         | 156   |
| Southern Region     |    | 198                      | 143       | 74        | 264         | 175          | 343         | 74         | 1,272 |
| upper part          |    | 117                      | 86        | 48        | 162         | 117          | 232         | 38         | 800   |
| Krabi               | 1  | 9                        | 12        | 7         | 26          | 16           | 23          | 6          | 98    |
| Chumphon            | 11 | 14                       | 5         | 5         | 29          | 16           | 47          | 3          | 119   |
| Nakhon Si Thammarat | 22 | 39                       | 32        | 12        | 33          | 40           | 68          | 11         | 237   |
| Phangnga            | 34 | 5                        | 5         | 5         | 13          | 6            | 12          | 3          | 49    |
| Phuket              | 41 | 9                        | 12        | 5         | 15          | 4            | 6           | 4          | 55    |
| Ranong              | 46 | 4                        | 3         | 1         | 12          | 4            | 5           | 2          | 31    |
| Surat Thani         | 64 | 36                       | 16        | 12        | 35          | 32           | 71          | 9          | 211   |
| lower part          |    | 82                       | 57        | 26        | 101         | 58           | 111         | 37         | 472   |
| Trang               | 14 | 11                       | 10        | 6         | 16          | 10           | 17          | 7          | 76    |
| Narathiwat          | 25 | 9                        | 4         | 1         | 6           | 4            | 8           | 6          | 37    |
| Pattani             | 31 | 12                       | 6         | 3         | 11          | 6            | 13          | 5          | 57    |
| Phthalung           | 35 | 8                        | 5         | 3         | 14          | 10           | 21          | 4          | 65    |
| Yala                | 44 | 6                        | 4         | 1         | 5           | 3            | 4           | 4          | 28    |
| Songkhla            | 55 | 31                       | 23        | 10        | 42          | 21           | 46          | 8          | 182   |
| Satun               | 56 | 5                        | 4         | 1         | 7           | 3            | 3           | 3          | 27    |
| Eastern Region      |    | 135                      | 83        | 88        | 275         | 167          | 342         | 30         | 1,120 |
| Chanthaburi         | 6  | 9                        | 7         | 3         | 49          | 8            | 12          | 4          | 91    |
| Chachoengsao        | 7  | 34                       | 19        | 24        | 50          | 46           | 93          | 2          | 268   |
| Chon Buri           | 8  | 40                       | 24        | 29        | 69          | 52           | 129         | 5          | 347   |
| Irat                | 15 | 3                        | 4         | 1         | 15          | 3            | 4           | 3          | 32    |
| Nakhon Nayok        | 18 | 5                        | 2         | 2         | 3           | 5            | 14          | 1          | 32    |
| Prachin Buri        | 30 | 13                       | 8         | 9         | 30          | 21           | 34          | 4          | 120   |
| Rayong              | 47 | 21                       | 17        | 16        | 47          | 21           | 41          | 6          | 168   |
| Sa Kaeo             | 74 | 10                       | 3         | 4         | 13          | 12           | 15          | 4          | 61    |
| Western Region      |    | 104                      | 36        | 53        | 214         | 111          | 260         | 30         | 808   |
| Kanchanaburi        | 2  | 21                       | 7         | 9         | 51          | 13           | 40          | 8          | 149   |
| Prachuap Khiri Khan | 29 | 19                       | 4         | 9         | 32          | 31           | 52          | 4          | 151   |
| Phetchaburi         | 38 | 20                       | 8         | 11        | 25          | 21           | 47          | 4          | 135   |
| Ratchaburi          | 48 | 15                       | 6         | 8         | 56          | 17           | 56          | 7          | 164   |
| Samut Songkhram     | 58 | 6                        | 2         | 4         | 7           | 6            | 22          | 1          | 47    |
| Suphan Buri         | 63 | 24                       | 9         | 12        | 44          | 23           | 44          | 7          | 162   |
| Total               |    | 1,179                    | 542       | 557       | 1,811       | 1,066        | 1,989       | 357        | 7,501 |

### 4.2.1.2 Railway

#### 1) Traffic Data

The number of operations of trains in 4 major lines (Northern line, Northeastern line, Southern line, Eastern line) and others of the Year 2011 are shown in Table 4.2.1.9. The location of lines of railway and their sections are shown in Figure 4.1.1.4.

Table 4.2.1.9(1) Number of Operations of Train in Year 2011

| Line              | Section | Station                 |                         | Distance (km) | Operation (one-way/day) |
|-------------------|---------|-------------------------|-------------------------|---------------|-------------------------|
| Northern Line     | N1      | Bangkok                 | Bang Sue Junction       | 7.47          | 175                     |
|                   | N2      | Bang Sue Junction       | Rangsit                 | 22.53         | 128                     |
|                   | N3      | Rangsit                 | Ban Phachi Junction     | 59.95         | 126                     |
|                   | N4      | Ban Phachi Junction     | Lop Buri                | 42.86         | 74                      |
|                   | N5      | Lop Buri                | Ban Takhli              | 60.2          | 70                      |
|                   | N6      | Ban Takhli              | Nakhon Sawan            | 52.77         | 66                      |
|                   | N7      | Nakhon Sawan            | Taphan Hin              | 73.22         | 64                      |
|                   | N8      | Taphan Hin              | Phitsanulok             | 70.28         | 62                      |
|                   | N9      | Phitsanulok             | Ban Dara Junction       | 69.03         | 44                      |
|                   | N10     | Ban Dara Junction       | Den Chai                | 75.63         | 36                      |
|                   | N11     | Den Chai                | Nakhon Lampang          | 108.35        | 32                      |
|                   | N12     | Nakhon Lampang          | Chiang Mai              | 109.13        | 26                      |
|                   | N13     | Ban Dara Junction       | Sawankalok              | 28.83         | 4                       |
|                   |         | Sub Total               |                         | 780.25        | 907                     |
| Northeastern Line | NE1     | Ban Phachi Junction     | Map Kabao               | 44.35         | 58                      |
|                   | NE2     | Map Kabao               | Thanon Chira Junction   | 131.98        | 50                      |
|                   | NE3     | Thanon Chira Junction   | Surin                   | 153.47        | 38                      |
|                   | NE4     | Surin                   | Ubon Ratchathani        | 155.35        | 34                      |
|                   | NE5     | Ubon Ratchathani        | Bua Yai Junction        | 79.22         | 14                      |
|                   | NE6     | Bua Yai Junction        | Samran                  | 115.21        | 32                      |
|                   | NE7     | Samran                  | Udon Thani              | 103.13        | 24                      |
|                   | NE8     | Udon Thani              | Nong Khai               | 57.26         | 10                      |
|                   | NE9     | Kaeng Khoi Junction     | Lam Narai               | 83.7          | 26                      |
|                   | NE10    | Lam Narai               | Bua Yai Junction        | 167.1         | 24                      |
|                   |         | Sub Total               |                         | 1,090.77      | 310                     |
| Eastern Line      | E1      | Yommarat                | Makkasan                | 3             | 40                      |
|                   | E2      | Makkasan                | Hua Mak                 | 10.24         | 50                      |
|                   | E3      | Hua Mak                 | Hua Takhe               | 15.5          | 50                      |
|                   | E4      | Hua Takhe               | Chachoengsao Junction   | 30.08         | 68                      |
|                   | E5      | Chachoengsao Junction   | Khlong Sip Kao Junction | 24.61         | 36                      |
|                   | E6      | Khlong Sip Kao Junction | Kaen Khoi Junction      | 82.83         | 23                      |
|                   | E7      | Kaen Khoi Junction      | Si Racha                | 69.61         | 50                      |
|                   | E8      | Khlong Sip Kao Junction | Kabin Buri              | 75.66         | 14                      |
|                   | E9      | Kabin Buri              | Aranyaprathet           | 93.24         | 6                       |
|                   | E10     | Chit Lada               | Makkasan                | 3.03          | 23                      |
|                   | E11     | Makkasan                | Mae Nam                 | 9.87          | 8                       |
|                   | E12     | Lat Krabang ICD         | Hua Takhe               | 1.5           | 30                      |
|                   | E13     | Si Racha                | Laem Chabang            | 9.25          | 34                      |
|                   | E14     | Si Racha                | Sattahip                | 66.2          | 22                      |
|                   | E15     | Kao Chin Chan Junction  | Map Ta Phut             | 20.48         | 10                      |
|                   |         | Sub Total               |                         | 515.10        | 464                     |

Source: Investment of Capacity Constraints and Determination of the Need for Track Doubling of SRT Network (SRT,2002)

Table 4.2.1.9(2) Number of Operations of Train in Year 2011

| Line           | Section | Station                  |                       | Distance (km) | Operation (one-way / day) |
|----------------|---------|--------------------------|-----------------------|---------------|---------------------------|
| Southern Line  | S1      | Bang Sue Junction        | Taling Chan Junction  | 14.66         | 46                        |
|                | S2      | Taling Chan Junction     | Nakhon Pathon         | 42.04         | 58                        |
|                | S3      | Nakhon Pathon            | Nong Pla Duk Junction | 16.07         | 56                        |
|                | S4      | Nong Pla Duk Junction    | Hua Hin               | 148.8         | 46                        |
|                | S5      | Hua Hin                  | Prachuap khiri khan   | 89.34         | 42                        |
|                | S6      | Prachuap khiri khan      | Chumphon              | 166.2         | 40                        |
|                | S7      | Chumphon                 | Surat Thani           | 166.49        | 38                        |
|                | S8      | Surat Thani              | Thung Song Junction   | 122.06        | 42                        |
|                | S9      | Thung Song Junction      | Hat Yai               | 171.5         | 38                        |
|                | S10     | Hat Yai                  | Yala                  | 110.16        | 24                        |
|                | S11     | Yala                     | Sungai Kolok          | 104.25        | 18                        |
|                | S12     | Thon Buri                | Taling Chan Junction  | 6.08          | 16                        |
|                | S13     | Nong Pla Duk Junction    | Malaiman              | 78.41         | 2                         |
|                | S14     | Nong Pla Duk Junction    | Nam Tok               | 130.05        | 8                         |
|                | S15     | Ban Thung Pho Junction   | Khiri Rattarikhom     | 31            | 2                         |
|                | S16     | Thung Song Junction      | Kantang               | 93            | 6                         |
|                | S17     | Khao Chum Thong Junction | Nakhon Si Thammarat   | 35.01         | 10                        |
|                | S18     | Hat Yai                  | Padang Besar          | 45.26         | 13                        |
|                |         | Sub Total                |                       | 1,570.38      | 505                       |
| Mae Klong Line | MK1     | Wongwian Yai             | Maha Chai             | 31.12         | 34                        |
|                | MK2     | Ban Laem                 | Mae Klong             | 33.54         | 8                         |
|                |         | Sub Total                |                       | 64.66         | 42                        |

Source: Investment of Capacity Constraints and Determination of the Need for Track Doubling of SRT Network (SRT,2002)

## 2) Estimated Emission

The estimated fuel consumption and SO<sub>x</sub> emission of railway of the Year 2011 in whole Thailand are shown in Table 4.2.1.10.

Table 4.2.1.10(1) Fuel Consumption and SO<sub>x</sub> Emission of Railway in Year 2011

| Line              | Section | Station                 |                         | Fuel Consumption (kton/year) | SO <sub>x</sub> Emission (tons/year) |
|-------------------|---------|-------------------------|-------------------------|------------------------------|--------------------------------------|
| Northern Line     | N1      | Bangkok                 | Bang Sue Junction       | 2.4                          | 1.4                                  |
|                   | N2      | Bang Sue Junction       | Rangsit                 | 5.3                          | 3.2                                  |
|                   | N3      | Rangsit                 | Ban Phachi Junction     | 13.8                         | 8.3                                  |
|                   | N4      | Ban Phachi Junction     | Lop Buri                | 5.8                          | 3.5                                  |
|                   | N5      | Lop Buri                | Ban Takhli              | 7.7                          | 4.6                                  |
|                   | N6      | Ban Takhli              | Nakhon Sawan            | 6.4                          | 3.8                                  |
|                   | N7      | Nakhon Sawan            | Taphan Hin              | 8.6                          | 5.1                                  |
|                   | N8      | Taphan Hin              | Phitsanulok             | 8.0                          | 4.8                                  |
|                   | N9      | Phitsanulok             | Ban Dara Junction       | 5.6                          | 3.3                                  |
|                   | N10     | Ban Dara Junction       | Den Chai                | 5.0                          | 3.0                                  |
|                   | N11     | Den Chai                | Nakhon Lampang          | 6.3                          | 3.8                                  |
|                   | N12     | Nakhon Lampang          | Chiang Mai              | 5.2                          | 3.1                                  |
|                   | N13     | Ban Dara Junction       | Sawankalok              | 0.2                          | 0.1                                  |
| Sub Total         |         |                         |                         | 80                           | 48                                   |
| Northeastern Line | NE1     | Ban Phachi Junction     | Map Kabao               | 4.7                          | 2.8                                  |
|                   | NE2     | Map Kabao               | Thanon Chira Junction   | 12.1                         | 7.2                                  |
|                   | NE3     | Thanon Chira Junction   | Surin                   | 10.7                         | 6.4                                  |
|                   | NE4     | Surin                   | Ubon Ratchathani        | 9.7                          | 5.8                                  |
|                   | NE5     | Ubon Ratchathani        | Bua Yai Junction        | 2.0                          | 1.2                                  |
|                   | NE6     | Bua Yai Junction        | Samran                  | 6.7                          | 4.0                                  |
|                   | NE7     | Samran                  | Udon Thani              | 4.5                          | 2.7                                  |
|                   | NE8     | Udon Thani              | Nong Khai               | 1.0                          | 0.6                                  |
|                   | NE9     | Kaeng Khoi Junction     | Lam Narai               | 4.0                          | 2.4                                  |
|                   | NE10    | Lam Narai               | Bua Yai Junction        | 7.3                          | 4.4                                  |
| Sub Total         |         |                         |                         | 63                           | 38                                   |
| Eastern Line      | E1      | Yommarat                | Makkasan                | 0.2                          | 0.1                                  |
|                   | E2      | Makkasan                | Hua Mak                 | 0.9                          | 0.6                                  |
|                   | E3      | Hua Mak                 | Hua Takhe               | 1.4                          | 0.9                                  |
|                   | E4      | Hua Takhe               | Chachoengsao Junction   | 3.7                          | 2.2                                  |
|                   | E5      | Chachoengsao Junction   | Khlong Sip Kao Junction | 1.6                          | 1.0                                  |
|                   | E6      | Khlong Sip Kao Junction | Kaen Khoi Junction      | 3.5                          | 2.1                                  |
|                   | E7      | Kaen Khoi Junction      | Si Racha                | 6.4                          | 3.8                                  |
|                   | E8      | Khlong Sip Kao Junction | Kabin Buri              | 1.9                          | 1.2                                  |
|                   | E9      | Kabin Buri              | Aranyaprathet           | 1.0                          | 0.6                                  |
|                   | E10     | Chit Lada               | Makkasan                | 0.1                          | 0.1                                  |
|                   | E11     | Makkasan                | Mae Nam                 | 0.1                          | 0.1                                  |
|                   | E12     | Lat Krabang ICD         | Hua Takhe               | 0.1                          | 0.0                                  |
|                   | E13     | Si Racha                | Laem Chabang            | 0.6                          | 0.3                                  |
|                   | E14     | Si Racha                | Sattahip                | 2.7                          | 1.6                                  |
|                   | E15     | Kao Chin Chan Junction  | Map Ta Phut             | 0.4                          | 0.2                                  |
| Sub Total         |         |                         |                         | 25                           | 15                                   |





Table 4.2.1.10(2) Fuel Consumption and SOx Emission of Railway in Year 2011

| Line           | Section | Station                  |                       | Fuel Consumption (kton/year) | SOx Emission (tons/year) |
|----------------|---------|--------------------------|-----------------------|------------------------------|--------------------------|
| Southern Line  | S1      | Bang Sue Junction        | Taling Chan Junction  | 1.2                          | 0.7                      |
|                | S2      | Taling Chan Junction     | Nakhon Pathon         | 4.5                          | 2.7                      |
|                | S3      | Nakhon Pathon            | Nong Pla Duk Junction | 1.6                          | 1.0                      |
|                | S4      | Nong Pla Duk Junction    | Hua Hin               | 12.5                         | 7.5                      |
|                | S5      | Hua Hin                  | Prachuap khiri khan   | 6.9                          | 4.1                      |
|                | S6      | Prachuap khiri khan      | Chumphon              | 12.2                         | 7.3                      |
|                | S7      | Chumphon                 | Surat Thani           | 11.6                         | 6.9                      |
|                | S8      | Surat Thani              | Thung Song Junction   | 9.4                          | 5.6                      |
|                | S9      | Thung Song Junction      | Hat Yai               | 11.9                         | 7.2                      |
|                | S10     | Hat Yai                  | Yala                  | 4.8                          | 2.9                      |
|                | S11     | Yala                     | Sungai Kolok          | 3.4                          | 2.1                      |
|                | S12     | Thon Buri                | Taling Chan Junction  | 0.2                          | 0.1                      |
|                | S13     | Nong Pla Duk Junction    | Malaiman              | 0.3                          | 0.2                      |
|                | S14     | Nong Pla Duk Junction    | Nam Tok               | 1.9                          | 1.1                      |
|                | S15     | Ban Thung Pho Junction   | Khiri Rattankhom      | 0.1                          | 0.1                      |
|                | S16     | Thung Song Junction      | Kantang               | 1.0                          | 0.6                      |
|                | S17     | Khao Chum Thong Junction | Nakhon Si Thammarat   | 0.6                          | 0.4                      |
|                | S18     | Hat Yai                  | Padang Besar          | 1.1                          | 0.6                      |
|                |         | Sub Total                |                       | 85                           | 51                       |
| Mae Klong Line | MK1     | Wongwian Yai             | Maha Chai             | 1.9                          | 1.2                      |
|                | MK2     | Ban Laem                 | Mae Klong             | 0.5                          | 0.3                      |
|                |         |                          | Sub Total             | 2.4                          | 1.7                      |
| Total          |         |                          |                       | 256                          | 153                      |

### 4.2.1.3 Ship

#### 1) Traffic Data and Estimated Emission

The number of calls and the estimated fuel consumption, NOx and SOx emission of vessel (in mooring) of the Year 2011 are shown in Table 4.2.1.11-4.2.1.12.

The number of calls and the estimated fuel consumption, NOx and SOx emission of vessel (in cruising) of the Year 2011 are shown in Table 4.2.1.13-4.2.1.14.

The number of fishing boats and their estimated fuel consumption, NOx and SOx emission of the Year 2011 by province in whole Thailand are shown in Table 4.2.1.15.

The number of trips of small boat and their estimated fuel consumption, NOx and SOx emission of the Year 2011 in Chao Phraya River are shown in Table 4.2.1.16 - 4.2.1.18.

Table 4.2.1.11(1) Results in Mooring(Arrival) by Ship Type in Year 2011

| Port                | Number of Voyager | Liquid Bulk           |                   |                   |                       |                   |                   | Solid Bulk            |                   |                   |                       |                   |                   |         |
|---------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|---------|
|                     |                   | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   |         |
|                     |                   | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) |         |
| Bangkok             | 550               | 716,722               | 34,094            | 24,369            | 3,076,069             | 215,325           | 104,586           | 603                   | 1,076,321         | 52,079            | 36,595                | 692,079           | 48,446            | 23,531  |
| Klong Toey Wharf    |                   |                       |                   |                   |                       |                   |                   | 20                    | 35,595            | 1,722             | 1,210                 | 22,888            | 1,602             | 778     |
| Klong Toey Pole     |                   |                       |                   |                   |                       |                   |                   | 30                    | 54,240            | 2,624             | 1,844                 | 34,876            | 2,441             | 1,186   |
| Bang Hua Suer Pole  |                   |                       |                   |                   |                       |                   |                   | 23                    | 40,680            | 1,968             | 1,383                 | 26,157            | 1,831             | 889     |
| Sathupradit Buoy    |                   |                       |                   |                   |                       |                   |                   | 129                   | 230,519           | 11,154            | 7,838                 | 148,225           | 10,376            | 5,040   |
| Tmn Wharf           |                   |                       |                   |                   |                       |                   |                   | 9                     | 15,255            | 738               | 519                   | 9,809             | 687               | 334     |
| Private Wharves     | 542               | 706,819               | 33,623            | 24,032            | 3,033,568             | 212,350           | 103,141           | 380                   | 677,998           | 32,806            | 23,052                | 435,955           | 30,517            | 14,822  |
| Others              | 8                 | 9,903                 | 471               | 337               | 42,502                | 2,975             | 1,445             | 12                    | 22,035            | 1,066             | 749                   | 14,169            | 992               | 482     |
| Provincial Area     | 5,811             | 7,571,187             | 360,156           | 257,420           | 32,494,478            | 2,274,613         | 1,104,812         | 2,225                 | 3,969,164         | 192,053           | 134,952               | 2,552,189         | 178,653           | 86,774  |
| Chachoengsao        | 301               | 392,799               | 18,685            | 13,355            | 1,685,840             | 118,009           | 57,319            | 2                     | 3,091             | 150               | 105                   | 1,988             | 139               | 68      |
| Chanthaburi         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Chon Buri           |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Ko Sichang          | 24                | 31,000                | 1,475             | 1,054             | 133,059               | 9,314             | 4,524             | 523                   | 933,935           | 45,190            | 31,754                | 600,524           | 42,037            | 20,418  |
| Laem Chabang        | 80                | 103,609               | 4,929             | 3,523             | 444,675               | 31,127            | 15,119            | 104                   | 186,009           | 9,000             | 6,324                 | 119,604           | 8,372             | 4,067   |
| Sattahip            | 2                 | 2,214                 | 105               | 75                | 9,504                 | 665               | 323               | 5                     | 9,097             | 440               | 309                   | 5,849             | 409               | 199     |
| Sri Rcha            | 1,057             | 1,377,399             | 65,522            | 46,832            | 5,911,607             | 413,812           | 200,995           | 248                   | 442,709           | 21,421            | 15,052                | 284,664           | 19,926            | 9,679   |
| Others              |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Chumphon            |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Krabi               | 4                 | 4,561                 | 217               | 155               | 19,573                | 1,370             | 665               | 119                   | 212,320           | 10,273            | 7,219                 | 136,523           | 9,557             | 4,642   |
| Nakhon Si Thammarat |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Khanom              | 74                | 96,147                | 4,574             | 3,269             | 412,648               | 28,885            | 14,030            | 34                    | 61,234            | 2,963             | 2,082                 | 39,374            | 2,756             | 1,339   |
| Pakpanang           |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Tha Sala            |                   |                       |                   |                   |                       |                   |                   | 19                    | 33,679            | 1,630             | 1,145                 | 21,656            | 1,516             | 736     |
| Phetchaburi         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Cha-am              |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Others              |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Phuket              | 216               | 280,800               | 13,357            | 9,547             | 1,205,156             | 84,361            | 40,975            | 27                    | 47,711            | 2,309             | 1,622                 | 30,679            | 2,148             | 1,043   |
| Prachuap Khiri Khan |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Bang Saphan         |                   |                       |                   |                   |                       |                   |                   | 55                    | 97,935            | 4,739             | 3,330                 | 62,973            | 4,408             | 2,141   |
| Thap Sakae          |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Others              |                   |                       |                   |                   |                       |                   |                   | 47                    | 83,245            | 4,028             | 2,830                 | 53,527            | 3,747             | 1,820   |
| Rayong              |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Maptaphut           | 2,664             | 3,470,882             | 165,107           | 118,010           | 14,896,542            | 1,042,758         | 506,482           | 272                   | 484,965           | 23,466            | 16,489                | 311,834           | 21,828            | 10,602  |
| Others              | 833               | 1,085,283             | 51,626            | 36,900            | 4,657,884             | 326,052           | 158,368           | 101                   | 180,130           | 8,716             | 6,124                 | 115,824           | 8,108             | 3,938   |
| Samut Sakhon        |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Mahachai            | 5                 | 6,178                 | 294               | 210               | 26,513                | 1,856             | 901               | 62                    | 109,966           | 5,321             | 3,739                 | 70,709            | 4,950             | 2,404   |
| Thachalom           |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Thachin             |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Others              | 5                 | 6,178                 | 294               | 210               | 26,513                | 1,856             | 901               | 17                    | 29,606            | 1,433             | 1,007                 | 19,037            | 1,333             | 647     |
| Samut Songkhram     |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Maeklong            |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Satun               |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Songkhla            | 548               | 714,134               | 33,971            | 24,281            | 3,064,963             | 214,547           | 104,209           | 344                   | 613,281           | 29,674            | 20,852                | 394,342           | 27,604            | 13,408  |
| Surat Thani         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Trang               |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Katang              |                   |                       |                   |                   |                       |                   |                   | 247                   | 440,252           | 21,302            | 14,969                | 283,084           | 19,816            | 9,625   |
| Total               | 6,361             | 8,287,908             | 394,250           | 281,789           | 35,570,548            | 2,489,938         | 1,209,399         | 2,828                 | 5,045,485         | 244,133           | 171,547               | 3,244,269         | 227,099           | 110,305 |



Table 4.2.1.11(2) Results in Mooring(Arrival) by Ship Type in Year 2011

| Port                | Fully Cellular Container |                       |                   |                   |                       |                   |                   | Semi-Container    |                       |                   |                   |                       |                   |                   |
|---------------------|--------------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|
|                     | Number of Voyager        | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   | Number of Voyager | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   |
|                     |                          | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) |                   | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) |
| Bangkok             | 1,711                    | 4,157,233             | 226,907           | 141,346           | 1,930,470             | 135,133           | 65,636            | 193               | 322,273               | 15,428            | 10,957            | 197,820               | 13,847            | 6,726             |
| Klong Toey Wharf    | 1,164                    | 2,827,657             | 154,337           | 96,140            | 1,313,062             | 91,914            | 44,644            | 126               | 211,145               | 10,108            | 7,179             | 129,606               | 9,072             | 4,407             |
| Klong Toey Pole     |                          |                       |                   |                   |                       |                   |                   | 1                 | 1,588                 | 76                | 54                | 974                   | 68                | 33                |
| Bang Hua Suer Pole  |                          |                       |                   |                   |                       |                   |                   | 5                 | 7,998                 | 380               | 270               | 4,872                 | 341               | 166               |
| Sathupradit Buoy    |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Tinn Wharf          |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Private Wharves     | 540                      | 1,311,110             | 71,562            | 44,578            | 608,832               | 42,618            | 20,700            | 60                | 100,016               | 4,788             | 3,401             | 61,392                | 4,297             | 2,087             |
| Others              | 8                        | 18,466                | 1,008             | 628               | 8,575                 | 600               | 292               | 1                 | 1,588                 | 76                | 54                | 974                   | 68                | 33                |
| Provincial Area     | 1,712                    | 4,160,201             | 227,069           | 141,447           | 1,931,848             | 135,229           | 65,683            | 320               | 535,487               | 25,635            | 18,207            | 328,695               | 23,009            | 11,176            |
| Chachoengsao        | 9                        | 21,048                | 1,149             | 716               | 9,774                 | 684               | 332               |                   |                       |                   |                   |                       |                   |                   |
| Chanthaburi         |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Chon Buri           |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Ko Sichang          | 3                        | 8,259                 | 451               | 281               | 3,835                 | 268               | 130               | 24                | 39,761                | 1,903             | 1,352             | 24,406                | 1,708             | 830               |
| Laem Chabang        | 1,101                    | 2,674,802             | 145,994           | 90,943            | 1,242,082             | 86,946            | 42,231            | 152               | 253,945               | 12,157            | 8,634             | 155,878               | 10,911            | 5,300             |
| Sattahip            | 2                        | 4,129                 | 225               | 140               | 1,918                 | 134               | 65                |                   |                       |                   |                   |                       |                   |                   |
| Sri Rcha            | 8                        | 20,647                | 1,127             | 702               | 9,588                 | 671               | 326               | 46                | 76,681                | 3,671             | 2,607             | 47,069                | 3,295             | 1,600             |
| Others              |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Chumporn            |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Krabi               |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Nakhon Si Thammarat |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Khanom              |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Pakpanang           |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Tha Sala            |                          |                       |                   |                   |                       |                   |                   | 2                 | 2,868                 | 137               | 97                | 1,760                 | 123               | 60                |
| Phetchaburi         |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Cha-am              |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Others              |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Phuket              | 17                       | 42,042                | 2,295             | 1,429             | 19,523                | 1,367             | 664               |                   |                       |                   |                   |                       |                   |                   |
| Prachuap Khiri Khan |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Bang Saphan         |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Thap Sakae          |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Others              |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Rayong              |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Maptaphut           |                          |                       |                   |                   |                       |                   |                   | 6                 | 9,733                 | 466               | 331               | 5,975                 | 418               | 209               |
| Others              | 43                       | 103,783               | 5,665             | 3,529             | 48,193                | 3,374             | 1,639             | 31                | 51,911                | 2,485             | 1,765             | 31,864                | 2,231             | 1,083             |
| Samut Sakhon        |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Mahachai            |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Thachalom           |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Thachin             |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Others              |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Samut Songkhram     |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Maeklong            |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Satun               |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Songkhla            | 529                      | 1,285,490             | 70,164            | 43,707            | 596,935               | 41,785            | 20,296            | 60                | 100,587               | 4,815             | 3,420             | 61,743                | 4,322             | 2,099             |
| Surat Thani         |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Trang               |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Katang              |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Total               | 3,423                    | 8,317,434             | 453,975           | 282,793           | 3,862,317             | 270,362           | 131,319           | 513               | 857,760               | 41,062            | 29,164            | 526,515               | 36,856            | 17,902            |



Table 4.2.1.11(3) Results in Mooring(Arrival) by Ship Type in Year 2011

| Port                | Number of Voyger | Ro-Ro                 |                   |                   |                       |                   |                   | Conventional     |                       |                   |                   |                       |                   |                   |
|---------------------|------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|
|                     |                  | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   | Sub Diesel       |                       |                   | Sub Boiler        |                       |                   |                   |
|                     |                  | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Number of Voyger | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) |
| Bangkok             | 58               | 284,220               | 14,737            | 9,663             | 246,761               | 17,273            | 8,390             | 1,336            | 5,097,314             | 249,359           | 173,309           | 3,437,427             | 240,620           | 116,873           |
| Klong Toey Wharf    | 46               | 223,649               | 11,596            | 7,604             | 194,173               | 13,592            | 6,602             | 474              | 1,809,075             | 88,499            | 61,509            | 1,219,969             | 85,398            | 41,479            |
| Klong Toey Pole     |                  |                       |                   |                   |                       |                   |                   | 89               | 340,788               | 16,671            | 11,587            | 229,814               | 16,087            | 7,814             |
| Bang Hua Suer Pole  |                  |                       |                   |                   |                       |                   |                   | 78               | 297,283               | 14,543            | 10,108            | 200,476               | 14,033            | 6,816             |
| Sathupradit Buoy    |                  |                       |                   |                   |                       |                   |                   | 89               | 340,788               | 16,671            | 11,587            | 229,814               | 16,087            | 7,814             |
| Tmn Wharf           |                  |                       |                   |                   |                       |                   |                   | 10               | 39,879                | 1,951             | 1,356             | 26,893                | 1,883             | 914               |
| Private Wharves     | 12               | 60,572                | 3,141             | 2,059             | 52,588                | 3,681             | 1,788             | 584              | 2,229,622             | 109,072           | 75,807            | 1,503,569             | 105,250           | 51,121            |
| Others              |                  |                       |                   |                   |                       |                   |                   | 10               | 39,879                | 1,951             | 1,356             | 26,893                | 1,883             | 914               |
| Provincial Area     | 337              | 1,652,693             | 85,691            | 56,192            | 1,434,875             | 100,441           | 48,786            | 4,010            | 15,302,006            | 748,568           | 520,268           | 10,319,068            | 722,335           | 350,848           |
| Chachoengsao        |                  |                       |                   |                   |                       |                   |                   | 152              | 581,820               | 28,462            | 19,782            | 392,356               | 27,465            | 13,340            |
| Chanthaburi         |                  |                       |                   |                   |                       |                   |                   |                  |                       |                   |                   |                       |                   |                   |
| Chon Buri           |                  |                       |                   |                   |                       |                   |                   |                  |                       |                   |                   |                       |                   |                   |
| Ko Sichang          | 7                | 33,341                | 1,729             | 1,134             | 28,947                | 2,026             | 984               | 1,241            | 4,734,526             | 231,611           | 160,974           | 3,192,777             | 223,494           | 108,554           |
| Laem Chabang        | 260              | 1,273,959             | 66,054            | 43,315            | 1,106,057             | 77,424            | 37,606            | 670              | 2,555,690             | 125,023           | 86,893            | 1,723,457             | 120,642           | 58,598            |
| Sattahip            |                  |                       |                   |                   |                       |                   |                   | 25               | 97,285                | 4,759             | 3,308             | 65,605                | 4,592             | 2,231             |
| Sri Rcha            | 7                | 33,341                | 1,729             | 1,134             | 28,947                | 2,026             | 984               | 274              | 1,044,190             | 51,081            | 35,502            | 704,160               | 49,291            | 23,941            |
| Others              |                  |                       |                   |                   |                       |                   |                   | 3                | 12,971                | 635               | 441               | 8,747                 | 612               | 297               |
| Chumporn            |                  |                       |                   |                   |                       |                   |                   | 2                | 6,570                 | 321               | 223               | 4,430                 | 310               | 151               |
| Krabi               | 11               | 51,498                | 2,670             | 1,751             | 44,711                | 3,130             | 1,520             | 180              | 687,872               | 33,650            | 23,388            | 463,874               | 32,471            | 15,772            |
| Nakhon Si Thammarat |                  |                       |                   |                   |                       |                   |                   |                  |                       |                   |                   |                       |                   |                   |
| Khanom              |                  |                       |                   |                   |                       |                   |                   | 94               | 360,174               | 17,620            | 12,246            | 242,887               | 17,002            | 8,258             |
| Pakpanang           |                  |                       |                   |                   |                       |                   |                   |                  |                       |                   |                   |                       |                   |                   |
| The Sala            |                  |                       |                   |                   |                       |                   |                   | 7                | 26,194                | 1,281             | 891               | 17,665                | 1,237             | 601               |
| Phetchaburi         |                  |                       |                   |                   |                       |                   |                   |                  |                       |                   |                   |                       |                   |                   |
| Cha-am              |                  |                       |                   |                   |                       |                   |                   |                  |                       |                   |                   |                       |                   |                   |
| Others              |                  |                       |                   |                   |                       |                   |                   | 2                | 9,445                 | 462               | 321               | 6,369                 | 446               | 217               |
| Phuket              | 31               | 154,298               | 8,000             | 5,246             | 133,962               | 9,377             | 4,555             | 77               | 294,142               | 14,389            | 10,001            | 198,358               | 13,885            | 6,744             |
| Prachuap Khiri Khan |                  |                       |                   |                   |                       |                   |                   |                  |                       |                   |                   |                       |                   |                   |
| Bang Saphan         |                  |                       |                   |                   |                       |                   |                   | 176              | 670,310               | 32,791            | 22,791            | 452,031               | 31,642            | 15,369            |
| Thap Sakae          |                  |                       |                   |                   |                       |                   |                   |                  |                       |                   |                   |                       |                   |                   |
| Others              |                  |                       |                   |                   |                       |                   |                   | 189              | 722,678               | 35,353            | 24,571            | 487,345               | 34,114            | 16,570            |
| Rayong              |                  |                       |                   |                   |                       |                   |                   |                  |                       |                   |                   |                       |                   |                   |
| Maptaphut           | 6                | 28,567                | 1,481             | 971               | 24,802                | 1,736             | 843               | 602              | 2,296,844             | 112,361           | 78,093            | 1,548,901             | 108,423           | 52,663            |
| Others              |                  |                       |                   |                   |                       |                   |                   | 76               | 288,958               | 14,136            | 9,825             | 194,862               | 13,640            | 6,625             |
| Samut Sakhon        |                  |                       |                   |                   |                       |                   |                   |                  |                       |                   |                   |                       |                   |                   |
| Mahachai            |                  |                       |                   |                   |                       |                   |                   | 9                | 36,185                | 1,770             | 1,230             | 24,402                | 1,708             | 830               |
| Thachalom           |                  |                       |                   |                   |                       |                   |                   |                  |                       |                   |                   |                       |                   |                   |
| Thachin             |                  |                       |                   |                   |                       |                   |                   |                  |                       |                   |                   |                       |                   |                   |
| Others              |                  |                       |                   |                   |                       |                   |                   | 12               | 45,232                | 2,213             | 1,538             | 30,502                | 2,135             | 1,037             |
| Samut Songkhram     |                  |                       |                   |                   |                       |                   |                   |                  |                       |                   |                   |                       |                   |                   |
| Maeklong            |                  |                       |                   |                   |                       |                   |                   |                  |                       |                   |                   |                       |                   |                   |
| Satun               |                  |                       |                   |                   |                       |                   |                   | 14               | 53,427                | 2,614             | 1,817             | 36,029                | 2,522             | 1,225             |
| Songkhla            | 16               | 77,689                | 4,028             | 2,641             | 67,449                | 4,721             | 2,293             | 160              | 610,533               | 29,867            | 20,758            | 411,719               | 28,820            | 13,998            |
| Surat Thani         |                  |                       |                   |                   |                       |                   |                   |                  |                       |                   |                   |                       |                   |                   |
| Trang               |                  |                       |                   |                   |                       |                   |                   |                  |                       |                   |                   |                       |                   |                   |
| Katang              |                  |                       |                   |                   |                       |                   |                   | 44               | 166,959               | 8,168             | 5,677             | 112,591               | 7,881             | 3,828             |
| Total               | 395              | 1,936,914             | 100,428           | 65,855            | 1,681,636             | 117,715           | 57,176            | 5,345            | 20,399,320            | 997,927           | 693,577           | 13,756,496            | 962,955           | 467,721           |

Table 4.2.1.11(4) Results in Mooring(Arrival) by Ship Type in Year 2011

| Port                | Number of Voyager | Others                |                   |                   |                       |                   |                   | Total             |                       |                   |                   |                       |                   |                   |                        |                   |                   |
|---------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|------------------------|-------------------|-------------------|
|                     |                   | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   | Sub Diesel        |                       |                   | Sub Boiler        |                       |                   | Total             |                        |                   |                   |
|                     |                   | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Number of Voyager | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (ton) | NO2 Emission (kg) | SO2 Emission (kg) |
| Bangkok             | 179               | 131,684               | 6,200             | 4,477             | 55,030                | 3,852             | 1,871             | 4,629             | 11,785,767            | 598,803           | 400,716           | 9,635,657             | 674,496           | 327,612           | 21,421                 | 1,273,299         | 728,328           |
| Klong Toey Wharf    | 5                 | 3,502                 | 165               | 119               | 1,464                 | 102               | 50                | 1,834             | 5,110,623             | 266,427           | 173,761           | 2,881,161             | 201,681           | 97,959            | 7,992                  | 468,109           | 271,721           |
| Klong Toey Pole     |                   |                       |                   |                   |                       |                   |                   | 121               | 396,615               | 19,372            | 13,485            | 265,665               | 18,597            | 9,033             | 662                    | 37,968            | 22,518            |
| Bang Hua Suer Pole  | 2                 | 1,401                 | 66                | 48                | 585                   | 41                | 20                | 107               | 347,301               | 16,957            | 11,806            | 232,091               | 16,246            | 7,891             | 579                    | 33,204            | 19,699            |
| Sathupradit Buoy    | 6                 | 4,203                 | 198               | 143               | 1,756                 | 123               | 60                | 224               | 575,510               | 28,023            | 19,567            | 379,795               | 26,586            | 12,913            | 955                    | 54,609            | 32,480            |
| Tmn Wharf           | 10                | 7,004                 | 330               | 238               | 2,927                 | 205               | 100               | 29                | 62,139                | 3,019             | 2,113             | 39,629                | 2,774             | 1,347             | 102                    | 5,793             | 3,460             |
| Private Wharves     | 151               | 111,371               | 5,244             | 3,787             | 46,542                | 3,258             | 1,582             | 2,270             | 5,197,506             | 260,235           | 176,715           | 5,742,447             | 401,971           | 195,243           | 10,940                 | 662,207           | 371,958           |
| Others              | 6                 | 4,203                 | 198               | 143               | 1,756                 | 123               | 60                | 45                | 96,074                | 4,770             | 3,267             | 94,869                | 6,641             | 3,226             | 191                    | 11,411            | 6,492             |
| Provincial Area     | 1,602             | 1,181,169             | 55,615            | 40,160            | 493,609               | 34,553            | 16,783            | 16,016            | 34,371,906            | 1,694,788         | 1,168,645         | 49,554,763            | 3,468,833         | 1,684,862         | 83,927                 | 5,163,621         | 2,853,507         |
| Chachoengsao        | 66                | 48,541                | 2,286             | 1,650             | 20,285                | 1,420             | 690               | 530               | 1,047,299             | 50,732            | 35,608            | 2,110,243             | 147,717           | 71,748            | 3,158                  | 198,449           | 107,356           |
| Chanthaburi         |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Chon Buri           |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Ko Sichang          | 10                | 7,518                 | 354               | 256               | 3,142                 | 220               | 107               | 1,832             | 5,788,342             | 282,713           | 196,804           | 3,986,690             | 279,068           | 135,547           | 9,775                  | 561,781           | 332,351           |
| Laem Chaabang       | 71                | 52,113                | 2,454             | 1,772             | 21,778                | 1,524             | 740               | 2,437             | 7,100,128             | 365,611           | 241,404           | 4,813,531             | 336,947           | 163,660           | 11,914                 | 702,558           | 405,064           |
| Sattahip            | 19                | 13,784                | 649               | 469               | 5,760                 | 403               | 196               | 53                | 126,509               | 6,179             | 4,301             | 88,636                | 6,205             | 3,014             | 215                    | 12,384            | 7,315             |
| Sri Rcha            | 14                | 10,024                | 472               | 341               | 4,189                 | 293               | 142               | 1,654             | 3,004,993             | 145,023           | 102,170           | 6,990,224             | 489,316           | 237,668           | 9,995                  | 634,339           | 339,837           |
| Others              |                   |                       |                   |                   |                       |                   |                   | 3                 | 12,971                | 635               | 441               | 8,747                 | 612               | 297               | 22                     | 1,247             | 738               |
| Chumpom             |                   |                       |                   |                   |                       |                   |                   | 2                 | 6,570                 | 321               | 223               | 4,430                 | 310               | 151               | 11                     | 632               | 374               |
| Krabi               | 70                | 51,612                | 2,430             | 1,755             | 21,568                | 1,510             | 733               | 383               | 1,007,863             | 49,241            | 34,267            | 686,249               | 48,037            | 23,332            | 1,694                  | 97,279            | 57,600            |
| Nakhon Si Thammarat |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Khanom              | 26                | 18,978                | 894               | 645               | 7,931                 | 555               | 270               | 228               | 536,533               | 26,050            | 18,242            | 702,840               | 49,199            | 23,897            | 1,239                  | 75,248            | 42,139            |
| Pakpanang           | 7                 | 5,061                 | 238               | 172               | 2,115                 | 148               | 72                | 7                 | 5,061                 | 238               | 172               | 2,115                 | 148               | 72                | 7                      | 386               | 244               |
| The Sala            | 3                 | 2,530                 | 119               | 86                | 1,057                 | 74                | 36                | 31                | 65,271                | 3,167             | 2,219             | 42,138                | 2,950             | 1,433             | 107                    | 6,117             | 3,652             |
| Phetchaburi         |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Cha-am              |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Others              |                   |                       |                   |                   |                       |                   |                   | 2                 | 9,445                 | 462               | 321               | 6,369                 | 446               | 217               | 16                     | 908               | 538               |
| Phuket              | 173               | 127,577               | 6,007             | 4,338             | 53,314                | 3,732             | 1,813             | 541               | 946,571               | 46,357            | 32,183            | 1,640,992             | 114,869           | 55,794            | 2,588                  | 161,227           | 87,977            |
| Prachuap Khiri Khan |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Bang Saphan         | 8                 | 6,071                 | 286               | 206               | 2,537                 | 178               | 86                | 239               | 774,316               | 37,816            | 26,327            | 517,540               | 36,228            | 17,596            | 1,292                  | 74,044            | 43,923            |
| Thap Sakae          |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Others              | 5                 | 4,047                 | 191               | 138               | 1,691                 | 118               | 58                | 242               | 809,970               | 39,572            | 27,539            | 542,563               | 37,979            | 18,447            | 1,353                  | 77,551            | 45,986            |
| Rayong              |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Maptaphut           | 23                | 17,178                | 809               | 584               | 7,179                 | 503               | 244               | 3,572             | 6,308,169             | 303,690           | 214,478           | 16,795,233            | 1,175,666         | 571,038           | 23,103                 | 1,479,356         | 785,516           |
| Others              | 14                | 10,020                | 472               | 341               | 4,188                 | 293               | 142               | 1,097             | 1,720,086             | 83,099            | 58,483            | 5,052,815             | 353,697           | 171,796           | 6,773                  | 436,796           | 230,279           |
| Samut Sakhon        |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Mahachai            | 111               | 82,146                | 3,868             | 2,793             | 34,329                | 2,403             | 1,167             | 187               | 234,475               | 11,253            | 7,972             | 155,953               | 10,917            | 5,302             | 390                    | 22,169            | 13,275            |
| Thachalom           |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Thachin             |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Others              | 171               | 125,841               | 5,925             | 4,279             | 52,589                | 3,681             | 1,788             | 204               | 206,857               | 9,864             | 7,033             | 128,642               | 9,005             | 4,374             | 335                    | 18,869            | 11,407            |
| Samut Songkhram     |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Maeklong            |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Satun               | 60                | 43,870                | 2,066             | 1,492             | 18,333                | 1,283             | 623               | 74                | 97,297                | 4,679             | 3,308             | 54,362                | 3,805             | 1,848             | 152                    | 8,485             | 5,156             |
| Songkhla            | 141               | 103,943               | 4,894             | 3,534             | 43,438                | 3,041             | 1,477             | 1,798             | 3,505,657             | 177,413           | 119,192           | 4,640,590             | 324,841           | 157,780           | 8,146                  | 502,255           | 276,972           |
| Surat Thani         |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Trang               |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Katang              | 611               | 450,313               | 21,203            | 15,311            | 188,185               | 13,173            | 6,398             | 901               | 1,057,524             | 50,673            | 35,956            | 583,860               | 40,870            | 19,851            | 1,641                  | 91,543            | 55,807            |
| Total               | 1,781             | 1,312,853             | 61,816            | 44,637            | 548,639               | 38,405            | 18,654            | 20,646            | 46,157,674            | 2,293,591         | 1,569,361         | 59,190,420            | 4,143,329         | 2,012,474         | 105,348                | 6,436,921         | 3,581,835         |



Table 4.2.1.12(1) Results in Mooring(Departure) by Ship Type in Year 2011

| Port                | Number of Voyager | Liquid Bulk           |                   |                   |                       |                   |                   | Solid Bulk            |                   |                   |                       |                   |                   |         |
|---------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|---------|
|                     |                   | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   |         |
|                     |                   | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) |         |
| Bangkok             | 374               | 493,247               | 23,507            | 16,770            | 2,151,275             | 150,589           | 73,143            | 523                   | 933,942           | 45,190            | 31,754                | 600,529           | 42,037            | 20,418  |
| Klong Toey Wharf    |                   |                       |                   |                   |                       |                   |                   | 15                    | 27,120            | 1,312             | 922                   | 17,438            | 1,221             | 593     |
| Klong Toey Pole     |                   |                       |                   |                   |                       |                   |                   | 19                    | 33,900            | 1,640             | 1,153                 | 21,798            | 1,526             | 741     |
| Bang Hua Suer Pole  |                   |                       |                   |                   |                       |                   |                   | 13                    | 23,730            | 1,148             | 807                   | 15,258            | 1,068             | 519     |
| Sathupradit Buoy    |                   |                       |                   |                   |                       |                   |                   | 134                   | 238,994           | 11,564            | 8,126                 | 153,674           | 10,757            | 5,225   |
| Tmn Wharf           |                   |                       |                   |                   |                       |                   |                   | 4                     | 6,780             | 328               | 231                   | 4,360             | 305               | 148     |
| Private Wharves     | 367               | 483,232               | 23,029            | 16,430            | 2,107,594             | 147,532           | 71,658            | 333                   | 593,248           | 28,705            | 20,170                | 381,461           | 26,702            | 12,970  |
| Others              | 8                 | 10,015                | 477               | 341               | 43,681                | 3,058             | 1,485             | 6                     | 10,170            | 492               | 346                   | 6,539             | 458               | 222     |
| Provincial Area     | 5,860             | 7,721,608             | 367,988           | 262,535           | 33,677,475            | 2,357,423         | 1,145,034         | 2,246                 | 4,007,973         | 193,931           | 136,271               | 2,577,144         | 180,400           | 87,623  |
| Chachoengsao        | 305               | 401,819               | 19,149            | 13,662            | 1,752,516             | 122,676           | 59,586            |                       |                   |                   |                       |                   |                   |         |
| Chanthaburi         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Chon Buri           |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Ko Sichang          | 29                | 38,073                | 1,814             | 1,294             | 166,053               | 11,624            | 5,646             | 525                   | 936,967           | 45,336            | 31,857                | 602,474           | 42,173            | 20,484  |
| Laem Chabang        | 83                | 109,441               | 5,216             | 3,721             | 477,321               | 33,412            | 16,229            | 104                   | 186,009           | 9,000             | 6,324                 | 119,604           | 8,372             | 4,067   |
| Sattahip            | 2                 | 2,240                 | 107               | 76                | 9,768                 | 684               | 332               | 5                     | 9,097             | 440               | 309                   | 5,849             | 409               | 199     |
| Sri Rcha            | 1,062             | 1,399,734             | 66,707            | 47,591            | 6,104,883             | 427,342           | 207,566           | 253                   | 451,806           | 21,861            | 15,361                | 290,513           | 20,336            | 9,877   |
| Others              |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Chumporn            |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Krabi               | 5                 | 6,918                 | 330               | 235               | 30,174                | 2,112             | 1,026             | 112                   | 199,831           | 9,669             | 6,794                 | 128,492           | 8,994             | 4,369   |
| Nakhon Si Thammarat |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Khanom              | 70                | 92,714                | 4,418             | 3,152             | 404,368               | 28,306            | 13,749            | 17                    | 30,617            | 1,481             | 1,041                 | 19,687            | 1,378             | 669     |
| Pakpanang           |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Tha Sala            |                   |                       |                   |                   |                       |                   |                   | 31                    | 58,111            | 2,667             | 1,874                 | 35,436            | 2,481             | 1,205   |
| Phetchaburi         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Cha-am              |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Others              |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Phuket              | 217               | 286,057               | 13,633            | 9,726             | 1,247,625             | 87,334            | 42,419            | 25                    | 44,905            | 2,173             | 1,527                 | 28,874            | 2,021             | 982     |
| Prachuap Khiri Khan |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Bang Saphan         |                   |                       |                   |                   |                       |                   |                   | 60                    | 107,728           | 5,213             | 3,663                 | 69,270            | 4,849             | 2,355   |
| Thap Sakae          |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Others              |                   |                       |                   |                   |                       |                   |                   | 36                    | 63,658            | 3,080             | 2,164                 | 40,932            | 2,865             | 1,392   |
| Rayong              |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Maptaphut           | 2,699             | 3,556,285             | 169,482           | 120,914           | 15,510,591            | 1,085,741         | 527,360           | 276                   | 491,893           | 23,801            | 16,724                | 316,289           | 22,140            | 10,754  |
| Others              | 833               | 1,097,587             | 52,308            | 37,318            | 4,787,082             | 335,096           | 162,761           | 87                    | 155,881           | 7,543             | 5,300                 | 100,232           | 7,016             | 3,408   |
| Samut Sakhon        |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Mahachai            | 2                 | 3,124                 | 149               | 106               | 13,624                | 954               | 463               | 83                    | 148,031           | 7,163             | 5,033                 | 95,185            | 6,663             | 3,236   |
| Thachalom           |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Thachin             |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Others              | 17                | 21,867                | 1,042             | 743               | 95,371                | 6,676             | 3,243             | 12                    | 21,147            | 1,023             | 719                   | 13,598            | 952               | 462     |
| Samut Songkhram     |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Maeklong            |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Satun               |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Songkhla            | 534               | 703,444               | 33,524            | 23,917            | 3,068,041             | 214,763           | 104,313           | 367                   | 655,674           | 31,726            | 22,293                | 421,601           | 29,512            | 14,334  |
| Surat Thani         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Trang               |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Katang              | 2                 | 2,306                 | 110               | 78                | 10,058                | 704               | 342               | 252                   | 449,619           | 21,755            | 15,287                | 289,107           | 20,238            | 9,830   |
| Total               | 6,234             | 8,214,854             | 391,495           | 279,305           | 35,828,750            | 2,508,013         | 1,218,178         | 2,770                 | 4,941,915         | 239,121           | 168,025               | 3,177,672         | 222,437           | 108,041 |

Table 4.2.1.12(2) Results in Mooring(Departure) by Ship Type in Year 2011

| Port                | Fully Cellular Container |                       |                   |                   |                       |                   |                   | Semi-Container    |                       |                   |                   |                       |                   |                   |
|---------------------|--------------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|
|                     | Number of Voyager        | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   | Number of Voyager | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   |
|                     |                          | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) |                   | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) |
| Bangkok             | 1,681                    | 4,101,667             | 224,037           | 139,457           | 1,903,855             | 133,410           | 64,799            | 164               | 615,648               | 30,026            | 20,932            | 409,733               | 28,681            | 13,931            |
| Klong Toey Wharf    | 1,161                    | 2,833,373             | 154,762           | 96,335            | 1,316,537             | 92,158            | 44,762            | 107               | 402,128               | 19,612            | 13,672            | 267,629               | 18,734            | 9,099             |
| Klong Toey Pole     |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Bang Hua Suer Pole  |                          |                       |                   |                   |                       |                   |                   | 3                 | 10,676                | 521               | 363               | 7,105                 | 497               | 242               |
| Sathupradit Buoy    |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Tmn Wharf           |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Private Wharves     | 515                      | 1,256,701             | 68,642            | 42,728            | 583,931               | 40,875            | 19,854            | 50                | 188,609               | 9,199             | 6,413             | 125,525               | 8,787             | 4,268             |
| Others              | 5                        | 11,593                | 633               | 394               | 5,387                 | 377               | 183               | 4                 | 14,235                | 694               | 484               | 9,474                 | 663               | 322               |
| Provincial Area     | 1,712                    | 4,177,935             | 228,203           | 142,050           | 1,941,293             | 135,891           | 66,004            | 321               | 1,200,650             | 58,557            | 40,822            | 799,071               | 55,935            | 27,168            |
| Chachoengsao        | 7                        | 16,914                | 924               | 575               | 7,859                 | 550               | 267               | 2                 | 6,490                 | 317               | 221               | 4,319                 | 302               | 147               |
| Chanthaburi         |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Chon Buri           |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Ko Sichang          | 10                       | 24,888                | 1,359             | 846               | 11,564                | 809               | 393               | 24                | 89,128                | 4,347             | 3,030             | 59,317                | 4,152             | 2,017             |
| Laem Chabang        | 1,096                    | 2,673,851             | 146,048           | 90,911            | 1,242,415             | 86,969            | 42,242            | 150               | 562,624               | 27,440            | 19,129            | 374,444               | 26,211            | 12,731            |
| Sattahip            | 2                        | 4,148                 | 227               | 141               | 1,927                 | 135               | 66                |                   |                       |                   |                   |                       |                   |                   |
| Sri Rcha            | 12                       | 29,035                | 1,586             | 987               | 13,491                | 944               | 459               | 48                | 178,255               | 8,694             | 6,061             | 118,634               | 8,304             | 4,034             |
| Others              |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Chumpom             |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Krabi               |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Nakhon Si Thammarat |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Khanom              |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Pakpanang           |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Tha Sala            |                          |                       |                   |                   |                       |                   |                   | 2                 | 6,428                 | 314               | 219               | 4,278                 | 299               | 145               |
| Phetchaburi         |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Cha-am              |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Others              |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Phuket              | 19                       | 46,070                | 2,516             | 1,566             | 21,407                | 1,498             | 728               |                   |                       |                   |                   |                       |                   |                   |
| Prachuap Khiri Khan |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Bang Saphan         |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Thap Sakae          |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Others              |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Rayong              |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Maptaphut           | 4                        | 9,477                 | 518               | 322               | 4,404                 | 308               | 150               | 4                 | 14,546                | 709               | 495               | 9,681                 | 678               | 329               |
| Others              | 37                       | 90,033                | 4,918             | 3,061             | 41,834                | 2,928             | 1,422             | 33                | 123,637               | 6,090             | 4,204             | 82,284                | 5,760             | 2,798             |
| Samut Sakhon        |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Mahachai            |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Thachalom           |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Thachin             |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Others              |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Samut Songkhram     |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Maeklong            |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Satun               |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Songkhla            | 526                      | 1,283,519             | 70,107            | 43,640            | 596,392               | 41,747            | 20,277            | 59                | 219,543               | 10,707            | 7,464             | 146,113               | 10,228            | 4,968             |
| Surat Thani         |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Trang               |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Katang              |                          |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |
| Total               | 3,392                    | 8,279,602             | 452,240           | 281,506           | 3,847,148             | 269,300           | 130,803           | 485               | 1,816,297             | 88,583            | 61,754            | 1,208,804             | 84,616            | 41,099            |



Table 4.2.1.12(3) Results in Mooring(Departure) by Ship Type in Year 2011

| Port                | Number of Voyager | Ro-Ro                 |                   |                   |                       |                   |                   | Conventional          |                   |                   |                       |                   |                   |         |
|---------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|---------|
|                     |                   | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   |         |
|                     |                   | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) |         |
| Bangkok             | 54                | 267,898               | 13,910            | 9,109             | 234,026               | 16,382            | 7,957             | 1,090                 | 4,173,386         | 204,281           | 141,895               | 2,821,587         | 197,511           | 95,934  |
| Klong Toey Wharf    | 42                | 206,798               | 10,738            | 7,031             | 180,652               | 12,646            | 6,142             | 345                   | 1,320,784         | 64,650            | 44,907                | 892,970           | 62,508            | 30,361  |
| Klong Toey Pole     |                   |                       |                   |                   |                       |                   |                   | 108                   | 414,792           | 20,303            | 14,103                | 280,437           | 19,631            | 9,535   |
| Bang Hua Suer Pole  |                   |                       |                   |                   |                       |                   |                   | 45                    | 171,011           | 8,371             | 5,814                 | 115,619           | 8,093             | 3,931   |
| Sathupradit Buoy    |                   |                       |                   |                   |                       |                   |                   | 98                    | 374,768           | 18,344            | 12,742                | 253,377           | 17,736            | 8,615   |
| Tmn Wharf           |                   |                       |                   |                   |                       |                   |                   | 9                     | 32,747            | 1,603             | 1,113                 | 22,140            | 1,550             | 753     |
| Private Wharves     | 12                | 61,100                | 3,172             | 2,077             | 53,374                | 3,736             | 1,815             | 476                   | 1,822,900         | 89,228            | 61,979                | 1,232,446         | 86,271            | 41,903  |
| Others              |                   |                       |                   |                   |                       |                   |                   | 10                    | 36,385            | 1,781             | 1,237                 | 24,600            | 1,722             | 836     |
| Provincial Area     | 337               | 1,665,235             | 86,464            | 56,618            | 1,454,690             | 101,828           | 49,459            | 3,995                 | 15,299,917        | 748,908           | 520,197               | 10,344,130        | 724,089           | 351,700 |
| Chachoengsao        |                   |                       |                   |                   |                       |                   |                   | 149                   | 570,654           | 27,933            | 19,402                | 385,814           | 27,007            | 13,118  |
| Chanthaburi         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Chon Buri           |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Ko Sichang          | 7                 | 33,632                | 1,746             | 1,143             | 29,380                | 2,057             | 999               | 1,219                 | 4,667,044         | 228,445           | 158,679               | 3,155,344         | 220,874           | 107,282 |
| Laem Chabang        | 256               | 1,267,581             | 65,817            | 43,098            | 1,107,314             | 77,512            | 37,649            | 696                   | 2,666,455         | 130,519           | 90,659                | 1,802,765         | 126,194           | 61,294  |
| Sattahip            | 2                 | 8,408                 | 437               | 286               | 7,345                 | 514               | 250               | 24                    | 91,128            | 4,461             | 3,098                 | 61,611            | 4,313             | 2,095   |
| Sri Rcha            | 10                | 50,448                | 2,619             | 1,715             | 44,070                | 3,085             | 1,498             | 270                   | 1,034,951         | 50,659            | 35,188                | 699,721           | 48,980            | 23,791  |
| Others              |                   |                       |                   |                   |                       |                   |                   | 3                     | 13,018            | 637               | 443                   | 8,802             | 616               | 299     |
| Chumporn            |                   |                       |                   |                   |                       |                   |                   | 2                     | 6,593             | 323               | 224                   | 4,458             | 312               | 152     |
| Krabi               | 11                | 51,947                | 2,697             | 1,766             | 45,379                | 3,177             | 1,543             | 180                   | 690,362           | 33,792            | 23,472                | 466,747           | 32,672            | 15,869  |
| Nakhon Si Thammarat |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Khanom              |                   |                       |                   |                   |                       |                   |                   | 67                    | 256,321           | 12,547            | 8,715                 | 173,296           | 12,131            | 5,892   |
| Pakpanang           |                   |                       |                   |                   |                       |                   |                   | 3                     | 13,145            | 643               | 447                   | 8,887             | 622               | 302     |
| Tha Sala            |                   |                       |                   |                   |                       |                   |                   | 24                    | 92,013            | 4,504             | 3,128                 | 62,209            | 4,355             | 2,115   |
| Phetchaburi         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Cha-am              |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Others              |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Phuket              | 31                | 155,643               | 8,081             | 5,292             | 135,964               | 9,517             | 4,623             | 77                    | 295,207           | 14,450            | 10,037                | 199,587           | 13,971            | 6,786   |
| Prachuap Khiri Khan |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Bang Saphan         |                   |                       |                   |                   |                       |                   |                   | 178                   | 683,248           | 33,444            | 23,230                | 461,937           | 32,336            | 15,706  |
| Thap Sakae          |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Others              |                   |                       |                   |                   |                       |                   |                   | 173                   | 662,225           | 32,415            | 22,516                | 447,724           | 31,341            | 15,223  |
| Rayong              |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Maptaphut           | 4                 | 19,210                | 997               | 653               | 16,782                | 1,175             | 571               | 610                   | 2,334,902         | 114,290           | 79,387                | 1,578,605         | 110,502           | 53,673  |
| Others              |                   |                       |                   |                   |                       |                   |                   | 62                    | 237,952           | 11,647            | 8,090                 | 160,877           | 11,261            | 5,470   |
| Samut Sakhon        |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Mahachai            |                   |                       |                   |                   |                       |                   |                   | 12                    | 45,395            | 2,222             | 1,543                 | 30,691            | 2,148             | 1,044   |
| Thachalom           |                   |                       |                   |                   |                       |                   |                   | 2                     | 9,079             | 444               | 309                   | 6,138             | 430               | 209     |
| Thachin             |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Others              |                   |                       |                   |                   |                       |                   |                   | 17                    | 63,554            | 3,111             | 2,161                 | 42,968            | 3,008             | 1,461   |
| Samut Songkhram     |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Maeklong            |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Satun               |                   |                       |                   |                   |                       |                   |                   | 18                    | 67,025            | 3,281             | 2,279                 | 45,315            | 3,172             | 1,541   |
| Songkhla            | 16                | 78,366                | 4,069             | 2,664             | 68,458                | 4,792             | 2,328             | 162                   | 618,809           | 30,290            | 21,040                | 418,371           | 29,286            | 14,225  |
| Surat Thani         |                   |                       |                   |                   |                       |                   |                   | 2                     | 6,572             | 322               | 223                   | 4,443             | 311               | 151     |
| Trang               |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |         |
| Katang              |                   |                       |                   |                   |                       |                   |                   | 46                    | 174,266           | 8,530             | 5,925                 | 117,820           | 8,247             | 4,006   |
| Total               | 391               | 1,933,133             | 100,374           | 65,727            | 1,688,716             | 118,210           | 57,416            | 5,084                 | 19,473,303        | 953,189           | 662,092               | 13,165,717        | 921,600           | 447,634 |

Table 4.2.1.12(4) Results in Mooring(Departure) by Ship Type in Year 2011

| Port                | Number of Voyager | Others                |                   |                   |                       |                   |                   | Number of Voyager | Total                 |                   |                   |                       |                   |                   |                        |                   |                   |
|---------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|------------------------|-------------------|-------------------|
|                     |                   | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   |                   | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   | Total                  |                   |                   |
|                     |                   | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) |                   | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (ton) | NO2 Emission (kg) | SO2 Emission (kg) |
| Bangkok             | 162               | 119,076               | 5,607             | 4,049             | 49,762                | 3,483             | 1,692             | 4,048             | 10,704,863            | 546,558           | 363,965           | 8,172,767             | 572,094           | 277,874           | 18,878                 | 1,118,651         | 641,839           |
| Klong Toey Wharf    | 5                 | 3,502                 | 165               | 119               | 1,464                 | 102               | 50                | 1,675             | 4,793,706             | 251,239           | 162,986           | 2,676,690             | 187,368           | 91,007            | 7,470                  | 438,608           | 253,993           |
| Klong Toey Pole     |                   |                       |                   |                   |                       |                   |                   | 127               | 448,692               | 21,944            | 15,256            | 302,235               | 21,156            | 10,276            | 751                    | 43,100            | 25,531            |
| Bang Hua Suer Pole  | 1                 | 700                   | 33                | 24                | 293                   | 20                | 10                | 62                | 206,117               | 10,073            | 7,008             | 138,275               | 9,679             | 4,701             | 344                    | 19,752            | 11,709            |
| Sathupradit Buoy    | 11                | 8,405                 | 396               | 286               | 3,513                 | 246               | 119               | 243               | 622,167               | 30,304            | 21,154            | 410,564               | 28,739            | 13,959            | 1,033                  | 59,044            | 35,113            |
| Tmn Wharf           | 14                | 10,507                | 495               | 357               | 4,391                 | 307               | 149               | 27                | 50,033                | 2,426             | 1,701             | 90,890                | 2,162             | 1,050             | 81                     | 4,588             | 2,751             |
| Private Wharves     | 124               | 91,758                | 4,320             | 3,120             | 38,346                | 2,684             | 1,304             | 1,877             | 4,497,547             | 226,297           | 152,917           | 4,522,677             | 316,587           | 153,771           | 9,020                  | 542,884           | 306,688           |
| Others              | 6                 | 4,203                 | 198               | 143               | 1,756                 | 123               | 60                | 37                | 86,601                | 4,276             | 2,944             | 91,436                | 6,401             | 3,109             | 178                    | 10,676            | 6,053             |
| Provincial Area     | 1,557             | 1,147,817             | 54,045            | 39,026            | 479,671               | 33,577            | 16,309            | 16,026            | 35,221,134            | 1,738,097         | 1,197,519         | 51,273,474            | 3,589,143         | 1,743,298         | 86,495                 | 5,327,240         | 2,940,817         |
| Chachoengsao        | 66                | 48,541                | 2,286             | 1,650             | 20,285                | 1,420             | 690               | 528               | 1,044,418             | 50,608            | 35,510            | 2,170,794             | 151,956           | 73,807            | 3,215                  | 202,564           | 109,317           |
| Chanthaburi         | 2                 | 1,607                 | 76                | 55                | 672                   | 47                | 23                | 2                 | 1,607                 | 76                | 55                | 672                   | 47                | 23                | 2                      | 123               | 77                |
| Chen Buri           |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Ko Sichang          | 7                 | 5,012                 | 236               | 170               | 2,095                 | 147               | 71                | 1,820             | 5,794,743             | 283,284           | 197,021           | 4,026,226             | 281,836           | 136,892           | 9,821                  | 565,120           | 333,913           |
| Laem Chaabang       | 72                | 53,416                | 2,515             | 1,816             | 22,322                | 1,563             | 759               | 2,458             | 7,519,376             | 386,555           | 255,659           | 5,146,186             | 360,233           | 174,970           | 12,666                 | 746,788           | 430,629           |
| Sattahip            | 14                | 10,024                | 472               | 341               | 4,189                 | 293               | 142               | 48                | 125,045               | 6,143             | 4,252             | 90,689                | 6,348             | 3,083             | 216                    | 12,491            | 7,335             |
| Sri Rcha            | 15                | 11,278                | 531               | 383               | 4,713                 | 330               | 160               | 1,671             | 3,155,507             | 152,658           | 107,287           | 7,276,025             | 509,322           | 247,385           | 10,432                 | 661,979           | 354,672           |
| Others              |                   |                       |                   |                   |                       |                   |                   | 3                 | 13,018                | 637               | 443               | 8,802                 | 616               | 299               | 22                     | 1,253             | 742               |
| Chumporn            |                   |                       |                   |                   |                       |                   |                   | 2                 | 6,593                 | 323               | 224               | 4,458                 | 312               | 152               | 11                     | 635               | 376               |
| Krabi               | 84                | 61,934                | 2,916             | 2,106             | 25,882                | 1,812             | 880               | 392               | 1,010,992             | 49,404            | 34,374            | 696,675               | 48,767            | 23,687            | 1,708                  | 98,172            | 58,061            |
| Nakhon Si Thammarat |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Khanom              | 19                | 13,917                | 655               | 473               | 5,816                 | 407               | 198               | 173               | 393,569               | 19,102            | 13,381            | 603,167               | 42,222            | 20,508            | 997                    | 61,323            | 33,889            |
| Pakpanang           | 3                 | 2,530                 | 119               | 86                | 1,057                 | 74                | 36                | 7                 | 15,675                | 763               | 533               | 9,944                 | 696               | 338               | 26                     | 1,459             | 871               |
| Tha Sala            | 10                | 7,591                 | 357               | 258               | 3,172                 | 222               | 108               | 67                | 161,142               | 7,841             | 5,479             | 105,096               | 7,357             | 3,573             | 266                    | 13,198            | 9,052             |
| Phetchaburi         |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Cha-am              |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Others              |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Phuket              | 175               | 128,737               | 6,062             | 4,377             | 53,799                | 3,766             | 1,829             | 544               | 956,618               | 46,915            | 32,525            | 1,687,255             | 118,108           | 57,367            | 2,644                  | 165,023           | 89,892            |
| Prachuap Khiri Khan |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Bang Saphan         | 11                | 8,094                 | 381               | 275               | 3,383                 | 237               | 115               | 250               | 799,070               | 39,038            | 27,168            | 534,590               | 37,421            | 18,176            | 1,334                  | 76,459            | 45,344            |
| Thap Sakae          |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Others              | 5                 | 4,047                 | 191               | 138               | 1,691                 | 118               | 58                | 214               | 729,929               | 35,686            | 24,818            | 490,347               | 34,324            | 16,672            | 1,220                  | 70,010            | 41,489            |
| Rayong              |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Maptaphut           | 25                | 18,609                | 876               | 633               | 7,777                 | 544               | 264               | 3,621             | 6,444,922             | 310,673           | 219,127           | 17,444,127            | 1,221,089         | 593,100           | 23,889                 | 1,531,762         | 812,228           |
| Others              | 10                | 7,157                 | 337               | 243               | 2,991                 | 209               | 102               | 1,062             | 1,712,248             | 82,782            | 58,216            | 5,175,301             | 362,271           | 175,960           | 6,888                  | 445,053           | 234,177           |
| Samut Sakhon        |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Mahachai            | 119               | 87,390                | 4,115             | 2,971             | 36,520                | 2,556             | 1,242             | 216               | 283,940               | 13,648            | 9,654             | 176,020               | 12,321            | 5,985             | 460                    | 25,970            | 15,639            |
| Thachalom           |                   |                       |                   |                   |                       |                   |                   | 2                 | 9,079                 | 444               | 309               | 6,138                 | 430               | 209               | 15                     | 874               | 517               |
| Thachin             |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Others              | 154               | 113,607               | 5,349             | 3,863             | 47,476                | 3,323             | 1,614             | 199               | 220,174               | 10,525            | 7,486             | 199,412               | 13,959            | 6,780             | 420                    | 24,484            | 14,266            |
| Samut Songkhram     |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Maeklong            |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Satun               | 61                | 45,160                | 2,126             | 1,535             | 18,872                | 1,321             | 642               | 79                | 112,186               | 5,407             | 3,814             | 64,188                | 4,493             | 2,182             | 176                    | 9,900             | 5,997             |
| Songkhla            | 111               | 81,753                | 3,849             | 2,780             | 34,164                | 2,392             | 1,162             | 1,774             | 3,641,107             | 184,272           | 123,798           | 4,733,140             | 332,720           | 161,607           | 8,394                  | 516,992           | 285,404           |
| Surat Thani         |                   |                       |                   |                   |                       |                   |                   | 2                 | 6,572                 | 322               | 223               | 4,443                 | 311               | 151               | 11                     | 633               | 375               |
| Trang               |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                        |                   |                   |
| Katang              | 593               | 437,410               | 20,595            | 14,872            | 182,793               | 12,796            | 6,215             | 893               | 1,063,602             | 50,991            | 36,162            | 599,778               | 41,984            | 20,392            | 1,663                  | 92,975            | 56,555            |
| Total               | 1,718             | 1,266,892             | 59,652            | 43,074            | 529,433               | 37,060            | 18,001            | 20,074            | 45,925,997            | 2,284,654         | 1,561,484         | 59,446,241            | 4,161,237         | 2,021,172         | 106,372                | 6,445,891         | 3,582,656         |



Table 4.2.1.13(1) Results in Cruising(Arrival) by Ship Type in Year 2011

| Port                           | Number of Voyager | Liquid Bulk           |                   |                   |                       |                   |                   |                       |                   |                   | Number of Voyager | Solid Bulk            |                   |                   |                       |                   |                   |                       |                   |                   |
|--------------------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|
|                                |                   | Main Diesel           |                   |                   | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   |                   | Main Diesel           |                   |                   | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   |
|                                |                   | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) |                   | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) |
| Bangkok                        | 550               | 275,472               | 17,398            | 9,366             | 54,054                | 973               | 1,838             | 143,949               | 10,076            | 4,894             | 603               | 322,853               | 20,301            | 10,977            | 72,961                | 1,313             | 2,481             | 57,512                | 4,026             | 1,955             |
| Klong Toey Wharf               |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 20                | 10,831                | 681               | 368               | 2,446                 | 44                | 83                | 1,928                 | 135               | 66                |
| Klong Toey Pole                |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 30                | 16,504                | 1,038             | 561               | 3,727                 | 67                | 127               | 2,938                 | 206               | 100               |
| Bang Hua Suer Pole             |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 23                | 6,820                 | 427               | 232               | 1,596                 | 29                | 54                | 1,258                 | 88                | 43                |
| Sathupradit Buoy               |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 129               | 91,443                | 5,759             | 3,189             | 20,437                | 368               | 695               | 16,110                | 1,128             | 548               |
| Tinn Wharf                     |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 9                 | 5,242                 | 330               | 178               | 1,178                 | 21                | 40                | 928                   | 65                | 32                |
| Private Wharves                | 542               | 271,241               | 17,131            | 9,222             | 53,228                | 958               | 1,810             | 141,750               | 9,922             | 4,819             | 380               | 185,309               | 11,645            | 6,300             | 42,062                | 757               | 1,430             | 33,156                | 2,321             | 1,127             |
| Others                         | 8                 | 4,231                 | 267               | 144               | 826                   | 15                | 28                | 2,200                 | 154               | 75                | 12                | 6,705                 | 422               | 228               | 1,514                 | 27                | 51                | 1,194                 | 84                | 41                |
| Provincial Area                | 5,811             | 684,924               | 42,248            | 23,287            | 155,940               | 2,807             | 5,302             | 415,281               | 29,070            | 14,120            | 2,225             | 255,739               | 15,696            | 8,695             | 67,348                | 1,212             | 2,290             | 53,088                | 3,716             | 1,805             |
| Chachoengsao                   | 301               | 35,534                | 2,192             | 1,208             | 8,090                 | 146               | 275               | 21,545                | 1,508             | 733               | 2                 | 199                   | 12                | 7                 | 52                    | 1                 | 2                 | 41                    | 3                 | 1                 |
| Chanthaburi                    |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Chon Buri                      |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Ko Sichang                     | 24                | 2,805                 | 173               | 95                | 639                   | 11                | 22                | 1,700                 | 119               | 58                | 523               | 60,175                | 3,693             | 2,046             | 15,847                | 285               | 539               | 12,491                | 874               | 425               |
| Lamni Chabang                  | 80                | 9,373                 | 578               | 319               | 2,134                 | 38                | 73                | 5,683                 | 398               | 193               | 104               | 11,985                | 736               | 407               | 3,156                 | 57                | 107               | 2,488                 | 174               | 85                |
| Sattahip                       | 2                 | 200                   | 12                | 7                 | 46                    | 1                 | 2                 | 121                   | 9                 | 4                 | 5                 | 586                   | 36                | 20                | 154                   | 3                 | 5                 | 122                   | 9                 | 4                 |
| Sri Racha                      | 1,057             | 124,606               | 7,686             | 4,237             | 28,370                | 511               | 965               | 75,551                | 5,289             | 2,569             | 248               | 28,524                | 1,751             | 970               | 7,512                 | 135               | 255               | 5,921                 | 414               | 201               |
| Others                         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Chumphon                       |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Krabi                          | 4                 | 413                   | 25                | 14                | 94                    | 2                 | 3                 | 250                   | 18                | 9                 | 119               | 13,680                | 840               | 465               | 3,603                 | 65                | 122               | 2,840                 | 199               | 97                |
| Nakhon Si Thammarat            |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Khanom                         | 74                | 8,698                 | 537               | 296               | 1,980                 | 36                | 67                | 5,274                 | 369               | 179               | 34                | 3,945                 | 242               | 134               | 1,039                 | 19                | 35                | 819                   | 57                | 28                |
| Pakpanang                      |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Tha Sala                       |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 19                | 2,170                 | 133               | 74                | 571                   | 10                | 19                | 450                   | 32                | 15                |
| Phetchaburi                    |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Cha-am                         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Others                         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Phuket                         | 216               | 25,402                | 1,567             | 864               | 5,784                 | 104               | 197               | 15,402                | 1,078             | 524               | 27                | 3,074                 | 189               | 105               | 810                   | 15                | 28                | 638                   | 45                | 22                |
| Prachuap Khiri Khan            |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Bang Saepan                    |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 55                | 6,310                 | 387               | 215               | 1,662                 | 30                | 56                | 1,310                 | 92                | 45                |
| Thap Sakae                     |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 47                | 5,364                 | 329               | 182               | 1,412                 | 25                | 48                | 1,113                 | 78                | 38                |
| Others                         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Rayong                         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Maitaphut                      | 2,664             | 313,992               | 19,368            | 10,676            | 71,488                | 1,287             | 2,431             | 190,378               | 13,326            | 6,473             | 272               | 31,247                | 1,918             | 1,062             | 8,229                 | 148               | 280               | 6,486                 | 454               | 221               |
| Others                         | 833               | 98,180                | 6,056             | 3,338             | 22,353                | 402               | 760               | 59,528                | 4,167             | 2,024             | 101               | 11,606                | 712               | 395               | 3,056                 | 55                | 104               | 2,409                 | 169               | 82                |
| Samut Sakhon                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Mahachulalongkornrajavidyalaya | 5                 | 559                   | 34                | 19                | 127                   | 2                 | 4                 | 339                   | 24                | 12                | 62                | 7,085                 | 435               | 241               | 1,866                 | 34                | 63                | 1,471                 | 103               | 50                |
| Thachin                        |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Others                         | 5                 | 559                   | 34                | 19                | 127                   | 2                 | 4                 | 339                   | 24                | 12                | 17                | 1,908                 | 117               | 65                | 502                   | 9                 | 17                | 396                   | 28                | 13                |
| Samut Songkhram                |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Macklong                       |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Satun                          |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Songkhla                       |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Surat Thani                    | 548               | 64,604                | 3,985             | 2,197             | 14,709                | 265               | 500               | 39,170                | 2,742             | 1,332             | 344               | 39,515                | 2,425             | 1,343             | 10,406                | 187               | 354               | 8,203                 | 574               | 279               |
| Trang                          |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Katang                         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 247               | 28,366                | 1,741             | 964               | 7,470                 | 134               | 254               | 5,888                 | 412               | 200               |
| Total                          | 6,361             | 960,396               | 59,647            | 32,653            | 209,994               | 3,780             | 7,140             | 559,230               | 39,146            | 19,014            | 2,828             | 578,592               | 35,997            | 19,672            | 140,309               | 2,525             | 4,771             | 110,600               | 7,742             | 3,760             |



Table 4.2.1.13(2) Results in Cruising (Arrival) by Ship Type in Year 2011

| Port                           | Number of Voyager | Fully Cellular Container |                   |                   |                       |                   |                   |                       |                   |                   | Number of Voyager | Semi-Container        |                   |                   |                       |                   |                   |                       |                   |                   |
|--------------------------------|-------------------|--------------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|
|                                |                   | Main Diesel              |                   |                   | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   |                   | Main Diesel           |                   |                   | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   |
|                                |                   | Fuel Consumption (kg)    | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) |                   | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) |
| Bangkok                        | 1,711             | 2,255,010                | 170,408           | 76,670            | 440,619               | 7,931             | 14,981            | 204,608               | 14,323            | 6,957             | 193               | 90,410                | 5,568             | 3,074             | 21,244                | 382               | 722               | 15,986                | 1,119             | 544               |
| Klong Toey Wharf               | 1,164             | 1,584,665                | 119,777           | 53,879            | 309,180               | 5,565             | 10,512            | 143,572               | 10,050            | 4,881             | 126               | 61,872                | 3,812             | 2,104             | 14,510                | 261               | 493               | 10,918                | 764               | 371               |
| Klong Toey Pole                |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   | 1                 | 465                   | 29                | 16                | 109                   | 2                 | 4                 | 82                    | 6                 | 3                 |
| Bang Hua Suer Pole             |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   | 5                 | 1,282                 | 79                | 44                | 311                   | 6                 | 11                | 234                   | 16                | 8                 |
| Sathupradit Buoy               |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Tinn Wharf                     |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Private Wharves                | 540               | 659,996                  | 49,849            | 22,440            | 129,421               | 2,329             | 4,400             | 60,098                | 4,207             | 2,043             | 60                | 26,325                | 1,621             | 895               | 6,205                 | 112               | 211               | 4,669                 | 327               | 159               |
| Others                         | 8                 | 10,349                   | 782               | 352               | 2,019                 | 36                | 69                | 938                   | 66                | 32                | 1                 | 465                   | 29                | 16                | 109                   | 2                 | 4                 | 82                    | 6                 | 3                 |
| Provincial Area                | 1,712             | 493,682                  | 36,418            | 16,785            | 112,316               | 2,022             | 3,819             | 52,156                | 3,651             | 1,773             | 320               | 33,227                | 1,998             | 1,130             | 9,086                 | 164               | 309               | 6,837                 | 479               | 232               |
| Chachoengsao                   | 9                 | 2,498                    | 184               | 85                | 568                   | 10                | 19                | 264                   | 18                | 9                 |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Chanthaburi                    |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Chon Buri                      |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Ko Sichang                     | 3                 | 980                      | 72                | 33                | 223                   | 4                 | 8                 | 104                   | 7                 | 4                 | 24                | 2,467                 | 148               | 84                | 675                   | 12                | 23                | 508                   | 36                | 17                |
| Laem Chaabang                  | 1,101             | 317,413                  | 23,415            | 10,792            | 72,214                | 1,300             | 2,455             | 33,534                | 2,347             | 1,140             | 152               | 15,757                | 947               | 536               | 4,309                 | 78                | 147               | 3,242                 | 227               | 110               |
| Sattahip                       | 2                 | 490                      | 36                | 17                | 111                   | 2                 | 4                 | 52                    | 4                 | 2                 |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Sri Racha                      | 8                 | 2,450                    | 181               | 83                | 557                   | 10                | 19                | 259                   | 18                | 9                 | 46                | 4,758                 | 286               | 162               | 1,301                 | 23                | 44                | 979                   | 69                | 33                |
| Others                         |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Chumphon                       |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Krabi                          |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Nakhon Si Thammarat            |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Khanong                        |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Pakpanang                      |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| The Sala                       |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   | 2                 | 178                   | 11                | 6                 | 49                    | 1                 | 2                 | 37                    | 3                 | 1                 |
| Phetchaburi                    |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Chiam                          |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Others                         |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Phuket                         | 17                | 4,989                    | 368               | 170               | 1,135                 | 20                | 39                | 527                   | 37                | 18                |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Prachuap Khiri Khan            |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Bang Saphan                    |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Thap Sakae                     |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Others                         |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Rayong                         |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Maiphut                        |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   | 6                 | 604                   | 36                | 21                | 165                   | 3                 | 6                 | 124                   | 9                 | 4                 |
| Others                         | 43                | 12,316                   | 908               | 419               | 2,802                 | 50                | 95                | 1,301                 | 91                | 44                | 31                | 3,221                 | 194               | 110               | 881                   | 16                | 30                | 663                   | 46                | 23                |
| Samut Sakhon                   |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Mahachulalongkornrajavidyalaya |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Thachin                        |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Others                         |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Samut Songkhram                |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Maeklong                       |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Salun                          |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Songkhla                       | 529               | 152,546                  | 11,253            | 5,187             | 34,705                | 625               | 1,180             | 16,116                | 1,128             | 548               | 60                | 6,241                 | 375               | 212               | 1,707                 | 31                | 58                | 1,284                 | 90                | 44                |
| Surat Thani                    |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Trang                          |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Katung                         |                   |                          |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| <b>Total</b>                   | <b>3,423</b>      | <b>2,748,691</b>         | <b>206,826</b>    | <b>93,456</b>     | <b>552,936</b>        | <b>9,952</b>      | <b>18,800</b>     | <b>256,764</b>        | <b>17,973</b>     | <b>8,730</b>      | <b>513</b>        | <b>123,636</b>        | <b>7,566</b>      | <b>4,204</b>      | <b>30,330</b>         | <b>546</b>        | <b>1,031</b>      | <b>22,823</b>         | <b>1,598</b>      | <b>776</b>        |



Table 4.2.1.13(3) Results in Cruising (Arrival) by Ship Type in Year 2011

| Port                | Number of Voyager | Ro-Ro                 |                   |                   |                       |                   |                   |                       |                   |                   | Number of Voyager | Conventional          |                   |                   |                       |                   |                   |                       |                   |                   |
|---------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|
|                     |                   | Main Diesel           |                   |                   | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   |                   | Main Diesel           |                   |                   | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   |
|                     |                   | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) |                   | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) |
| Bangkok             | 58                | 59,968                | 4,309             | 2,039             | 10,626                | 191               | 361               | 11,310                | 792               | 385               | 1,336             | 766,238               | 49,200            | 26,052            | 166,879               | 3,004             | 5,674             | 137,959               | 9,657             | 4,691             |
| Klong Toey Wharf    | 46                | 48,234                | 3,466             | 1,640             | 8,538                 | 154               | 290               | 9,088                 | 636               | 309               | 474               | 286,072               | 18,375            | 9,726             | 62,160                | 1,119             | 2,113             | 51,387                | 3,597             | 1,747             |
| Klong Toey Pole     |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 89                | 53,889                | 3,461             | 1,832             | 11,709                | 211               | 398               | 9,680                 | 678               | 329               |
| Bang Hua Suer Pole  |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 78                | 25,900                | 1,655             | 881               | 5,832                 | 105               | 198               | 4,822                 | 338               | 164               |
| Sathupradil Buoy    |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 89                | 70,254                | 4,519             | 2,389             | 15,107                | 272               | 514               | 12,489                | 874               | 425               |
| Tmn Wharf           |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 10                | 7,121                 | 458               | 242               | 1,539                 | 28                | 52                | 1,273                 | 89                | 43                |
| Private Wharves     | 12                | 11,734                | 843               | 399               | 2,088                 | 38                | 71                | 2,222                 | 156               | 76                | 584               | 316,695               | 20,327            | 10,768            | 69,161                | 1,245             | 2,351             | 57,176                | 4,002             | 1,944             |
| Others              |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 10                | 6,306                 | 405               | 214               | 1,370                 | 25                | 47                | 1,133                 | 79                | 39                |
| Provincial Area     | 337               | 75,474                | 5,293             | 2,566             | 15,579                | 280               | 530               | 16,581                | 1,161             | 564               | 4,010             | 512,377               | 32,119            | 17,421            | 129,821               | 2,337             | 4,414             | 107,323               | 7,513             | 3,649             |
| Chachoengsao        |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 152               | 19,482                | 1,221             | 662               | 4,936                 | 89                | 168               | 4,081                 | 286               | 139               |
| Chanthaburi         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Chon Buri           |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Ko Sichang          | 7                 | 1,523                 | 107               | 52                | 314                   | 6                 | 11                | 335                   | 23                | 11                | 1,241             | 158,532               | 9,938             | 5,390             | 40,167                | 723               | 1,366             | 33,206                | 2,324             | 1,129             |
| Laem Chabang        | 260               | 58,178                | 4,080             | 1,978             | 12,009                | 216               | 408               | 12,782                | 895               | 435               | 670               | 85,575                | 5,364             | 2,910             | 21,682                | 390               | 737               | 17,925                | 1,235             | 609               |
| Sattahip            |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 25                | 3,258                 | 204               | 111               | 825                   | 15                | 28                | 682                   | 48                | 23                |
| Sri Racha           | 7                 | 1,523                 | 107               | 52                | 314                   | 6                 | 11                | 335                   | 23                | 11                | 274               | 34,964                | 2,192             | 1,189             | 8,859                 | 159               | 301               | 7,324                 | 513               | 249               |
| Others              |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 3                 | 434                   | 27                | 15                | 110                   | 2                 | 4                 | 91                    | 6                 | 3                 |
| Chumphon            |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 2                 | 220                   | 14                | 7                 | 56                    | 1                 | 2                 | 46                    | 3                 | 2                 |
| Krabi               | 11                | 2,352                 | 165               | 80                | 485                   | 9                 | 17                | 517                   | 36                | 18                | 180               | 23,033                | 1,444             | 783               | 5,836                 | 105               | 198               | 4,824                 | 338               | 164               |
| Nakhon Si Thammarat |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Kluang              |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 94                | 12,060                | 756               | 410               | 3,056                 | 55                | 104               | 2,526                 | 177               | 86                |
| Pakpanang           |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| The Sata            |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 7                 | 877                   | 55                | 30                | 222                   | 4                 | 8                 | 184                   | 13                | 6                 |
| Phetchaburi         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Cha-am              |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Others              |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 2                 | 316                   | 20                | 11                | 80                    | 1                 | 3                 | 66                    | 5                 | 2                 |
| Phuket              | 31                | 7,046                 | 494               | 240               | 1,455                 | 26                | 49                | 1,548                 | 108               | 53                | 77                | 9,849                 | 617               | 335               | 2,495                 | 45                | 85                | 2,063                 | 144               | 70                |
| Prachuap Khiri Khan |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Bang Saphan         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 176               | 22,445                | 1,407             | 763               | 5,687                 | 102               | 193               | 4,701                 | 329               | 160               |
| Thap Sakae          |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Others              |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 189               | 24,198                | 1,517             | 823               | 6,131                 | 110               | 208               | 5,069                 | 355               | 172               |
| Rayong              |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Maitaphut           | 6                 | 1,305                 | 91                | 44                | 269                   | 5                 | 9                 | 287                   | 20                | 10                | 602               | 76,908                | 4,821             | 2,615             | 19,486                | 351               | 663               | 16,109                | 1,128             | 548               |
| Others              |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 76                | 9,676                 | 607               | 329               | 2,451                 | 44                | 83                | 2,027                 | 142               | 69                |
| Samut Sakhon        |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Mahachai            |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 9                 | 1,212                 | 76                | 41                | 307                   | 6                 | 10                | 254                   | 18                | 9                 |
| Thachafon           |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Thachin             |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Others              |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 12                | 1,515                 | 95                | 51                | 384                   | 7                 | 13                | 317                   | 22                | 11                |
| Samut Songkhram     |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Mueanglong          |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Satun               |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 14                | 1,789                 | 112               | 61                | 453                   | 8                 | 15                | 375                   | 26                | 13                |
| Songkhla            | 16                | 3,548                 | 249               | 121               | 732                   | 13                | 25                | 779                   | 55                | 27                | 160               | 20,443                | 1,282             | 695               | 5,180                 | 93                | 176               | 4,282                 | 300               | 146               |
| Surat Thani         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Trang               |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Katang              |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 44                | 5,591                 | 350               | 190               | 1,416                 | 25                | 48                | 1,171                 | 82                | 40                |
| Total               | 395               | 135,442               | 9,602             | 4,605             | 26,205                | 472               | 891               | 27,891                | 1,952             | 948               | 5,345             | 1,278,615             | 81,320            | 43,473            | 296,700               | 5,340             | 10,088            | 245,282               | 17,170            | 8,340             |





Table 4.2.1.14(1) Results in Cruising(Departure) by Ship Type in Year 2011

| Port                           | Number of Voyager | Liquid Bulk           |                   |                   |                       |                   |                   |                       |                   |                   | Number of Voyager | Solid Bulk            |                   |                   |                       |                   |                   |                       |                   |                   |
|--------------------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|-------------------|
|                                |                   | Main Diesel           |                   |                   | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   |                   | Main Diesel           |                   |                   | Sub Diesel            |                   |                   | Sub Boiler            |                   |                   |
|                                |                   | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) |                   | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) | Fuel Consumption (kg) | NO2 Emission (kg) | SO2 Emission (kg) |
| Bangkok                        | 374               | 187,592               | 11,848            | 6,378             | 36,808                | 663               | 1,251             | 98,024                | 6,862             | 3,333             | 523               | 284,919               | 17,918            | 9,687             | 64,340                | 1,158             | 2,188             | 50,716                | 3,550             | 1,724             |
| Klong Toey Wharf               |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 15                | 8,252                 | 519               | 281               | 1,864                 | 34                | 63                | 1,469                 | 103               | 50                |
| Klong Toey Pole                |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 19                | 10,315                | 649               | 351               | 2,330                 | 42                | 79                | 1,836                 | 129               | 62                |
| Bang Hua Suer Pole             |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 13                | 3,978                 | 249               | 135               | 931                   | 17                | 32                | 734                   | 51                | 25                |
| Sathupradit Buoy               |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 134               | 94,805                | 5,971             | 3,223             | 21,189                | 381               | 720               | 16,702                | 1,169             | 568               |
| Tinn Wharf                     |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 4                 | 2,330                 | 147               | 79                | 523                   | 9                 | 18                | 413                   | 29                | 14                |
| Private Wharves                | 367               | 183,361               | 11,581            | 6,234             | 35,982                | 648               | 1,223             | 95,824                | 6,708             | 3,258             | 333               | 162,145               | 10,189            | 5,513             | 36,804                | 662               | 1,251             | 29,011                | 2,031             | 966               |
| Others                         | 8                 | 4,231                 | 267               | 144               | 826                   | 15                | 28                | 2,200                 | 154               | 75                | 6                 | 3,095                 | 195               | 105               | 699                   | 13                | 24                | 551                   | 39                | 19                |
| Provincial Area                | 5,860             | 690,701               | 42,605            | 23,484            | 157,255               | 2,830             | 5,347             | 418,784               | 29,315            | 14,239            | 2,246             | 258,240               | 15,849            | 8,780             | 68,007                | 1,224             | 2,312             | 53,607                | 3,752             | 1,823             |
| Chachoengsao                   | 305               | 35,943                | 2,217             | 1,222             | 8,183                 | 147               | 278               | 21,793                | 1,525             | 741               |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Chanthaburi                    |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Chon Buri                      |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Ko Sichang                     | 29                | 3,406                 | 210               | 116               | 775                   | 14                | 26                | 2,065                 | 145               | 70                | 525               | 60,370                | 3,705             | 2,053             | 15,898                | 286               | 541               | 12,532                | 877               | 426               |
| Laem Chabang                   | 83                | 9,790                 | 604               | 333               | 2,229                 | 40                | 76                | 5,936                 | 415               | 202               | 104               | 11,985                | 736               | 407               | 3,156                 | 57                | 107               | 2,488                 | 174               | 85                |
| Sattahip                       | 2                 | 200                   | 12                | 7                 | 46                    | 1                 | 2                 | 121                   | 9                 | 4                 | 5                 | 586                   | 36                | 20                | 154                   | 3                 | 5                 | 122                   | 9                 | 4                 |
| Sri Racha                      | 1,062             | 125,207               | 7,723             | 4,257             | 28,506                | 513               | 969               | 75,915                | 5,314             | 2,581             | 253               | 29,111                | 1,787             | 990               | 7,666                 | 138               | 261               | 6,043                 | 423               | 205               |
| Others                         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Chumphon                       |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Krabi                          | 5                 | 619                   | 38                | 21                | 141                   | 3                 | 5                 | 375                   | 26                | 13                | 112               | 12,875                | 790               | 438               | 3,391                 | 61                | 115               | 2,673                 | 187               | 91                |
| Nakhon Si Thammarat            |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Khanom                         | 70                | 8,293                 | 512               | 282               | 1,888                 | 34                | 64                | 5,028                 | 352               | 171               | 17                | 1,973                 | 121               | 67                | 520                   | 9                 | 18                | 410                   | 29                | 14                |
| Pak Phanang                    |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| The Sala                       |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 31                | 3,551                 | 218               | 121               | 935                   | 17                | 32                | 737                   | 52                | 25                |
| Pheichaburi                    |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Cha-am                         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Others                         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Phuket                         | 217               | 25,588                | 1,578             | 870               | 5,826                 | 105               | 198               | 15,514                | 1,086             | 527               | 25                | 2,893                 | 178               | 98                | 762                   | 14                | 26                | 601                   | 42                | 20                |
| Prachuap Khiri Khan            |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Bang Saphan                    |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 60                | 6,941                 | 426               | 236               | 1,828                 | 33                | 62                | 1,441                 | 101               | 49                |
| Thap Sakae                     |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Others                         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   | 36                | 4,102                 | 252               | 139               | 1,080                 | 19                | 37                | 851                   | 60                | 29                |
| Rayong                         |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Maitaphut                      | 2,699             | 318,111               | 19,622            | 10,816            | 72,426                | 1,304             | 2,462             | 192,876               | 13,501            | 6,558             | 276               | 31,693                | 1,945             | 1,078             | 8,346                 | 150               | 284               | 6,579                 | 461               | 224               |
| Others                         | 833               | 98,180                | 6,056             | 3,338             | 22,353                | 402               | 760               | 59,528                | 4,167             | 2,024             | 87                | 10,044                | 616               | 341               | 2,645                 | 48                | 90                | 2,085                 | 146               | 71                |
| Samut Sakhon                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Mahachulalongkornrajavidyalaya | 2                 | 279                   | 17                | 10                | 64                    | 1                 | 2                 | 169                   | 12                | 6                 | 83                | 9,538                 | 585               | 324               | 2,512                 | 45                | 85                | 1,980                 | 139               | 67                |
| Thachalorn                     |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Thachin                        |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Others                         | 17                | 1,956                 | 121               | 67                | 445                   | 8                 | 15                | 1,186                 | 83                | 40                | 12                | 1,263                 | 84                | 46                | 359                   | 6                 | 12                | 283                   | 20                | 10                |
| Samut Songkhram                |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Maeklong                       |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Satun                          |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Songkhla                       | 534               | 62,923                | 3,881             | 2,139             | 14,326                | 258               | 487               | 38,151                | 2,671             | 1,297             | 367               | 42,246                | 2,593             | 1,436             | 11,125                | 200               | 378               | 8,770                 | 614               | 298               |
| Surat Thani                    |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Trang                          |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |                   |                       |                   |                   |                       |                   |                   |                       |                   |                   |
| Katang                         | 2                 | 206                   | 13                | 7                 | 47                    | 1                 | 2                 | 125                   | 9                 | 4                 | 252               | 28,970                | 1,778             | 985               | 7,629                 | 137               | 259               | 6,014                 | 421               | 204               |
| Total                          | 6,234             | 878,293               | 54,453            | 29,862            | 194,064               | 3,493             | 6,598             | 516,807               | 36,177            | 17,571            | 2,770             | 543,159               | 33,768            | 18,467            | 132,346               | 2,382             | 4,500             | 104,323               | 7,303             | 3,547             |