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Transportation and  
Telecommunications

# Sweden

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NATIONAL INTELLIGENCE SURVEY

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## NATIONAL INTELLIGENCE SURVEY PUBLICATIONS

The basic unit of the NIS is the *General Survey*, which is now published in a bound-by-chapter format so that topics of greater perishability can be updated on an individual basis. These chapters—Country Profile, The Society, Government and Politics, The Economy, Military Geography, Transportation and Telecommunications, Armed Forces, Science, and Intelligence and Security, provide the primary NIS coverage. Some chapters, particularly Science and Intelligence and Security, that are not pertinent to all countries, are produced selectively. For small countries requiring only minimal NIS treatment, the *General Survey* coverage may be bound into one volume.

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# SWEDEN

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*This General Survey supersedes the one dated September 1967, copies of which should be destroyed.*

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# Transportation and Telecommunications

## A. Appraisal (C)

Transportation and telecommunications (telecom) in Sweden are excellent, fully capable of meeting economic needs and of supporting moderate to heavy military operations. In proportion to the population, the density of both systems is probably the highest in Europe. Geography and the broad dispersal of the population have influenced the pattern of the networks. Most of the major ports and by far the greater portion of railroad, highway, and inland waterway mileage are located in the south (Figure 8). Except in the Kiruna iron ore area, the land in the north, especially above the Arctic Circle, is considerably less developed. In most of the country the cold winter climate affects transportation and telecommunications, presenting problems in construction, maintenance, and operation.

Railroads are the primary means of long-distance transportation, but competition from highway transport is continually increasing. Stockholm is the focal point of the rail network, with lines radiating to the larger ports and major cities. Three lines connect Stockholm with the north, west, and south; another, a connecting route, permits north-south traffic to avoid the largest lakes without having to make major east-west diversions. Train-ferry connections are made with Denmark, West Germany, East Germany, and Finland.

Highway transport provides short-haul feeder service to the railroads and is the country's leading

passenger carrier. In many sections of central and northern Sweden, highways afford the only means of transport; however, the network there is inadequate because of the steady growth of traffic and the paucity of alternative routes. Of the 1970 total freight traffic of 34 billion ton-miles, highways accounted for 19 billion ton-miles. Highway transport handled about 98% of all short-haul traffic, which accounted for 80% of the total highway traffic. Principal commodities moved were manufactured and semimanufactured goods and agricultural products. Inland waterway transport plays a significant role in the economy. Although handling only 2% of the annual total freight tonnage moved by the three modes, waterways account for about 14% of the total ton-miles.

Ocean transport is vital to Sweden's economy. More than 160 ports are scattered along the long coastline, and the merchant fleet ranks high in deadweight tonnage among the nations of the world. About 80% of the merchant fleet is engaged in profitable trade between foreign countries. The fleet carries nearly 30% of the nation's international seaborne exports.

Civil aviation, supported by an extensive system of excellent airfields, is becoming increasingly significant to the expanding economy. The government views air transport as a means of developing commerce, tourism, and international good will. Sweden has 65 major aircraft registered.

Telecom facilities are among the best in the world and satisfy the requirements of the public, government, and private enterprise. Telephone is the

most used service, but extensive telegraph and broadcast services are also available. Domestic and international communications are handled by an integrated system of cables, open-wire lines, and radio-relay links. AM, FM, and TV services reach over 90% of the population. The principal telecom centers are Stockholm, Goteborg,<sup>1</sup> and Malmo.

Most transportation and telecommunications are administered by the Ministry of Communications and its subordinate agencies. Public and private ownership of rail, highway, and waterway facilities exist side by side. Most ports are owned by the municipalities in which they are located; most telecom facilities are government owned.

Several plans for the improvement of both transportation and telecommunications are being implemented. Railroads are being improved through modernization of facilities and equipment, but no new rail construction is envisioned. Highway development is being implemented through a 15-year road plan (1970-85). The plan calls for construction of almost 1,000 miles of limited access, four-lane divided motorways, most of them in the Stockholm area, and about 5,600 miles of two- and four-lane national highways. Major maintenance is to be performed on 100,000 miles of state, municipal, and private roads. Facilities at all major ports are being continually improved, and most of the significant airfields are benefiting from a long-term modernization program, which began in 1950. Sweden is also improving its already outstanding telecom system. A major project underway is designed to reinforce substantially the coaxial cable system and provide it with the world's largest transmitting capacity.

**B. Strategic mobility (C)**

Sustained movement and resupply operations in support of military forces in southern Sweden would be accomplished over excellent transportation and telecommunications systems. The high density and quality of the area's rail network would facilitate major operations. The most important highways—between Oslo and Stockholm, Stordien and Sundsvall, and Halsingborg and Sundsvall via Jonkoping and Stockholm—all have sufficient widths to handle two lanes of resupply traffic. Inland waterways would be useful in the movement of bulk cargos.

In the north and north-central parts of Sweden the low density of the rail network, its lack of alternate routes, and its high vulnerability to interdiction and

<sup>1</sup>For diacritics on place names see the list of names on the apron of the Terrain and Transportation map and the map itself.

interruption would permit only limited military support. Above the 60th parallel the highway network is incapable of supporting sustained movement because of the paucity of roads, severe damaging effects of spring thaws, and low road and bridge capacities.

Sweden's 162 usable airfields could assume varying roles in support of military forces; however, only a few fields are located in the north. The chief role of the air force is defensive; consequently, very few airfields are capable of supporting sustained operations of aircraft heavier than medium or light bombers. The limited quantity of fuel available is also an adverse factor. Underground hangars have been constructed at a few airfields. In the event of war or other national emergency requiring augmentation of the Royal Swedish Air Force's airlift capability, the Swedish-registered transport aircraft and Swedish personnel of the Scandinavian Airlines System (SAS) could be withdrawn from the consortium and used for military purposes. The considerable government holdings in *Linjeflug AB* would assure the ready transfer of the company's aircraft to the military, and the aircraft of the nonscheduled and other aviation enterprises could be acquired by requisition.

All of Sweden's major ports and most of the minor facilities are adaptable to military use. The merchant fleet's 146 cargo-type ships (dry cargo, roll-on roll-off/container, roll-on roll-off/trailer, container, and timber carrier), which have a capacity of about 1,070,000 deadweight tons, have extensive potential for short-haul (48 hours' steaming) troop-lift and logistics support in nearseas operations. However, a large number of these ships are employed in cross trades between foreign countries and might not be readily available for military support operations. About 30% of the units have booms of 40 tons or more lift and hatches of more than 50 feet in length. With expansion of the normal passenger capacity, the 12-passenger and two-passenger/cargo ships would have considerable potential for longer haul (more than 48 hours' steaming) troop transport. The 46 tankers, which have an estimated capacity of 16,720,000 U.S. barrels, could provide a moderate fleet-oiler or other military support capability for a short period.

The modern well-integrated telecom system, especially in the south, would be of great value to military users in large-scale operations. Major telecom facilities are well protected and would be vulnerable only to a highly concentrated sabotage effort. Most intercity cables are buried, and numerous alternate routes are available. Many telecom facilities are installed in bombproof shelters, and emergency power



supplies are provided. To cut off intercity telecom circuits with Stockholm, or any other major urban area, would require destruction of cables, radio-relay, and broadcast facilities in a wide area surrounding the city.

### C. Railroads (C)

The rail network had decreased in size in recent years as a result of the government policy of closing unprofitable lines which do not provide an important service. Route mileage declined to 7,578 at the beginning of 1971 from 10,300 in 1954. The Swedish State Railroads (*Statens Järnvägar-SJ*) owns and operates 7,004 miles of standard-gage (4'8 1/2") line and 165 miles of 3'6" and 2'11" narrow-gage line. Of SJ's 4,373 route miles of electrified line, 723 are double track. A short segment of Finnish 5'0" broad-gage line extends into Sweden in the Haparanda region near the border. The remaining 311 miles of standard-gage and 98 miles of 2'11" narrow-gage lines are privately owned and, except for one branch line listed in Figure 1, will not be covered in this study.

The SJ, one of the largest industries in Scandinavia, is an important carrier of international traffic consisting mainly of machinery, ore, wood products, construction material, and POL. The network has one of the highest ratios of railroad mileage to population in the world (0.92 mile per 1,000 people), and is more than adequate for the needs of the country.

The SJ serves major administrative and populated areas, industrial and mining centers, and all major ports in Sweden. Although rail and highway transport are competitive, intermodal operations are facilitated by concentrating freight handling at 32 rail centers. The SJ controls over 20% of all buses and has subsidiary trucking lines. Container operations are concentrated at the following locations: Stockholm, Goteborg, Malmo, Orebro, and Sundsvall; Vasteras is a site of future operations. Over 90,000 containers were handled by SJ in 1970, and this figure is expected to more than double by 1975. Heavy competition from highway transport, particularly for short-haul traffic (less than 60 miles), and from coastal shipping has limited the growth of the rail share of the freight market. However, the SJ continues to carry about 70% of the long-distance freight traffic. Recently the railroads have been successful in drawing additional timber traffic away from waterways. The continued increase in private ownership of automobiles has lessened the growth of rail passenger traffic.

The Swedish network is concentrated mainly in the southern part of the country where most of the

important ports, population centers, and economic activities are located. The sparsely populated and less productive northern areas are linked by two north-south main lines, which are connected by several east-west lines. The far north is served by the strategic Lulea-Narvik, Norway line.

The mountainous topography and numerous streams and lakes throughout the country require extensive tunneling and bridging. Bogs also require special construction techniques and maintenance. Snowsheds and galleries in the north protect the lines from drifting snow, falling rocks, and avalanches.

There are four international rail connections with the standard-gage Norwegian system: two routes lead to Oslo, one to Trondheim, and one to Narvik. The last is the most important revenue-producing line in the Swedish system. A fifth international connection is made with Finland at Haparanda where a short segment of 5'0" broad-gage line parallels the standard-gage line between Haparanda and Tornio, Finland. Freight moving between the two systems must be transloaded at Haparanda or Tornio. Regular train-ferry service affords five additional international connections: two with Denmark and one each with Finland, East Germany, and West Germany.

The Swedish railroads, like those of France and West Germany, have high standards of construction and are well maintained. The SJ is a semiautonomous agency under the Minister of Communications. Policy control is exercised by the Railroad Board headed by a director general.

In 1970 the SJ employed 47,224 personnel, down from 52,303 in 1966. Subsidiary companies employed an additional 8,030 people. The gradual decline in personnel strength is a reflection of higher wages as well as increased efficiency and mechanization. There is no shortage of skilled personnel. Intensive on-the-job training programs are conducted at two main centers: one at Stockholm for administrative training and the other at Angelholm (with branches at Revingehed/Harlosa and Ystad) for technical skills. The railroads offer afterhours courses and sponsor studies with independent institutions. A few highly qualified individuals attend advanced courses in other European countries and in the United States.

The principal classification yards are located at Hallsberg, Stockholm, Mjolby, Bracke, Kristinehamn, Langsele, Ange, Nassjo, Malmo, Borlange, Boden, Goteborg, Riksgransen, Trelleborg, Gavle, and Charlottenberg. The facilities at Borlange and Hallsberg have automatic hump yards, and automation of the Savenas yard near Goteborg is in

**FIGURE 1. Selected standard-gage rail lines (C)**  
 (Unless noted, all lines are single track and electrified; direction of maximum grade unknown except where noted; maximum axleloads greater than 22 short tons are noted under remarks; minimum length of passing tracks is 2,460 ft.)

| TERMINALS  | MAXIMUM | MINIMUM             | MAXIMUM                         | REMARKS  |
|--|---------|---------------------|---------------------------------|--|
|  | GRADE   | RADIUS OF CURVATURE | INTERVAL BETWEEN PASSING TRACKS |  |
|  | Percent | Feet                | Miles                           |  |
| Lulea-Riksgrensan-Norway border.....<br>289 miles            | 1.2     | 955                 | 12.4                            | International connection with Norway. Iron ore line to Narvik, Norway. Maximum axleload limit, 27.5 short tons.  |
| Boden-Haparanda-Finland border.....<br>103 miles             | 1.6     | 1,273               | 14.0                            | Nonelectrified. International connection with Finland; transloading operations at Haparanda and at Tornio, Finland, to Finnish 5'0" line. Following nonelectrified branch lines having same general characteristics extend from terminals on main line: Morjarv-Kalix, 16 miles; Karungi-Overtornea, 20 miles.   |
| Gallivare-Ostersund.....<br>464 miles                        | 1.2     | 1,273               | 21.7                            | Nonelectrified. Following branch lines having same general characteristics connect terminals on main line with terminals on Boden-Stockholm line: Arvidsjaur-Jorn, 47 miles; Storuman-Hallnas, 109 miles; Hoting-Torsmo, 75 miles.   |
| Boden-Bracke-Kilafors-Krylbo-Uppsala-Stockholm.<br>727 miles | 1.6     | 955                 | 23.5                            | Double track. Stockholm-Uppsala, 41 miles. Following nonelectrified branch lines having same general characteristics extend from terminals on main line: Alvsbyn-Pitea, 32 miles; Bastutrack-Skelleftea, 30 miles; Vannas-Umea, 20 miles; Mellanel-Ornskoldsvik, 18 miles. Stockholm is Swedish rail-ferry terminal for international connection with Finland. |
| Bracke-Storlien-Norway border.....<br>145 miles              | 1.7     | 955                 | 8.5                             | International connections with Norway.   |
| Langele-Hudiksvall-Gavle-Uppsala.....<br>329 miles           | 1.5     | *1,432              | 8.5                             |  |
| Brunflo-Krylbo.....<br>300 miles                             | 1.4     | *955                | 16.7                            | Borlange-Krylbo, 46 route miles, electrified.  |
| Gavle-Borlange-Kil-Goteborg.....<br>354 miles                | 1.6     | 974                 | 12.9                            | Branch line having same general characteristics Vanersborg-Stromstad, 112 route miles. Maximum axleload limit, 25 short tons.  |
| Laxa-Charlottenberg-Norway border.....<br>71 miles           | 1.0     | 819                 | 7.3                             | International connection with Norway.  |
| Krylbo-Mjolby.....<br>157 miles                              | 1.0     | 791                 | 3.0                             | Double track. Hallsberg-Frovi, 31 miles.   |
| Stockholm-Laxa-Goteborg.....<br>283 miles                    | 1.0     | 955                 | 2.9                             | Double track. Stockholm is Swedish rail-ferry terminal for connection with Finland.  |
| Sodertalje-Mjolby-Malmo.....<br>350 miles                    | 1.2     | 1,910               | 18.6                            | Double track. Common trackage to Jarna with Stockholm-Laxa-Goteborg line. Following double track branch lines having same general characteristics extend from terminals on main lines: Ludvika-Oxelosund, 170-mile private line; Nassjo-Oskarsham, 92-miles nonelectrified; Nassjo-Kalmar, 104-miles nonelectrified; Nassjo-Falkoping, 70-miles.               |

Footnotes at end of table.

FIGURE 1. Selected standard-gage rail lines (C) (Continued)

| TERMINALS  | MAXIMUM GRADE  | MINIMUM RADIUS OF CURVATURE | MAXIMUM INTERVAL BETWEEN PASSING TRACKS | REMARKS   |
|--|----------------|-----------------------------|---|---|
|  | <i>Percent</i> | <i>Feet</i>                 | <i>Miles</i>                            |   |
| Goteborg-Varnamo-Karlskrona . . . . .<br>219 miles | 1.0            | *1,000                      | 6.2                                     | Double track. 3-mile section Goteborg-Almedal, common trackage with Goteborg-Malmo line; electrified, Varnamo-Karlskrona, 112-miles. Nonelectrified branch lines having same general characteristics Varnamo-Jonkoping, 45-miles; Karlskrona Kristianstad, 81-miles.  |
| Goteborg-Malmo-Trelleborg . . . . .<br>210 miles   | 1.2            | 955                         | 6.2                                     | Double track. 3-mile section Goteborg-Almedal, common trackage with Goteborg-Karlskrona line. Train-ferry connections with Denmark at Malmo; East and West Germany, at Trelleborg. Branch lines having same general characteristics Astorp-Halsingborg, 16-miles, where rail-ferry connection is made with Denmark; Malmo-Kristianstad via Ystad, 71-miles. |
| Katrineholm-Norrkoping . . . . .<br>30 miles       | 1.0            | na                          | 2.9                                     | Double track.   |
| Mellerud-Kornsjo, Norway . . . . .<br>40 miles     | 1.0            | na                          | 8.0                                     | International connection with Norway.   |

na Data not available.  
\*Estimated.

progress. The trend is to consolidate and modernize yards which are adequate for present needs.

The approximately 3,100 railroad bridges have an aggregate length of over 30 miles and generally are of steel-girder and reinforced-concrete construction. The longest, the Arsta Bridge, a 2,500-foot double-track steel structure with an arched-steel span and reinforced-concrete arches, crosses the Arstaviken (lake) just south of Stockholm.

The 78 tunnels have an aggregate length of 11 miles. Many are cut through massive granite and gneiss formations and do not require lining. Tunnels on electrified sections, however, are generally lined with concrete to reduce seepage. Most tunnels on double-track lines are also double track. The recently completed 1.3-mile tunnel at Garda near Goteborg on the Almedal-Boras line is now the longest in the system. The plan to link Sweden to Denmark by rail tunnel has been indefinitely postponed. In the north are numerous snowsheds and avalanche galleries.

Rail ferries are very important links with other Scandanavian countries and the rest of Europe and very important transporters of international traffic. The SJ operates five ferries: the *Trelleborg* (capacity 34 two-axle freight cars), the *Skane* (capacity 39), the

*Starke* (capacity 21), and the *Drottningen* (capacity 20) connect Trelleborg and Sassnitz, East Germany. The *Drottningen* also links Trelleborg with Travemunde, West Germany, and Stockholm with Naantali, Finland. The *Malohus* (capacity 12 two-axle freight cars) connects Malmo with Copenhagen, Denmark. It is planned to add large new ferries to the Sassnitz and Naantali routes. Denmark and East Germany also operate rail ferries to Sweden.

Automatic block signaling has been installed on most lines. Centralized traffic control (CTC) is in use on 1,179 miles. Most CTC is found on the heavily trafficked lines in the southern and central portions of the country and on the Lulea-Narvik line in the north. Plans call for 1,800 miles of CTC operated from 10 control centers. Administrative centers are linked by an automatic telephone network. A selective telephone network connects the stations, most of which have telegraph. Because of the great demand for complete data at all levels of operation, the teleprinter network now has over 400 terminals. In the past, radiocommunication was used chiefly in yard operations. Full-scale tests of radiocommunication have been made on the Kiruna-Riksgransen line to link stations, trains, and repair and maintenance

crews. The SJ believes that the use of radios will improve train control, increase safety, and enhance efficiency. If the tests are successful, radiocommunications are to be introduced between Stockholm and Goteborg.

Electric power supplies traction for 95% of the freight traffic and 94% of total train miles, but only 62% of the total route mileage is electrified. In 1968-69 (the SJ fiscal year ends on 30 June) the SJ used over 1.24 billion kilowatt-hours of electricity. Sweden's abundant hydroelectric power resources are supplemented by thermal generating plants. Almost all of the rail system operates on 15,000-volt 16 2/3-cycle alternating current which is drawn from the national grid and converted for rail operations at strategically located converter plants, most of which are underground. About 65 miles of line in the Stockholm area are operated on a 1,500-volt direct current system. Crude oil, imported from the Soviet Union, Venezuela, Saudi Arabia, Iraq, Iran, and Nigeria, is refined domestically. The SJ used 9.8 million gallons of fuel oil in 1968-69.

The supply of locomotives and rolling stock is adequate, and all equipment is maintained in excellent condition.

The average car capacity increased from 24.6 short tons in 1965 to 26 short tons in 1970. The replacement of older locomotives with powerful new electric and diesel-electric units has continued. The SJ has fifteen 9,750-horsepower electric units, among the most powerful in the world, on the Lulea-Narvik line. Most equipment has the standard European hook-link-and-screw couplers and side buffers; rail-car sets have automatic couplers, and the new high-capacity ore-hopper cars used on the Lulea-Narvik line have automatic center-buffer couplers. Most of the freight cars (40,656) and about 25% of the passenger cars are suitable for use in international traffic. Most of the equipment has air brakes. All new equipment is designed to accommodate automatic couplers.

At the beginning of 1970 the SJ equipment inventory included the following:

|  |        |
|--|--------|
| Locomotives:                               |        |
| Diesel .....                               | *654   |
| Electric .....                             | 882    |
| Railcars (electric and diesel) .....       | 565    |
| Passenger cars .....                       | 2,642  |
| Baggage and mail cars .....                | 382    |
| Box cars .....                             | 13,425 |
| Condolas .....                             | 1,831  |
| Flat cars .....                            | 24,751 |
| Refrigerated/insulated .....               | 1,411  |
| Special purpose, including tank cars ..... | 6,928  |

\*438 are under 350 hp.

Two-axle freight cars predominate; however, the trend is increasingly toward high-capacity four-axle cars.

Most rail equipment is produced domestically, but in some cases foreign components are used. Principal domestic suppliers are ASEA (*Allmänna Svenska Elektriska Aktiefbolaget*), ASJ (*Aktiefbolaget Svenska Järnvägsverkstaderna*), KVAB (*Kalmar Verkstadsaktiefbolag*), and Nohab. Limited quantities of rail material are purchased abroad, chiefly from the United Kingdom, West Germany, and other Scandinavian countries.

Standards of maintenance and repair are high. Major repair shops and maintenance facilities are located throughout the system: eight for electric traction, nine for diesel-electric traction, and 14 for rolling stock. Construction and maintenance operations are highly mechanized. Equipment is manned by a well-trained and efficient work force. Seasonally frozen ground, frost heaves, avalanches, washouts, snow, and extensive bogs create the greatest problems for construction and maintenance.

The SJ administration and the Swedish Government are concentrating on improving and modernizing the existing network. A hot-box detection system is being extended, and automated safety equipment is being installed at grade crossings. An electronic car tracing system and a centralized freight billing procedure are in operation along with an electronic passenger reservation system. The SJ is experimenting with high-speed passenger service and is improving its roadbed to handle the increased speeds.

Operating procedures are efficient and effective. There are no major operating problems or interruption factors other than heavy snowfall in the north. Exports and imports constitute the principal traffic and are carried in almost equal proportions. The major products hauled are iron ore, wood products, iron and steel, other ores, POL, cement, brick, food, machinery, stone, gravel, lime, coal and coke, and grain. Iron ore carried on the Lulea-Narvik line is the chief source of freight revenue. SJ traffic statistics in fiscal years 1969 and 1970, in millions, were as follows:

|                            | FY 69   | FY 70    |
|----------------------------|---------|----------|
| Passengers .....           | 55.5    | 57.8     |
| Passenger-miles .....      | 2,894.7 | 2,937.5  |
| Freight (short tons) ..... | 64.5    | 66.1     |
| Short-ton-miles .....      | 9,580.8 | 10,512.8 |

Total SJ receipts during FY71 were equivalent to US\$510.2 million, and operating expenditures of \$553.7 million produced a deficit of \$43.5 million. FY70 operations showed a slight profit.

The Swedish railroads use T-section rails 33 to 66 feet in length and ranging in weight from 55 to 101

pounds per yard with 87 and 101 pounds per yard predominating. About 125 miles of rail is renewed each year, most of which is welded into 919-foot sections. In 1969 there were over 1,300 miles of continuous-welded rail; the longest single section was 34 miles long. Concrete ties now predominate over treated pine ties. Clamp-type fastenings are used with concrete ties; spring-type fastenings, spikes, and tie plates are used with wooden ties. Ballast consists of gravel and broken stone.

#### D. Highways (C)

The distribution of highways has been influenced chiefly by the rugged terrain, severe climatic conditions, and population factors. The basic highway system is concentrated in the southern part of the country, where it provides access to major urban areas, industrial centers, agricultural areas, and rail terminals and ports. Large lake areas have influenced to some extent the alignment of roads in the network. North of latitude 60° rugged terrain and long, severe winters, during which travel is infeasible, account for the paucity of roads. International highway connections are made with the adjacent countries of Norway and Finland.

The highway network totals 61,000 miles, of which 44,500 are crushed stone, gravel, or improved earth, and the remaining 16,500 miles are surfaced with bitumen, concrete, stone block, or cobblestone. The policy is to surface roads with bitumen, and the use of cobblestone and concrete has been reduced. Roads in the south are in fair to good condition; gravel and earth roads (Figure 2) in the north are generally in poor condition. Except for some sections of four-lane divided highways, surface widths are generally 18 to 26 feet. Roads are usually 20 to 24 feet wide near urban areas; rural roads may be as narrow as 10 feet. Shoulders, where they exist, normally are of earth and are up to 5 feet in width. Roads above the Arctic Circle are narrow, but during the winter when they are frozen they have greater supporting capacity and are wider because snow is plowed to the outside edge of the shoulders. About 18% of the total network is open to 10-ton axle and 16-ton tandem-axle weights. This is true for 81% of the national routes and 34% of the principal through routes. Axle and tandem-axle weights on 94% of the country's total network are 8 and 12 tons, respectively.

About 67% of the 9,400 bridges on the highway network are reinforced concrete, 18% are stonemasonry, 11% are timber, and 4% are of steel. The

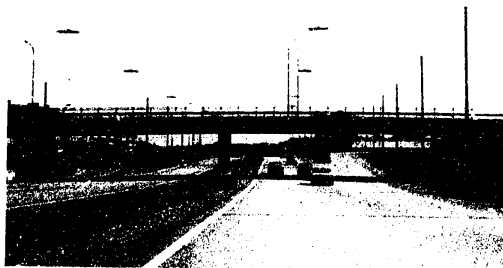
reliance on concrete is due primarily to the low maintenance requirements. Stonemasonry bridges are largely concentrated in the south; timber bridges, almost all of which are on local roads in the north, are gradually being replaced with concrete structures. Bridges on national and provincial highways are in good condition. National routes have 95% of the bridges, and 63% are on roads permitting 10-ton axle and 16-ton tandem-axle weights.

The three international ferry crossings on the system provide connections with Denmark. Tunnels are being constructed on national highways in order to improve alignment and eliminate bottlenecks on these routes. One tunnel is on the national route between Malmo and the Norway border. The Tingstad tunnel is a 1,883-foot six-lane structure under the Gotaaly in the vicinity of Goteborg.

FIGURE 2. Swedish highways (J/OU)



Typical gravel road in northern Sweden



Four-lane divided highway exiting Stockholm to the north toward Uppsala

The responsibility for highway construction and maintenance rests with the National Road Administration (NRA), an agency of the Ministry of Communications. There are local administrations of the NRA in each of Sweden's 25 regions. The larger cities and urban areas carry out their own construction and maintenance activities and receive subsidies from the state for principal through routes. About 54% of the total construction of rural roads is done by contractors, mainly on bridges and surfacing, while the NRA performs all other work.

Highway construction, particularly in bridging, grading, and draining, is difficult because of the extreme climate. Swedish highways require constant maintenance because of severe winters and heavy traffic. Sudden spring thaws and resultant floods, coupled with frozen subsoil, cause severe damage to surfaces and bases. Because optimum soil moisture content is rarely attained in most areas, soils are difficult to compact.

The average construction time for a highway project is 2 years. Earthmoving is done during the winter; surfacing, during the summer. In the northern two-thirds of the country the many deeply incised valleys necessitate relatively high bridges with long spans. Along the entire coast, bridges over river estuaries and to islands must be high enough to permit uninterrupted waterway shipping. The many bogs and lakes require large amounts of rock and gravel for causeways, and it is sometimes necessary to remove unstable subsoils to construct the causeways. North of latitude 60° the terrain is characterized by more rugged relief and high mountains along the border of Norway. Because of the problems involved in combating the effects of snow and ice, considerable effort and expense is required to keep the roads open, and snow fences are used extensively in many regions. Large quantities of sand are spread on icy roads each winter. Severe damaging effects of spring thaws can be remedied only by extensive rebuilding. Unpaved roads often become soft and, in many places, impassable. Sweden produces ample amounts of steel and cement for construction and maintenance purposes but must rely on imports for bitumen.

Because of rapid increases in traffic and a decline in highway financing, the Ministry of Communication began an extensive review of the Twenty Year Road Plan (1958-77), and established the Road Planning Commission to undertake the review. The result was a new Fifteen Year Road Plan (1970-85) adopted in 1969. The new plan incorporates the major provisions of the old plan, which emphasized widening existing

roads, extensive bridge construction and reconstruction, paving gravel roads, and improving alignment and reducing bottlenecks by building tunnels. A more ambitious program scheduled for completion in 1980 deals primarily with development in and around Stockholm, envisioning a series of belt thoroughways and connecting feeder roads to serve the main traffic routes approaching the center of the city.

The Road Planning Commission report estimated that by 1985 automobile registration would increase from 2.2 million to 4.6 million, or one auto per two inhabitants. The new plan calls for construction of 944 miles of limited-access four-lane divided motorways and 5,592 miles of national roads (four-lane undivided) and primary through routes (two-lane main highways) and maintenance of 60,000 miles of state-controlled highways and 40,000 miles of urban streets and private roads. Financing, most of which is to come from the annual road budget, will be the major impediment to accomplishing the objectives of the plan. Over the next 5 years increases in automobile registration fees and gasoline taxes are to net US\$12 billion, which is to be earmarked for construction of the 944 miles of limited access four-lane divided motorways.

Bottlenecks that restrict highway traffic include narrow and low-capacity bridges, sharp curves and steep grades, ferries on some routes, and numerous underpasses. Poor surfaces, narrow roadways, and high traffic volumes in and near the larger population centers result in major restrictions to traffic. Roads in the north become impassable during spring thaws.

State Motor Traffic Boards grant licenses to establish and operate motor transport services, and long-distance bus service is provided almost exclusively by the Swedish State Railways, whose bus routes serve most of the country. Commercial freight rates are published annually, but these rates are general commodity rates and may be negotiated between trucker and shipper. Tolls and other ancillary charges incurred by the trucker are not included in the negotiated rates and are borne by the shipper.

In January 1970 the 2,349,815 motor vehicles registered in Sweden consisted of 2,193,635 passenger cars and 156,180 trucks and buses. Sweden is a significant producer of automobiles, but, because the variety of domestic models is limited, about two-thirds of domestic demand is met by imports. The principal sources of vehicle imports are West Germany and the United Kingdom.

Figure 3 lists characteristics of the most significant highways.

FIGURE 3. Selected highways (C)

| ORIGIN AND DESTINATION   | DISTANCE     | SURFACE TYPE                               | SURFACE WIDTH | SHOULDER WIDTH | REMARKS   |
|--|--------------|--|---------------|----------------|---|
|  | <i>Miles</i> |  | <i>Feet</i>   |                |   |
| Halsingborg to Finland border at Haparanda via Jonkoping, Stockholm, Ornskoldsvik. | 1,066        |  |               |                | Undulating to hilly terrain. Fair to good condition.  |
| Mile 0 to Mile 617.....  | 617          | Bituminous.....                            | 18 to 26      | 0 to 6         | First 25 miles exiting Stockholm two 25-ft. roadways.   |
| Mile 617 to Mile 732.....  | 115          | do.....                                    | 20 to 30      | na             | Hilly terrain; width includes lanes for slow-moving traffic.  |
| Mile 732 to Mile 1,066.....  | 334          | Gravel, some bituminous.....               | 16 to 23      | na             |   |
| Odsahog to Finland border at Karesuando via Orebro, Ostersund, Stensele.           | 1,074        | Bituminous, concrete, gravel, cobblestone. | 15 to 23      | 0 to 5         | Hilly to mountainous terrain; some sharp curves and steep grades. Fair to good condition.           |
| Malmö to Norway border via Halsingborg, Goteborg.                                  | 380          | Bituminous, concrete, some cobblestone.    | 17 to 26      | na             | Undulating to hilly terrain. Good condition.  |
| Malmö to Norrkoping via Kristianstad, Karlskrona, Kalmar.                          | 371          |  |               |                | Undulating terrain. Good condition.   |
| Mile 0 to Mile 136.....  | 136          | Bituminous, concrete.....                  | 17 to 28      | na             |   |
| Mile 136 to Mile 371.....  | 235          | Bituminous, cobblestone, gravel.           | 17 to 23      | 0 to 8         |   |
| Norway border to Stockholm via Arjang, Orebro, Vasteras.                           | 289          | Bituminous.....                            | 20 to 32      | 0 to 13        | Undulating to hilly terrain. Fair to good condition. Some stretches tree lined; some being widened. |
| Norway border at Storlien to Sundsvall via Ostersund.                              | 380          | do.....                                    | 2 at 18 to 20 | na             | Mountainous terrain. Good condition. Resurfacing nearing completion Mile 0- Mile 236.               |

na Data not available.

### E. Inland waterways (C)

A system of inland waterways has been maintained since the 17th century when a canal was completed between Malaren and Hjalmaran lakes in southeastern Sweden. Today the waterways total 1,275 miles, including the navigable channels through the four main lakes: Malaren, Vanern, Vattern, and Hjalmaran. By 1945, road and rail transport had caused the waterways to decline in importance; since 1945, however, some canals have made a comeback and again play some part in providing low-cost transportation for bulk and general cargos. Freight carried on inland waterways in 1970 amounted to 7.6 million short tons, 300,000 tons less than in 1969, and about 90% of this tonnage traveled on two canals, the Trollhatte Kanal and the Sodertalje Kanal. Principal cargos are ore, lumber, coal, cement, metals, and petroleum products. The waterway system is considered adequate for normal requirements.

The inland waterways form two basic networks extending generally east-west in the southern third of the country and providing access to southern Sweden as well as a cross-peninsula route from the Baltic Sea to the Kattegat. The many rivers in the northern part of the country, unsuitable for navigation, are used extensively for rafting timber to sawmills on the Baltic. Development of a waterway system has been relatively easy because nearly 10% of the country's area is covered by lakes. The Dalslands Kanal, leading northwestward out of Vanern, connects with the Norwegian canal system to provide the only international connection on the Swedish waterways.

Most inland waterways are limited to craft of from 150 to 300 tons. Exceptions are the 52-mile Trollhatte Kanal, the 180-mile main channel of the Malaren-Hjalmaran system, and the 13-mile Sodertalje Kanal, which can accommodate vessels of 2,200 tons, 3,000 tons, and 4,000 tons, respectively. Other principal waterways are the Gota Kanal from the Baltic Sea to Vanern, the Dalslands Kanal system in western Sweden, the Saffle Kanal system, and the routes through the four major lakes. The Gota Kanal is the longest waterway, and the Trollhatte Kanal carries the greatest tonnage. The water-level difference on the Trollhatte Kanal between Vanern and Goteborg is 144 feet.

The major impediment to navigation is ice, which either delays or halts traffic on an average of 3 or 4 months each winter. Icebreakers, normally used on the most important routes, alleviate the situation somewhat. Spring floods also occasionally interrupt the normal flow of traffic. Frequent locks and bridges on some waterways impede traffic and increase transit times.

Numerous structures of various types have been built on the waterways, including at least 23 dams,

165 locks, and 258 bridges. Most of the locks are more than 100 years old and cannot accommodate craft of greater than 300 tons capacity. Most bridges are highway structures with movable spans of the swing or bascule type. Twenty of the dams, built for the generation of electricity, are bypassed with land-cut or natural channels equipped with locks.

There are at least 100 ports of varying sizes and importance along the waterways. Goteborg and Stockholm are the largest, and, although primarily maritime ports, they also handle an impressive amount of inland waterway traffic. Other important waterway ports are Karlstad, Vasteras, Linkoping, Sodertalje, and Trollhattan. Each of these serves largely as a transshipment point and has from 3,000 to 5,000 linear feet of wharfage suitable for alongside berthing of waterway craft; each has adequate handling, storage, and clearance facilities. Sodertalje and Vasteras have important storage facilities for petroleum products.

The inland waterway fleet in 1969 numbered about 725 vessels, ranging in size from small barges to coaster-type vessels and having a total cargo capacity of about 220,000 short tons. It is estimated that some 300 of the 725 vessels are for inland waterway use only and range in capacity from 100 to 300 tons. The fleet is generally adequate for present needs and is well maintained. More than half the fleet is over 30 years old.

Swedish waterways are owned and operated by the national government, by municipalities, and by private companies. The government agency responsible for most of the waterways, both state owned and private, is the Board of Shipping and Navigation of the Ministry of Communications. The Trollhatte and Saffle Kanals, both state owned, are controlled by the State Power Board of the Ministry of Finance and Economy; portions of these waterways are used for generating electricity. The Gota, Dalslands, and Kinda Kanals are the best known of the privately owned waterways.

Some new waterway construction is in progress and more is planned. Extensive improvements to the Trollhatte Kanal have begun, and the first phase of the project involves widening the Karls Grav section. Total cost is to approximate US\$10 million, and work is to be completed by late 1974. The canal is to be navigable by 3,000-ton vessels, compared with its present 1,500-ton limitation. The Swedish Government has recently approved a program to provide for deepening the shipping channels in Malaren lake by 4.2 feet to insure a channel depth of 22.3 feet from the Sodertalje lock to Stockholm and to the important inland port of Vasteras. Completion of the project will require 3 years.

Characteristics of the principal waterways are listed in Figure 4.



FIGURE 4. Characteristics of principal waterways (C)  
(Measurements in feet)

| NAME, TYPE, NAVIGABLE LENGTH   | CHANNEL CHARACTERISTICS |            | CONTROLLING LOCK DIMENSIONS                         |       | CONTROLLING UNDERBRIDGE CLEARANCES |           | REMARKS                 |
|--|-------------------------|------------|---|-------|------------------------------------|-----------|-------------------------|
|  | Width                   | Safe draft | Length  | Width | Horizontal                         | Vertical  |                         |
| Trollhatte Kanal; natural, dredged, canalized sections of Gotaalv (river); land-cut canals, lake channels. 32 miles. | 82                      | 15.1       | Length: 295<br>Width: 45<br>Depth over sill: 18     | 295   | 45                                 | Unlimited | 6 locks.                |
| Gota Kanal; lake channels connected by land-cut canals. 111.7 miles.   | 65                      | 9.0        | Length: 114.3<br>Width: 25<br>Depth over sill: 9.7  | 114.3 | 23.6                               | do        | 58 locks.               |
| Kinda Kanal; canalized river sections, land-cut canals, lake channels. 50.6 miles.                                   | 15                      | 4.8        | Length: 95.5<br>Width: 15.8<br>Depth over sill: 5.3 | 95.5  | 22.9                               | do        | 15 locks.               |
| Dalslands Kanal; lake channels interconnected by straits, land-cut canals. 74.6 miles.                               | 13.6                    | 5.5        | Length: 97.4<br>Width: 13.6<br>Depth over sill: 5.9 | 97.4  | 13.8                               | 69        | 22 locks.               |
| Saffle Kanal; improved river, short land-cut canals, connecting streams. 58.2 miles.                                 | 50                      | 9.8        | Length: 105<br>Width: 23.4<br>Depth over sill: 9.8  | 105   | 30                                 | Unlimited | Only lock is at Saffle. |
| Malaren-Hjalmaren system; series of lakes connected by land-cut canals or canalized streams. 540 miles.              | 25                      | 6.4        | Length: 67.3<br>Width: 17.5<br>Depth over sill: 5.8 | 67.3  | 23.3                               | 47.6      | 47 locks.               |
| Sodertalje Kanal; lake channel, land-cut canal, canalized stream. 13 miles.  | 80                      | 18         | Length: 443<br>Width: 65.6<br>Depth over sill: 24.6 | 443   | 65.6                               | Unlimited | One lock.               |

## F. Ports (C)

Sweden has more than 160 ports ranging in size from small landing places owned by industrial firms to some of the largest and most modern maritime facilities in the world. The seaports, most of which are in the southern half of the country, are valuable centers for importing coal and petroleum products and are outlets for the wood products, pulp, and manufactured commodities shipped throughout the world.

The ports are scattered along the shore from the northernmost part of the Gulf of Bothnia on the east coast to the upper reaches of the Skagerrak on the west. Swedish ports on the northern part of the Gulf of Bothnia are often icebound from 4 to 6 months each year. The four largest are in the southern third of the country. On the west coast are Goteborg, Malmo, and Halsingborg, and on the east coast is Stockholm (Figure 5), about 30 miles inland from the Baltic Sea.

Most ports are owned by the municipality in which they are located. Each operates under the direction of a harbor or port captain who in turn is supervised by a harbor or port authority responsible to the city council. Goteborg, Malmo, and Stockholm have free ports, which are municipally owned but are operated by a separate company affiliated with the municipal government. A few ports such as Limhamn, Lulea, and Oxelosund are privately owned and operated by large industrial firms.

Sweden has 17 major and about 150 minor ports. The largest ports—Goteborg, Stockholm, Malmo, and Halsingborg—are well maintained and well equipped with modern, efficient handling facilities (including roll on, roll off capabilities) and are completely adequate for normal requirements. The remaining major ports are also well equipped for cargo transfer and are adequate for all normal requirements.

The ports continue to expand at a significant pace, with present port development concentrated on the larger ports. At Halsingborg an additional area of over 6 acres and having a quay length of 985 feet is to be developed near the Ocean Basin. Plans are being formulated at Malmo for further land reclamation for the development of industrial sites and additional berthing facilities. Goteborg's second largest harbor project, Alvsborg, is under construction at a site immediately to the west of the Skandia Harbor. The area is scheduled for completion in 1975. Long-range plans exist for the development of a new and larger petroleum facility about 3 miles west of the present Torshamn site.

Details of major ports are tabulated in Figure 6.

## G. Merchant marine (C)

The Swedish merchant fleet is one of the most modern, efficient, and well maintained of the traditional maritime nations and serves major trade routes throughout the world. About 80% of the fleet's tonnage is employed either exclusively or primarily in trade between foreign countries. The considerable amount of net earnings in foreign exchange derived from this trade, which was equivalent to US\$368 million in 1970, makes an important contribution to Sweden's balance of payments. During the last few years the fleet has carried no more than 30% of the country's total volume of international seaborne exports. Because of the importance to the economy of the tramp operations, there is little interest by the government and shipowners in carrying a larger portion of Sweden's international trade.

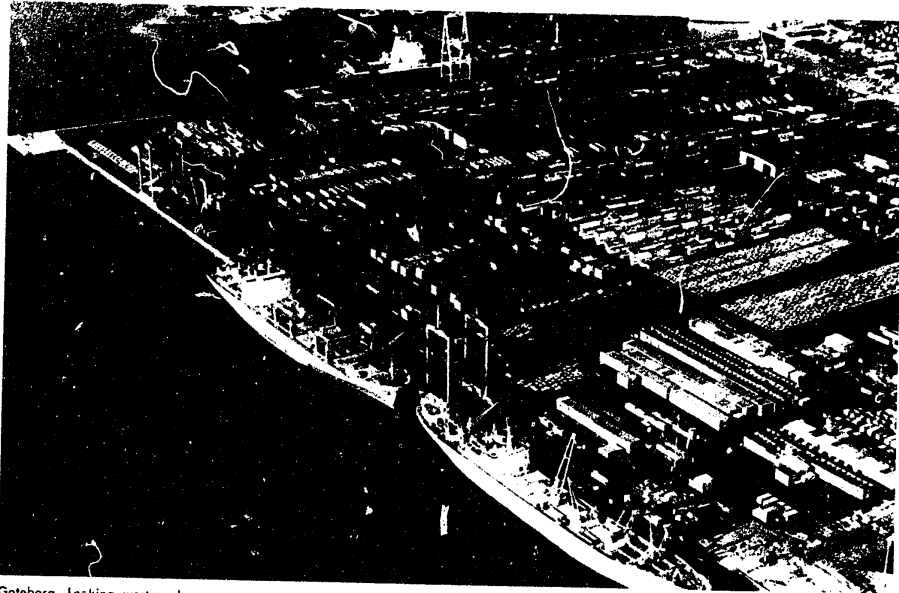
In February 1972 the fleet consisted of 352 ships of 1,000 gross register tons (g.r.t.) and over, totaling 4,641,218 g.r.t. and 7,138,988 deadweight tons (d.w.t.), as follows:

| TYPE                        | NUMBER | G.R.T.    | D.W.T.    |
|-----------------------------|--------|-----------|-----------|
| Tanker                      | 46     | 1,371,333 | 2,500,280 |
| Tanker/ore carrier          | 23     | 826,521   | 1,429,944 |
| Bulk cargo                  | 52     | 728,732   | 1,118,788 |
| Dry cargo                   | 128    | 806,457   | 1,038,875 |
| Car/bulk carrier            | 11     | 194,398   | 286,789   |
| Refrigerator                | 28     | 200,170   | 204,566   |
| Chemical carrier            | 15     | 127,653   | 202,070   |
| Timber carrier              | 7      | 78,165    | 112,080   |
| Passenger                   | 12     | 116,941   | 28,087    |
| Passenger/cargo             | 2      | 14,198    | 15,800    |
| Other specialized carriers* | 28     | 176,650   | 201,909   |

\*3 wine tankers; 2 roll-on roll-off/trailer ships; 3 container ships; 6 roll-on roll-off/container ships; 9 liquefied-gas tankers; 1 cement, 1 asphalt and 3 car carriers.

About 14% (189 ships) of the total fleet deadweight tonnage is of less than 10,000 d.w.t.; 14% (73 ships), between 10,000 and 19,999 d.w.t.; 45% (76 ships), between 20,000 and 99,999 d.w.t.; and 27% (14 ships), more than 100,000 d.w.t. The largest ships are two tankers and one tanker/ore carrier, each of more than 200,000 d.w.t. Of the fleet deadweight tonnage, 76% is less than 10 years old, 15% is between 10 and 14 years old, and 9% is 15 years or older. A total of 74 ships have service speeds of 18 knots and over (29 dry cargo, 27 refrigerator, 10 passenger, four roll-on roll-off/container, three container, and one bulk cargo); 218 have service speeds of 14 to 17 knots; and 60 ships have speeds of less than 14 knots. A total of 330 ships are diesel powered, and 22 have oil-fired boilers.

The merchant fleet is controlled by 48 private beneficial owners (entities which take the profit or loss



Goteborg. Looking westward

Free port area of Stockholm. Looking southward

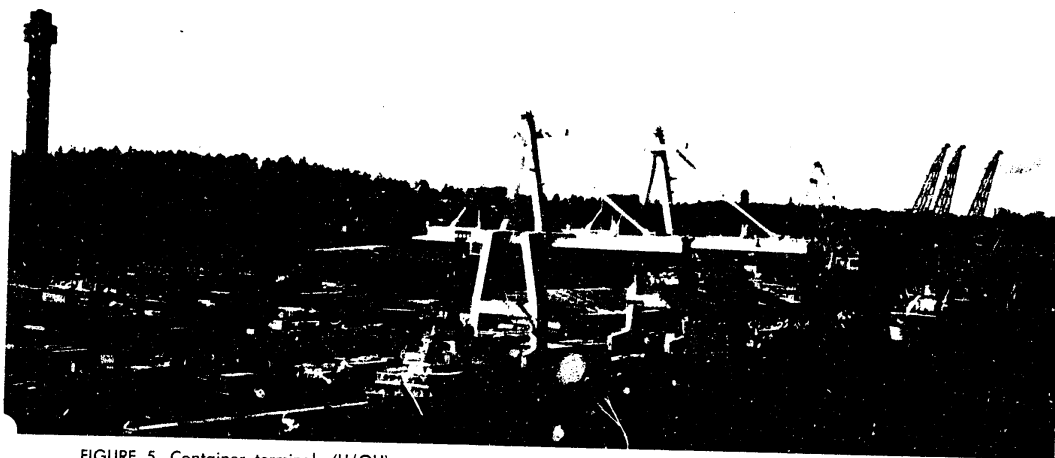


FIGURE 5. Container terminals (U/OU)

FIGURE 6. Major ports (C)

| NAME; LOCATION;<br>ESTIMATED MILITARY<br>PORT CAPACITY* | ACTIVITIES   | HARBOR   | BERTHS   |
|---|--|--|--|
| Gavle.....<br>60°41'N., 17°10'E.<br>26,500              | Ranks fifth in maritime traffic; serves one of largest and richest industrial areas. Principal shipments— <i>ore</i> , wood products, paper. Principal receipts—POL, coal and coke, iron goods, clays, cement.   | Natural, well-sheltered estuarial harbor comprising mouth of Gavleån (river) and head of Gavlebukten (bay). Water area, 850 acres; depths, 13 to 34 ft.; 12 miles from open waters of Gulf of Bothnia.<br>Fairway limitations—N. approach channel about 5 miles long; dredged depth, 26 ft.; minimum width, 200 ft.; S. approach channel about 5 miles long; narrow; controlling depth, 14½ ft.  | Alongside—For 6 standard, 6 small ocean-type cargo vessels; 2 standard, 65 small coaster-type cargo vessels; 17 lighters; 1 large, 1 standard ocean-type tanker; 1 standard coaster-type tanker.<br>Anchorage for large number of all sizes of vessels in outer harbor; well sheltered in depths of 30 to 50 ft. over good holding ground of mud and clay.   |
| Goteborg.....<br>57°42'N., 11°57'E.<br>78,000           | Largest Swedish port, Scandinavian center for containerized cargo (Figure 5); handles general cargo, POL, grain, coal, lumber, passengers. Principal Swedish shipbuilding center; 4 large yards; 4 graving docks, largest 1,253 ft. long; 11 shipbuilding ways, largest 700 ft. long; 7 floating drydocks, lifting capacity of largest, 30,000 tons. | Improved river harbor consisting of outer harbor with 1 basin and inner harbor comprising 7-mile stretch of Gotaalv with 6 tidal basins. Good natural protection.<br>Fairway limitations—Approach from Kattegat (strait) to Vinga (island) free and clear; Vinga to Knippelholmen channel 8 miles long; controlling depth, 49 ft. Knippelholmen to entrance to Gotaalv channel 2 miles long; controlling depth, 40 ft. Channel in Gotaalv; controlling depth, 33 ft. to Stigberg Quay, 31 ft. to Free Port Basin, 19 ft. to head of harbor. Least width of channels, 600 ft. Alvsborg Bridge just inside Gotaalv has 148-ft. vertical clearance; Hisingbron, draw bridge near head of Gotaalv, has 57-ft. horizontal clearance through draw span. Channel to Torshamn Petroleum Terminal; controlling depth, 63 ft. for tankers up to 250,000 d.w.t. Depths leading to berths exceed depths in berths. | Alongside—For 15 large, 39 standard and, 39 small ocean-type cargo vessels; 24 standard, 38 small coaster-type cargo vessels; 46 lighters; 9 large, 6 standard, 1 small ocean-type tankers; 5 standard coaster-type tankers; 3 tank barges; 11 medium (SS, MSO, MSC), 20 small (PT) naval vessels.<br>Fixed mooring—For 1 large, 4 standard, 1 small ocean-type cargo vessels.<br>Anchorage—For large numbers of all sizes of vessels in W. and S. approaches to Goteborg in depths of 24 to 96 ft. over good holding ground of clay; fair protection except from WSW. |
| Halmstad.....<br>56°40'N., 12°51'E.<br>12,100           | Major industry of port is handling lumber. Principal receipts—coal, coke, chemicals, machinery, pig iron, cement. Principal shipments—lumber and wood products, flour, steel goods. Shipyard has 2 marine railways; slip 1 has hauling capacity of 500 tons; slip 2, 1,000 tons.   | Consists of 1¼-mile breakwater-protected section of the Nissan; includes 2 basins, 1 a new POL basin E. of river entrance and second a ferry-turning basin on W. side of entrance, general depths of 21 to 26 ft.<br>Fairway limitations—Approach from Kattegat to Halmstad free and clear; dredged channel about ½ mile long, 180 ft. wide; controlling depth, 26 ft.   | Alongside—For 6 standard and 5 small ocean-type cargo vessels, 3 lighters; 17 small coaster-type, 2 small ocean-type tankers.<br>Anchorage—None in harbor except for small craft; exposed S. through W. anchorage in open roadstead provides large number of berths for vessels of all sizes in Laholmsbukten in depths of 22½ to 36 ft., sand over clay bottom, good holding ground.  |

|  |  |  |   |
|--|--|--|---|
| <p>Halsingborg . . . . .<br/>56°03'N., 12°42'E.<br/>22,000</p> | <p>Sweden's third most active seaport after Goteborg and Stockholm. Principal receipts—foodstuffs, refined POL products, chemicals, metals, grain, fertilizers, motor vehicles, coal. Principal shipments—foodstuffs, chemicals, rubber products, wood, paper, glass and glassware, machinery, motor vehicles. 1 medium, 3 small shipyards; 1 end-launching shipbuilding way 330 ft. long; 2 graving docks, lengths on floor 367 and 288 ft. Small shipyards in harbor at Raa builds wooden-hulled fishing and pleasure craft and coasters; 1 slipway and 2 marine railways, hauling capacities up to 850 tons; yards in poor condition.</p> | <p>Artificial harbor consisting of 4 breakwater-protected divisions extending 4 miles along shore of The Sound; total water area, 173 acres; general depths, 16 to 36 ft.<br/>Fairway limitations—Approach through The Sound deep and unobstructed; controlling entrance widths to 4 breakwater-protected divisions, 295, 350, 260, 80 ft.; controlling entrance depths, 33, 39, 34, 16 ft.; depths leading to berths exceed or equal depths in berths.</p>  | <p>Alongside—For 6 large, 17 standard, 5 small ocean-type cargo vessels; 1 standard, 21 small coaster-type cargo vessels; 1 lighters; 2 large, 1 small ocean-type tankers.<br/>Anchorage—For large numbers of vessels of all sizes in roadstead of Raa harbor in depths 42 to 58 ft., over clay bottom, protected from channel currents in SW. swells, and in Halsingborg roadstead 1/2 mile SW. of Norrahammen (North Harbor), depths 42 to 96 ft., over good holding ground, open to channel currents and swells.</p> |
| <p>Kalmar . . . . .<br/>56°40'N., 16°22'E.<br/>15,000</p>      | <p>Area served by port is agricultural and highly developed industrially. Principal shipments—lumber, wood pulp, paper, grain, flour, matches. Principal receipts—coal, coke, POL, machinery, chemicals. 1 shipyard (Kalmar Shipyard) builds coaster-type vessels up to 3,000 d.w.t.; 2 end-launching shipbuilding ways; 1 floating drydock, lifting capacity of 3,000 d.w.t.; 1 marine railway, hauling capacity of 800 tons.</p>   | <p>Well-protected artificial harbor on W. shore of Kalmarsund consisting of inner harbor having water area of about 80 acres and depths of 11 to 21 ft., and outer harbor having depth of 26 ft.<br/>Fairway limitations—Approach to Kalmar is through Kalmarsund from N. or S.; controlling depth through strait is 26 ft. and minimum width of fairway is 280 ft. Entrance channel to inner harbor, which branches off main fairway, is 1,500 ft. long, 150 ft. wide, 21 1/2 ft. deep; depths leading to berths in inner harbor exceed depths in berths.</p> | <p>Alongside—For 12 small ocean-type cargo vessels; 4 standard, 17 small coaster-type cargo vessels; 20 lighters; 1 small ocean-type tanker.<br/>Anchorage—For large numbers of vessels of all sizes in roadstead NE. of harbor or SE. of Grimskar (island), both well protected in depths of 24 to 36 ft., clay bottom.</p>  |
| <p>Karlshamn . . . . .<br/>56°10'N., 14°51'E.<br/>8,200</p>    | <p>Important industries: vegetable-oil and concentrated-food factory, granite quarry. Principal shipments—lumber, granite, vegetable oils. Principal receipts—corn, cotton, copper, cement, copra, soybeans, POL.</p>  | <p>Well-protected natural harbor consisting of water area of about 60 acres having depths of 13 to 36 ft.<br/>Fairway limitations—Dredged channel from outer harbor has least width of 200 ft., controlling depth of 36 ft.</p>  | <p>Alongside—For 3 standard, 9 small ocean-type cargo vessels; 5 small coaster-type cargo vessels; 7 lighters; 1 large ocean-type tanker.<br/>Anchorage—For large numbers of vessels of all sizes in outer harbor in depths of 26 to 40 ft., well sheltered, over good holding ground of mud and clay.</p>  |
| <p>Karlskrona . . . . .<br/>56°10'N., 15°36'E.<br/>9,000</p>   | <p>Important naval base; numerous industries. Principal shipments—lumber, fish, paper pulp. Principal imports—coal, coke, oil, clay, fertilizer, cement, grain. 1 large shipyard (<i>Karlskronavarvet AB</i>) builds and repairs general-cargo ships and special vessels but specializes in building, repairing, converting naval vessels; 1 side-haul marine railway with hauling capacity of 200 tons; 7 graving docks, largest 600 ft. Has principal naval operating base.</p>  | <p>Well-protected natural harbor; facilities located on several islands surrounding city of Karlskrona. Harbor has general depths of 7 to 29 ft.<br/>Fairway limitations—Channel from Kungsholmen to harbor entrance about 3 miles long, 500 ft. wide, 65 ft. deep; dredged approach channel to wharves 1 mile long, 300 ft. wide, has controlling depth of 26 ft.</p>   | <p>Alongside—For 2 standard, 6 small ocean-type cargo vessels; 5 standard, 4 small coaster-type cargo vessels; 4 lighters; 1 standard coaster-type tanker; 5 medium-size (DI, DE) naval vessels.<br/>Anchorage—For large numbers of vessels of all sizes in depths of 45 to 78 ft. in outer roadstead; well sheltered over good holding ground of mud and clay.</p>   |

Footnote at end of table.

FIGURE 6. Major ports (C) (Continued)

| NAME; LOCATION;<br>ESTIMATED MILITARY<br>PORT CAPACITY* | ACTIVITIES   | HARBOR   | BERTHS  |
|---|--|--|---|
| Landakrona.....<br>55°51'N., 12°50'E.<br>14,000         | Local industrial activities: shipbuilding, fertilizer production, metal works. Principal receipts—Volkswagens, molasses, metal plates, chemicals used in fertilizer production. Principal shipments—fertilizer, grain. 1 large shipyard (The Sound) builds vessels up to 110,000 d.w.t. and repairs general-cargo ships, freighters, refrigerated-cargo vessels, passenger ships; 3 shipbuilding ways, 500, 620, 950 ft. long; 1 floating drydock, lifting capacity 2,500 tons; 1 graving dock, length on floor 630 ft.  | Well-sheltered, natural deep-water harbor formed between mainland and off-lying islands and shoal area; about 7,500 ft. long, 200 to 500 ft. wide, depths of 22 to 29 ft.<br>Fairway limitations—Approach through The Sound deep and clear of dangers. Entrance and harbor fairways natural; least width of 200 ft., controlling depth of 36 ft. Berths rather than fairways leading to them limit size of vessels that can be accommodated in harbor.   | Alongside—For 9 standard, 8 small ocean-type cargo vessels; 7 standard, and 6 small coaster-type cargo vessels; 6 lighters.<br>Anchorage—For large numbers of vessels of all sizes 2½ miles WNW. of harbor entrance, well sheltered in depths of 36 ft. over good holding ground of sand and clay.  |
| Lulea.....<br>65°35'N., 22°09'E.<br>10,500              | One of world's largest and most modern ore harbors. Principal shipments—iron ore, pig iron, lumber. Principal receipts—coal, coke, POL, fertilizer, cement. 1 small yard capable of minor repair for small ships.  | Natural deepwater harbor consisting of 2 divisions extending about 5 miles NW.-SE.; water area of about 5,000 acres, general depths of 8 to 39 ft.<br>Fairway limitations—Dredged channel from Finnklippan through Svartosund 8 miles long, 245-ft. least width, 40-ft. controlling depth. Channel from Germundofjarden through Tjuvholmssundet about 5 miles long, 200 ft. wide, 29½ ft. deep. Bascule bridge allowing 100-ft. fairway width crosses channel between N. and S. harbor division.   | Alongside—For 2 large, 7 standard, 9 small ocean-type cargo vessels; 1 standard, 5 small coaster-type cargo vessels; 9 lighters; 1 large, 1 small ocean-type tanker.<br>Anchorage—For large numbers of vessels of all sizes in Germundofjarden in depths of 40 to 65 ft. over good holding ground of mud and clay.  |
| Malmö.....<br>55°37'N., 13°00'E.<br>50,000              | Important commercial and industrial center. Principal receipts—POL, coal and coke, iron, tobacco, automobiles, general cargo. Principal shipments—iron, wood, chemicals, fertilizers, general cargo. 1 large shipyard (Kockums Shipyard), 1 small yard. Kockums Shipyard, one of largest in country, builds and repairs general-cargo vessels, bulk carriers, tankers, naval vessels, diesel engines, steam turbines, steam boilers; 1 side-launching, 4 end-launching shipbuilding ways 250, 370, 903, 710, 520 ft. long; 4 graving docks, lengths on floor 195, 525, 623, 1,329 ft. Small shipyard at Limhamn has several slipways capable of minor repairs. | Artificial coastal breakwater-protected harbor having numerous basins; divided into two components, Malmö harbor and Limhamn harbor.<br>Fairway limitations—3 fairways to Malmö harbor from open roadstead: northernmost fairway to new oil harbor 330 ft. wide and has 30½-ft. controlling depth; main fairway 330 ft. wide and has 30-ft. controlling depth; S. fairway 260 ft. wide and has 19½-ft. controlling depth. 3 fairways to Limhamn harbor: N. fairway to outer POL berth 340 ft. wide and has 34-ft. controlling depth; fairway to central harbor has 25-ft. minimum width and 26-ft. controlling depth; fairway to S. harbor has 200-ft. minimum width and 16-ft. controlling depth. Depths leading to berths exceed depths in berths. | Alongside—For 4 large, 41 standard, 24 small ocean-type cargo vessels; 18 standard, 10 small coaster-type cargo vessels; 41 lighters; 3 large, 2 small ocean-type tankers; 4 standard coaster-type tankers.<br>Anchorage—For numerous vessels of all sizes in roadstead N., NW., and SE. of Malmö harbor in depths of 39 to 45 ft. over stiff clay bottom; well protected except from SW. |

|  |   |   |  |
|--|---|---|--|
| <p>Norrköping.....<br/>58°36'N., 16°12'E.<br/>17,200</p> | <p>Distribution center of one of Sweden's major industrial areas. Local industrial activities: plants involving metals, textiles, paper, electrical equipment, rubber, chemicals, ship repair. Principal shipments—fertilizer, ore, grain, lumber. Principal receipts—coal, coke, POL, fertilizer, phosphate. 1 small shipyard capable of most floating repairs on large vessels and complete repairs on vessels up to 3,000 d.w.t.; marine railway has 3,000-ton hauling capacity.</p>   | <p>Well-protected natural harbor at head of Braviken (bay), 30 miles from Baltic Sea. Consists of Outer Harbor, a cove 3 miles long, 2 miles wide, and having central depths of 12 to 50 ft., and 2 1/2-mile stretch of Motala Strom (river) having general depths of 16 to 26 ft.</p>  | <p>Alongside—For 5 standard, 18 small ocean-type cargo vessels; 21 small coaster-type cargo vessels; 5 lighters; 1 standard, 1 small ocean-type, 2 standard coaster-type tankers.</p>  |
| <p>Oxelosund.....<br/>58°40'N., 17°07'E.<br/>6,500</p>   | <p>Second most important ore-shipping port in Sweden after Lulea. Principal receipts—oil, coal, coke, scrap iron, limestone, automobiles. Principal shipments—iron ore, timber, paper, tractors. Small engineering firm in rear of quay No. 1, performs minor repairs.</p>  | <p>Fairway limitations—Dredged channel through Outer Harbor, 2 miles long and having 200-ft. least width, and 26 ft. controlling depth; dredged channel in entrance via Lindokanalen 1 1/4 miles long, 200-ft. wide, has 23-ft. controlling depth.</p>  | <p>Anchorage—For large numbers of vessels of all sizes in well sheltered Outer Harbor in depths of 46 to 65 ft.; clay bottom.</p>  |
| <p>Stockholm.....<br/>59°20'N., 18°03'E.<br/>71,000</p>  | <p>Capital and second largest port. Principal shipments—paper, paper pulp, timber, machines, metals. Principal receipts—oil, coal, metals, chemicals, machinery, agricultural produce, lumber. Shipyards—Port has 2 large and 2 small shipyards. Finnboða Shipyard, on S. side of channel to Strommen (bay), builds and repairs general-cargo ships up to 15,000 d.w.t.; 2 shipbuilding ways (largest 490 ft.) and 4 floating drydocks (largest 478 ft. and has lifting capacity of 8,200 long tons). Former naval ship-repair activities transferred to new underground naval base and ship-repair complex on island of Musko. Ekensberg Shipyard, at W. end of Grondal, builds and repairs general-cargo ships up to 13,000 d.w.t.; 3 shipbuilding ways (largest 440 ft.), 2 floating drydocks (largest 364 ft. and has lifting capacity of 3,300 long tons), and 2 marine railways (largest has hauling capacity of 750 long tons). 2 small shipyards build and repair small coasters, tugs, pleasure craft; 2 shipbuilding ways (175 and 180 ft.), 1 marine railway (hauling capacity of 800 long tons). 3 floating drydocks (largest 131 ft. has lifting capacity of 1,000 long tons).</p> | <p>Well-sheltered natural harbor formed between 2 peninsulas and several off-lying islands; water area about 80 acres. Steel-mill quay lies in partly sheltered roadstead, about 2 miles NE. of main harbor. Depths in main harbor, 18 to 66 ft.; in roadstead, 18 to 48 ft., bottom of mud and clay. Main entrance to harbor has controlling depth of 72 ft. in fairway. Depths leading to berths exceed depths at berths.</p> | <p>Alongside—For 2 large, 2 standard, 1 small ocean-type cargo vessels; 3 standard, 2 small coaster-type cargo vessels; 9 lighters; 1 large ocean-type tanker.</p> <p>Fixed mooring—For 1 small ocean-type cargo vessel in depth of 36 ft.</p> <p>Anchorage—For numerous vessels of all sizes S. and SE. of port in depths of 42 to 72 ft.; good holding ground of mud and clay. Good protection except from E. through S.</p> |
|  |   | <p>Natural irregularly shaped well-protected harbor occupying position partly on sea and partly on Malaren; consists of 2 arms of sea, smaller arm off 1 of larger arms, and several basins; total water area of about 3,600 acres; general depths range from 10 to 38 ft.</p>  | <p>Alongside—For 8 large, 19 standard, 48 small ocean-type cargo vessels; 11 standard, 67 small coaster-type cargo vessels, 33 lighters; 1 large ocean-type, 1 standard coaster-type tanker; 1 representative sound-and-river-type tank barge; 11 medium-size (MSO, MSC), 45 small (PT) naval vessels.</p>   |
|  |   | <p>Fairway limitations—Three approaches provide access to port: E approach, Sando Channel, shortest and most direct (36 nautical miles); controlling depth 36 ft. N. approach Soderarm (55 nautical miles); controlling depth 33 ft. S. channel (77 nautical miles); controlling depth 20 1/2 ft. Depths leading to berths exceed depths in berths.</p>   | <p>Anchorage—For unlimited number of vessels of all sizes in open roadstead in depths of 48 to 270 ft. over clay, good holding ground.</p>   |

Footnote at end of table.

FIGURE 6. Major ports (C) (Continued)

| NAME; LOCATION;<br>ESTIMATED MILITARY<br>PORT CAPACITY* | ACTIVITIES   | HARBOR   | BERTHS  |
|---|--|--|---|
| Sundsvall.....<br>62°23'N., 17°20'E.<br>25,000          | Largest timber-products industry in N. Sweden. Principal shipments—lumber, pulp, paper, tar. Principal receipts—coal, POL, salt, food-stuffs, alcohol. 1 medium shipyard, largest dry-docking facility is graving dock 541 ft. long.   | Large well-protected natural harbor with 4 main divisions: Sundsvallfjärden, length 2 miles width 1 mile, depths 33-75 ft.; Klingerfjärden, length 5 miles, width to 3 miles, depths 30-150 ft.; 1 mile stretch of Alnosundet, width 1/2-1 mile, depths 30-150 ft.; mouth of Ljungan (river), length 2 1/2 miles, width 1/2-2 miles, depths 30-160 ft. | Alongside—For 2 large, 10 standard, 14 small ocean-type cargo vessels; 13 standard, 18 small coaster-type cargo vessels; 23 lighters; 1 large, 1 small ocean-type, 3 coaster-type tankers. Anchorage—For large numbers of vessels of all sizes in Sundsvallfjärden in depths of 33 to 75 ft. over mud and clay bottom; in Sundsvallbukten in depths of 30 to 96 ft. over mud and clay bottom; in Klingerfjärden in depths of 45 to 150 ft. over sand and clay bottom, good holding ground; Sundsvallbukten open SE. to NE.; Klingerfjärden exposed to SE. |
| Trelleborg.....<br>55°21'N., 13°09'E.<br>6,500          | Surrounded by densely populated, highly developed agricultural area. Principal shipments—farm products, rubber goods, general cargo. Principal receipts—automobiles, fertilizers, oil, coal, coke.   | Artificial harbor formed by 2 breakwaters; total water area of about 37 acres; depths range from 9 to 26 ft. Fairway limitations—Dredged channel from Trelleborg Roads has over 1-mile length, 300-ft. width, and controlling depth of 28 ft.; 280-ft. distance between breakwaters; depths leading to berths exceed depths in berths.                 | Alongside—For 7 standard, 3 small ocean-type cargo vessels; 4 lighters; 1 standard ocean-type tanker. Anchorage—For large numbers of vessels of all sizes in Trelleborg Roads in depths of 23 to 46 ft. over clay and sand.   |
| Uddevalla.....<br>58°21'N., 11°55'E.<br>9,100           | Principal importance derived from timber trade and ancillary products. Principal receipts—coal, coke, grain, linseed, cotton, iron, ore, salt, POL. Principal shipments—woodpulp, paper, granite, stone, oats, barrels, general cargo. Port used as refuge for vessels during severe weather. Uddevalla Shipyard has 4 building ways (largest 985 ft. long) and 591-ft. floating drydock having 10,800-long-ton lifting capacity. Yard's activities include building super-tankers and main diesel engines and all types of repairs. | Situated around mouth of Bavean, river emptying into Byfjorden. Harbor consists of Kusenbukten, just outside and N. of mouth of Bavean, and small bay immediately W. of entrance to Kasonbukten. Fairway limitations—Three channels lead into Uddevalla, most important, the S. channel, has 36-ft. controlling depth and 262-ft. least width.         | Alongside—For 1 large, 7 standard, 4 small ocean-type cargo vessels; 4 standard, 2 small coaster-type cargo vessels; 13 lighters; 2 large, 1 small ocean-type and 2 standard coaster-type tankers. Anchorage—For numerous vessels of all sizes over good holding ground of clay.  |
| Vasteras.....<br>59°37'N., 16°33'E.<br>7,500            | Largest lake harbor in Sweden. Principal shipments—POL, ore, lumber, machines, grain, general cargo. Principal receipts—cement and sand, petroleum, metals, scrap iron, chemicals, fertilizers.  | Well-protected lake harbor converging area of about 1 square mile; general depths of 14 to 21 ft. Fairway limitations—Channel from Sodertälje has about 50-mile length and 21-ft. controlling depth; lock at Sodertälje has 442.9-ft. length, 65.6-ft. width, 24.6-ft. depth.  | Alongside—For 11 small ocean-type cargo vessels; 5 small coaster-type cargo vessels; 6 lighters; 1 standard coaster-type tanker. Anchorage—For large numbers of vessels of all sizes well-protected in Vasteras harbor in depths of 36 to 52 ft. over good holding ground of mud and clay.  |

\*The estimated military port capacity is the maximum amount of general cargo—expressed in long tons—that can be unloaded onto the wharves and cleared from the wharf aprons during a period of one 24-hour day (20 effective cargo-working hours). The estimate is based on the static cargo-transfer facilities of the port existing at the time the estimate is prepared and is designed for comparison rather than for operational purposes; it cannot be projected beyond a single day by straight multiplication.



from operations). Eleven domestic and one foreign owner, each having more than 100,000 d.w.t., together control about 85% of the total fleet deadweight tonnage (239 ships). The larger of these owners are as follows:

| OWNER                           | SHIPS | D.W.T.    |
|---------------------------------|-------|-----------|
| Axel Brostrom & Son, Goteborg   | 63    | 1,382,546 |
| Salenrederierna, Stockholm      | 43    | 1,282,170 |
| Granges A/B, Stockholm          | 19    | 715,680   |
| Malmros Rederi A/B, Trelleborg  | 9     | 584,440   |
| Axel Axelson Johnson, Stockholm | 32    | 496,695   |
| M. Bergman, Kungsbacka          | 4     | 401,500   |
| Total                           | 170   | 4,863,021 |

The only foreign owner is Stove Shipping, Oslo, which controls eight ships aggregating 162,300 d.w.t. A few owners control many ships, but most of the shipowners have from one to three ships.

In order to compete more effectively with "flag-of-convenience" fleets and those of other traditional maritime nations, Swedish shipowners have concentrated on structural and technical modernization of their fleets. Rapid changes in structure have been necessitated by the demands of shippers and by technical innovations for adaptation to international shipping standards. In addition to fleet modernization, some shipowners have been engaged in reorganizing their shipping enterprises, either through merging one or more Swedish shipping companies or entering into cooperative agreements with foreign-flag shipping interests for more productive operations.

Since 1967, Swedish shipowners have concentrated on selling and scrapping a large amount of noncompetitive tonnage and replacing it with more efficient used or new units and have added to their fleets highly specialized units especially designed for employment on new trade routes.

Most of the fleet is engaged in liner (scheduled) service and has experienced continuous increases in operating costs. During 1970, shipowners' costs were estimated to have risen by 30%, largely the result of increased wages, cargo handling, and bunkering (fuel). In an effort to offset one of the highest crew wage rates among the world's merchant fleets, Swedish owners have concentrated on reducing workload and replacing manpower aboard ship by automation and technical improvements, as well as disposing of less productive ships requiring large crews.

In October 1971, Swedish shipowners had on order for delivery through 1975 a total of 86 new ships aggregating about 4,859,300 d.w.t. About 93% of this tonnage comprised 25 tankers, including seven units each of more than 230,000 d.w.t.; 10 tanker/ore and

tanker/ore/bulk carriers ranging between 100,000 and 270,000 d.w.t.; and 12 bulk-cargo ships between 25,400 and 115,000 d.w.t. About 67% of the total deadweight tonnage on order was placed in domestic shipyards and the remainder in shipyards in East Germany, Finland, France, the Netherlands, Norway, Spain, the Soviet Union, West Germany, and Yugoslavia.

In addition to ships of 1,000 g.r.t. and over, there are several hundred smaller merchant ships employed in coastal operations and in trade with neighboring countries bordering the Baltic Sea. Included in this trade are about 70 tankers ranging between 100 and 999 g.r.t., totaling about 26,000 g.r.t., and an undetermined number of dry-cargo, passenger, and ferry units. Included in Sweden's ferry fleet are 31 car/passenger ferries of 1,000 g.r.t. and over, totaling about 92,000 g.r.t., which are employed between Swedish ports and between Swedish and other northern European ports. The oceangoing fishing fleet consists of about 100 vessels between 100 and 499 g.r.t., totaling 16,500 g.r.t.

Merchant-marine functions are administered by the Ministry of Communications through the Department of Shipping and Board of Shipping. Sweden is a member of the Intergovernmental Maritime Consultative Organization (IMCO) and is party to the following IMCO conventions: Safety of Life at Sea, 1948 and 1960; Prevention of Collisions at Sea, 1960; Oil Pollution, 1954 and 1962; Facilitation of International Maritime Traffic, 1965; and Load Lines, 1966.

The basic philosophy underlying the nation's maritime policy is one of freedom of competition on the seas. However, Swedish shipowners engaged in trade between foreign countries are faced with increasing hardships caused by flag-discrimination practices of foreign governments. As a measure to counter such discrimination against Swedish ships, the government prohibits Swedish shipping interests from the chartering of or transport by ships registered in the discriminating countries. Except for this prohibition, the government policy toward merchant shipping is nonrestrictive and nondiscriminatory; there is no significant intervention in operations of the shipping industry.

In keeping with the government's policy of noninterference and the shipowners' preference for free enterprise, no direct subsidization is provided for fleet development or operations in international trade. Indirect assistance to shipowners is primarily in the form of tax benefits. Shipowners are not taxed on earnings derived from the sale of ships providing such earnings are used for acquiring new ships; owners are

also permitted to transfer profits to a tax-free fund for equalizing market fluctuations in the business cycle. Another form of assistance to shipowners is the provision of state-guaranteed loans for new-ship construction.

In mid-1970, about 16,000 seafaring personnel were employed aboard Swedish merchant ships of 300 g.r.t. and over, including 6,000 foreign nationals. For many years the demand for workers ashore in highly industrialized Sweden has made it difficult to recruit native seafaring personnel. The large number of aliens employed on Swedish ships is attributed not only to the shortage of Swedish personnel but to superior wage rates.

Government-sponsored merchant marine schools provide training for officer cadets who must complete a period of practical shipboard experience prior to completing a variety of excellent courses. Swedish seamen are not required to have previous training and experience for unskilled jobs but are trained aboard ship. Swedish shipowners generally believe that quality rather than quantity is more important to manning their ships and thus are placing more emphasis on individual specialized and theoretical training to increase a seaman's competence for more qualified work.

Because of negotiation rather than imposition of law, there is an excellent relationship between shipowners and the Swedish maritime unions. Much shipowner success in reducing the number of employees is attributable to the understanding attitude and support of the maritime unions and organizations. Crew reduction has been accomplished primarily by introducing very specialized shore training, by improved planning and organization of work aboard ship, and by considerable changes made in manning structure.

#### H. Civil air (C)

Sweden's domestic civil aviation policies are designed to promote a balanced expansion of its internal air services in order to accommodate the growth in demand generated by the nation's expanding economy. These internal air links are especially significant to the northern areas where surface transportation is adversely affected by winter conditions. Because of its membership in the Scandinavian Airlines System (SAS) consortium with Denmark and Norway, Sweden pursues international aviation policies that are closely integrated with these two nations. These policies are aimed toward expanding SAS' worldwide services while insuring that the company remains the dominant carrier within Scandinavia.

As a result of the success of these policies, Sweden has excellent domestic and international scheduled passenger service. Two Swedish airlines serve 23 domestic points; daily high-frequency service links the major population centers.

SAS is the larger of the scheduled airlines and is the only one providing both domestic and international services. The Swedish participant in the SAS consortium is *Aktiebolaget Aerotransport*, a non-operating holding company owned jointly by the government and private interests. SAS serves 26 cities in Scandinavia, including seven in Sweden, and flies scheduled services worldwide to 90 cities in 46 countries. SAS operates through the U.S.S.R. from Stockholm via Moscow and Tashkent to the Far East. Flight operations are conducted with a fleet of 74 aircraft composed of two Boeing 747B's, six Douglas DC-8-63's, five Douglas DC-8-62's, three Douglas DC-8-62F's, 24 Douglas DC-9-40's, two Douglas DC-9-30F's, 10 Douglas DC-9-20's, 13 Aerospatiale Caravelles, and nine Convair 440/340's. Thirty of these aircraft are registered in Sweden; the remaining are registered in Denmark and Norway in accordance with the SAS consortium agreement. The SAS system employs about 14,300, in three countries, including 1,160 pilots, 80 navigators, and 3,700 maintenance and overhaul personnel.

SAS owns 30% of Thai International, Thailand's international flag carrier, and has a 25% interest in *Gronlandsfly A/S* (Greenlandair), which provides domestic service within Greenland and performs coastal ice patrols. With its subsidiary, Scanair, SAS has entered the growing vacation charter market, and with another subsidiary, *Linjeflug AB* (LIN), SAS controls the Swedish domestic airline market. LIN serves 22 towns and cities in Sweden with a fleet of four Aerospatiale N-262's and 16 Convair CV 440/340's.

The general aviation sector of the Swedish civil aviation establishment is comprised of a large number of charter cargo and passenger and airwork companies. It is the fastest growing component of aviation because of the popularity of private flying and the necessity for developing specialized aviation enterprises to support the expansion of the domestic economy. For example, about 400 to 500 students per year are trained and receive private licenses, and the number of civil aircraft registered in Sweden is just under 1,000. Sweden has 19 operating charter companies; the largest of these are Scanair and Sterling Airways. Five large airwork companies perform various tasks such as aerial ambulance and mapping operations. Finally, some 130 gliding and flying clubs are active throughout the country.

The following 72 civil aircraft of at least 20,000 pounds gross weight are registered in Sweden:

|    |                            |    |                        |
|----|----------------------------|----|------------------------|
| 4  | Aerospatiale N-262         | 1  | Douglas DC-8-55        |
| 4  | Aerospatiale Caravelle III | 2  | Douglas DC-8-62        |
| 5  | BAC Viscount 700D          | 1  | Douglas DC-8-62F       |
| 1  | Boeing 747B                | 3  | Douglas DC-8-63        |
| 2  | Boeing 727-100             | 10 | Douglas DC-9-40        |
| 1  | Boeing 727-100C            | 1  | Douglas DC-9-30F       |
| 23 | Convair 440/340            | 4  | Douglas DC-9-20        |
| 1  | Dassault Falcon 20         | 1  | Douglas DC-3           |
| 2  | Douglas DC-6B              | 3  | Lockheed L-188 Electra |

Three Swedish-registered DC-8-30 aircraft are leased to Thai International.

Most Swedish transport pilots receive their initial flight training during their military service. The most complete training facility is SAS's flight-simulator equipped base at Stockholm where the airline conducts aircraft conversion training, transport-rating courses, and routine training to maintain flight crew proficiency. In addition, 12 specialized flight schools offer training for helicopter licenses and flight engineer and airline transport ratings. Regular primary flight training courses are also offered.

The nation's most complete maintenance facilities are those of SAS at Stockholm. Airframe and engine overhauls for all versions of the DC-8 aircraft used by SAS are accomplished here. SAS maintenance centers in Norway and Denmark handle DC-9 and Caravelle repair work. Twenty other civil aircraft maintenance organizations carry out various types of aircraft, powerplant, and aircraft component overhaul. The largest of these are *FFV Forende Fabriksverken, AB Svenska Flygerkstaderna*, and *Ostermans Aero AB*.

The Swedish Board of Civil Aviation administers Sweden's civil aviation affairs. Sweden is a member of the International Civil Aviation Organization—ICAO and is a party to the major multilateral conventions and agreements governing international air transportation. The government has entered into air transport agreements or arrangements with some 90 other countries. SAS is a member of the International Air Transport Association—IATA and has operating agreements with Swissair and KLM covering maintenance and training arrangements for its Boeing 747B's and newly ordered Douglas DC-10's.

### I. Airfields<sup>2</sup> (C)

The air facilities system of Sweden (including the island of Gotland) consists of 162 usable airfields, 27 sites, and nine seaplane stations. Of the usable airfields, 29 are primarily military but open to civil

<sup>2</sup>For detailed information on individual air facilities in Sweden see Volume 12, *Airfields and Seaplane Stations of the World*, published by the Aeronautical Chart and Information Center for the Defense Intelligence Agency.

traffic. One airfield is used jointly. All of the major civil airfields and most of the permanent Royal Swedish Air Force bases are located in the south, primarily in the Stockholm area and the central lowlands to the west and southwest. The remaining airfields are widely dispersed, and only a few permanent military bases are located in the sparsely populated northern regions.

Sweden's airfields and navigational and landing aids comprise an efficient and well-integrated system entirely adequate to support domestic and international air traffic. Arlanda, the principal international airfield, is capable of handling the heaviest aircraft in use. Arlanda and Bromma have extensive logistic-support capability, all types of cargo-handling equipment, and extensive parking facilities. Bromma, originally developed as the main international traffic terminal, is used primarily for domestic flights and as an alternate airfield for Arlanda. Excellent maintenance facilities are available, and the airfield is capable of supporting two squadrons of B-57 aircraft. The runways at the remaining international airfields of Torslanda, Visby, and Sundsvall/Harnosand are constructed to withstand sustained operations of C-121 aircraft, and Bulltofta can support C-124 aircraft. The airfields of Kungsängen, Skelleftea, Umea, Karlstad, Ornskoldsvik, Kiruna, Jonkoping, and Sandviken are capable of handling aircraft up to and including the C-130. Hultsfred and Gunnarn are good operational airfields. Halmstad has an excellent weight-bearing capacity. A new international airfield, under construction at Sturup, about 12 miles east-southeast of Malmo, is to be the second largest airfield in Sweden and is to replace Bulltofta as Malmo's international airfield.

Eighty-six airfields have hard-surfaced runways, most in good condition. About 75% have the weight-bearing capacity to accommodate light-cargo and troop-carrier aircraft; nearly all have taxiways and most have aprons. About 25% to 30% have airline operations. Many of the 76 natural-surface airfields are used by aeroclubs; others are maintained as emergency landing grounds or auxiliary fields for the air force. The 27 sites are unusable in their present condition. Only one of the nine seaplane stations is active.

Sweden intends to equip and maintain airports of entry to meet future demands of international traffic. A modernization program begun in 1950 to meet the increasing demands of high-speed aircraft is continuing. At this time budgetary limitations make prospects for major expansion remote. The military airfield system seems adequate to handle needs into the 1980's.

Figure 7 lists characteristics of the most important airfields.

FIGURE 7. Selected airfields (C)

| NAME AND LOCATION   | LONGEST RUNWAY;<br>SURFACE; DIMENSIONS;<br>ELEVATION ABOVE<br>SEA LEVEL |        | ESWL*                  | LARGEST AIRCRAFT<br>NORMALLY SUPPORTED   | REMARKS |
|---|---|--------|------------------------|--|---------|
|   | Feet  | Pounds |                        |  |         |
| Arlanda.....<br>59°40'N., 17°56'E.<br>N. of Stockholm     | Concrete.....<br>10,827 x 148<br>123                                    | 71,500 | Boeing 747.....        | Civil. International airfield. Avgas, jet fuel available.                                |         |
| Bromma.....<br>59°21'N., 17°57'E.<br>NW. of Stockholm     | Asphalt.....<br>6,617 x 197<br>48                                       | 48,494 | DC-7.....              | Civil. International airfield. Avgas, jet fuel available. Mainly feeder traffic.         |         |
| Bulltofta.....<br>55°36'N., 13°04'E.<br>E. of Malmo       | Asphalt.....<br>6,234 x 197<br>19                                       | 48,494 | DC-7.....              | Civil. International airfield. Avgas, jet fuel available.                                |         |
| Frosön.....<br>63°12'N., 14°30'E.<br>NW. of Ostersund     | Asphalt.....<br>7,546 x 131<br>1,233                                    | 59,893 | C-124.....             | Military. Avgas, jet-fuel storage underground.   |         |
| Halmstad.....<br>56°41'N., 12°49'E.                       | Concrete.....<br>7,546 x 131<br>83                                      | 51,102 | C-97.....              | Military. Avgas, jet-fuel storage underground. Excellent weight-bearing capacity.        |         |
| Hultsfred.....<br>57°36'N., 15°50'E.                      | Asphalt.....<br>6,562 x 131<br>368                                      | 17,034 | C-131.....             | Military. Avgas, jet fuel available. Good operational field.                             |         |
| Jonköping.....<br>57°46'N., 14°05'E.                      | Asphalt.....<br>5,938 x 148<br>739                                      | 17,034 | Convair 440.....       | Civil. Serves industrial area. Avgas available.  |         |
| Kallax.....<br>65°33'N., 22°08'E.<br>S. of Lulea          | Asphalt.....<br>7,218 x 148<br>55                                       | 59,893 | C-124.....             | Military. Avgas, jet fuel underground. Strategic location.                               |         |
| Kalmar.....<br>56°41'N., 16°17'E.                         | Asphalt.....<br>7,546 x 125<br>21                                       | 28,160 | C-54.....              | Military. Avgas, jet fuel underground.   |         |
| Karlstad.....<br>59°22'N., 13°28'E.                       | Asphalt.....<br>4,593 x 148<br>152                                      | 17,034 | Convair 440.....       | Civil. Avgas available. Good operational airfield.                                       |         |
| Kiruna.....<br>67°49'N., 20°21'E.                         | Asphalt.....<br>6,562 x 148<br>1,507                                    | 48,494 | DC-7.....              | Civil. Avgas available. Northernmost airfield in Sweden.                                 |         |
| Kungsängen.....<br>58°36'N., 16°15'E.<br>E. of Norrköping | Concrete.....<br>5,577 x 148<br>17                                      | 35,500 | C-130.....             | Military. Avgas, jet fuel available.   |         |
| Ornskoldsvik.....<br>63°25'N., 18°59'E.                   | Asphalt.....<br>4,921 x 148<br>351                                      | 17,034 | Convair 440.....       | Civil. Avgas available. Good operational field.  |         |
| Ronneby.....<br>56°16'N., 15°16'E.                        | Concrete.....<br>7,546 x 131<br>191                                     | 17,034 | C-131.....             | Military. Avgas, jet fuel available.   |         |
| Sandviken.....<br>60°36'N., 16°57'E.                      | Asphalt.....<br>6,562 x 148<br>222                                      | 35,500 | C-130.....             | Joint. Avgas, jet fuel available. Good weight-bearing capacity.                          |         |
| Skellefteå.....<br>64°38'N., 21°05'E.                     | Asphalt.....<br>4,921 x 148<br>153                                      | 17,034 | Convair 440.....       | Civil. Avgas available. Good operational field.  |         |
| Sundsvall Harnosand.....<br>62°32'N., 17°27'E.            | Asphalt.....<br>5,249 x 197<br>13                                       | 17,034 | .....do.....           | Civil. International airfield. Avgas, jet fuel available.                                |         |
| Torslanda.....<br>57°42'N., 11°47'E.<br>W. of Göteborg    | Asphalt.....<br>6,329 x 197<br>27                                       | 60,160 | Super Constellation... | Civil. International airfield. Avgas, jet fuel available. Limited fuel-storage capacity. |         |

Footnote at end of table.

FIGURE 7. Selected airfields (C) (Continued)

| NAME AND LOCATION                | LONGEST RUNWAY;<br>SURFACE; DIMENSIONS;<br>ELEVATION ABOVE<br>SEA LEVEL |        | ESWL*                  | LARGEST AIRCRAFT<br>NORMALLY SUPPORTED                    | REMARKS |
|----------------------------------|---|--------|------------------------|---|---------|
|                                  | Feet  | Pounds |                        |   |         |
| Umea.....<br>63°48'N., 20°17'E.  | Asphalt.....<br>5,249 x 148<br>148                                      | 17,034 | Convair 440.....       | Civil. Avgas available. Good operational field.           |         |
| Visby.....<br>57°39'N., 18°20'E. | Asphalt.....<br>6,302 x 197<br>167                                      | 60,160 | Super Constellation... | Joint. International airfield. Avgas, jet fuel available. |         |

\*Equivalent Single-Wheel Loading: Capacity of an airfield runway to sustain the weight of any multiple wheel landing-gear aircraft in terms of the single-wheel equivalent.

**J. Telecommunications (C)**

The telecommunication (telecom) systems in Sweden are modern and among the most highly developed in the world. Domestic and international telephone, telegraph, telex, facsimile, data transmission, and radio and television (TV) broadcast services meet all of the public, government, industrial, and military requirements. Facilities are available throughout Sweden, but the networks are denser in the more populous southern half of the country. Key telecom centers are in Stockholm, Goteborg, Malmo, Karlstad, and Sundsvall. Sweden ranks second to the United States in numbers of telephones and TV receiver sets per capita and leads all European countries in the number of radiobroadcast receivers.

Most telecom facilities are government owned and operated. The Swedish Telecommunication Administration (*Televerket*—STA), a government-owned commercial enterprise under the jurisdiction of the Ministry of Communications, is responsible for telecom operations. The Swedish parliament legislates on policies regarding the services to be provided, but the STA controls and operates most of the facilities in the public telecom system and performs administration and planning functions. The most significant commercial telecom enterprise is the Swedish Broadcasting Corporation (*Sveriges Radio AB*—SBC), operating under government concession. The SBC operates radio and TV studios and prepares most radio and TV programs, but several other commercial firms also operate TV studios and prepare programs for the SBC. Public utilities, private railroads, taxicab companies, and manufacturers are among the commercial organizations that operate private telecom facilities.

Domestic systems include on-wire lines, coaxial and multiconductor cables, and radio-relay links. The

main long-distance network is comprised of coaxial and multiconductor cables for telephone, telegraph, telex, and data transmission. The major cable lines extend from Malmo, in the south, to Kiruna, in the north, and from Stockholm, in the east, to Goteborg, in the west. The cable routes are commonly paralleled by radio-relay links used primarily for radiobroadcast and TV programs, but telephone channels also are available on the main routes. Traffic-handling capacity of the entire system is greatly increased by the use of carrier and automatic switching equipment; computer-controlled exchanges are in use in the national long-distance network. Sweden has about 58 telephones per 100 population; all of the 4,636,000 telephones are connected to automatic exchanges. Conventional telegraph traffic includes about 9,300 teletypewriters of which 8,000 are of the dial type connected to the automatic teletypewriter exchange service, and 1,300 are full-time fixed connections outside the automatic telex network.

International telecom facilities consist of telephone, telegraph, telex, facsimile, data transmission, radiobroadcast, and TV services. Circuits are provided by radiocommunication stations, radio-relay links, landlines, submarine cables, and a satellite ground station. Radiocommunication facilities, controlled from Stockholm, provide direct high-frequency (HF) circuits between Sweden and all major world centers. Radio-relay links provide circuits to Denmark, Finland, and Norway. International landlines, a continuation of domestic networks, link Sweden with Norway and Finland. Ten submarine cables providing direct channels for telephone, telegraph, and telex circuits, as well as radio and TV broadcast programs, extend to Denmark, West Germany, East Germany, Finland, and the United Kingdom. As a member of the Scandinavian Telecommunication Satellite Council (*Telestratrad*), Sweden operates jointly with

Denmark and Norway a satellite ground station at Tanum, north of Goteborg. The station employs 34 permanent telephone circuits with the United States and Canada; additional equipment in the near future is to enable the station to establish connections with South America, Africa, and the Middle East. Occasional TV programs are being exchanged in both directions with the United States and Canada.

Government agencies and commercial firms operate special telecom systems, generally not available for public services. The STA provides wire lines, most of the radio equipment, and controls the use of special-purpose radio stations. The Civil Air Administration and the air force operate aeronautical radio stations for air traffic control and navigation. The navy has radio stations for ship-to-shore service. The Swedish State Railways also operates an extensive telephone and telegraph service. Civil Defense units use about 500 fixed and 5,000 mobile very-high-frequency (VHF) radio stations; police, fire brigades, and municipal governments also use these facilities.

Radio, TV, and wired-broadcast networks are well developed, and programs in at least one medium are available to most of the population. Forty-two AM radiobroadcast stations have 73 transmitters ranging in capacity from 60 watts (w.) to 600 kilowatts (kw.). With the exception of two 100-kw. international transmitters at Horby, in southern Sweden, all AM stations broadcast on low and medium frequencies. Principal studios are in the Stockholm broadcasting center, where all national programs are organized and distributed. FM service consists of 85 stations having over 230 transmitters. The effective radiated power of FM transmitters ranges from less than 30 w. to 60 kw. There are about 5 million radiobroadcast receivers, a density of nearly 65 per 100 population. The TV network consists of 196 stations, providing service to about 99% of the population. All but two stations broadcast on channels in the VHF band; the two exceptions broadcast on the UHF band. Effective radiated power of transmitters ranges from 1 w. to 1,000 kw. TV telecasts in black and white and color are programed in two national channels. There are over 2.7 million TV receivers, of which 460,000 are color sets. Sweden has the highest TV receiver density in Europe, 31 per 100 inhabitants.

Topography and climate affect the installation, operation, and maintenance of telecom facilities. Many rivers and lakes, a long, irregular coastline, and mountainous regions influence the choice of equipment used for long-distance circuits. During the winter, open-wire lines are subject to damage by accumulation of ice and sleet, and maintenance is hampered by deep snow. The *aurora borealis* produces

electrical and magnetic disturbances that affect telecom operations.

The Swedish electronic and telecom equipment manufacturing industry is advanced in all phases of technology and fulfills most public and military requirements. The industry, however, relies heavily on imported components, particularly of military electronics (60%), and some industrial and professional equipment. The latter consists of semiconductors, integrated circuits, printed-circuit boards, and microelectronic components. Imports originate mainly from the United States, West Germany, the United Kingdom, the Netherlands, and Denmark. The L.M. Ericsson Telephone Company manufactures most telephones, telegraph teleprinters, and carrier equipment; a subsidiary produces coaxial cables. Standard Radio and Telephone AB, a subsidiary of International Telephone and Telegraph Corporation, produces electronic telephone and telegraph equipment. A newly formed company, ASEA-LME Automation, composed of ASEA, Sweden's leading electronic manufacturer, and the Ericsson Telephone Company, produces computer-based equipment used in the telecom industry. Facilities for electronic research and development are excellent; training facilities in electronics and engineering are available at private and government institutes and universities.

Development plans include completion of automation of the long-distance telephone network with computer-controlled telephone exchanges equipped with all-electronic switching systems. In early 1972 this new system, consisting of 16,000 channels and serving about 12,000 subscribers in the Stockholm area, was being doubled. Upon its completion, about 75% of these subscribers will be able to dial directly to most European countries. During 1972-73, a number of experimental videophone sets are to be installed in public telephone booths for calls between Stockholm, Goteborg, and Malmo, but widespread use of videophones among private individuals is not anticipated at present. Work began in early 1972 on reinforcing the 12-megahertz system of coaxial cables, providing 2,700 telephone channels, with a new 60-megahertz 10,800-channel system having the largest transmitting capacity in the world. The first 400 kilometers of this system, between Vasteras and Goteborg, is to have twin cables and a total of 21,600 telephone channels. Further expansion of the radio-relay network for radiobroadcast and TV program distribution is also planned. Expanded use of the satellite ground station at Tanum is to increase the number of telephone circuits to the United States, Canada, Latin America, Africa, and the Middle East and the number of TV programs exchanged with the United States and Canada.

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## Glossary (u/ou)

| ABBREVIATION | SWEDISH                    | ENGLISH                                    |
|--------------|----------------------------|--|
| LIN          | <i>Linjeflyg AB</i>        | Scandinavian Airlines System               |
| SAS          |                            | Swedish Broadcasting Corporation           |
| SBC (SR)     | <i>Sveriges Radio AB</i>   | State Railways                             |
| SJ           | <i>Statens Jarnvagar</i>   | (Swedish) Telecommunication Administration |
| STA          | <i>Sveriges Televerket</i> |  |

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①

Places and features referred to in this General Survey

②

|                         | COORDINATES |       |   | COORDINATES |       |   | COORDINATES |       |
|-------------------------|-------------|-------|---|-------------|-------|---|-------------|-------|
|                         | ° 'N.       | ° 'E. |   | ° 'N.       | ° 'E. |   | ° 'N.       | ° 'E. |
| .....                   | 66 51       | 23 32 | Karesuando.....                           | 68 27       | 22 29 | Säffle.....                             | 59 08       | 12 56 |
| .....                   | 68 20       | 18 51 | Karlsborg.....                            | 65 48       | 23 17 | Säffle Kanal (canal).....               | 59 07       | 12 55 |
| .....                   | 59 14       | 18 05 | Karlshamn.....                            | 56 10       | 14 51 | Saltejobaden.....                       | 59 17       | 18 18 |
| sla).....               | 57 41       | 12 00 | Karlskrona.....                           | 56 10       | 15 35 | Sassnitz, E. Germany.....               | 54 31       | 13 39 |
| (channel).....          | 62 24       | 17 23 | Karlstad.....                             | 59 22       | 13 30 | Säve.....                               | 57 48       | 11 55 |
| .....                   | 57 40       | 11 52 | Karungi.....                              | 66 03       | 23 57 | Sävenas (sec. of Göteborg).....         | 57 43       | 12 02 |
| ec. of Göteborg).....   | 60 34       | 17 27 | Katrineholm.....                          | 59 00       | 16 12 | Simpvarp.....                           | 57 25       | 16 40 |
| .....                   | 65 40       | 21 00 | Kattegat (strait).....                    | 57 00       | 11 00 | Skagerrak (strait).....                 | 57 45       | 09 00 |
| .....                   | 63 27       | 14 03 | Kemi, Finland.....                        | 65 44       | 24 34 | Skåne (region).....                     | 55 59       | 13 30 |
| .....                   | 56 15       | 12 51 | Kil.....                                  | 59 30       | 13 19 | Skalstugan (farm).....                  | 63 35       | 12 16 |
| ven (strm).....         | 62 48       | 17 55 | Kilafors.....                             | 61 14       | 16 34 | Skara.....                              | 58 22       | 13 25 |
| ..... of Göteborg)..... | 57 42       | 11 50 | Kimstad.....                              | 58 32       | 15 58 | Skärholmen (sec. of Stockholm).....     | 59 17       | 17 53 |
| .....                   | 59 23       | 12 08 | Kinda Kanal (canal).....                  | 58 17       | 15 42 | Skelleftea.....                         | 64 46       | 20 57 |
| of Stockholm).....      | 59 18       | 18 03 | Kiruna.....                               | 67 51       | 20 13 | Skövde.....                             | 58 24       | 13 50 |
| (lake).....             | 59 18       | 18 02 | Klingerjärden (bay).....                  | 62 29       | 17 26 | Södertälje.....                         | 59 12       | 17 37 |
| .....                   | 65 35       | 19 10 | Knippholmen (isls).....                   | 57 41       | 11 49 | Södertälje Kanal (canal).....           | 59 12       | 17 38 |
| .....                   | 56 08       | 12 57 | Kongsvinger, Norway.....                  | 60 12       | 12 00 | Solna.....                              | 59 22       | 18 01 |
| .....                   | 60 09       | 16 12 | Kopparberg.....                           | 59 52       | 14 59 | Sound, The (sound).....                 | 55 50       | 12 40 |
| sea).....               | 56 00       | 18 00 | Kornsjø, Norway.....                      | 58 57       | 11 39 | Stensele.....                           | 65 05       | 17 10 |
| estate).....            | 55 46       | 12 57 | Kristianstad.....                         | 56 02       | 14 08 | Stenungsund.....                        | 58 05       | 11 49 |
| .....                   | 64 47       | 20 02 | Kristinehamn.....                         | 59 20       | 14 07 | Stockholm.....                          | 59 20       | 18 03 |
| .....                   | 58 21       | 11 55 | Krylbo.....                               | 60 08       | 16 13 | Storlien (rr sta).....                  | 63 19       | 12 06 |
| .....                   | 59 05       | 18 08 | Kubikenborg (sec. of Sundsvall).....      | 62 23       | 17 21 | Storaman.....                           | 65 06       | 17 06 |
| land).....              | 58 24       | 13 45 | Kungsbacka.....                           | 57 29       | 12 04 | Strängnäs.....                          | 59 23       | 17 02 |
| .....                   | 65 50       | 21 42 | Kungsholmen (isls).....                   | 56 06       | 15 35 | Stråssa.....                            | 59 45       | 15 13 |
| .....                   | 57 43       | 12 55 | Kungälv.....                              | 59 29       | 17 45 | Strömmen (bay).....                     | 59 19       | 18 05 |
| .....                   | 60 29       | 15 25 | Kvaiv (farm).....                         | 58 38       | 15 18 | Strömstad.....                          | 58 56       | 11 10 |
| .....                   | 58 34       | 15 17 | Laholmsbukten (bay).....                  | 56 35       | 12 50 | Studsвик.....                           | 58 46       | 17 23 |
| alf of (gulf).....      | 63 00       | 20 00 | Laisvall.....                             | 66 08       | 17 10 | Sundbyberg.....                         | 59 22       | 17 58 |
| .....                   | 62 43       | 15 27 | Landskrona.....                           | 55 52       | 12 50 | Sundsvall.....                          | 62 23       | 17 18 |
| ilet).....              | 58 38       | 16 32 | Landsort.....                             | 58 45       | 17 52 | Sundsvallsbukten (bay).....             | 62 20       | 17 35 |
| fiord).....             | 58 22       | 11 26 | Langsele.....                             | 63 31       | 17 49 | Sundsvallsjärden (bay).....             | 62 23       | 17 21 |
| .....                   | 63 05       | 14 49 | Lapland (region).....                     | 68 00       | 25 00 | Swappavaara.....                        | 67 39       | 21 04 |
| erg.....                | 59 53       | 12 17 | Laxå.....                                 | 58 59       | 14 37 | Svartosund (narrows).....               | 65 33       | 22 13 |
| Denmark.....            | 55 40       | 12 35 | Leksands-Noret.....                       | 60 44       | 14 59 | Taby (sec. of Stockholm).....           | 59 30       | 18 03 |
| ion).....               | 61 01       | 14 04 | Leningrad, U.S.S.R.....                   | 59 55       | 30 15 | Tanum.....                              | 58 43       | 11 20 |
| anal (canal).....       | 59 08       | 18 24 | Lidingö.....                              | 59 22       | 18 08 | Tingstad (sec. of Göteborg).....        | 57 44       | 11 59 |
| anal (canal).....       | 58 51       | 12 24 | Limhamn.....                              | 55 35       | 12 54 | Tjuvholmssundet (narrows).....          | 65 32       | 22 11 |
| (sec. of Borlänge)..... | 60 30       | 15 27 | Linköping.....                            | 58 25       | 15 37 | Tornio, Finland.....                    | 65 51       | 24 08 |
| .....                   | 59 38       | 17 04 | Ljungan (strm).....                       | 62 19       | 17 23 | Torsmo.....                             | 61 12       | 14 58 |
| .....                   | 58 10       | 13 31 | Lövö.....                                 | 56 59       | 16 28 | Travemünde, W. Germany.....             | 53 58       | 10 52 |
| of Stockholm).....      | 59 15       | 18 05 | Ludvika.....                              | 60 09       | 15 11 | Trelleborg.....                         | 55 22       | 13 10 |
| (isls).....             | 65 29       | 22 45 | Luleå.....                                | 65 34       | 22 10 | Trollhatte Kanal (canal).....           | 57 43       | 11 58 |
| .....                   | 63 16       | 17 12 | Luleålv.....                              | 65 35       | 22 03 | Trollhättan.....                        | 58 16       | 12 18 |
| Norway.....             | 60 22       | 18 09 | Lund.....                                 | 55 42       | 13 11 | Trondheim, Norway.....                  | 63 25       | 10 25 |
| .....                   | 59 08       | 14 52 | Luossavaara (mt).....                     | 67 52       | 20 14 | Trossa.....                             | 58 54       | 17 33 |
| .....                   | 67 08       | 20 42 | Lycksele.....                             | 64 36       | 18 40 | Uddevall.....                           | 58 21       | 11 55 |
| .....                   | 57 35       | 12 06 | Lysekil.....                              | 58 16       | 11 26 | Ulsunda (sec. of Stockholm).....        | 59 20       | 17 58 |
| .....                   | 60 40       | 17 10 | Mälaren (lake).....                       | 59 30       | 17 12 | Umeå.....                               | 63 50       | 20 15 |
| m).....                 | 60 40       | 17 09 | Malmberget.....                           | 67 10       | 20 40 | Umeålv.....                             | 62 47       | 20 16 |
| (bay).....              | 60 42       | 17 20 | Malmö.....                                | 55 36       | 13 00 | Uppsala.....                            | 59 52       | 17 38 |
| arden (bay).....        | 65 29       | 22 13 | Malmslätt (isls).....                     | 58 25       | 15 30 | Vaddö.....                              | 59 59       | 18 49 |
| (canal).....            | 58 50       | 13 58 | Märsta.....                               | 59 37       | 17 51 | Vällingby (sec. of Stockholm).....      | 59 22       | 17 52 |
| n).....                 | 57 42       | 11 52 | Marviken (cove).....                      | 60 07       | 18 49 | Vällinge (farm).....                    | 59 16       | 17 42 |
| .....                   | 57 43       | 11 58 | Mellansel.....                            | 63 26       | 18 19 | Vänern (lake).....                      | 58 55       | 13 30 |
| .....                   | 57 30       | 18 33 | Mellerud.....                             | 58 42       | 12 28 | Vänernsberg.....                        | 58 22       | 12 19 |
| .....                   | 60 05       | 14 59 | Midsommarkransen (sec. of Stockholm)..... | 59 18       | 18 00 | Vännäs.....                             | 63 55       | 19 45 |
| arden (sound).....      | 59 43       | 19 09 | Mjölby.....                               | 58 19       | 15 08 | Varberg.....                            | 57 06       | 12 15 |
| .....                   | 56 39       | 16 22 | Mo, Norway.....                           | 66 19       | 14 12 | Värnamo.....                            | 57 11       | 14 02 |
| astle).....             | 59 15       | 17 13 | Morjärv.....                              | 66 04       | 22 43 | Västerås.....                           | 59 37       | 16 33 |
| of Stockholm).....      | 59 19       | 18 00 | Motala Ström (strm).....                  | 58 38       | 16 00 | Västergötland (region).....             | 58 01       | 13 03 |
| nia (gulf).....         | 63 00       | 20 00 | Muskö (isls).....                         | 59 00       | 18 06 | Västervik.....                          | 56 15       | 14 24 |
| .....                   | 59 27       | 18 08 | Mysingen (bay).....                       | 59 00       | 18 15 | Västra Frölunda (sec. of Göteborg)..... | 57 39       | 11 52 |
| .....                   | 60 02       | 13 42 | Nantali, Finland.....                     | 60 27       | 22 02 | Vaxjö.....                              | 56 53       | 14 49 |
| on).....                | 57 01       | 12 42 | Nässjö.....                               | 57 39       | 14 41 | Vaxholmstjärning (fort).....            | 59 24       | 18 21 |
| .....                   | 64 19       | 19 38 | Narvik, Norway.....                       | 68 26       | 17 25 | Vättern (lake).....                     | 58 24       | 14 36 |
| .....                   | 59 04       | 15 07 | Nashypark.....                            | 59 26       | 18 06 | Vidsel.....                             | 65 51       | 20 31 |
| .....                   | 59 39       | 12 50 | Nissan (strm).....                        | 56 40       | 12 51 | Vietas.....                             | 67 30       | 18 25 |
| .....                   | 56 03       | 12 42 | Norrköping.....                           | 58 36       | 16 11 | Vinga (isls).....                       | 57 38       | 11 36 |
| .....                   | 65 50       | 24 10 | North Sea (sea).....                      | 56 00       | 03 00 | Ystad.....                              | 55 25       | 13 49 |
| .....                   | 55 43       | 13 32 | Norwegian Sea (sea).....                  | 70 00       | 05 00 |   |             |       |
| .....                   | 62 38       | 17 56 | Nyköping.....                             | 58 45       | 17 00 |   |             |       |
| .....                   | 56 09       | 13 46 | Nynäshamn.....                            | 58 54       | 17 57 |   |             |       |
| .....                   | 57 46       | 11 53 | Odeshog.....                              | 58 14       | 14 39 |   |             |       |
| ke).....                | 59 15       | 15 45 | Öland (isls).....                         | 56 45       | 16 38 |   |             |       |
| .....                   | 55 51       | 13 39 | Örebro.....                               | 59 17       | 15 13 |   |             |       |
| by).....                | 59 04       | 16 10 | Örnsköldsvik (rr sta).....                | 63 17       | 18 42 |   |             |       |
| .....                   | 64 07       | 18 10 | Oskarshamn.....                           | 57 16       | 16 26 |   |             |       |
| .....                   | 61 41       | 17 07 | Oslo, Norway.....                         | 59 55       | 10 45 |   |             |       |
| frm).....               | 62 31       | 17 27 | Östersund.....                            | 63 11       | 14 39 |   |             |       |
| on).....                | 63 26       | 14 04 | Övertorneå.....                           | 66 23       | 23 40 |   |             |       |
| .....                   | 59 06       | 17 34 | Oxelösund.....                            | 58 40       | 17 06 |   |             |       |
| ec. of Linköping).....  | 58 25       | 15 37 | Piteå.....                                | 65 20       | 21 30 |   |             |       |
| .....                   | 57 47       | 14 11 | Råå (sec. of Hälsingborg).....            | 56 00       | 12 44 |   |             |       |
| .....                   | 57 45       | 12 10 | Råö (farm).....                           | 57 24       | 11 56 |   |             |       |
| .....                   | 65 04       | 20 02 | Raon (isls).....                          | 58 09       | 11 24 |   |             |       |
| (bay).....              | 59 09       | 27 07 | Revingehed.....                           | 55 43       | 13 29 |   |             |       |
| .....                   | 67 33       | 18 38 | Riksgränsen.....                          | 68 23       | 18 06 |   |             |       |
| .....                   | 65 51       | 23 08 | Ringhals (point).....                     | 57 15       | 12 05 |   |             |       |
| .....                   | 56 40       | 16 22 | Ritsemjökkan (resort).....                | 67 43       | 17 25 |   |             |       |
| und).....               | 56 40       | 16 25 | Romeleåsen (hills).....                   | 55 34       | 13 33 |   |             |       |
| .....                   |             |       | Rönnskär (rr stop).....                   | 64 40       | 21 16 |   |             |       |

Selected airfields

|                          |       |       |
|--------------------------|-------|-------|
| Arlanda.....             | 59 40 | 17 50 |
| Bromma.....              | 59 21 | 17 57 |
| Bulltofta.....           | 55 36 | 13 04 |
| Frosön.....              | 63 12 | 14 30 |
| Halmstad.....            | 56 41 | 12 49 |
| Hälsingfors.....         | 57 36 | 15 50 |
| Jonköping.....           | 59 46 | 14 05 |
| Kallax.....              | 65 33 | 22 08 |
| Kalmar.....              | 56 41 | 16 17 |
| Karlstad.....            | 59 22 | 13 28 |
| Kiruna.....              | 67 49 | 20 21 |
| Kungsängen.....          | 58 35 | 16 15 |
| Örnsköldsvik.....        | 63 25 | 18 59 |
| Ronneby.....             | 56 16 | 15 16 |
| Sandviken.....           | 60 36 | 16 57 |
| Skelleftea.....          | 64 38 | 21 05 |
| Sundsvall Harnosund..... | 62 32 | 17 27 |
| Torslanda.....           | 57 42 | 11 47 |
| Umeå.....                | 63 48 | 20 17 |
| Visby.....               | 57 39 | 18 20 |

| COORDINATES                     |       |       | COORDINATES                          |       |       | COORDINATES                        |     |     |
|---------------------------------|-------|-------|--------------------------------------|-------|-------|------------------------------------|-----|-----|
|                                 | 'N.   | 'E.   |                                      | 'N.   | 'E.   |                                    | 'N. | 'E. |
| Aapus                           | 66 51 | 23 32 | Karlsuando                           | 68 27 | 22 29 | Säffle                             |     |     |
| Abisko                          | 68 20 | 18 51 | Karlsborg                            | 65 48 | 23 17 | Säffle Kanal (canal)               |     |     |
| Ågesta                          | 59 14 | 18 05 | Karlshamn                            | 56 10 | 14 51 | Saltsjöbaden                       |     |     |
| Almedal (rr sta)                | 57 41 | 12 00 | Karlskrona                           | 56 10 | 15 35 | Sassnitz, E. Germany               |     |     |
| Alnöundet (channel)             | 62 24 | 17 23 | Karlstad                             | 59 22 | 13 30 | Save                               |     |     |
| Ålvsborg                        | 57 40 | 11 52 | Karungi                              | 66 03 | 23 57 | Savenäs (sec. of Göteborg)         |     |     |
| Ålvkarleby                      | 60 34 | 17 27 | Katrineholm                          | 59 00 | 16 12 | Simpvarp                           |     |     |
| Ålvsbyn (sec. of Göteborg)      | 63 40 | 21 00 | Kattegat (strait)                    | 57 00 | 11 00 | Skagerrak (strait)                 |     |     |
| Ånge                            | 63 27 | 14 03 | Kemi, Finland                        | 65 44 | 24 34 | Skåne (region)                     |     |     |
| Ångelholm                       | 56 15 | 12 51 | Kil                                  | 59 30 | 13 19 | Skalstugan (farm)                  |     |     |
| Ångermanäven (strm)             | 62 48 | 17 56 | Kilafors                             | 61 14 | 16 34 | Skara                              |     |     |
| Ärendal (sec. of Göteborg)      | 57 42 | 11 50 | Kimstad                              | 58 32 | 15 58 | Skärholmen (sec. of Stockholm)     |     |     |
| Ärjäng                          | 59 23 | 12 08 | Kinda Kanal (canal)                  | 58 17 | 15 42 | Skelleftea                         |     |     |
| Årsta (sec. of Stockholm)       | 59 18 | 18 03 | Kiruna                               | 67 51 | 20 13 | Skövde                             |     |     |
| Årstaviken (lake)               | 59 18 | 18 02 | Elingerfjärden (bay)                 | 62 29 | 17 26 | Sodertälje                         |     |     |
| Arvidsjaur                      | 65 35 | 19 10 | Knippholmen (isls)                   | 57 41 | 11 49 | Sodertälje Kanal (canal)           |     |     |
| Åstorp                          | 56 08 | 12 57 | Kongsvinger, Norway                  | 60 12 | 12 00 | Solna                              |     |     |
| Åvesta                          | 60 09 | 16 12 | Kopparberg                           | 59 52 | 14 59 | Sound, The (sound)                 |     |     |
| Baltic Sea (sea)                | 56 00 | 18 00 | Korsjø, Norway                       | 58 57 | 11 39 | Stensele                           |     |     |
| Barsbäck (estate)               | 55 46 | 12 57 | Kristianstad                         | 56 02 | 14 08 | Stenungsund                        |     |     |
| Bastuträsk                      | 64 47 | 20 02 | Kristinehamn                         | 59 20 | 14 07 | Stockholm                          |     |     |
| Båveån (strm)                   | 58 21 | 11 55 | Krylbo                               | 60 08 | 16 13 | Storlien (rr sta)                  |     |     |
| Berga (farm)                    | 59 05 | 18 08 | Kubikensborg (sec. of Sundsvall)     | 62 23 | 17 21 | Storaman                           |     |     |
| Billingen (upland)              | 58 24 | 13 45 | Kungsbacka                           | 57 29 | 12 04 | Strängnäs                          |     |     |
| Boden                           | 65 50 | 21 42 | Kungsholmen (isl)                    | 56 06 | 15 35 | Stråssa                            |     |     |
| Borås                           | 57 43 | 12 55 | Kungssingen                          | 59 29 | 17 45 | Strömmen (bay)                     |     |     |
| Borlänge                        | 60 29 | 15 25 | Kvarn (farm)                         | 58 38 | 15 18 | Strömstad                          |     |     |
| Sorensberg                      | 58 34 | 15 17 | Laholmsbukten (bay)                  | 56 35 | 12 50 | Studsvik                           |     |     |
| Bothnia, Gulf of (gulf)         | 63 00 | 20 00 | Laisvall                             | 66 08 | 17 10 | Sundbyberg                         |     |     |
| Bracke                          | 62 43 | 15 27 | Landskrona                           | 55 52 | 12 50 | Sundsvall                          |     |     |
| Bråviken (inlet)                | 58 38 | 16 32 | Landsort                             | 58 45 | 17 52 | Sundsålsbukten (bay)               |     |     |
| Brofjorden (fiord)              | 58 22 | 11 26 | Langsele                             | 63 31 | 17 49 | Sundsålsfjärden (bay)              |     |     |
| Brunflo                         | 63 05 | 14 49 | Lapland (region)                     | 68 00 | 25 00 | Swappavaara                        |     |     |
| Charlottenberg                  | 59 53 | 12 17 | Laxå                                 | 58 59 | 14 37 | Svartosund (narrows)               |     |     |
| Copenhagen, Denmark             | 55 40 | 12 35 | Leksands-Noret                       | 60 44 | 14 59 | Täby (sec. of Stockholm)           |     |     |
| Dalarna (region)                | 61 01 | 14 04 | Leningrad, U.S.S.R.                  | 59 55 | 30 15 | Tanum                              |     |     |
| Dalarö                          | 59 08 | 18 24 | Lidingö                              | 59 22 | 18 08 | Tingstad (sec. of Göteborg)        |     |     |
| Dalslands Kanal (canal)         | 58 51 | 12 24 | Limhamn                              | 55 35 | 12 54 | Tjувholmssundet (narrows)          |     |     |
| Domnarvet (sec. of Borlänge)    | 60 30 | 15 27 | Linköping                            | 58 25 | 15 37 | Tornio, Finland                    |     |     |
| Enköping                        | 59 38 | 17 04 | Ljungan (strm)                       | 62 19 | 17 23 | Torsmo                             |     |     |
| Falköping                       | 58 10 | 13 31 | Lövö                                 | 56 59 | 16 28 | Travemünde, W. Germany             |     |     |
| Farsta (sec. of Stockholm)      | 59 15 | 18 05 | Ludvika                              | 60 09 | 15 11 | Trelleborg                         |     |     |
| Finnkilpippa (isl)              | 65 29 | 22 45 | Luleå                                | 65 34 | 22 10 | Trollhätte Kanal (canal)           |     |     |
| Forsmo                          | 63 16 | 17 12 | Luleålv                              | 65 35 | 22 03 | Trollhättan                        |     |     |
| Forsmark                        | 60 22 | 18 09 | Lund                                 | 55 42 | 13 11 | Trondheim, Norway                  |     |     |
| Fredrikstad, Norway             | 59 13 | 10 57 | Ljusåvaara (mt)                      | 67 52 | 20 14 | Trosa                              |     |     |
| Frovi                           | 59 08 | 14 52 | Lyckeå                               | 64 36 | 18 40 | Uddevalla                          |     |     |
| Gällivars                       | 67 08 | 20 42 | Lysekil                              | 58 16 | 11 26 | Ulvsunda (sec. of Stockholm)       |     |     |
| Gårda                           | 57 35 | 12 06 | Mälaren lake                         | 59 30 | 17 12 | Umeå                               |     |     |
| Gävle                           | 60 40 | 17 10 | Malmberget                           | 10    | 20 10 | Umeålv                             |     |     |
| Gävleån (strm)                  | 60 40 | 17 09 | Malmö                                | 56 36 | 13 00 | Uppsala                            |     |     |
| Gävlebukten (bay)               | 60 42 | 17 20 | Malslätt                             | 58 25 | 17 00 | Vaddö                              |     |     |
| Germundofjärden (bay)           | 65 29 | 22 13 | Marsun                               | 59 37 | 17 31 | Vallingby (sec. of Stockholm)      |     |     |
| Göta Kanal (canal)              | 58 50 | 13 58 | Marviken (cove)                      | 60 07 | 18 49 | Vällinge (farm)                    |     |     |
| Götaålv (strm)                  | 57 42 | 11 52 | Mellansel                            | 63 26 | 18 19 | Vänern (lake)                      |     |     |
| Göteborg                        | 57 43 | 11 58 | Mellerud                             | 58 42 | 12 28 | Vänernsberg                        |     |     |
| Gotland (isl)                   | 57 30 | 18 35 | Midsommarkransen (sec. of Stockholm) | 59 18 | 18 00 | Vännäs                             |     |     |
| Grängesberg                     | 60 05 | 14 50 | Mjölby                               | 58 19 | 15 08 | Varberg                            |     |     |
| Granhamsfjärden (sound)         | 59 43 | 19 09 | Mo, Norway                           | 66 19 | 14 10 | Värnamo                            |     |     |
| Grimskär (isl)                  | 56 39 | 16 22 | Morjärv                              | 66 04 | 22 43 | Västerås                           |     |     |
| Gripsholm (castle)              | 59 15 | 17 13 | Motla Ström (strm)                   | 58 38 | 16 00 | Västergötland (region)             |     |     |
| Gröndal (sec. of Stockholm)     | 59 19 | 18 00 | Musko (isl)                          | 59 00 | 18 06 | Västervik                          |     |     |
| Gulf of Bothnia (gulf)          | 63 00 | 20 00 | Mysingen (bay)                       | 59 00 | 18 15 | Västra Frölunda (sec. of Göteborg) |     |     |
| Hägernäs                        | 59 27 | 18 08 | Naantali, Finland                    | 60 27 | 22 02 | Vaxjö                              |     |     |
| Hagfors                         | 60 02 | 13 42 | Nessjö                               | 57 39 | 14 41 | Vaxholmsfastning (fort)            |     |     |
| Halland (region)                | 57 01 | 12 42 | Narvik, Norway                       | 68 26 | 17 25 | Vättern (lake)                     |     |     |
| Hällnas                         | 64 19 | 19 38 | Nasbypark                            | 59 26 | 18 06 | Videls                             |     |     |
| Hallsberg                       | 59 04 | 15 07 | Nissan (strm)                        | 56 40 | 12 51 | Vietsa                             |     |     |
| Halmstad                        | 56 39 | 12 50 | Norrköping                           | 58 36 | 16 11 | Vinga (isl)                        |     |     |
| Hälsingborg                     | 56 03 | 12 42 | North Sea (sea)                      | 56 00 | 03 00 | Ystad                              |     |     |
| Haparanda                       | 65 50 | 24 10 | Norwegian Sea (sea)                  | 70 00 | 05 00 |                                    |     |     |
| Harlösa                         | 55 43 | 13 32 | Nyköping                             | 58 45 | 17 00 |                                    |     |     |
| Härnösand                       | 62 38 | 17 56 | Nynashamn                            | 58 54 | 17 57 |                                    |     |     |
| Hässelholm                      | 56 09 | 13 46 | Ödesbög                              | 58 14 | 14 39 |                                    |     |     |
| Hisingen (isl)                  | 57 46 | 11 53 | Öland (isl)                          | 56 45 | 16 38 |                                    |     |     |
| Hjälmarén (lake)                | 59 15 | 15 45 | Örebro                               | 59 17 | 15 13 |                                    |     |     |
| Hörby                           | 55 51 | 13 39 | Örnsköldsvik (rr sta)                | 63 17 | 18 42 |                                    |     |     |
| Horsfjärden (bay)               | 59 04 | 16 10 | Oskarshamn                           | 57 16 | 16 26 |                                    |     |     |
| Hoting                          | 64 07 | 18 10 | Oslo, Norway                         | 59 55 | 10 45 |                                    |     |     |
| Hudiksvall                      | 61 44 | 17 07 | Östersund                            | 63 11 | 14 39 |                                    |     |     |
| Indalsälven (strm)              | 62 31 | 17 27 | Övertorneå                           | 66 23 | 23 40 |                                    |     |     |
| Jämtland (region)               | 63 26 | 14 04 | Oxelösund                            | 58 40 | 17 06 |                                    |     |     |
| Järna                           | 59 06 | 17 34 | Piteå                                | 65 20 | 21 30 |                                    |     |     |
| Johannelund (sec. of Linköping) | 58 25 | 15 37 | Råå (sec. of Hälsingborg)            | 56 00 | 12 44 |                                    |     |     |
| Jönköping                       | 57 47 | 14 11 | Råö (farm)                           | 57 24 | 11 56 |                                    |     |     |
| Jonsered                        | 57 45 | 12 10 | Råön (isl)                           | 58 09 | 11 24 |                                    |     |     |
| Jörn                            | 65 04 | 20 02 | Revingehed                           | 55 43 | 13 29 |                                    |     |     |
| Jungfruöfjärden (bay)           | 59 09 | 27 07 | Riksråden                            | 68 23 | 18 06 |                                    |     |     |
| Kaitum                          | 67 33 | 18 38 | Ringhals (point)                     | 57 15 | 12 05 |                                    |     |     |
| Kalix                           | 65 51 | 23 08 | Ritsemjökätan (resort)               | 67 43 | 17 28 |                                    |     |     |
| Kalmar                          | 56 40 | 16 22 | Romeleåsen (hills)                   | 55 34 | 13 33 |                                    |     |     |
| Kalmarssund (sound)             | 56 40 | 16 25 | Rönnskär (rr stop)                   | 64 40 | 21 16 |                                    |     |     |

Selected airfields

|                     |  |  |
|---------------------|--|--|
| Arlanda             |  |  |
| Bromma              |  |  |
| Bulltofta           |  |  |
| Frosön              |  |  |
| Halmstad            |  |  |
| Hultefred           |  |  |
| Jönköping           |  |  |
| Kallax              |  |  |
| Kalmar              |  |  |
| Karlstad            |  |  |
| Kiruna              |  |  |
| Kungsängen          |  |  |
| Örnsköldsvik        |  |  |
| Ronneby             |  |  |
| Sandviken           |  |  |
| Skelleftea          |  |  |
| Sundsvall Harnosand |  |  |
| Torslanda           |  |  |
| Umeå                |  |  |
| Visby               |  |  |

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|                     | 'N.   | 'E.   |   | 'N.   | 'E.   |   | 'N.   | 'E.   |
|---------------------|-------|-------|---|-------|-------|---|-------|-------|
|                     | 66 51 | 23 32 | Karesuando.....                           | 68 27 | 22 29 | Saffle.....                             | 59 08 | 12 50 |
|                     | 68 20 | 18 51 | Karlsborg.....                            | 65 48 | 23 17 | Saffle Kanal (canal).....               | 59 07 | 12 55 |
|                     | 59 14 | 18 05 | Karlskrona.....                           | 56 10 | 14 51 | Saltsjobaden.....                       | 59 17 | 18 18 |
| Ma)                 | 57 41 | 12 00 | Karlskrona.....                           | 56 10 | 15 35 | Sassnitz, E. Germany.....               | 54 31 | 13 39 |
| channel)            | 62 24 | 17 23 | Karlstad.....                             | 59 22 | 13 30 | Säve.....                               | 57 48 | 11 55 |
|                     | 57 40 | 11 52 | Karungi.....                              | 66 03 | 23 57 | Sävenäs (sec. of Göteborg).....         | 57 43 | 12 02 |
|                     | 60 34 | 17 27 | Katrineholm.....                          | 59 00 | 16 12 | Simpvarp.....                           | 57 25 | 16 40 |
| of Göteborg)        | 65 40 | 21 00 | Kattegat (strait).....                    | 57 00 | 11 00 | Skagerrak (strait).....                 | 57 45 | 09 00 |
|                     | 63 27 | 14 03 | Kemi, Finland.....                        | 65 44 | 24 34 | Skåne (region).....                     | 55 59 | 13 30 |
|                     | 56 15 | 12 51 | Kil.....                                  | 59 30 | 13 19 | Skalstugan (farm).....                  | 63 35 | 12 16 |
| en (strm)           | 62 48 | 17 56 | Kilafors.....                             | 61 14 | 16 34 | Skara.....                              | 58 22 | 13 25 |
| of Göteborg)        | 57 42 | 11 50 | Kimstad.....                              | 58 32 | 15 58 | Skärholmen (sec. of Stockholm).....     | 59 17 | 17 53 |
|                     | 59 23 | 12 08 | Kinda Kanal (canal).....                  | 58 17 | 15 42 | Skelleftea.....                         | 64 46 | 20 57 |
| of Stockholm)       | 50 18 | 18 03 | Kiruna.....                               | 67 51 | 20 13 | Skövde.....                             | 58 24 | 13 50 |
| lake)               | 59 18 | 18 02 | Klingerfjärden (bay).....                 | 62 29 | 17 26 | Södertälje.....                         | 59 12 | 17 37 |
|                     | 65 35 | 19 10 | Knippenholmen (ists).....                 | 57 41 | 11 49 | Södertälje Kanal (canal).....           | 59 12 | 17 38 |
|                     | 56 08 | 12 57 | Kongsvinger, Norway.....                  | 60 12 | 12 00 | Solna.....                              | 59 22 | 18 01 |
|                     | 60 09 | 16 12 | Kopparberg.....                           | 59 52 | 14 59 | Sound, The (sound).....                 | 55 50 | 12 40 |
| sa)                 | 56 00 | 18 00 | Korsnjo, Norway.....                      | 58 57 | 11 39 | Stensele.....                           | 65 05 | 17 10 |
| state)              | 55 46 | 12 57 | Kristianstad.....                         | 56 02 | 14 08 | Stenungsund.....                        | 58 05 | 11 49 |
|                     | 64 47 | 20 02 | Kristinehamn.....                         | 59 20 | 14 07 | Stockholm.....                          | 59 20 | 18 03 |
|                     | 58 21 | 11 55 | Krylbo.....                               | 60 08 | 16 13 | Storlien (rr sta).....                  | 63 19 | 12 06 |
|                     | 59 03 | 18 08 | Kubikenborg (sec of Sundsvall).....       | 62 23 | 17 21 | Storman.....                            | 65 06 | 17 06 |
| land)               | 58 24 | 13 45 | Kungsbacka.....                           | 57 29 | 12 04 | Strängnäs.....                          | 59 23 | 17 02 |
|                     | 65 50 | 21 42 | Kungsholmen (isl).....                    | 56 06 | 15 35 | Stråssa.....                            | 59 45 | 15 13 |
|                     | 57 43 | 12 55 | Kungsingen.....                           | 59 29 | 17 45 | Strömmen (bay).....                     | 59 19 | 18 05 |
|                     | 60 29 | 15 25 | Kvarn (farm).....                         | 58 38 | 15 18 | Strömstad.....                          | 58 56 | 11 10 |
|                     | 58 34 | 15 17 | Laholmsbukten (bay).....                  | 56 35 | 12 50 | Studsvik.....                           | 58 46 | 17 23 |
| lf of gulf)         | 63 00 | 20 00 | Laisvall.....                             | 66 08 | 17 10 | Sundbyberg.....                         | 50 22 | 17 58 |
|                     | 62 43 | 15 27 | Landskrona.....                           | 55 52 | 12 50 | Sundsvall.....                          | 62 23 | 17 15 |
| let)                | 58 38 | 16 32 | Landsort.....                             | 58 45 | 17 52 | Sundsvallsbukten (bay).....             | 62 20 | 17 35 |
| fiord)              | 58 22 | 11 26 | Langsele.....                             | 63 31 | 17 49 | Sundsvallsfjärden (bay).....            | 62 23 | 17 21 |
|                     | 63 05 | 14 49 | Lapland (region).....                     | 68 00 | 25 00 | Svappavaara.....                        | 67 39 | 21 04 |
| rg)                 | 59 53 | 12 17 | Laxå.....                                 | 58 59 | 14 37 | Svartosund (narrows).....               | 65 33 | 22 13 |
| Denmark)            | 55 40 | 12 35 | Leksands-Noret.....                       | 60 44 | 14 59 | Täby (sec. of Stockholm).....           | 59 30 | 18 03 |
| son)                | 61 01 | 14 04 | Leningrad, U.S.S.R. ....                  | 59 55 | 30 15 | Tanum.....                              | 58 43 | 11 20 |
|                     | 59 08 | 18 24 | Lidingö.....                              | 59 22 | 18 08 | Tingstad (sec. of Göteborg).....        | 57 44 | 11 59 |
| anal (canal)        | 58 51 | 12 24 | Limhamn.....                              | 55 35 | 12 54 | Tjuvholmssundet (narrows).....          | 65 32 | 22 11 |
| (sec. of Borlänge)  | 60 30 | 15 27 | Linköping.....                            | 58 25 | 15 37 | Tornio, Finland.....                    | 65 51 | 24 08 |
|                     | 59 38 | 17 04 | Ljungan (strm).....                       | 62 19 | 17 23 | Torsmo.....                             | 61 12 | 14 58 |
|                     | 58 10 | 13 31 | Lövö.....                                 | 56 59 | 16 28 | Truemünde, W. Germany.....              | 53 58 | 10 52 |
| of Stockholm)       | 59 15 | 18 05 | Ludvika.....                              | 60 09 | 15 11 | Trelleborg.....                         | 55 22 | 13 10 |
| (isl)               | 65 29 | 22 45 | Luleå.....                                | 65 34 | 22 10 | Trollhätte Kanal (canal).....           | 57 43 | 11 58 |
|                     | 63 16 | 17 12 | Luleålv.....                              | 65 35 | 22 03 | Trollhättan.....                        | 58 16 | 12 18 |
|                     | 60 22 | 18 09 | Lund.....                                 | 55 42 | 13 11 | Trondheim, Norway.....                  | 63 25 | 10 25 |
| Norway)             | 59 13 | 10 57 | Luossavaara (mt).....                     | 67 52 | 20 14 | Trosa.....                              | 58 54 | 17 33 |
|                     | 59 08 | 14 52 | Lycksele.....                             | 64 36 | 18 40 | Uddevalle.....                          | 58 21 | 11 55 |
|                     | 67 08 | 20 42 | Lysekil.....                              | 58 16 | 11 26 | Ulvsunda (sec. of Stockholm).....       | 59 20 | 17 58 |
|                     | 57 35 | 12 06 | Mälaren (lake).....                       | 59 30 | 17 12 | Umeå.....                               | 63 50 | 20 15 |
|                     | 60 40 | 17 10 | Malmberget.....                           | 67 10 | 20 40 | Umeålv.....                             | 63 47 | 20 16 |
| m)                  | 60 40 | 17 09 | Malmö.....                                | 55 36 | 13 00 | Uppsala.....                            | 59 52 | 17 38 |
| (bay)               | 60 42 | 17 20 | Malmslätt.....                            | 58 25 | 15 30 | Vaddö.....                              | 59 59 | 18 49 |
| arden (bay)         | 65 29 | 22 13 | Märsta.....                               | 59 37 | 17 51 | Vällingby (sec. of Stockholm).....      | 59 22 | 17 52 |
| (canal)             | 58 50 | 13 58 | Marviken (cove).....                      | 60 07 | 18 49 | Vällinge (farm).....                    | 59 16 | 17 42 |
| ni)                 | 57 42 | 11 52 | Mellensel.....                            | 63 26 | 18 19 | Vänern (lake).....                      | 58 55 | 13 30 |
|                     | 57 43 | 11 58 | Mellerud.....                             | 58 42 | 12 28 | Vänern.....                             | 58 22 | 12 19 |
|                     | 57 30 | 18 33 | Midsommarkransen (sec. of Stockholm)..... | 59 18 | 18 00 | Vännäs.....                             | 63 55 | 19 45 |
|                     | 60 05 | 14 59 | Mjölby.....                               | 58 19 | 15 08 | Varberg.....                            | 57 06 | 12 15 |
| arden (sound)       | 59 43 | 19 09 | Mo, Norway.....                           | 66 19 | 14 10 | Värnamo.....                            | 57 11 | 14 02 |
| il)                 | 56 39 | 16 22 | Morjärv.....                              | 66 04 | 22 43 | Västerås.....                           | 59 37 | 16 33 |
| saale)              | 59 15 | 17 13 | Motala Ström (strm).....                  | 58 38 | 16 00 | Västergötland (region).....             | 58 01 | 13 03 |
| nia (gulf)          | 59 19 | 18 00 | Musko (isl).....                          | 59 00 | 18 06 | Västervik.....                          | 56 15 | 14 24 |
|                     | 63 00 | 20 00 | Mysingen (bay).....                       | 59 00 | 18 15 | Västra Frölunda (sec. of Göteborg)..... | 57 39 | 11 52 |
|                     | 59 27 | 18 08 | Naantali, Finland.....                    | 60 27 | 22 02 | Vaxjö.....                              | 56 53 | 14 49 |
|                     | 60 02 | 12 42 | Nässjö.....                               | 57 39 | 14 41 | Vaxholmsfastning (fort).....            | 59 24 | 18 21 |
| on)                 | 57 01 | 12 42 | Narvik, Norway.....                       | 68 26 | 17 25 | Vättern (lake).....                     | 58 21 | 14 36 |
|                     | 64 19 | 19 38 | Näsbypark.....                            | 59 26 | 18 06 | Vidsele.....                            | 65 51 | 20 31 |
|                     | 59 04 | 15 07 | Nissan (strm).....                        | 56 40 | 12 51 | Vietas.....                             | 67 30 | 18 25 |
|                     | 56 39 | 12 50 | Norrköping.....                           | 58 36 | 16 11 | Vinga (isl).....                        | 57 38 | 11 36 |
|                     | 56 03 | 12 42 | North Sea (sea).....                      | 56 00 | 03 00 | Ystad.....                              | 55 25 | 13 49 |
|                     | 65 50 | 24 10 | Norwegian Sea (sea).....                  | 70 00 | 05 00 |   |       |       |
|                     | 55 43 | 13 32 | Nyköping.....                             | 58 45 | 17 00 |   |       |       |
|                     | 62 38 | 17 56 | Nynäshamn.....                            | 58 54 | 17 57 |   |       |       |
|                     | 56 09 | 13 46 | Ödeshög.....                              | 58 14 | 14 39 |   |       |       |
|                     | 57 46 | 11 53 | Öland (isl).....                          | 56 45 | 16 38 |   |       |       |
| lake)               | 59 15 | 15 45 | Örebro.....                               | 59 17 | 15 13 |   |       |       |
|                     | 55 51 | 13 39 | Örnsköldsvik (rr sta).....                | 63 17 | 18 42 |   |       |       |
| (bay)               | 59 04 | 16 10 | Oskarshamn.....                           | 57 16 | 16 26 |   |       |       |
|                     | 64 07 | 18 10 | Oslo, Norway.....                         | 59 55 | 10 45 |   |       |       |
|                     | 61 44 | 17 07 | Östersund.....                            | 63 11 | 14 39 |   |       |       |
| (strm)              | 62 31 | 17 27 | Övertorneå.....                           | 66 23 | 23 40 |   |       |       |
| panion)             | 63 26 | 14 04 | Oxelösund.....                            | 58 40 | 17 06 |   |       |       |
|                     | 59 06 | 17 34 | Piteå.....                                | 65 20 | 21 30 |   |       |       |
| (sec. of Linköping) | 58 25 | 15 37 | Råå (sec. of Hälsingborg).....            | 56 00 | 12 44 |   |       |       |
|                     | 57 47 | 14 11 | Råö (farm).....                           | 57 24 | 11 56 |   |       |       |
|                     | 57 45 | 12 10 | Råön (isl).....                           | 58 09 | 11 24 |   |       |       |
|                     | 65 04 | 20 02 | Revingehed.....                           | 55 43 | 13 29 |   |       |       |
| en (bay)            | 59 09 | 27 07 | Riksgränsen.....                          | 68 23 | 18 06 |   |       |       |
|                     | 67 33 | 18 38 | Ringhals (point).....                     | 57 15 | 12 05 |   |       |       |
|                     | 65 51 | 23 08 | Ritsemjokkåtan (resort).....              | 67 43 | 17 28 |   |       |       |
|                     | 56 40 | 16 22 | Rimeleåsen (hills).....                   | 55 34 | 13 33 |   |       |       |
| (sound)             | 56 40 | 16 25 | Rönnskär (rr stop).....                   | 64 40 | 21 16 |   |       |       |

Selected airfields

|                          |       |       |
|--------------------------|-------|-------|
| Arlanda.....             | 59 40 | 17 50 |
| Bromma.....              | 59 21 | 17 57 |
| Bulltofta.....           | 55 36 | 13 04 |
| Frosön.....              | 63 12 | 14 30 |
| Halmstad.....            | 56 41 | 12 49 |
| Hultsfred.....           | 57 36 | 15 50 |
| Jönköping.....           | 59 46 | 14 05 |
| Kallax.....              | 65 33 | 22 08 |
| Kalmar.....              | 56 41 | 16 17 |
| Karlstad.....            | 59 22 | 13 28 |
| Kiruna.....              | 67 49 | 20 21 |
| Kungsängen.....          | 58 35 | 16 15 |
| Örnsköldsvik.....        | 63 25 | 18 50 |
| Ronneby.....             | 58 16 | 15 16 |
| Sandviken.....           | 60 36 | 16 57 |
| Skelleftea.....          | 64 38 | 21 05 |
| Sundsvall Harnosand..... | 62 32 | 17 27 |
| Torslanda.....           | 57 42 | 11 47 |
| Umeå.....                | 63 48 | 20 17 |
| Visby.....               | 57 39 | 18 20 |

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(6)

(6)

# Sweden

International boundary  
 Province (Län) boundary  
 Provincial capital  
 Provincial (Län) capital  
 Road  
 Railroad  
 Field  
 Harbor  
 Port  
 Other place  
 Population  
 747,480  
 100,000 to 800,000  
 50,000 to 100,000  
 10,000 to 50,000  
 Under 10,000

Elevations in feet

1:3,500,000

Scale Miles

Scale Meters

Baltic Sea

Åland

Åland

Åland

Åland

Åland

Åland

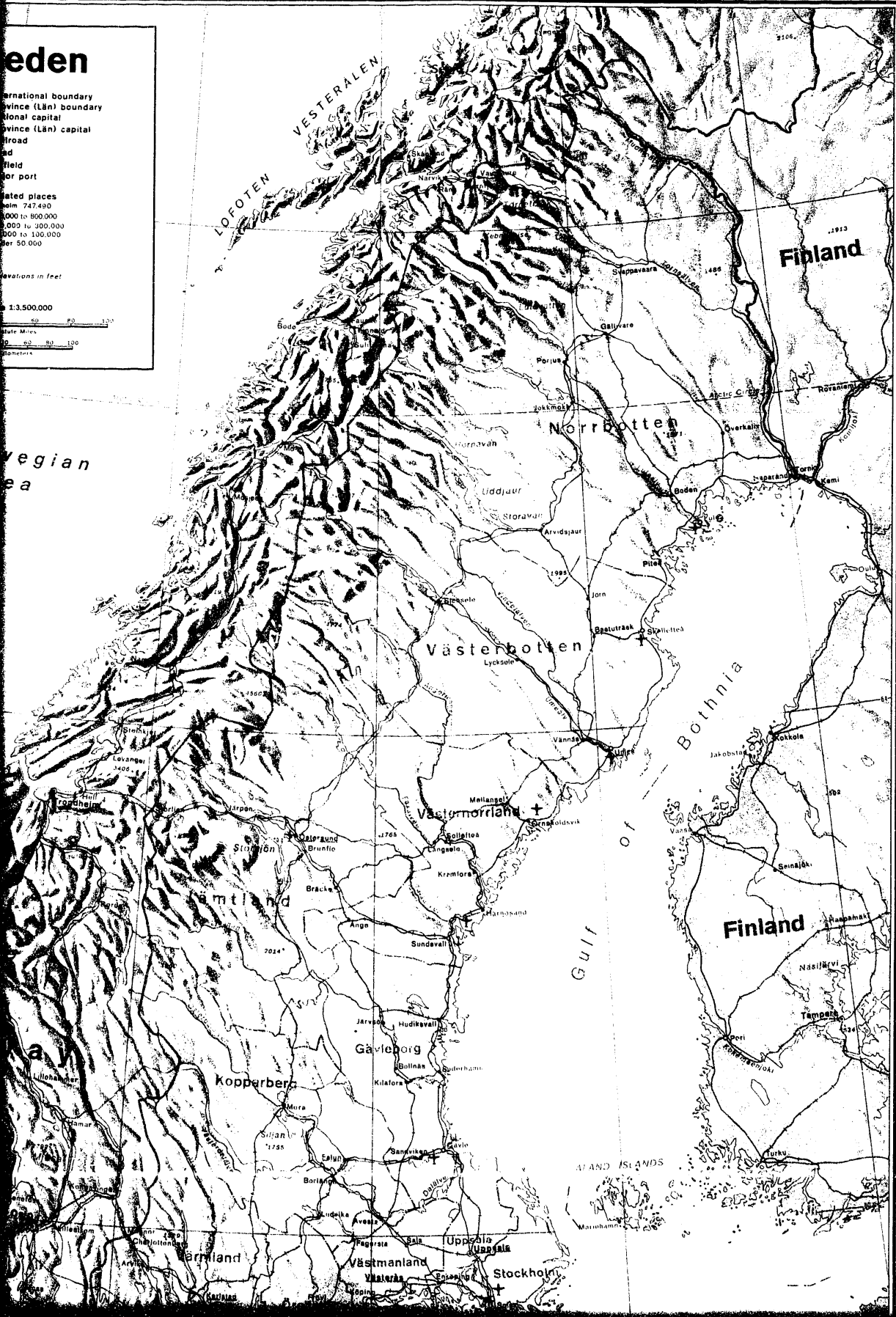
Åland

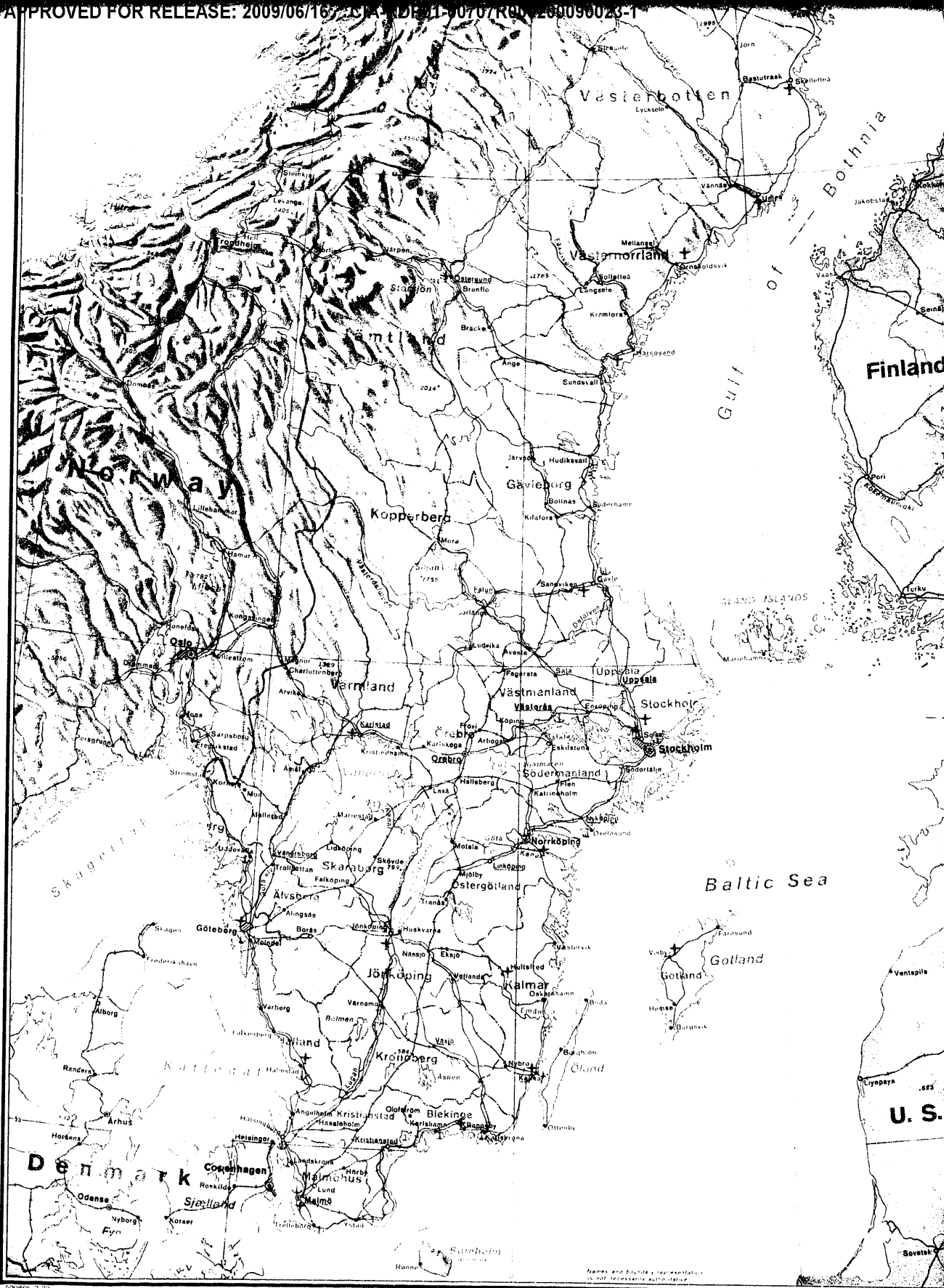
Åland

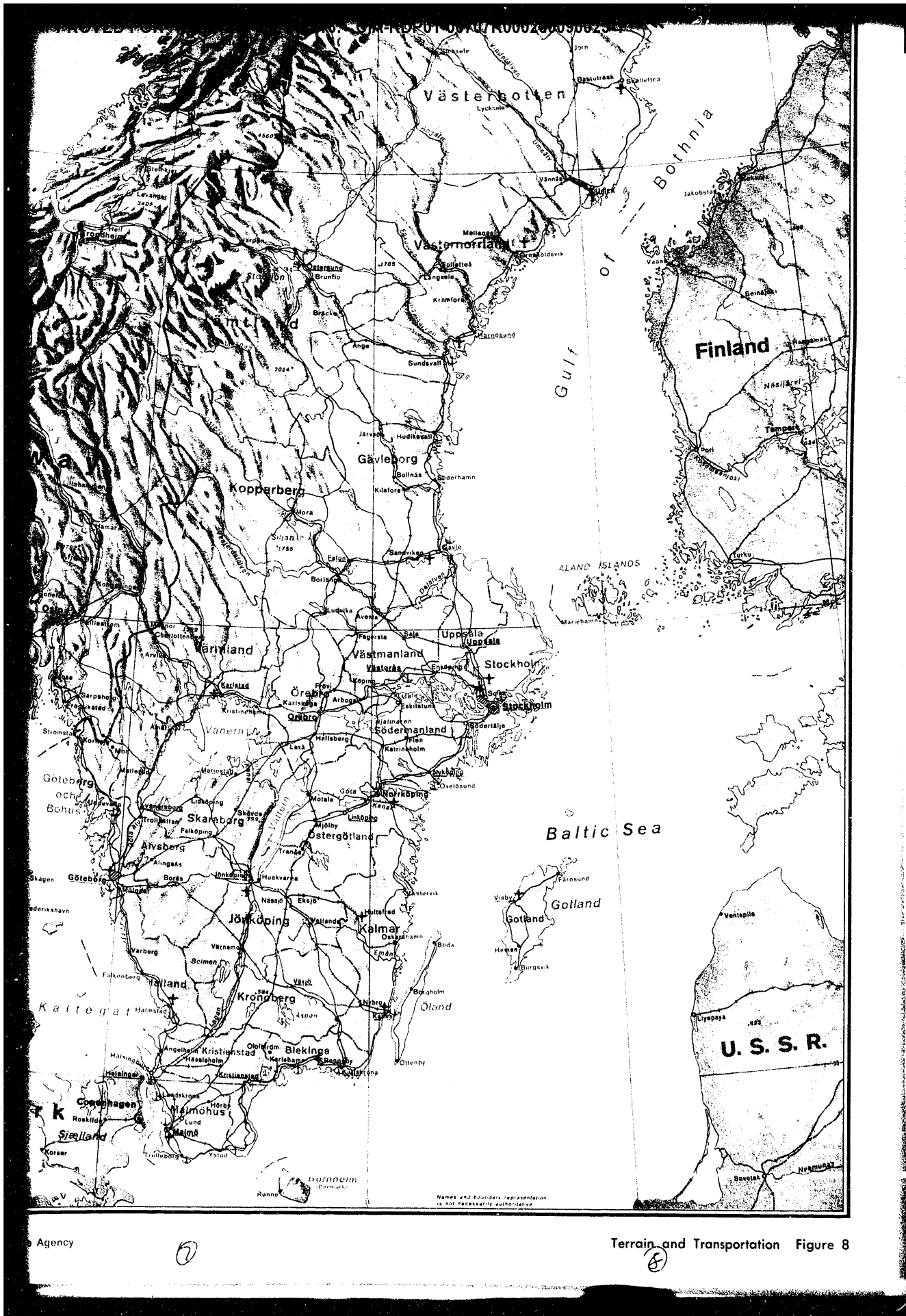
Åland

Åland

Åland







Agency

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Terrain and Transportation Figure 8

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