Sweden Changes to Right-Hand Driving

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•WORLD attention was centered on Sweden on September 3, 1967, when that country, a nation of 8 million people and 2 million motor vehicles, changed from left-hand to right-hand traffic.

With this change, all countries on the European continent now drive to the right. In the European area, left-hand traffic is now the rule only in Great Britain, Ireland, Cyprus, Malta and Iceland—and Iceland will switch in 1968. The remainder of the world is still divided, with Japan, Australia, New Zealand, India, parts of Africa, and many former British colonies driving on the left and the rest of the world keeping to the right.

The reasons for right-hand or left-hand traffic are clouded in antiquity. The fact that man is essentially right-handed has undoubtedly influenced the decision, but sometimes in one direction and sometimes in the other. Presumably the need to keep the sword hand free so as to fight effectively from the back of a horse had something to do with it. Later the choice between controlling a horse-drawn coach from a seat on the coach versus riding one of the horses played a part in the decision between right and left traffic. The coach-seat driver kept to the left and the postillion rider to the right—and the differences began.

The first known legislation on the subject came in 1736 in Saxony; an English law appeared in 1756. By the time that the motor vehicle arrived on the scene, the world was greatly divided on the matter. The Swedish change, however, was by no means the first. Canada changed in 1922, Portugal in 1929, Austria, Hungary and Czechoslovakia between 1930 and 1941, Argentina in 1945, and Ethiopia as recently as 1964. Undoubtedly this list is not complete, but in none of the previous changes was a vehicle population of 2 million involved, nor was the problem approached in as careful and scientific a manner as in Sweden.

The history of the change-over in Sweden goes back at least 40 years, for the first bill on this subject was introduced in the Swedish Parliament that long ago. Public opinion was not favorable, however, and the matter was set aside. As recently as 1955, when a plebiscite was held on the subject, the vote was 83 percent in favor of retaining left-hand traffic. The decision to make the change was not reached until May 1963, when the Parliament voted almost 6 to 1 in favor of making the switch.

Parenthetically, it is worth noting that nearly two months after the change, a public opinion poll showed 57 percent of the populace favorably disposed to the change and only 20 percent opposed. Perhaps this is only acceptance of the inevitable, but it is a major shift from the opinion expressed in 1955.

The motives which prompted the decision to make the switch were a mixture, as might be expected, of political, economic, and social reasons.

The Scandinavian Council and the Council of Europe both urged Sweden to make the change. International traffic developments were cited as rendering closer coordination of traffic regulations a necessity.

International traffic crossing the Swedish frontier in 1955 totaled 1.5 million vehicles, with the 1970 total estimated at from 15 to 20 million vehicles and between 75 and 95 million people. The bridge to be built over the Great Belt in Denmark and that contemplated over the Sound between Denmark and Sweden will provide a land route from Germany through Denmark to Sweden. This, together with the long common border with

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Figure 1. New signs in Stockholm covered prior to the changeover.

Figure 2. New pavement markings installed before the changeover while left-hand traffic was still operating.

Norway and the proximity of Finland to the east, will greatly increase the amount of tourist and commercial traffic to and from Sweden in the near future.

The social aspect was emphasized by a study of accidents involving Swedish vehicles abroad and those involving foreign vehicles in Sweden. Both types were increasing faster than the number of vehicles crossing the frontier. It was assumed that this disproportionate increase was due to the difference in traffic rules.

The benefits, some tangible and some intangible, were thus felt to be great enough to justify the change-over. The costs of the change were estimated at over 600 million Swedish kronor, or about $120 million. Of this total amount, slightly more than half went for the conversion of buses, street cars and other vehicles; about 40 percent was for physical changes in streets and roads, and for new traffic controls; about 5 percent for information and training; and the remaining amount for administration.

It is interesting in this connection to compare these estimated 1967 costs with earlier figures. It was estimated that the transition in 1943 would cost about 16 million kronor ($3.2 million), that the costs in 1946 would be about 27 million kronor ($5.4 million), and that the costs in 1959 would be 215 million kronor ($43 million).

The costs of the change-over were borne almost entirely by the government, through a special tax on vehicles from 1964 to 1967 of 20 kronor ($4) on motorcycles, 40 kronor ($8) on vehicles weighing up to 1,100 kg., and 75 kronor ($15) for all other vehicles.

The cost of the change, $120 million, has been estimated as 5 percent of the annual cost of motor vehicle transportation in Sweden, including vehicle purchase costs, road and street building, operating costs, accidents, and all secondary investments.

Once the decision was made by the Parliament, the government appointed a national commission to serve as a decision-making body in planning and executing the change-over. The commission itself was a small group of six, but it was advised by two 10-member groups, one concerned with technical and economic questions and the other

dealing with matters of safety. A secretariat was created, and several committees of experts were created to work with the staff, which was set up in sections to deal with (1) highway safety, (2) street and highway changes, (3) conversion of vehicles, (4) economic and other surveys, (5) legal and administrative problems, and (6) public information media. Special committees were established to perform scientific studies and to develop necessary educational programs.

The scientific group recognized that the change-over would seriously disturb the mutual adaptation of man and environment, imperfect as that might be. To provide at least the same degree of adaptation after the change as before, it was accepted that changes would be involved in the environment (the road, the vehicle, and the law) as well as in the road user.

In the environmental area, for instance, it was decided that new or modified highway signs ought to be introduced well in advance of the change date and that the duplication would serve to assist the road user in learning the new signs before he was also faced by learning many other new tasks connected with right-hand driving.

Although the change-over involved many projects which extended over a substantial period of time, the switch itself was a relatively momentary phenomenon. For the road user himself, this requirement for instantaneous adaptation was regarded as the most serious problem. New reflex actions would have to be learned and old reflexes forgotten.

It was recognized that this would not happen at once, and that education would be a gradual process which would continue for a period of time after the change-over.

This concept affected the decision as to the exact date of the change-over: September 3, 1967, was selected. This date would provide an opportunity to reach road users through their normal communication channels for a brief intensive period just prior to the switch. Schools would open the week before, with special attention to traffic education. More importantly, it would be possible just after the switch to use fully the facilities of the schools, employers, organizations, and all mass media to educate and to remind both drivers and pedestrians.

The question of timing for training in right-hand driving was given early study. It was decided, on the basis of experimentation, that such training prior to the change-over could cause more harm than good. Simulation demonstrated that drivers who drove in left-hand traffic, then in right-hand traffic, and then again in left-hand traffic made more mistakes than drivers who had not experienced the intermediate step of right-hand driving. This was confirmed by a questionnaire study of Swedish drivers who had driven abroad in right-hand traffic and then come back home to left-hand traffic.

Another interesting conclusion was reached in connection with changes in environment. It was determined, through simulation, that a driver who changed his environment

Figure 3. A main street in Stockholm with three lanes of traffic before the changeover.

at the time of the change-over made fewer errors than a driver who remained in the same environment. But when the first driver returned to his familiar environment, he made more errors than the one who had remained in the same area. It was concluded, therefore, not to recommend a change of environment after the date of the change-over.

The scientific group also looked into the amount of knowledge of the traffic law, highway signs, and safe driving practices possessed by school children and adults. The results of a survey carried out in late 1965 and early 1966 showed that such knowledge was far from complete, and the planned educational effort carried out in the autumn of 1966 was designed to correct these deficiencies.

A number of traffic studies were conducted to identify possible problem areas and to guide the planning for the change. One such study examined the matter of lateral placement of vehicles on the road. In Sweden, most vehicles already had the steering wheel on the left side, so the switch to right-hand traffic would move the driver from the curb side to the center of the road. Measurements of the lateral placement of vehicles in Sweden and in Denmark (which has right-hand traffic) indicated no substantial differences, however, between the two situations.

It was decided that the change would place the driver in a relatively poorer position to see overtaking vehicles, and it was recommended that outside rearview mirrors be installed on the left side of all vehicles. Forward visibility was examined on a number of horizontal and vertical alignment configurations, and it was concluded that the switch would not create problems.

The overtaking maneuver was examined by comparing results of Swedish studies with those in other countries where right-hand driving is the rule. The results indicated that the average duration was the same in right-hand and left-hand traffic, but that the distance was shorter in right-hand traffic. In an effort to explain this, the Swedish authorities guessed that the better visibility afforded in right-hand traffic (as compared with the pre-change Swedish situation where the driver was at the curb side of the vehicle) might mean that Swedish drivers made their overtaking maneuvers at higher relative speeds.

The behavior of pedestrians when crossing a roadway was recognized early as a major factor. It was taken for granted that it would be difficult for pedestrians to remember to look first to the left before stepping off the curb. A photographic study of pedestrian actions was made, which showed that 70 percent of the pedestrians looked to the right before leaving the curb, but that only 15 percent looked to the left. A total of 80 percent looking to the left was not reached until 7 feet from the curb. In the case of a divided

Figure 4. The same street on H-Day.

Figure 5. The same street operating with four lanes of traffic keeping to the right.

highway, the 80 percent looking to the left figure was not reached until 20 feet from the curb. A report published late in October indicated that about twice as many pedestrians are looking first in the wrong direction in right-hand traffic as looked wrong in left-hand traffic, so the lesson has not yet been learned.

Because of the common use of vehicles with the steering wheel on the left side, few changes were needed in passenger cars. It was necessary to change asymmetrical headlamps, however, and this was the single item of cost borne directly by each vehicle owner.

The situation in regard to buses was by no means as easy to solve. Some 7,000 buses were operating in Sweden, and because several street car lines were abandoned at the time of the change-over, 700 additional buses were added at that time. Prior to 1963, all buses had doors on the left side and were designed throughout for left-hand traffic. No left-side doors were to be used after the change, so a massive rebuilding or replacement operation was obviously required.

Three alternatives were open: partial rebuilding (doors only), complete rebuilding (a mirror change for right-hand traffic), or replacement with a new vehicle. Because the bus changes could not be made instantaneously but had to be spread over many months, a number of buses with doors on both sides resulted. It is planned to close the left-hand doors eventually.

At the time of the change-over, the fleet of 7,700 buses was composed of 2,900 partially rebuilt buses, 630 completely rebuilt buses, 150 old vehicles with doors on both sides, and 4,020 new buses. Of this last group, 2,520 were designed for right-hand traffic only, with the other 1,500 having doors on both sides and thus capable of operating in either left-hand or right-hand traffic.

Of the buses in the Swedish fleet in 1963, about 3,700 are in use after the change-over. More than half of the 4,020 new buses represent replacements for older vehicles which would have been withdrawn from service in any case. About 1,000 additional buses were needed, due to cessation of street car lines, school organization changes, and other factors, so only about 1,000 buses were withdrawn from service one or more years earlier than expected.

The necessary adjustments in streets and highways and in traffic control devices represented the next greatest item of expense. Plans for these changes were prepared by municipal authorities and the regional road authorities, and then submitted to the national commission. Based on these plans, the costs were distributed about as follows:

In general, major reconstruction work was carried out in advance of the date of the change-over. It was not possible to complete all projects in advance, however, and some work was left for the change-over day and some for even later completion. For

Cost Item	Percent	Cost Item	Percent
In urban areas:		In rural areas:	
Traffic circles, etc.	49	Freeway access	30
Street intersections	25	Intersections	20
Bus stops	10	Bus stops	18
Miscellaneous	16	Left-turn lanes	14
		Visibility improvements	7
		Slow traffic lanes	6
		Miscellaneous	5

instance, it was not possible to remove street car loading platforms before the cars stopped operating, and this did not occur until the last few hours.

The fact that more than three years advance notice of the change was available meant that some work which would otherwise have been carried on between 1963 and 1967 was postponed, waiting for right-hand traffic. In Stockholm, for example, it was estimated that from 15 to 20 percent of the total cost was for work delayed in anticipation of the change. This was principally for new paving and for new traffic signals.

In Stockholm, the largest city in the country with over a million people, there were 175 traffic signals which had to be revised for right-hand traffic. In addition, 29 new signals were installed because of different traffic patterns following the change.

Many of the previous signals were traffic-actuated. Although signal heads could be modified or new heads installed in advance of the change-over, it was felt that right-hand detectors should not be installed while left-hand traffic was still operating. As a result, at the time of the change most signals in Stockholm were operating on a fixed-time basis. Interconnection was similarly delayed and thus progression, or the "green wave" as it is referred to in Europe, was not present in the early days of right-hand traffic.

About 800 traffic signals were revised throughout the country, and an estimated 220,000 highway signs were replaced or newly installed. As was mentioned earlier, left-hand signs were duplicated on the right-hand side, partly as an education measure. This was not practical in all cases (for example, in the case of directional arrows) and so many of the new signs had to be erected and then covered or masked out. Following the change the old signs were removed as rapidly as possible. Some critical signs were covered the day of the change, with removal scheduled for later.

In Stockholm the authorities took the occasion of the change-over to up-grade numerous signs, particularly overhead directional signs. Suspended signs at many important circles and other important junctions were replaced by internally illuminated signs on fixed supports.

The change-over was also used as an opportunity to bring Sweden into conformity with the rest of the Continent in the matter of signs. Although Sweden had followed the European standard in general, there had been a few differences, chiefly in colors, which were eliminated when the new signs were installed.

Road or pavement markings had to be changed, and this presented a special problem because it could not be done at the last minute and left-hand traffic would be forced to operate for some period of time with any new markings for right-hand traffic. Yellow had been used for all pavement markings, and the authorities decided to solve the problem by using white for all markings for right-hand traffic. Drivers were instructed to obey the yellow markings up to the date of the change-over, then to obey the white markings. Certain arrows were left without heads, with these all-important features added the day of the change-over.

The details of changing curb, removing islands, revising signals, replacing signs and providing new pavement markings required much planning and scheduling. A substantial amount of effort very obviously went into the task of coordinating all the work so that left-hand traffic could continue up to almost the last moment. For most of the country,

traffic was stopped only for 5 hours early Sunday morning. In the big cities the suspension was longer, but the longest time (in Stockholm) was only 28 hours.

In Stockholm, the change-over was accompanied by the development of a revised traffic circulation plan, which together with other changes, was designed to improve greatly the traffic capacity of the street system. The number of one-way streets was increased, many complicated intersections were rebuilt, and the abandonment of street cars made possible the correction of a number of traffic bottlenecks. New parking regulations, which prohibit daytime parking in virtually all the downtown section, were placed in effect, although this did not appear to be an essential element in the change-over and seemed rather to be riding on the coattails of the larger program. Several new traffic facilities, including an important urban freeway section, were also timed to open with the change-over. All in all, traffic patterns in Stockholm were substantially changed and it may be impossible to isolate the effect of the change-over to right-hand traffic in the city.

In addition to the changes already cited, a number of new regulations went into effect at the time of the change-over or shortly before. Beginning on January 1, 1967, pedestrians have been required to obey traffic signals and to use nearby pedestrian crossings. Drivers have been required to yield to pedestrians crossing on a green light.

The basic right-of-way rule was revised as of the day of the change-over. Where drivers yielded to a vehicle on the left under the old system, they must now yield to the vehicle on the right. The authorities announced that the new rule would be applied much more strictly than had been the case for the old rule.

Beginning with the date of the change-over, another new regulation went into effect, prohibiting the crossing of a solid line to the right of a broken centerline. Also new was the use of a single solid white line to indicate no crossing or straddling of the line.

Last but not least in importance, speed limits were reduced, at least temporarily. It was stated that the duration of the reductions would depend upon the accident experience. Specifically, the previous 50 kph limit was reduced to 40 kph; the limit for freeways was set at 90 kph; and the general limit elsewhere was set at 60 kph for two days, then raised to 70 kph.

It is interesting to note that by the end of October, the freeway limit was raised to 100 kph (up to 62 mph from the earlier 56 mph) and the general rural limit was upped from 70 to 80 kph (from 43 to 50 mph). Local authorities were given the option of increasing the 40 kph (25 mph) limit up to 70 kph (42 mph).

The change-over itself was made with what appeared to be a minimum of difficulty. The actual shift took place at 5 a. m. on Sunday morning, and a surprising number of people were up to watch it. In places there was applause and even a few cheers when vehicles moved over to the right side. By Sunday afternoon, Stockholm was flooded by "Sunday drivers" anxious to try their wings. The greatest difficulty appeared to be the result of the changes in the circulation pattern in the city core—a taxi driver delivered me a block from my destination with the explanation that he "couldn't get there from here."

Great interest was expressed over the initial accident experience. Two general theories were advanced ahead of the change: either the rate would be immediately high and decline slowly over a long period of time, or the initial rate would be moderate and then would slowly increase before dropping again to an average figure.

On the basis of experience during the first two months of right-hand traffic, neither theory appears to have been entirely correct. Fatal accidents have been much below the average rate for this time of year, and total accidents have occurred at a rate about average.

The first few weeks saw a higher than average experience in injury accidents involving bicycles and mopeds, of which there are many in Sweden as in most of Europe. Traffic volumes were down very slightly during the first weeks, but not enough to account for the lower accident totals. It is perhaps too early to tell the full story, but it appears that the transition has been accomplished without undue blood-letting.

Relapses to left-hand driving practices appear to have been fairly common among drivers. A survey conducted by a committee of the official commission reported that such relapses had happened at least once to the average driver. As previously mentioned,

pedestrians appeared to have fallen short of making a complete adjustment to right-hand traffic, with many still looking the wrong way first before stepping off the curb.

In the initial days of right-hand traffic, nearly 150,000 volunteers manned both ends of busy crosswalks throughout the country to assist pedestrians. The volunteers included teenagers, members of the military services, and others, both male and female. Wearing white cuffs for identification, these "living reminders" exercised no police power but did serve to alert pedestrians to the new traffic conditions and new regulations. Such reminders would be useful for a long time, according to one Swedish psychologist, who stated that it would not be until the year 2020 that Sweden would be entirely free from people who might react incorrectly in right-hand traffic, reverting to the reflex action associated with left-hand driving.

That the change-over occurred as smoothly as it did is a tremendous tribute to the Swedish people. As the Minister of Communications, Olof Palme, said in a press conference, it was not possible to foresee the atmosphere and spirit which prevailed during the switch. It is perhaps most significant that the change was attempted at all, for this took considerable courage. Great praise is due those who planned so thoroughly and organized so skillfully that the transition went off with no major hitches. Finally, and most importantly, major credit must be given the Swedish road users for their display of discipline in adapting to such a major change in traffic operation.