Steadily Reducing CO₂ Emissions and Packaging and Wrapping Materials Used in Logistics

Reduction of Environmental Impact from Two Perspectives

Toyota transports vehicle parts and completed vehicles throughout Japan and overseas. For FY2000, Toyota’s transport volume in Japan was 3.1 billion ton-kilometers (tons times kilometers). In FY2000, Toyota was active in reducing the impact on the environment, guided by the following two key perspectives:

1. reducing CO₂ emissions by streamlining transport operations
2. reducing usage of packaging and wrapping materials by simplifying specifications for packaging and wrapping materials and by promoting the use of returnable containers

Toyota has been continuously conducting these activities with the principal objective of improvement proposals and innovations that are unique in logistics. These improvements take all processes into consideration, including development and design, procurement and production. Furthermore, the Production Environment Logistics Subcommittee was established within the Production Environment Committee in April 2001 to engage in further activities designed to reduce environmental impact.

Reducing CO₂ Emissions by Streamlining Transport Operations

The Logistics Group has set a goal of "stabilizing CO₂ emission volume at 1990 levels by 2005." To achieve this goal, it increased loading efficiency and filling factors to reduce the number of shipments, increased modal shifts and collaborative shipments, and worked to achieve optimal transport routes in FY2000 also.

As a result of these efforts, Toyota achieved the goal of CO₂ emissions of 3,300 tons/year, exceeding the goal of 2,700 tons/year for FY2000. The results of the actions taken to reduce CO₂ emissions are described in the table on the next page.

The Logistics Group is also promoting the deployment of clean-energy vehicles. As of March 2001, it had 26 natural gas and LPG vehicles in use.

*For CO₂ emissions, CO₂ equivalent values are now used instead of carbon equivalent values

Logistics for Completed Vehicles

Loading efficiency for the Hiace and Duet was increased through improvements made to carrier vehicles, and transport routes in the Tohoku and Kyushu regions were improved to allow carrier vehicles to be effectively utilized on return routes. Also, some routes to Shikoku and Kyushu from the Kansai region were shifted to maritime transport, resulting in reduction in CO₂ emissions.

Improvement in Carrier Vehicles

Toyota Logistics

Logistics for Completed Vehicles
Logistics for transporting completed vehicles from plants to Japanese dealers and exported to overseas distributors

Logistics for Production Parts*
Logistics to supply parts to assembly plants in Japan and local assembly plants overseas

*Due to a change in the organization of the Logistics Group, logistics in procurement and logistics for knockdown parts have been integrated

Logistics for Service Parts
Logistics to supply service parts to Japanese dealers and overseas distributors
**Logistics for Production Parts**

The number of freight runs in procurement transportation within Japan was reduced by mixed loading. Engines, a heavy item, are loaded together with empty return pallets, a light item, so that interplant trucks are fully loaded.

In international container shipping, in conjunction with the deregulation of trailer truck loading restrictions in Europe and North America, specialized vehicles with minimal added load on the road (three-axle chassis models) were actively introduced for transport to the port for loading in Japan, which increased the loadable weight per container and reduced the total number of containers used.

**Introduction of Three-Axle Chassis Container Trailers**

![Three-axle and Two-axle Container Trailers](image)

**Logistics for Service Parts**

Using railways rather than trucks to return steel containers to Fukuoka and Hiroshima was also aimed at reducing CO₂ emissions. Also, packaging for parts to be transported overseas were moved to centers close to the ports, thereby reducing the number of freight runs between centers.

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### Results of Major CO₂ Reducing Actions

<table>
<thead>
<tr>
<th>Group</th>
<th>Topic</th>
<th>Details</th>
<th>Reduction in CO₂</th>
</tr>
</thead>
</table>
| Logistics for completed vehicles | Improvements in loading efficiency | (1) Increased loading efficiency through improved carrier vehicles  
(2) Use of high-efficiency roundtrip routes in the Tohoku and Kyushu regions  
(3) Use of ships rather than trailers for some transports from the Kansai region bound for Shikoku and Kyushu | 920 tons/year  
660 tons/year  
110 tons/year |
| Logistics for production parts | Optimal route                             | (1) Increased transport efficiency through improved loading logistics (combination of heavy weight and light weight items)  
(2) Increased loading efficiency through the use of three-axle chassis container trailers for transport of international containers within Japan  
(3) Promoted roundtrip use of containers in international transport (percentage of containers used roundtrip increased from 29% in FY1999 to 36% in FY2000) | 290 tons/year  
25 tons/year  
45 tons/year |
| Logistics for service parts | Modal shifts                               | (1) Use of railways for return of empty containers (reduction of freight runs equivalent to 40 tons/month)  
(2) Reduction in the number of shipments from each center by changing the base where packaging is performed for overseas transport (reduction of 143 freight runs/month) | 200 tons/year  
220 tons/year |

*For CO₂ emissions, CO₂ equivalent values are now used instead of carbon equivalent values
Conversion formula: \((\text{g-CO}_2) = (\text{g-C}) \times 3.67\)

| Truck (standard commercial truck) | 177.3 (48.3) g-CO₂/ton-kilometer |
| Railway (Japan Railways Cargo)   | 21.7 (5.9) g-CO₂/ton-kilometer   |
| Ship (coastal service)           | 35.6 (9.7) g-CO₂/ton-kilometer   |

Note: Figures in parentheses are carbon equivalent values
Source: *The Environment, Transport, and Traffic*, Institution for Transport Policy Studies
In consideration of environmental preservation, Logistics Centers are conducting activities to reduce the amount of electricity consumption, to prevent long vehicle engine idling times and to reduce waste. The results of such activities in FY2000 are shown in the table below.

### Main Results of Activities to Cut Packaging and Wrapping Materials

<table>
<thead>
<tr>
<th>Group</th>
<th>Topic</th>
<th>Details</th>
<th>Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logistics for production parts</td>
<td>Elimination</td>
<td>(1) Elimination of packing containers through mixed loading of Taiwan-bound Dyna engines and mufflers</td>
<td>1.2 tons/year</td>
</tr>
<tr>
<td></td>
<td>Increasing use of returnable materials</td>
<td>(2) Switching from cardboard boxes to lightweight, returnable, foldable plastic boxes for shipments to Europe and Taiwan</td>
<td>23 tons/year</td>
</tr>
<tr>
<td></td>
<td>Streamlining</td>
<td>(3) Expansion of use of lidless shipping boxes to external subcontractors</td>
<td>3 tons/year</td>
</tr>
<tr>
<td>Logistics for service parts</td>
<td>Changing materials</td>
<td>(1) Switch from one-way cardboard and wooden boxes to steel returnable boxes for shipment of medium and small parts within Japan and to North America</td>
<td>610 tons/year</td>
</tr>
<tr>
<td></td>
<td>Changing materials</td>
<td>(2) Switch from returnable cardboard boxes to returnable plastic boxes for packaging of rebuilt automatic transmissions to greatly increase the number of times each box can be used</td>
<td>140 tons/year</td>
</tr>
</tbody>
</table>

### Major Activities at Bases

<table>
<thead>
<tr>
<th>Details</th>
<th>Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Switch from wrapping used to prevent damage during transport to wrapping cords</td>
<td>3 tons/year</td>
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<tr>
<td>(2) Development of core-less craft tape</td>
<td>1.6 tons/year</td>
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<tr>
<td>(3) No-idling campaigns</td>
<td>Rate of conformity 93%</td>
</tr>
<tr>
<td>(4) Recycling of combustible materials (picking cards, receiving kanban etc.)</td>
<td>42 tons/year</td>
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<tr>
<td>(5) Compost of used tea leaves in center’s gardens</td>
<td>1 ton/year</td>
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<td>(6) Shutting off lights when bases are not operating or when light not needed</td>
<td>83 tons/year (CO₂)</td>
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<tr>
<td>(7) Implementation of a drivers’ contest (see next page)</td>
<td></td>
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For CO₂ emissions, CO₂ equivalent values are now used instead of carbon equivalent values.

CO₂ conversion coefficient: Electricity 0.3817 kg-CO₂/kWh

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Toyota has set a voluntary goal of reducing the volume of packaging and wrapping materials to “15% less than the volume used in 1995 by 2000,” and has been proceeding with the simplification of specifications and use of returnable materials.

As a result of these efforts, packaging and wrapping materials were reduced by 3,500 tons/year in FY2000, exceeding the goal of 2,100 tons/year and achieving a reduction of approximately 20% compared to 1995 levels. The specific amounts and instances of the reduction are indicated in the table below.

In addition, the use of lidless shipping boxes was expanded to external subcontractors (see next page).

Mixed loading of Dyna engines and mufflers
Development of Lightweight Returnable Boxes

Seeking Ways to Reduce Packaging and Wrapping Materials

Until recently, the majority of packaging used for shipment of parts for vehicle assembly in overseas plants was a one-way system of using cardboard boxes and then discarding them after use at the destination site.

The Logistics Group, in an attempt to reduce the use of packaging and wrapping materials as well as CO\textsubscript{2} emissions, has been involved in sporadic efforts to reduce the use of cardboard boxes by increasing the use of returnable plastic cases since 1991. These efforts, however, did not reach the level of expanded implementation due to issues of meeting requirements for efficiency in capacity of packaging form, and weight, and cost.

During this time, Toyota Motor Manufacturing France (TMMF), which began operations in January 2001, was striving to achieve zero landfill waste generation under its concept “Green, Clean, and Lean Factory 21,” and was in need of effective logistics ideas. What TMMF wanted was to develop a new lightweight, low-cost, returnable box equivalent to cardboard boxes. The specifications required for the returnable box were as follows:

1. must meet knockdown size specification
2. must weigh less than half that of existing plastic boxes (collapsible containers)
3. can carry the same load as a cardboard box
4. can be folded to smaller size for return
5. must withstand 16 or more roundtrip shipments (four times a year over four years)

Debut of the F-Box, Trial in Taiwan and Europe

After several types of trial products, the Logistics Group finally developed a returnable box that met all the required specifications. The box was called the ‘F-Box’ and trial use began starting January 2000 at TMUK (U.K.) and Kuozui Motors, Ltd. (Taiwan). After six months of trial use, evaluation and analysis confirmed its effectiveness, shipments to TMMF began in December 2000.

With the adoption of the F-Box, Toyota made further advances in changing and improving the conventional packaging specifications. As of April 2001, the cardboard box reduction rate (use of returnable containers) increased from 30% to 80% for France-bound parts packaging, and also promoted unification of materials used for packaging materials to make for easier recycling. TMMF is currently successfully maintaining zero landfill waste.

In the future, Toyota plans to increase the variety of F-Boxes and to expand the areas in which they can be used.

Logistics Initiatives (2)

Driving Trailers Too at Low Fuel Consumption

Logistics Drivers’ Contest

In logistics for completed vehicles, in order to promote the improvement of driving skills of drivers of carrier vehicles, Toyota began a Drivers’ Contest in FY1999 in which drivers selected from five blocks nationwide compete in terms of accumulated points scored in a written and practical skills contest.

The contest tests safety, loading, and unloading skills and also includes a practical test on environmental awareness with items such as “saving fuel” and “no-idling” checks.

The most recent contest, the second to be held so far, was at Kamigo Logistics Center on October 15 and 16, 2000. 28 finalist drivers from the five blocks participated, and the top three drivers received awards.