No.

INTI, Argentina
INT, Brazil
INMETRO, Brazil
ITAL - CETEA, Brazil
INTN, Paraguay
LATU, Uruguay

Study on Improvement of Packaging Technology for Merchandise Distribution in MERCOSUR (Argentina, Brazil, Paraguay, Uruguay)

FINAL REPORT (SUMMARY)

March, 2007

JAPAN INTERNATIONAL COOPERATION AGENCY

UNICO INTERNATIONAL CORPORATION

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ABBREVIATIONS

Abbreviation	Description
AD Converter	Analog-digital converter
AMN	Asociación Mercosur de Normalización
AMS	Mercosur Standardization Association
ANTT	Inland Transportation National Agency (Brazil)
AR	Argentina
BR	Brazil
C/P	Counterpart
CAN	Andean Community
CARICOM	Caribbean Community and Common Market
CEPAL	Latin America Economic Committee
CETEA	Packaging Technology Center (of ITAL) (Sao Paulo, Brasil)
CSM	Packaging Sector Committee
DER SMART	Commercial brand of sensors of Yoshida Seiki Corp. (Japon)
DINATRAN	Inland Transportation National Office (Paraguay)
DNV	Road Transportation National Office (Argentina)
DUMMY	"dummy" load
EPS	Expanded polystyrene
G	Gravity Acceleration
GMT	Greenwitch Mean Time
GNP	Gross National Product
GPS	Global Positioning System
Grms	Gravity-root means square (Vibrational Energy Unit (root means square over a frequency range))
IBGE	Geograpy and Statistic Institute of Brazil
IDB	Interamerican Development Bank
IMF	International Monetary Fund
INDEC	Instituo Nacional de Estadistica y Censos
INMETRO	National Institute of Metrology and Standarization and Industrial Quality (Brazil)
INT	Technology National Institute (Brazil)
INTI	Industrial Technology National Institute (Argentina)
INTN	Technology and Standarization National Institute (Paraguay)
JBIC	Japan Bank for International Cooperation
JETRO	Japan External Trade Organization
JICA	Japan International Cooperation Agency
LATU	Technology Laboratory of Uruguay (Uruguay)
MATCH	Term used for indicating "matching" with GPS system
NAFTA	North American Free Trade Agreement
PE	Poly ethylene
PSD	Power Spectrum Density (energy parameter for vibration tests)
PY	Paraguay
PyMEs	Small and Medium size enterprises
RN XX	Code of National Route
RP XX	Code of Provincial Route
SAVER	Commercial brand of sensors of Lansmont (USA)
SECEX	Brazilian Foreign Trade Secretariat
TEU	Twenty Feet Equivalent Unit
TG	Technical Guidance
USD	US dollars
UY	Uruguay
WS	Workshop
WTO	World Trade Organization

Table of Contents

Chapter 1 Purpose and Background of the Study

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1.1 Overall Goal

Overall Goal

The appropriate packaging for physical-distribution of merchandise in the MERCOSUR area will become widespread.

Purpose of the Study

To formulate the "Reference Guide for Packaging Tests, for Evaluation (preliminary)" for the design of suitable packaging for the transportation, considering as "target" the main export-goods in the MERCOSUR Countries (dairy products among food products, and white electric appliances).

1.2 Scope of the Study

- Selection of the product areas, transportation routes and cooperating companies for the Study
- Implementation of transportation environment surveys
- Development of a common database for MERCOSUR
- Detection of the causes of damages on the products
- Recommendation of measures to decrease the damage ratio
- Proposal of "Reference Guide for Packaging Tests, for Evaluation" for MERCOSUR
- Implementation of the Model Project (Trial tests)
- Technology transfer through the above mentioned items

1.3 Significance of Regional Cooperation

This Study aims basically the promotion of export-import of the manufactured products within the Mercosur economic block, through the improvement of competitivity, based on the technology strengthening related to packaging of those products for land transportation among the MERCOSUR four member countries, which has been created as common market block (in this time, the targeted area for the Study is Argentina, Brasil, Paraguay and Uruguay). For this purpose, the establishment and issue of the "Reference Guideline for Packaging Tests, for Evaluation (preliminary) " has been fixed as objective of the Study.

On this way, through the development of few basic studies under limited resources and time on this large region, and simultaneously, carriying out training courses for Counterparts' institutes personnel, a high expenctancy is arisen aiming technology strenghtening and diffusion of technologies on related fields, consolidating the future sustainability.

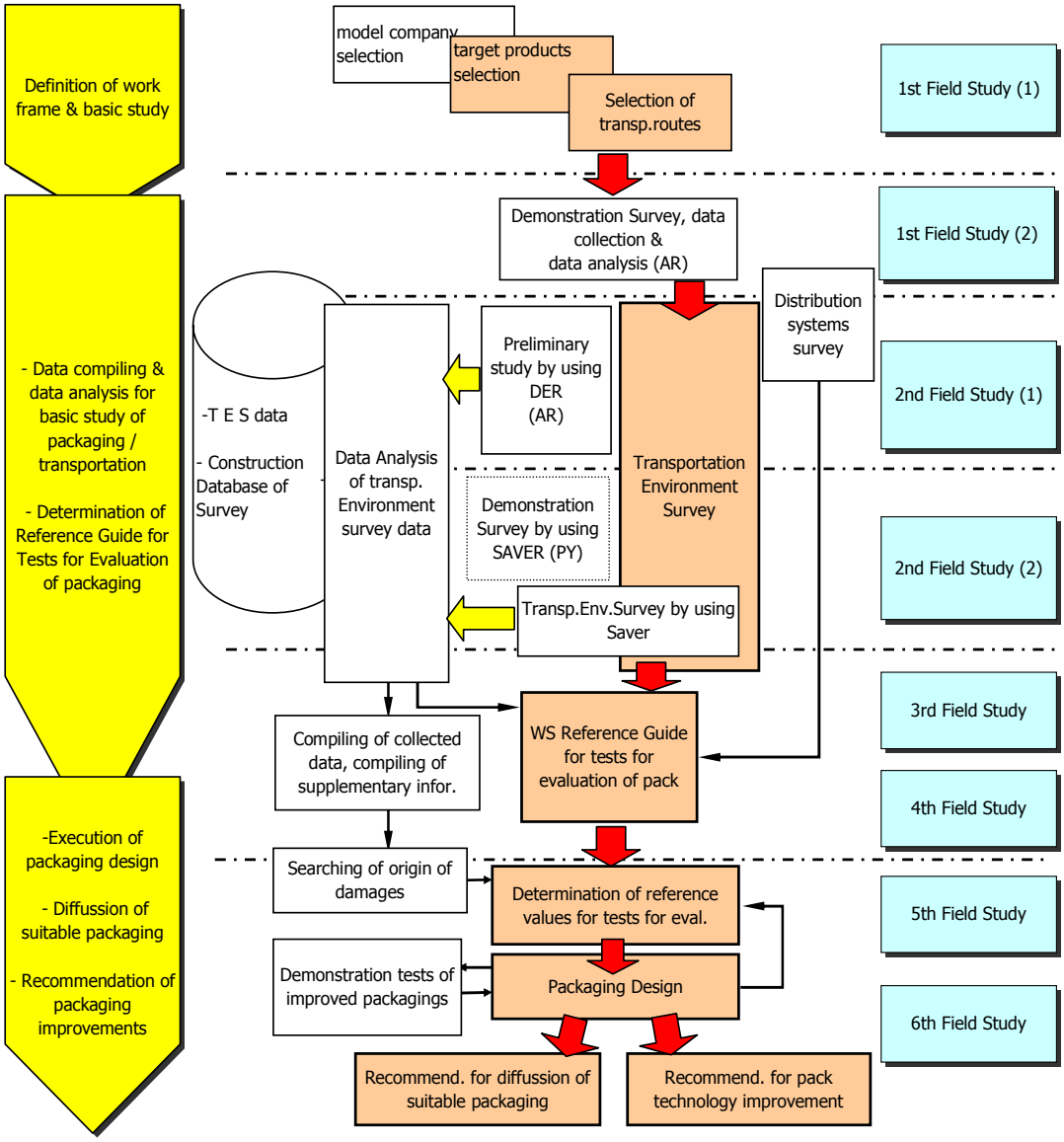
Taking into account that this Study is a pioneer project due to technology application to regional level, the following aspects can be pointed out:

(1) The coordination and harmonization of the four member countries of the MERCOSUR
(2) The technology capacity building of the Counterparts institutes of the four member countries of the MERCOSUR, strenghtening the capabilities related to packaging technologies
(3) The awareness of public and private sector centered into one common point, looking for the future development
(4) The monitoring of all the process of the Study, at each stage
(5) The measures aiming the establishment of a common database, applicable for the four member countries of the MERCOSUR
(6) The technology strenghtening through the mutual cooperation among the Counterparts institutes, and their leadership towards the private sector
(7) To give support for the efforts aiming to enshrine into regulation of a MERCOSUR Standard

1.4 Summary of the Study Process

The Study process was planned by stages, aiming different objectives (see diagram below). The content of each stage is indicated so that the overview can be seen from top to bottom.

Regarding to the general schedule of the Study, each field study has been developed according to the timing indicated in the diagram.

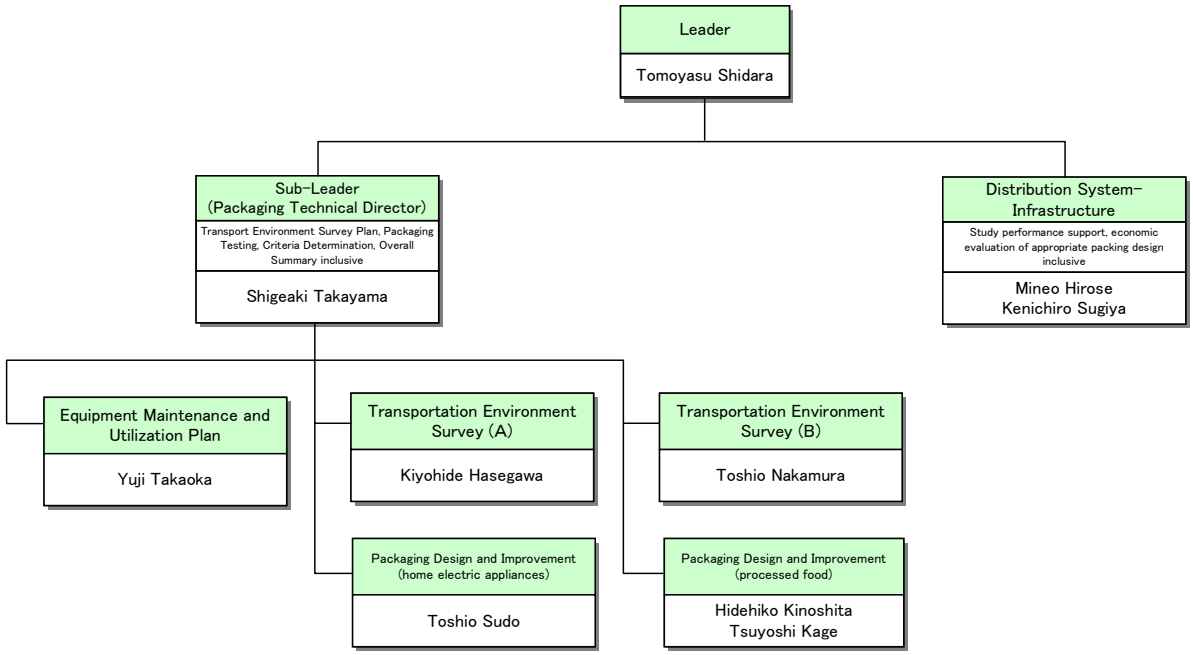


Source: JICA Study Team

Fig. 1-1 Process Diagram of the Study

1.5 Project Implementation Structure

The JICA Study Team began studying for the project based on the following organization chart and the table of work contents of each member.



Source: JICA Study Team

Fig. 1-2 Project Implementation Structure of the Study Team (Plan)

Table 1-1 Description of Assignment by Team Member

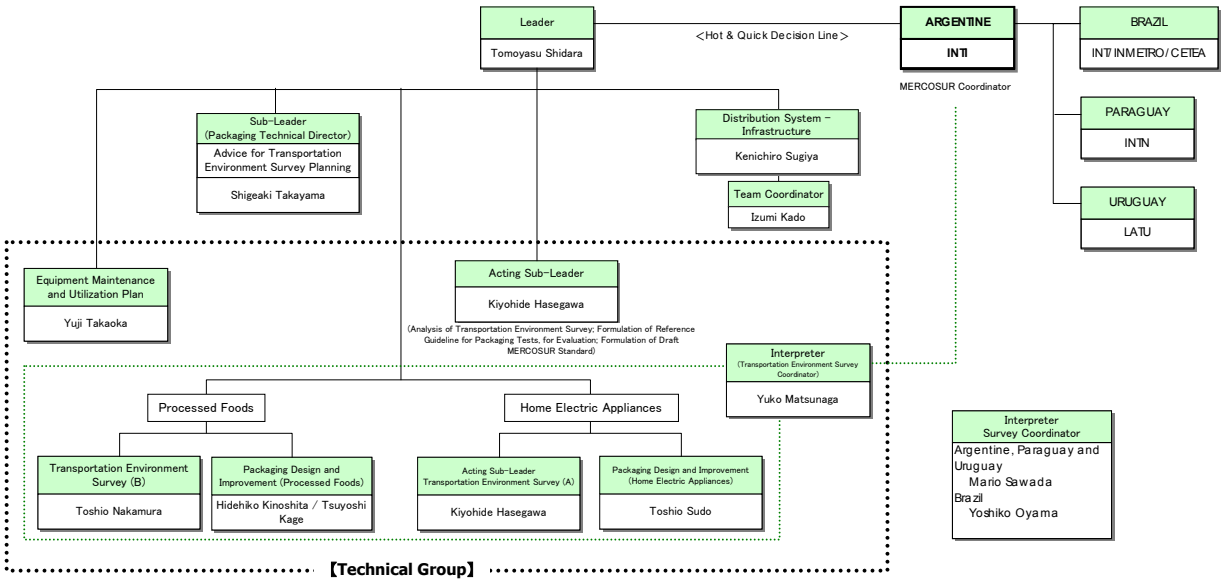
	Name	Assignment	Main Assigned Tasks
1	Tomoyasu Shidara	Leader	1) General management of the Study 2) Coordination with counterparts, government, and concerned organizations 3) Coordination of target products and transportation routes 4) General management on policy recommendation for appropriate transportation packaging popularization 5) Coordination of "Transportation Environment Survey" by the Study Team initiative 6) Coordination and support on specific items (varied models, demonstration training, etc.) of "Transportation Environment Survey" 7) Coordination of a model project at final stage (corresponding to long-distance export)
2	Mineo Hirose / Kenichiro Sugiya	Distribution System / Infrastructure	1) General management of the Study 2) Coordination with counterparts, government, and concerned organizations 3) Coordination of target products and transportation routes 4) General management on policy recommendation for appropriate transportation packaging popularization 5) Coordination of "Transportation Environment Survey" by the Study Team initiative 6) Coordination and support on specific items (varied models,

	Name	Assignment	Main Assigned Tasks
			demonstration training, etc.) of “Transportation Environment Survey”
3	Shigeaki Takayama	Sub-Leader / Packaging Technical Director / Packaging Testing, Criteria Determination	1) Survey on storage, packaging, handling by cooperating companies (home electric appliances) 2) Instruction and support for the Transportation Environment Study 3) Instruction and support for data analysis of transportation environment 4) Data compilation and policy formulation guidance for “Reference Guideline for Packaging Tests, for Evaluation (Draft)”
4	Kiyohide Hasegawa	Transportation Environment Survey (A)	1) Survey on storage, packaging, handling by cooperating companies (home electric appliances) 2) Guidance for transportation environment survey 3) Guidance for data analysis of transportation environment 4) Data compilation and policy formulation guidance for “Reference Guideline for Packaging Tests, for Evaluation (Draft)” 5) Planning and implementation of for “Transportation Environment Survey” by the Study Team (home electric appliances) 6) Operation of varied models, analysis and demonstration training (Paraguay)
5	Toshio Nakamura	Transportation Environment Survey (B)	1) Survey on storage, packaging, handling by cooperating companies (processed foods) 2) Survey on transportation material supply situation of processed foods 3) Guidance for transportation environment survey 4) Guidance for data analysis of transportation environment 5) Data compilation and policy formulation guidance for “Reference Guideline for Packaging Tests, for Evaluation (Draft)” 6) Guidance for transportation packaging design of processed foods 7) Implementation of demonstration test utilizing limited equipment in Argentina 8) Planning and implementation of “Transportation Environment Survey” by the Study Team (processed foods) 9) Operation of varied models and demonstration training (Paraguay) 10) Guidance for dummy designing and production of varied equipment correspondence
6	Toshio Sudo	Packaging Design and Improvement (home electric appliances)	1) Survey on transportation material supply situation of home electric appliances 2) Guidance and support for transportation packaging design of home electric appliances including implementation of laboratory and actual shipment tests 3) Recommendations for transportation packaging improvement of home electric appliances 4) “Transportation Environment Survey” by the Study Team 5) Operation of varied models, data gathering and analysis
7	Hidehiko Kinoshita	Packaging Design and Improvement	1) Guidance and support for transportation packaging design of processed foods including protection of product deterioration

	Name	Assignment	Main Assigned Tasks
	/ Tsuyoshi Kage	(Processed foods)	2) Recommendations for transportation packaging improvement of processed foods including protection of product deterioration 3) "Transportation Environment Survey" by the Study Team 4) Operation of varied models and data gathering
8	Yuji Takaoka	Equipment Maintenance / Utilization Plan	1) Survey on existing equipment of transportation packaging evaluation test in four countries 2) Detailed planning for the measurement equipment of transportation environment and the equipment of packaging evaluation testing 3) Detailed description for equipment and materials for surveys

Source: JICA Study Team

Since two different types of measurement equipment utilizing for transportation environment survey were prepared, it was necessary to hold the technical training courses on theory, operation and technique as the joint technical training session of four countries in Asuncion, Paraguay in August 2005. After the Transportation Environment Surveys were subsequently implemented by the Study Team initiative in each four countries, it was expected that there would be differences in many ways among those countries. As a result, the structure and function of the Study Team had reorganized with emphasis on efficiency development, schedule control and cost control by reviewing members' ability and mobility since the beginning of the year 2006 in order to revise the issue mentioned above. Following figure is the reorganized structure and it has been effective since the progress report meeting and workshop held in Brazil in March, 2006.



Source: JICA Study Team

Fig. 1-3 Project Implementation Structure of the Study Team (Actual)

As for the organization and function of counterpart, the Container and Packaging Center of INTI (Industrial Technology National Institute) of Argentina undertook a role of coordinator for the counterparts of 4 MERCOSUR countries for the JICA Study.

Three counterpart organizations are in Brazil. The INT of Rio de Janeiro is under the Ministry of Science and Technology for international cooperation function of whole technical aspect. The INMETRO of Rio de Janeiro established the research center under the Ministry of Development, Industry and Trade in Rio de Janeiro. The Study Team mainly performed their activities at the Packaging Technology Center (CETEA) of the Food Technology Institute (ITAL). The institute in Campinas has testing equipment of packaging technology and implements tests and development of packaging technology outsourced by private companies and promotion activities.

The counterpart of Paraguay is INTI (National Institute of Technology and Standards) as a function of general institute of technology, and concentrates on technological enhancement, facility expansion and human resource development of the packaging Technology Section. This is the only one counterpart institute as a full-fledged member of the MERCOSUR Standardization Association (Headquarter in Sao Paulo, Brazil).

The counterpart of Uruguay is LATU (Technological Laboratory of Uruguay; strong independency) which is originally established as an institute for development of forest products industry. The Packaging Section was established as an organization directly controlled by the Director-General especially for the JICA Study and put their effort into technology and human resource development. This Packaging Section took the initiative from the stage of the Transportation Environment Survey, and the Plastic Section of the packaging material research division jointed for technology acquisition on the stage of package designing and trial production.

Chapter 2 Target Products of the Study

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2.1 Foreign Trade Trends

Introduction

Looking all the main parameters related to the MERCOSUR 4 Member Countries for 2005, they can be summarized as shown in Table 2-1. The GDP variation for the whole region in 2005 exceeded that of across Latin America, that increased by 4.3%.

Table 2-1 MERCOSUR General Summary（2005）

Country	Population. (mill.inhab)	Area (km^2)	GDP (mill. US$)	GDP per capita (US$)	Exports (mill. US$)	Exports/ GDP (%)	Imports (mill. US$)
Argentina	38.23	2,791,810	183,394	4,802	39,898	21.8	28,698
Brazil	181.59	8,514,877	795,924	4,316	118,308	14.9	73,500
Paraguay	5.90	406,752	7,670	1,301	1,688	22.0	3,251
Uruguay	3.24	176,215	16,800	5,200	3,400	20.2	3,900
Total	228.96	11,889,654					

Sources: ECLAC, Search, Central Bank, World Bank, JETRO, etc.

Table 2-2 Variations of MERCOSUR Extra-zone Exports (1990-2004)

(unit: %)

Country	MERCOSUR		CAN		CARICOM		NAFTA		Others	
	'90	'04	'90	'04	'90	'04	'90	'04	'90	'04
Argentina	14.8	18.1	4.1	4.9	0.3	0.7	17.0	14.6	63.8	61.7
Brazil	4.2	9.2	2.8	4.3	0.4	0.9	27.9	26.4	64.7	59.2
Paraguay	39.6	59.1	1.6	3.9	0.1	0.2	4.5	4.2	54.2	32.6
Uruguay	35.1	26.2	1.5	2.6	0.1	0.2	12.2	19.7	51.1	51.3
MERCOSUR	8.9	12.3	3.1	4.4	0.3	0.8	23.9	23.0	63.8	59.5

Source: JETRO, ECLAC, Institute for International Economic Studies

2.1.1 Production and Trade Trend of Dairy Products in Argentina

According to the information from Argentine Secretariat of Agriculture, Livestock, Fisheries and Food (*Secretaría de Agricultura, Ganaderia Pesca y Alimentos*: SAGPYA), the production of milk and dairy products for the period from 2001 to 2005 is as shown in the Table 2-3.

Analyzing the evolution throughout these years, it can be seen that the production of fresh milk increased i.e. from 1,499,806 KL in 2004 to 1,584,735 KL in 2005, resulting a 5.7% increase.

Exports for the same period increased from 7,657 KL in 2004 to 13,201 KL in 2005, i.e. a significant 73.4% growth. Conversely, imports decreased by 80.2%, from 5,293 KL in 2004 to 1,049 KL in 2005.

Besides, the aggregate production of dairy products (powdered milk, cheese, yogurt, butter, milk jam <*dulce de leche*>) decreased by 7.9%, from 1,180,566 tons in 2004 to 1,086,821 tons in 2005.

As regards exports, there was a significant 152.6% increase, from 109,203 tons in 2004 to 275,797 tons in 2005.

Likewise, imports increased from 8,450 tons in 2004 to 15,199 tons in 2005, i.e. by 81.1%. The volume of exports of dairy products in Argentina during the period from 1992 to 1999 increased 5.4 times. However, this was mainly due to the impact of reduction in customs duties upon the creation of the MERCOSUR. Besides, historically, a big portion of the exports of dairy products (50%) go to Brazil; and although this has not changed, since 2002 there have been fluctuations due to the devaluation of the currency of both countries.

Table 2-3 Production and Trade of Dairy Products in Argentina

	Year		2001	2002	2003	2004	2005
1	Fluid Milk *						
2	Manufacturing	KL	1,614,899	1,436,231	1,386,253	1,503,839	1,598,559
3	Stock (1)	KL	-6,223	-6,850	-135	1,667	1,672
4	Net Production (2)	KL	1,622,782	1,432,564	1,418,189	1,499,806	1,584,735
5							
6	Export	KL	6,534	10,696	1,948	7,658	13,201
7	Import	KL	8,194	179	33,748	5,293	1,049
8							
9	Dairy Products						
10	Manufacturing	tn	1,175,607	1,071,464	1,042,940	1,272,546	1,361,709
11	Stock (1)	tn	26,729	-48,816	2,761	-8,773	14,289
12	Net Production (2)	tn	1,089,614	1,042,644	973,164	1,180,566	1,086,821
13							
14	Export	tn	77,516	88,293	77,692	109,203	275,797
15	Import	tn	18,252	10,657	10,677	8,450	15,199
16							
17	(Powdered Milk)						

	Year		2001	2002	2003	2004	2005
18	Manufacturing	tn	244,362	238,136	228,891	295,366	286,431
19	Stock (1)	tn	23,211	-33,903	4,619	-8,119	6,252
20	Net Production (2)	tn	117,236	110,591	108,305	106,370	102,917
21							
22	Export	tn	104,507	161,740	119,389	199,238	181,829
23	Import	tn	592	292	3,423	2,123	4,567
24							
25	(Cheese)						
26	Manufacturing	tn	430,956	379,677	332,293	378,347	414,412
27	Stock (1)	tn	471	-5,066	-4,585	800	5,080
28	Net Production (2)	tn	419,870	359,929	315,179	344,285	359,720
29							
30	Export	tn	17,536	25,781	23,183	34,822	51,891
31	Import	tn	6,921	966	1,484	1,599	2,280
32							
33	(Yoghurt)						
34	Manufacturing	tn	264,923	246,051	271,463	357,140	405,241
35	Stock (1)	tn	-642	-199	805	-51	472
36	Net Production (2)	tn	268,500	251,021	271,655	357,323	402,747
37							
38	Export	tn	710	881	675	1,310	3,353
39	Import	tn	3,645	5,652	1,672	1,422	1,331

(1): Stock = (Final Stock – Initial Stock)
(2): Net Production = (Manufacturing + Import – Export – Stock)
*: Fluid Milk = Includes all the manufactured milk as liquid.
**: Dairy products= includes powdered milk, cheese, butter, cream, *dulce de leche*, caseine etc
Source: *Secretaria de Agricultura, Ganaderia, Pesca y Alimentos* - SAGPYA (AR)

Argentina imports dairy products from MERCOSUR countries, mainly from Uruguay, including fresh milk (30%), cheese (13%), casein (11%) and fermented products other than yoghurt (12%).

2.1.2 Production Trend of Refrigerators, Freezers, and Air Conditioners for Household Use in Argentina

The following table shows the production trend (per unit) of refrigerators, freezers, and air conditioners from 2000 to 2005 based on reports issued by the Argentine INDEC.

Table 2-4 Production of Household Appliances in Argentina

(Unit. appliance)

Product	2000	2001	2002	2003	2004	2005
Household refrigerators	325,416	247,634	167,912	149,286	241,178	163,532*1
Household freezers	80,034	63,736	29,319	50,515	80,180	51,441*1
Household air conditioners	112,336	190,930	4,159	39,227	173,527	45,704*2

*1 : 2006 = from January to July
*2 : 2006= from January to June
Source: Prepared by the JICA Study Team based on data from INDEC (AR)

Comparing the figures corresponding to the first semester of 2005 against those for the same period of 2004, significant increases can be seen, including 80.2% in refrigerators, 62.8% in freezers and 423.3% in air conditioners.

2.1.3 Production Trend of Household Appliances in Brazil

Sales of household appliances in Brazil in 2005 amounted to 40 million units, 12.8% higher than in the previous year. Of this figure, 9.8 million units correspond to TVs.

However, if the sales corresponding to 2004 are considered equal to 100 for each kind of appliance, in 2005, white appliances would represent 98.39, i.e. -1.61% reductions as compared to the previous year. In 2005, the aggregate sales of household appliances increased by 12.8%, measured in units, due to the market shift to TVs and DVD players.

The Brazilian market value corresponding to electro-electronic appliances is around US$ 38,000 million (5% of the GDP). It has increased by 40% in the last five years and there is a growing trend in production.

As regards imports, electro-electronic products represent 20% of the aggregate amount, which is very high. Besides, a continuous 2 digit growth in exports has been recorded. The volume of exports for 2005 was US$ 7,767 million, 45.3% higher than in the previous year. Of this figure, exports of household appliances, including car radio amounted to US$ 914.4 million, representing a 17.6% increase as compared to the previous year. In addition, imports of electro-electronic products for 2005 amounted to US$ 15,131 million, 19.5% higher than in the previous year, doubling the volume of exports.

Exports of household refrigerators, a target product of Study, amounted to US$ 253.3 million. As compared to 2001, it represents a 250.3% increase.

The status of trade of white appliances (refrigerators, washing machines and vacuum cleaners) imported from Chile (a MERCOSUR associate country) can be analyzed from the point of view of the common market.

Taking into account the data corresponding to 2005, 45,627 refrigerators were imported from Brazil, representing 60.6% of total imports. As regards washing machines, 5,732 units were imported from Brazil (i.e. 2.1% of the aggregate imports), and 2,641 units from Argentina (1% of the aggregate imports).

Besides, in 2005, vacuum cleaners imported from Brazil amounted to 4,845 units, representing. 1.1% of the aggregate imports.

In the case of Chile, a high percentage of products other than refrigerators are imported from Asian countries of the APEC group, in part due to geographic reasons.

2.1.4 Target Products and the Cooperating Companies

During the stage of the issue of Inception Report, the target products and cooperating companies have been selected, looking forward for the Transportation Environment Surveys in the field. The actual transportation studies began based on this information.

Cooperating Companies: Products/Routes (at the beginning of the Study)

Country	Sector/product		Cooperating Company	Country
Argentina	1	Powdered milk	(1) Rafaela－Resistencia－Asunción（800km）	Williner
	2	Olives	(2) Aimogasta－Santiago－Resistencia－	NUCETE
	3	Refrigerators, show cases	Uruguayana－Guarapuaba（BRA）（2,500km）	
			（Demonstration Test： Buenos Aires－Aimogasta）	
			(3)Rosario－San Luis－Mendoza－Santiago	FRIMETAL
			（CHL）（1,500km）	
Brasil	1	Refrigerators	(1) Hortolandia－Sao Paulo－Recife (2800 km)	BSH Group
	2	Refrigerators, etc.	(1)' Joinville－Sao Paulo－Recife (3180 km)	Multibras S.A.
			(2-1) Manaus－Belem (1700 km river)	Multibras S.A.
			(2-2) Belem－Sao Paulo(3000 km)	Multibras S.A.
			(3) Sao Paulo－Uruguayana (1800 km)	Multibras S.A.
Paraguay	1	UHT milk, Pasteurized milk, yogurt, pudding, caramel.	(1) Loma Plata－Asuncion（480km）	Chortitzer
			(2) Loma Plata－Pedro J.Caballero－（BRA）	Chortitzer
			（560km）	
			(3) Asuncion－Ciudad del Este（340km）	Chortitzer
			(4) Asuncion－Encarnacion（400km）	Chortitzer
Uruguay	1	Powdered milk (for export)	(1) Florida－Montevideo（100km）	CONAPROLE
			(2) Montevideo－Chui（400km）	CONAPROLE
			(3) Montevideo－Fray Bentos（300km）	CONAPROLE

Source: JICA Study Team

Throughout the Survey of Transportation Environment in respect of the food products (mainly dairy products), the cooperating companies showed an increasing interest in the technical aspects of outstanding issues related to transportation, secondary packaging, and primary packaging. As a consequence, and focused on the design of packages-packaging for transportation, a process that begins with the Survey of Transportation Environment, followed by data analysis and lab tests, and ending with the implementation of improvements and Route demonstration for the Model Project (final stage of the Study), the results described in the table below were obtained.

In respect of this general overview, some of the scheduled activities were delayed due to certain management changes. In Brazil, for example, despite the main products selected for the Study are household refrigerators, surveys of the transportation of external air conditioners were carried out, etc. However, the household refrigerators are the main product within the selected products for this Study.

Cooperating Companies for the Model Project (at initial stage)

Country	Sector/product	Cooperating Company
Argentina	Refrigerators	FRIMETAL
	Dairy products (yogurt, UHT milk, milk jam)	WILLINER
		Mastellone
	Olive by-products	NUCETE
	Edible Oil	MOLINOS
Brasil	Refrigerators	BSH
	Air Conditioners (external)	Multibras
		Klabin (manufacturer of packaging materials)
Paraguay	Dairy products (yogurt, pouch milk)	Chortitzer
Uruguay	Dairy product (yogurt, pouch milk)	Conaprole

Source: JICA Study Team

Chapter 3 Testing Equipment and Facilities for the Study

Chapter 3 Testing Equipment and Facilities for the Study

3.1 Test Equipment Utilization Plan

The testing equipments to be utilized in the Study are described in the Fig.3-1 attached hereto, including the description of equipments and the definition of their utilization. This document has been issued and explained during the 1st Joint Meeting of 4 Member Countries on March 10th, 2005. On the other hand, for CETEA's equipment case, and as result of the survey, INMETRO confirmed that the software of acceleration measurement (Item 7) is suitable to be used to the vibration test equipment (Item 2) and impact testing equipment (Item 3).

Study on Improvement of Packaging Technology for Merchandise Distribution in MERCOSUR - First Field Survey (2nd Stage)

10 MAR 2005

JICA – Study Team

Utilization Plan for Test Equipment for Packaging

1. Test Equipment available by each member country of MERCOSUR, and utilization plan.

		① Compression Tester	② Vibration Test System	③ Shock Test System	④ Drop Tester	⑤ Electromagnetic Hook	⑥ Slope Tester	⑦ Acceleration Measuring Tester	⑧ Atmospheric Simulation Chamber	⑨ Dynamic Drop Tester for Cushion Materials
A	Argentina									
	UP	The maximum load is 5 t. So, for higher loads tests, it is necessary to use the equipment of Brazil.	The Random signal generator and vibration controller need to be repaired.	It is necessary to repari the cushion piece. - In case that Uruguay or Paraguay request the use of the equipment, it should be allowed.	In case that Uruguay or Paraguay request the use of the equipement, it should be allowed.	In case that Brazil or Paraguay request the use of the equipement, it should be allowed.	In case that Brazil or Paraguay or Uruguay request the use of the equipement, it should be allowed.	In case that Brazil or Paraguay or Uruguay request the use of the equipement, it should be allowed.	It is necessary to prepare a test chamber with capacity for a board box. If not, the small chamber of another dept of INTI,applied for pa-ckaging materials, can be used.	In case that Brazil or Paraguay or Uruguay request the use of the equipement, it should be allowed. (Repair is required)
B	Brasil						Equipment not avail	Equipment not available		Equipment not available
	UP	In case that Argentina or Uruguay or Paraguay request the use of the equipement, it should be allowed.	In case that Argentina or Uruguay or Paraguay request the use of the equipement, it should be allowed.	In case that Uruguay or Paraguay request the use of the equipement, it should be allowed.	In case that Uruguay or Paraguay request the use of the equipement, it should be allowed.	In case of big size samples, which implies difficult handling, request the use of the equipment of Argentina or Uruguay.	In case of necessity to carry out Slope Tests, request the equipment of Argentina.		In case that Argentina or Paraguay request the use of the equipement, it should be allowed.	In case of necessity of cushion materials tests, request the use of the equipment to Argentina.
U	Uruguay			Equipment not availabl			Equipment not avail	Equipment not available		Equipment not available
	UP	The maximum load is 2 t. So, for higher loads tests, it is necessary to use the equipment of Brazil.	For the Random vibration test, to use the equipment of Brazil.	To use the equipment of Argentina or Brazil	In case of big size samples, request the use of equipment of Argentina or Brazil.	In case that Brazil or Paraguay request the use of the equipement, it should be allowed.	In case of necessity to carry out Slope Tests, request the equipment of Argentina.	In case of necessity of acceleration tests, request the borrowing of this equipment to Argentina.	In case that Argentina or Paraguay request the use of the equipement, it should be allowed.	In case of necessity of cushion materials tests, request the use of equipment of Argentina.
P	Paraguay	Equipment not availab	Equipment not availabl	Equipment not availabl	Equipment not availabl	Equipment not available	Equipment not avail	Equipment not available	Equipment not available	Equipment not available
	UP	To use the equipment of Argentina or Brazil or Uruguay, depend on the purpose.	To use the equipment of Brazil.	To use the equipment of Argentina or Brazil.	To use the equipment of Argentina or Brazil.	To use the equipment of Argentina or Brazil.	To use the equipment of Argentina or Uruguay.	In case of necessity of acceleration tests, request the borrowing of this equipment to Argentina.	To use the equipment of Argentina, Brazil, or Paraguay.	In case of necessity of cushion materials tests, request the equipment of Argentina.

Note: UP: Utilization Plan

2. Up todate and future status of the equipment for each country

Argentina
Argentina has the packaging test equipment. However, it is observed a degradation of their functions due to the lack of maintenance. It is desirable to ensure the function of the equipment, through the adequate maintenance and renewal of the controllers and parts. Specially, the vibration test system is very important, so, it is expected the renewal of the Random vibration controller.

Brasil
Several equipment are available and the preventive maintenance are carried out. Therefore, there is no problem for their utilization. Also, Brazil is planning to purchase a tester for packaging cushion materials, so that it is kindly requested to allow the use of this machine by Uruguay and Paraguay after received them. On the other hand, the JICA Study Team took notice that cooperative companies also have some of the above mentioned equipment. Therefore, it is requested to survey those equipment owned by the companies, including the specifications in order to make a good use for an efficient test process.

Uruguay
Uruguay has 5 items of the packaging test equipment mentioned in the above left Table. However, the testers of compression, vibration tester and drop tester have some restrictiones due to a limitation of the capacity of the equipment. Therefore, in case of necessity, it is requested to make a good use of the equipment of another 3 member countries of MERCOSUR.

Paraguay
At the moment, Paraguay has no any test equipment for packaging tests. Therefore, it is necessary to make a good use of the equipment of another 3 member countries of MERCOSUR. On the other hand, it is planned to incorporate equipment such as atmospheric simulation chamber, the compression tester, the drop tester etc through the other JICA Project which will be completed at the end of March 2006. Paraguay is kindly requested to allow the use of these equipment after incorporated.

Fig. 3-1 Test Equipment Utilization Plan for Packaging Tests

Chapter 4 Transportation Environment Surveys

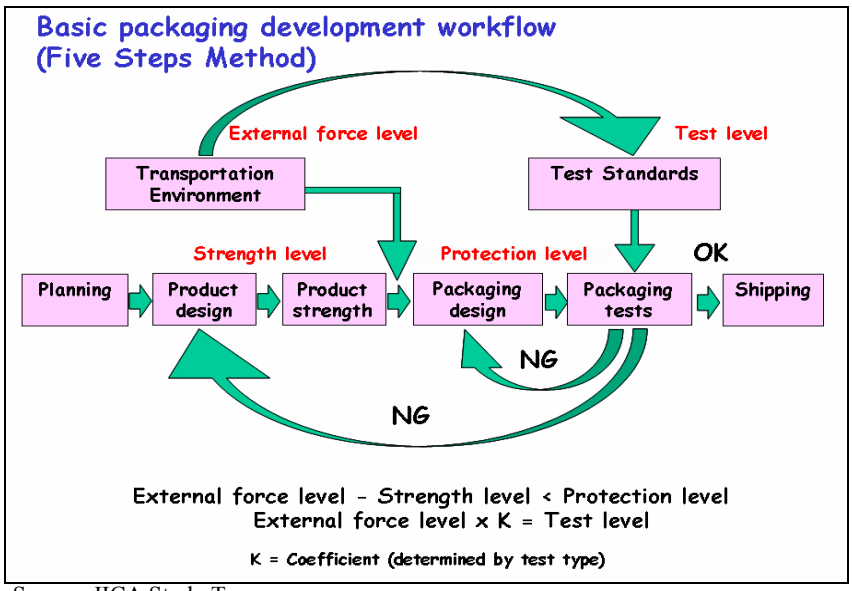
Chapter 4 Transportation Environment Surveys

4.1 Measuring Equipment for the Transportation Environment Survey

4.1.1 Basic Flow of Packaging Design (5 stages)

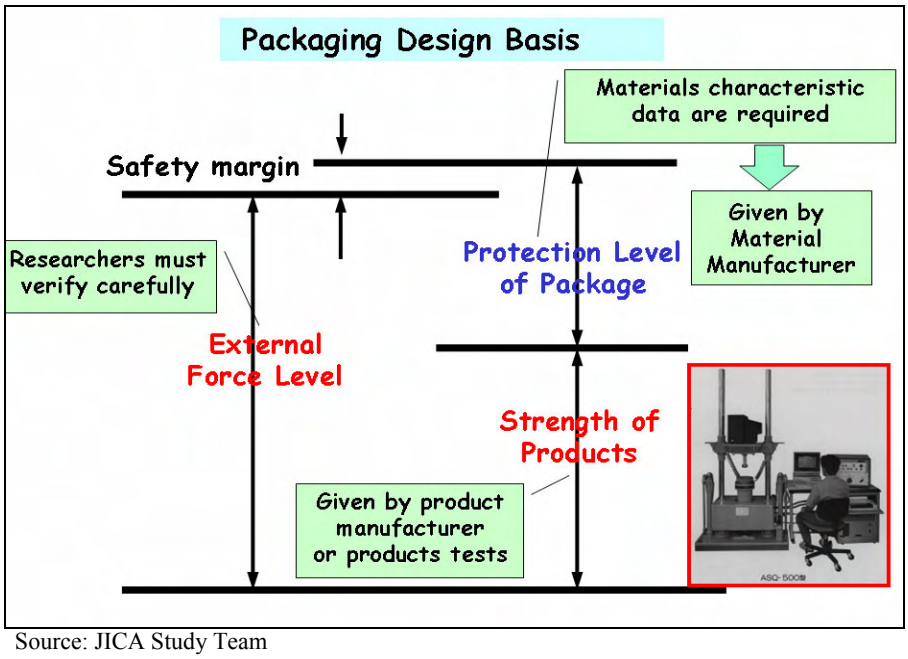
The development of packaging for products, especially for household appliances, can be executed according to the flowchart on Fig. 4-1. First, a theoretical external force applied on the cargo is assumed, within the frame of transportation environment, and then, the value for testing is determined by applying a multiplier factor. Regarding to the definition of this factor, it will depend on some aspects to be considered, such as product characteristics, and the social impact related to the reliability of the product. The packaging designer must design them on such way that the product can fully withstand the specifications of the "Reference Guideline for Packaging Tests, for Evaluation".

The mechanical resistance of the packaged goods, capable to withstand the external loads, are the sum of their own resistance of the product plus the protection resistance provided by the packaging, as shown in Fig. 4-2. This means, if the product resistance is very high for instance, the packaging resistance could be relatively low, for compensation. The process for the packaging development is based on stepwise process. In each step, the adequate resistance of the packaging is to be determined, taking into account the product own resistance. Finally both resistances are summed-up.



Source: JICA Study Team

Fig. 4-1 Packaging Design Development, Basic Flowchart (5 steps)



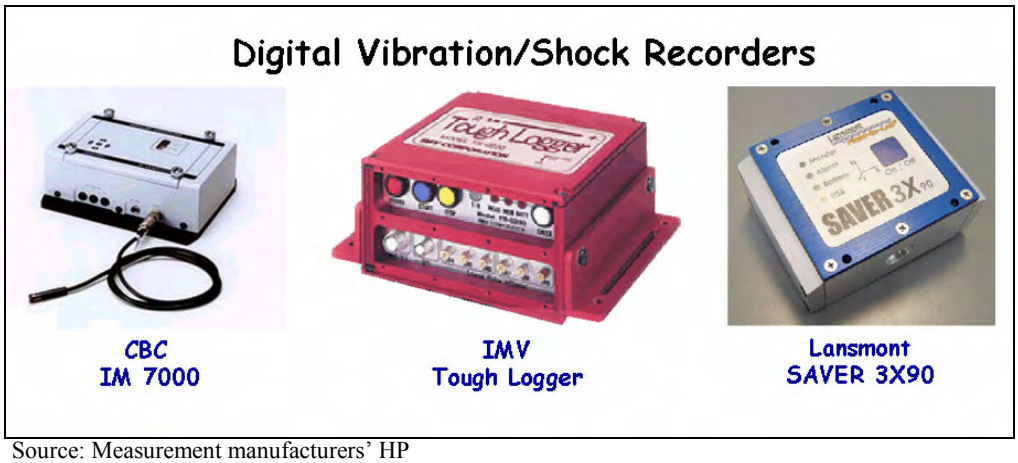
Source: JICA Study Team

Fig. 4-2 Relationship among Packed Cargo Resistance, External Forces and Protection Level

4.1.2 Digital Vibration / Impact Sensors for the Transportation Environment Survey

The manufacturers of the digital vibration / impact sensors for Transportation Environment Surveys are limited to only 6 companies in all over the world, due to their special characteristics. The products of each manufacturer –the most representative one- are shown in the Fig. 4-3 and Table 4-1, including the picture and main specifications.

In the present Study, the DER-SMART sensors of Yoshida Seiki Ltd, and the SAVER3X90 of Lansmont Co, have been utilized for the Transportation Environment surveys.



Source: Measurement manufacturers' HP

Fig. 4-3 Digital Vibration/ Impact Sensors for Transportation Environment Surveys

Table 4-1 Specifications of the Digital Sensors

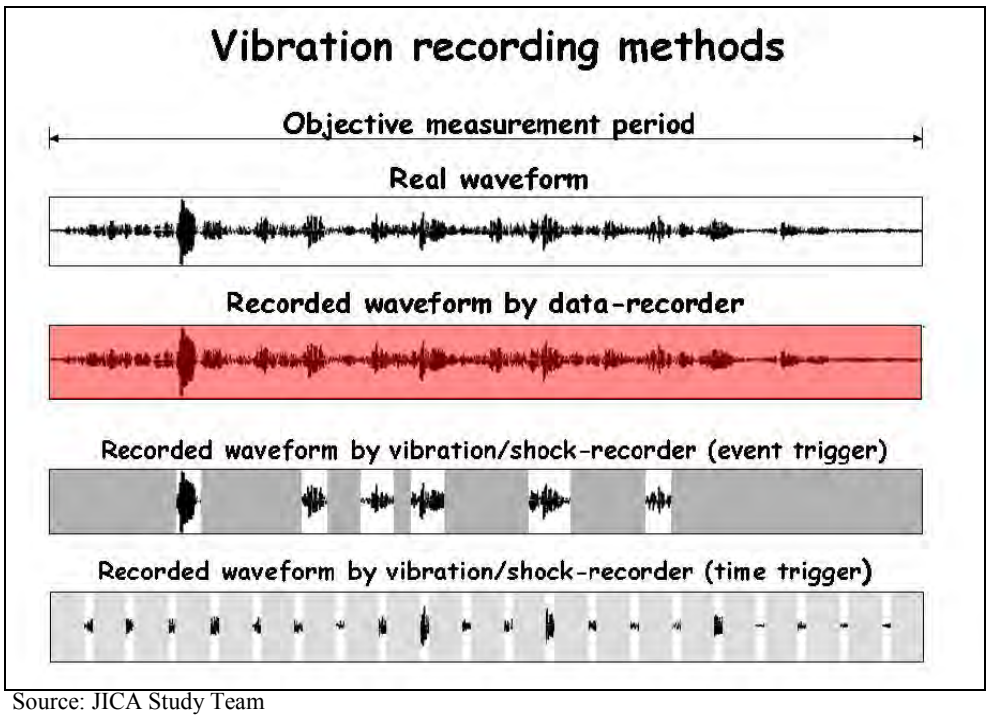
Manufacturer	Yoshida Seiki	Kyowa Dengyo	CBC Materials
Model	DER-SMART	RSD-33A	Serie: IM7000
Range	10; 50; 200G	10;20;50; 100; 200G	40; 80; 120G
Nbr sensores	In or Out－3	In or Out－3	In－3
A-D	12 bit	12 bit	Sin datos
Frame Length	512－4,096	512; 2048	512 - 2048
Sampling period	0.25－10ms	0.25－32ms	1; 2; 5;10ms
Memory size	64MB	Sin datos	2MB
Records Nbr	20000	330	512
Pre-trigger	20－60% long frame	1/8 step long frame	Possible
Cont.operation time	48days	50days	30days
Dimensions (L x W x H mm)	123×112×70	167×134×118	170×122×76
Weight	900g	2700g	2000g

Manufacturer	IMV	IST	Lansmont
Model	TR-0220	EDR-3/4	SAVER3X90
Range	10; 20; 50; 200G	10; 50; 200G	10 to 200G
Nbr sensors	In-3, Out-3	In-3	In-3 or Out-1
A-D	Data NA	10bit	16bit
Frame Length	1280－5120	512	10 to 16384
Sampling period	0.2～4ms	0.3ms	0.2－20ms
Memory size	Equiv 35 min	108MB	128MB
Records Nbr	35 min	3910	35951
Pre-trigger	Data NA	Possible	0 to 100%
Cont.operation time	20 days	30 days	90 days
Dimensions(L x W x H mm)	150×150×80	107×112×56	95×74×43
Weight	2000g	1000g	473 g

Source: Measurement manufacturers' HP

4.1.3 Recording of Vibration Wave

For the analysis of real vibrations on a product, the theoretical method consists of, gathering all the collected vibration waves into one register, and analyze the data as a whole. However, the sensors mentioned above have a limited capacity of memory, so that the recordings over a long period of time are becoming almost impossible. Therefore, some methods are applied, such as the so called "event trigger" method, where vibration waves are registered (i.e. 2 seconds before and after the event) when the acceleration of the sensor surpasses a certain predetermined value; or the other method, "time trigger" method, where data is collected in predetermined cyclical periods of time and at predetermined intervals (See Fig. 4-4).



Source: JICA Study Team

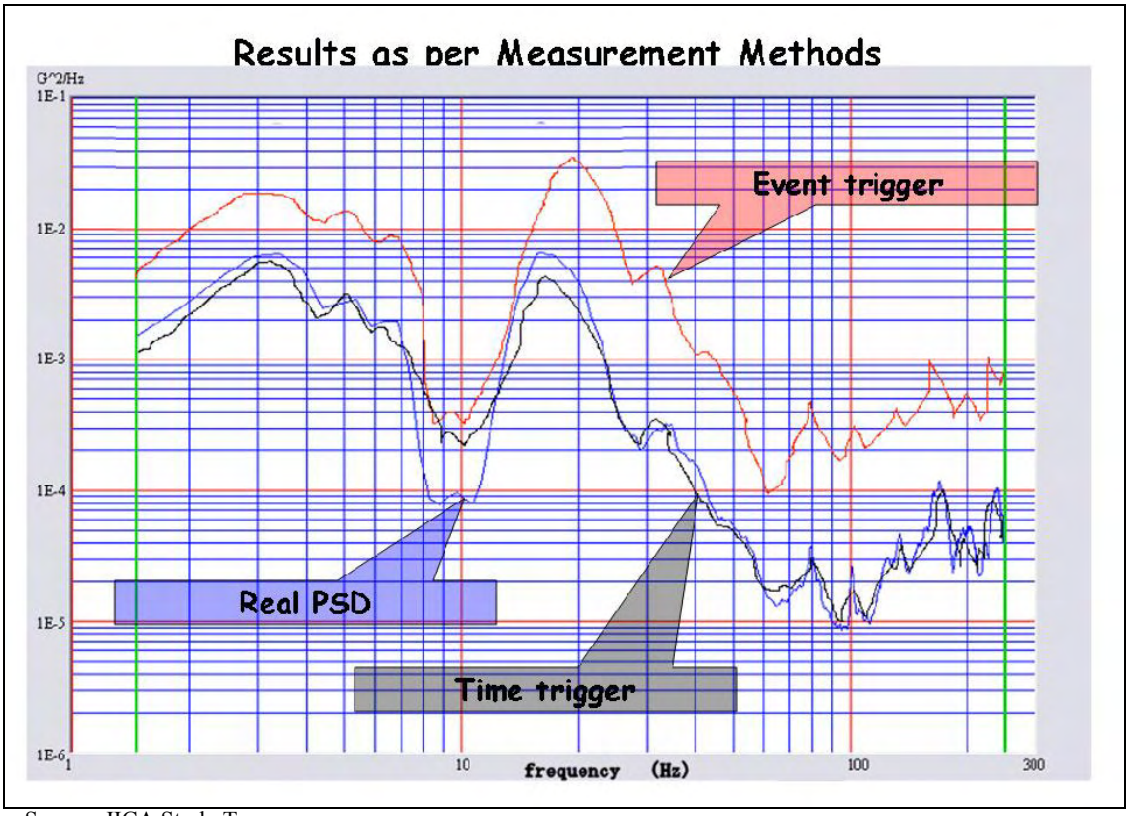
Fig. 4-4 Vibrations Registration Method

The "event trigger" method for registering data takes into account only events with significant oscillations, and therefore the PSD analysis provides a vibration wave curve higher than actuality. On the other hand, the "time trigger" method has a tendency of producing lower values than in reality because of the numerous vibrations that may occur while the device is inactive and go unnoticed in the analysis.

Nevertheless, if enough number of data registries is gathered, providing a large memory unit, the results will tend finally to the actual vibration wave curve indefinitely. But, since the memory units have limited capacity, these errors can not be dismissed.

To obtain such data using the digital registers, normally they are used the "time trigger" method, and then use the data for the PSD analysis. In the case of applying "event trigger" method, it would only provide data surpassing certain vibration waves, resulting in an excessive packaging design, so becoming an uneconomic solution (See Fig. 4-5).

In addition, there are some companies adopting "event trigger" method for gathering data, and later, deliberately shortening the period of testing. Actually, there is no any conclusion about the validity to applying this method compared with the first method of using the 100% of data. Probably this matter is an interesting topic to be considered as a future task.



Source: JICA Study Team

Fig. 4-5 Differences in PSD Curves Depending on Registry Method

4.1.4 Coordination with GPS Equipment

The availability of the GPS (Global Positioning System) allows the use of satellite signals to gather data on the geographic locations and itinerary times of the trucks. Also, the data link option facilitates the calculations on the truck's velocity and the exact location where vibration observations occur.

The sensors used for this current study (DER-SMART y SAVER3X90) are equipped with the necessary elements allowing data matching with the GPS equipment.

4.2 Selection of the Cooperative Companies

During the first year of the Study, on the first stage, the cooperating companies have been pre-selected through the recommendations of the counterpart institutes of each Member Country. Based on this, the JICA Study Team decided to contact again the companies in order to explain the guidelines and details of the Study and to select the routes for surveys related to the products to be analyzed. Also, the details were given about the measuring devices to be used during the Transportation Environment surveys (sensors and Global Positioning System GPS), the dummy cargoes for gathering impacts data and the work schedule as well.

The selected companies on each country are as follows:

Argentina:	Nucete e Hijos (Agro-aceitunera), Herederos de A. Williner SA, Frimetal SA
Brazil:	Multibras SA, BSH (Bosch und Siemens Hausgeräte), Klabin SA
Paraguay:	Cooperativa Chortitzer Komittee
Uruguay:	CONAPROLE (Cooperativa Nacional de Productores de Leche)

4.3 Selection of the Distribution Routes for the Study

A series of meetings have been held between the JICA Study Team and the cooperating companies of the 4 countries, in order to discuss the details of the routes for surveys of the Study, and the work schedule as well.

For the first field surveys, it was defined the organization to be leaded by the JICA Study Team and with the participation of the members of the counterpart. The working groups have been divided to one per each country.

The target products for the surveys, classified by countries, were as follows:

Argentina:	Olive products, dairy products, refrigerators, edible oil
Brazil:	Refrigerators, air conditioning equipment (outdoor type)
Paraguay:	Dairy products
Uruguay:	Dairy products

The routes studied during the Transportation Environment Surveys are indicated in the following map and summary table (See Fig. 4-6 and Table 4-2).

Source: JICA Study Team

Fig. 4-6 Map of Selected Routes and Surveyed during the Study

Table 4-2 Transportation Environment Surveys, Routes and Itinerary

County	Original Plan				Actual Plan				
	Route	Target Product	Distance One way	Company	Route	Target Product	Distance	Company	Date
Argentina	Bs.As. - Aimogasuta	Processed Olive	1,200km	NUCETE	Bs.As. - Aimogasta	Processed Olive	2,500km (Round trip)	NUCETE	2/9 - 2/12 '05
	Rafaela - Asunción	Powdered Milk	800km	Willner	Rafaela - Asunción	Powdered Milk	1,600km (Round trip)	Willner	7/3 - 7/7 '05
	Aimogasta - Curitiba	Olive Product	2,500km	NUCETE	Aimogasta - Curitiba	Olive Product	2,500km	NUCETE	7/19 - 7/23 '05
	Rafaela - Neuquen	Dairy Product	1,300km	Willner	Rafaela - Neuquen	Dairy Product	1,800km	Willner	7/8 - 7/12 '05
					Neuquen- Santa Rosa	Only measurement	500km	Williner	7/11 '05
	Neuquen - Bariloche	Dummy Cargo Handling Survey		Willner	Neuquen - Bariloche	Dummy Cargo Handling Survey		Willner	Dummy was improved for impact test after 3 months past
					Aimogasta- Iguazú	Olive Product	1,600km	NUCETE	11/20-21 '05
	Rosario - Mendoza - Santiago	Refrigerator, Showcase	1,500km	FRIMETAL	Cancelled because of Chile boarder closing due to heavy snow ('05)				
	Uruguaiana - Medoza - Los Andes	Refrigerator	1,700km	Multibras	Uruguaiana - Mendoza - Los Andes	Refrigerator	1,700km	Multibras	10/11-20 '05
	Rosario - Mendoza - Santiago	Refrigerator, Showcase	1,500km	FRIMETAL	Cancelled because of Chile boarder closing due to heavy snow ('06)				
	Bs.As. - Mendoza	Vegetable Oil	1,000km	MOLINOS	Bs.As. - Mendoza	Vegetable Oil	1,000km	MOLINOS	5/26 '06
	Bs.As. - Rosario	Refrigerator	300km	FRIMETAL	Bs.As. - Rosario	Refrigerator	300km	FRIMETAL	Several times including model projects in 2006
Brazil	São Paulo - Recife	Refrigerator	3,000km	Multibras	Joinville - Salvador	Refrigerator	2,500km	Multibras	9/8 - 9/12 '05
	Sã Paulo - Recife	Refrigerator	3,000km	BSH	Campinas - Recife	Refrigerator	2,650km	BSH	10/21 - 26 '05
	Manaus - Belem - São Paulo	Refrigerator, Other Home Appliances	4,700km	Multibras	Manaus - Belem - São Paulo	Air Conditioner	4,700km	Multibras	9/14 - 9/23
	São Paulo - Uruguaiana - BsAs	Refrigerator	2,500km	Multibras	Joinville - Uruguaiana - Santiago	Refrigerator	2,700km	Multibras	10/11 - 20 '05
Paraguay	Loma Plata - P.J. Caballero	Dairy Product	800km	Choritizer	Asunción - PJ Caballero - Campo Grande	Dairy Product	1,000km	Chortizer	12-'06
	Asunción - Cd. del Este	Dairy Product	340km	Choritizer	Loma Plata - Asunción - Cd. del Este	Dairy Product	860km	Choritizer	9/27 - 28 '05
	Asunción - Encarnación	Dairy Product	400km	Choritizer	Loma Plata - Asunción Encarnación	Dairy Product	900km	Choritizer	10/4 - 10/5
					Gran Asunción Delivery	Dairy Product		Choritizer	9/30 '05
					Asunción City Delivery	Dairy Product		Choritizer	10/14 '05

County	Original Plan				Actual Plan				
	Route	Target Product	Distance One way	Company	Route	Target Product	Distance	Company	Date
Uruguay	Florida - Montevideo	Butter, Powered Milk	100km	Conaprole	Rivera - Florida - Montevideo	Long Life Milk	4,800km	Conaprole	9/8 - 9 '05
	Montevideo - Chuy	Butter, Powered Milk	250km	Conaprole	Montevideo - Rocha	Long Life Milk	200km	Conaprole	Several times in LATU
	Montevideo - Fray Bentos	Butter, Powered Milk	300km	Conaprole	Montevideo - Fray Bentos	Long Life Milk, Yoghurt, Cheese	400km	Conaprole	9/5 '05

Source: JICA Study Team

Note): In Paraguay, the transportation environment surveys were implemented by INTN and Chortitzer during the absence of the Study Team.

1. Loma Plata – Asunción; 550km (one-way)×6 times=3,300km
2. Loma Plata – Encarnación; 1,100km (one-way)×1 time
3. Asunción - Campo Grande (BRA); 1,000km(one-way)×1 time
4. Loma - Plata Ciudad del Este; 800km(one-way)×1 time

4.4 Data Collection on the Transportation Environment Surveys

The Transportation Environment Surveys have been carried out in two stages. The first stage was developed as a Demonstration Test, using at this time DER-SMART sensors, and studying the return way of Buenos Aires - Aimogasta (La Rioja Province) in Argentina, separated 1,200km each other. On this survey, the products transported were packed with olives.

After that, in July 2005, the first effective route survey was carried out, with Williner company products (dairy products) and using the same type of sensors (DER-SMART).

The studied routes for this company are as follows:

(1) Rafaela (Santa Fe Province) – Clorinda (Formosa Prov.) – Asuncion (Paraguay)

(2) Rafaela (Santa Fe Province) – Neuquen (Neuquen Prov.)

After that, in August 2005, a new training program was held in Asuncion (Paraguay) due to incorporation of new type of sensors for the Study (SAVER 3X90), in order to allow the counterpart members of the 4 countries to be familiar with the handling and operation of the new devices.

On this stage of the Project, all the counterpart of the 4 Member Countries finally received the total lot of the measuring devices, so that the field survey activities started with full capacity from September 2005. This is the timing of starting the 2nd Stage of the Transportation Environment Surveys on routes. As result of the activities on this stage of the Study, in the case of Brazil, the surveys covered the following routes:

1) Joinville – Salvador (Bahia)
2) Manaus – Belem – San Pablo
3) Joinville – (through Argentina) - Santiago (Chile)
4) Hortlandia – Recife

In the case of Paraguay, the surveyed routes are 6:

1) Loma Plata - Asuncion
2) Loma Plata – Asuncion - Encarnacion
3) Loma Plata – Asuncion – Ciudad del Este
4) Gran Asuncion (Urban area)
5) Zona del Asuncion (suburban area)
6) Asuncion – Campo Grande

For the case of Uruguay, the studied routes are 5:

1) Montevideo – Rivera (2 surveys)
2) Montevideo – Rocha (2 surveys)
3) Montevideo – Fray Bentos

As result of all these surveys, a series of data have been gathered by each country. These data have been processed for data analysis and a group of database was obtained

The JICA Study Team compiled all the collected information into a common database. One copy of this database have been transferred to each counterpart institute during May-June 2006, by sending one unit of Hard Disk Drive (HDD) for each party.

4.5 Measurements during the Demonstration Test

While the Demonstration Test carried out in Argentina, the cargo loaded empty plastic drums used to carry olives on the outward journey, so that it only carried 0.8 tons against the total capacity of 25 tons. The truck used was a double trailer truck, as shown in Fig. 4-7.

The return trip was made in a 25 ton semi-trailer, loaded with 18 ton cargo of palletized olive boxes.

The following items were also confirmed.

- Performance of GPS and sensor was confirmed
- Data was collected
- Counterparts were acquired operational methods
- Grms/PSD graph from collected data was made in Argentina for the first time
- Olive production and packaging procedures were confirmed

Outward Journey
(25 ton Full Trailer)

Front Wheel-1 axis,
RearWheel-3 axes, Leaf Suspension
& Air Suspension

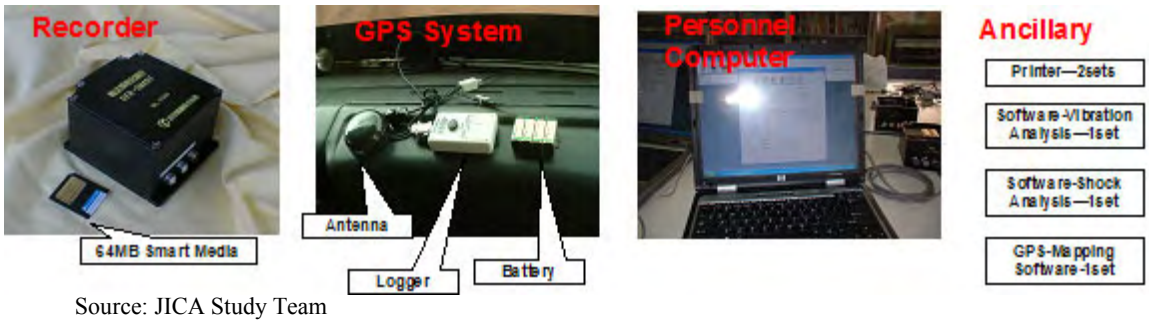
Homeward Journey
(25 ton Semi-Trailer)

Front Wheel-2 axes,
RearWheel-3 axes, Leaf Suspension

Source: JICA Study Team

Fig. 4-7 Trucks used in the Demonstration Test

The data record form for trucks data used on the test and surveys is shown in Fig. 4-8.
On the other hand, the measuring equipment used during the Test are as follows.
(see Fig. 4-9)



Source: JICA Study Team

Fig. 4-8 Equipment for the Transportation Survey

Questionnnaire on the Vehicle, Cargoes and Related Matters

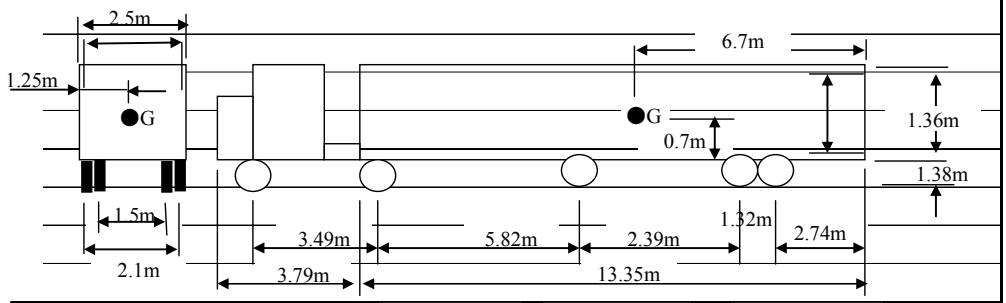
Date 24 Augsut 2005 **Written by:** Hirose/JICA

1)Cooperating Enterprise

● Name	Choritizer
● Destination	Encarnacion
● Other notes	

2) Vehicle

● Number Plate	ABY842	(Tractor)	AJX291	(Trailer)
● Type and Size	□Full Trailer	■ Semi Trailer	□ Truck	
● Manufacuture	MAN , Germany			
● Year of Manufacturing	1991			
● Driving Distance	2.269.858	km		
● Loading Capacity	25	tons	●Vehicle Weght	12,4 tons (Tractor+Trailer)



Suspension (Air,Leaf)	Leaf	Leaf	Air	Leaf
Tire (Sinle, Double)	Single	Double	Double	2 x Doule
Max. Axle Load				
Tire Air Pressure(kg/cm2)	7.7	7.7	7.7	7.7

● Other Notes

Condition of Vehicle	Flat Body

3)Cargoes

● Kind of Cargoes		Long Life Milk (Tetra-pack flat and vertical)
● Temparature Control Management		None (Room Temparature)
● Form of Cargoes	Pallet Size	1 m x 1.2 m
	Weight/Pallet	819 tons/pallet(Average)
	No. of Vanning	26 pallets
	Others	pallet itself=26 kg →793kg/pallet (net product)

● Actual Loadage 21,3 tons

● Other Notes

4)Driver

● Name	Marcio Martinez
● Experience	9 years
● Other Notes	

Source: JICA Study Team

Fig. 4-9 Form for Truck Data Records during the Study

Chapter 5 Data Collection and Data Analysis of Transportation Environment Study

Chapter 5 Data Collection and Analysis of Transportation Environment Study

As a part of the current JICA Study, the Demonstration Test of Transportation Environment Study was performed in February 2005 in Argentina. After that, the gathered data related to the transportation conditions, intensively executed by each member country of MERCOSUR, were stored as "raw" data, following the classification method agreed between the JICA Study Team and the members of their counterpart institutions, at the time of the presentation of the Progress Report. Following this stage, the data analysis was conducted in compliance with the JICA MERCOSUR (SAVER3) analysis methodology, to establish reference values as standards to evaluate packaging through tests. This task was undertaken by the JICA Study Team and their counterparts, coordinated by INTI Argentina as the MERCOSUR Coordinator. As a result of this coordinated effort, the JICA Study Team finalized on setting the "Reference Value for Evaluation of Packaging Tests" (preliminary version).

5.1 Construction of the MERCOSUR Database

Introduction

Regarding to the construction of the MERCOSUR database, a data classification method has been issued and agreed upon at the stage of the Progress Report, at the Joint Meeting of the Four (4) countries on February 16th 2006 (see Fig. 5-1). However, it is considered that there is the difficulty of directly taking upon the construction of this database, because of insufficient capacity of the existing counterparts' computer systems on both hardware and software, and the lack of human resources for the task. For that reasons, it was decided to explain the general guideline in this chapter, which will be complemented in detail in the Chapter 10.

The database, containing information about collected data, result of data analysis, numerical information and graphics (hereinafter "informative resources") developed by the "Study of Improvement of Packaging Technology for Merchandise Distribution in MERCOSUR" integrated by Argentina, Brazil, Paraguay and Uruguay, will become an important source of information regarding improvement techniques for transporting and packaging of products within the region once it is placed on the Internet Website for public access.

5.1.1 Use of the Database

As the final users of the database, two main types of users have been defined, and to be considered for the construction of the database for Web site.

1) Passive users, whose main objective is the sole acquisition of information, for example, for the study of specialized knowledge.

2) Active users, seeking information and graphics for managerial, educational or investigative purposes that are provided to the public via the Internet Website.

The use case 1) is similar to any Internet Web Page, whereas the data corresponding to 2) will require characteristic properties of a database. In this case, the provider of the information must prepare high quality data and validate to be used as a reliable source. Also, in the case 2), the informative resources open to the public use may be utilized as secondary sources, in other words, the information may be downloaded and used as material for presentations in seminars and conferences as visual aides as movies, posters or prints, CD-ROM, and even link to other websites. The database may be a non-profit source of information for investigative or educational purposes, or, it can be commercialized. Regardless of the case, the copyright must be properly referenced throughout its use.

5.1.2 Expansion of DB Users

The information of database can be used on several ways, within the packaging technology. On the other hand, the type of users would be diversified also. The published information on the web can be accessed by a wide variety of users. Also, once the site is in operation, the users may also issue questions, comments and requests regarding the provided information, so that the planning how to respond to such demand will become a very important topic.

5.1.3 Useful Database

The important thing is to “construct something that is truly useful.” A mean or vehicle is required, to transmit the information, and the user will acquire the information through the mean deemed most user-friendly. Placing the information in Web format for public access only makes sense if the provided information could not be given through the currently conventional means of communication. It is obvious that a database will not be completed before its construction is finished. In order to maintain the usefulness of a database, it is required a constant work, not only to update and correct the data, but also working to address the requests and comments of its users.

JICA MERCOSUR - Data Analysis Procedure (SAVER3X90 case)

The following is the procedure for Data Analysis of vibrations recorded during the Transportation Environment Survey by using the SAVER sensors.

1) **Applied terminology**
   Sxd files "Raugh Data" files, recorded by the SAVER sensors.

   Sxe files Modified data files from Sxd data by SAVER's program, under MS Access format.

   GPS files GPS data recorded by GPS system, indicating the truck position, time.

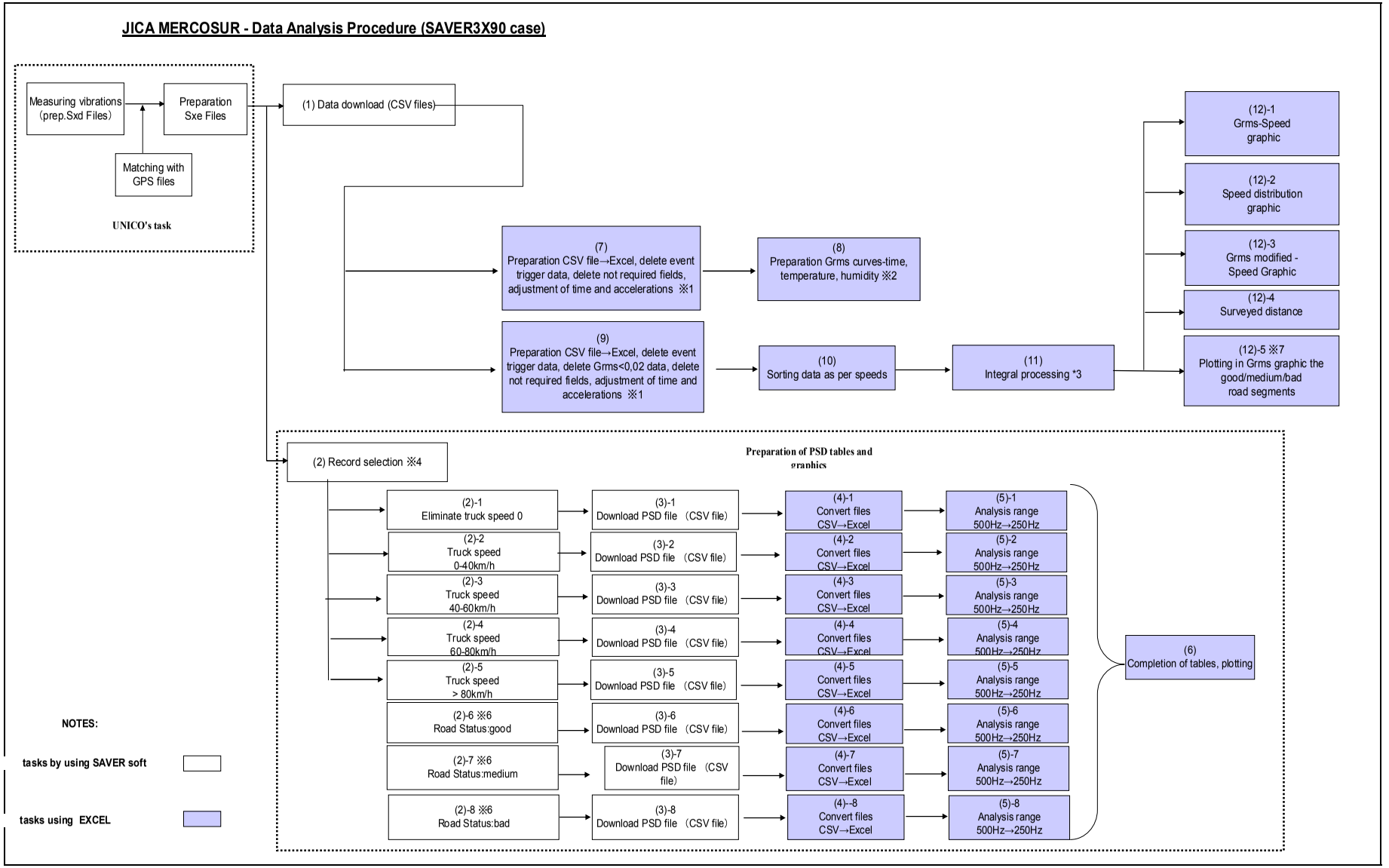
2) **Data Analysis works flow diagram**

   For issuing the request of Data Analysis to Kobe University, basically a Sxe file is transferred, in which they are included the positioning data after complete the data matching of vibration data with GPS data.

   Regarding to the data analysis works, they are divided into 2 main activities.

   a) Works by using SAVER programs (mainly to obtain PSD data) and export to an EXCEL file.

   b) Data Analysis works by using EXCEL functions.


JICA MERCOSUR - Data Analysis Procedure (SAVER3X90 case)
Measuring vibrations (prep.Sxd Files)
Preparation Sxe Files
Matching with GPS files
UNICO's task
(1) Data download (CSV files)
(7) Preparation CSV file→Excel, delete event trigger data, delete not required fields, adjustment of time and accelerations ※1
(8) Preparation Grms curves-time, temperature, humidity ※2
(9) Preparation CSV file→Excel, delete event trigger data, delete Grms<0,02 data, delete not required fields, adjustment of time and accelerations ※1
(10) Sorting data as per speeds
(11) Integral processing *3
(12)-1 Grms-Speed graphic
(12)-2 Speed distribution graphic
(12)-3 Grms modified - Speed Graphic
(12)-4 Surveyed distance
(12)-5 ※7 Plotting in Grms graphic the good/medium/bad road segments
(2) Record selection ※4
Preparation of PSD tables and graphics
(2)-1 Eliminate truck speed 0
(2)-2 Truck speed 0-40km/h
(2)-3 Truck speed 40-60km/h
(2)-4 Truck speed 60-80km/h
(2)-5 Truck speed > 80km/h
(2)-6 ※6 Road Status:good
(2)-7 ※6 Road Status:medium
(2)-8 ※6 Road Status:bad
(3)-1 Download PSD file (CSV file)
(3)-2 Download PSD file (CSV file)
(3)-3 Download PSD file (CSV file)
(3)-4 Download PSD file (CSV file)
(3)-5 Download PSD file (CSV file)
(3)-6 Download PSD file (CSV file)
(3)-7 Download PSD file (CSV file)
(3)-8 Download PSD file (CSV file)
(4)-1 Convert files CSV→Excel
(4)-2 Convert files CSV→Excel
(4)-3 Convert files CSV→Excel
(4)-4 Convert files CSV→Excel
(4)-5 Convert files CSV→Excel
(4)-6 Convert files CSV→Excel
(4)-7 Convert files CSV→Excel
(4)-8 Convert files CSV→Excel
(5)-1 Analysis range 500Hz→250Hz
(5)-2 Analysis range 500Hz→250Hz
(5)-3 Analysis range 500Hz→250Hz
(5)-4 Analysis range 500Hz→250Hz
(5)-5 Analysis range 500Hz→250Hz
(5)-6 Analysis range 500Hz→250Hz
(5)-7 Analysis range 500Hz→250Hz
(5)-8 Analysis range 500Hz→250Hz
(6) Completion of tables, plotting
NOTES:
tasks by using SAVER soft
tasks using EXCEL

JICA MERCOSUR - Data Analysis Procedure (SAVER3X90 sensor case)

NOTES:

※1: At the stage of "exporting" data from SAVER's program to an EXCEL file, the time is indicated by GMT and the speeds by miles/hour. These data must be converted into "local time" and "km/h".

※2: See please EXCEL sample file.

※3: See please EXCEL sample file.

※4: The SAVER program is suitable for a fast selection of data, based on required speed values. However, for the deletion of zero speed data, it is carried out bu Grms < 0.02 condition.

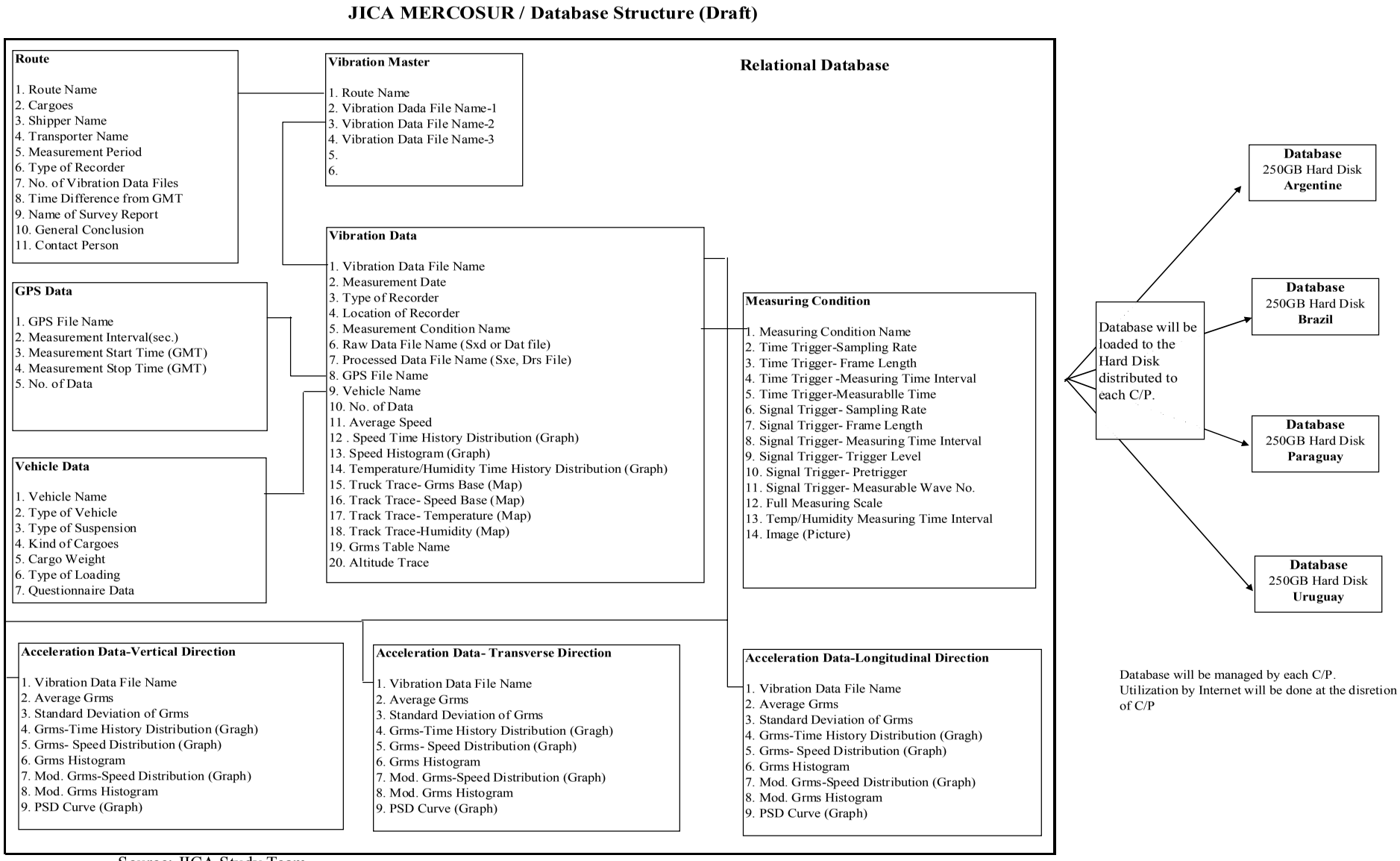
※5: In the case of sampling time of 1ms, the SAVER program calculates automatically the PSD values within a range up to 500Hz. In this case, it is required to make a re-calculation of PSD within a range up to 250Hz, in order to match with DER-SMART system.

※6: The PSD values are manually calculated for each route condition (good, medium, bad), based on a previous selection of related route segments and referred to "time records" registered manually during the surveys. Since the selection of route segments is made manually, this process requires time. For this reason, this process will be developed only for the route of Brasil (Belem-San Pablo, Sep21-22) ; Joinville-Santiago route and Campinas-Recife route.

※7: The plotting process for identify the route status of "good", "medium" and "bad", is made manually, so that it requires time. The data to be processed manually are those indicated in ※6.

Source: JICA Study Team

Fig. 5-1 Data Analysis Procedure Diagram - (SAVER3X90 case)



Source: JICA Study Team

Fig. 5-2 Data Classification for Data Collection and Analysis

Chapter 6 Establishment of the "Reference Guidelines for Packaging Tests"