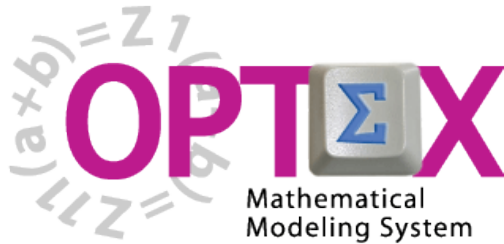


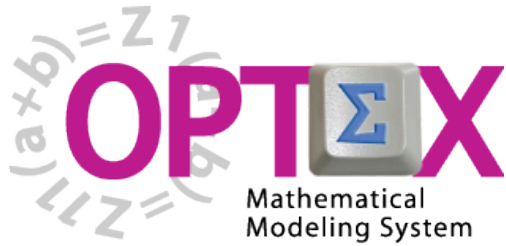
TUTORIAL – SESSION 5 IMPLEMENTATION OF THE VRP PROBLEM (VEHICLE ROUTING PROBLEM)





TUTORIAL BASIC

- 1. SESSION 1: INTRODUCTION**
 - Introduction to OPTEX (Section 1)
 - OPTEX-EXCEL-MMS (Section 2)
- 2. SESSION 2: VRP MODELING IN EXCEL**
 - VRP: Vehicle Routing Problem (Section 3)
 - Implementing VRP Model using EXCEL (Section 4)
- 3. SESSION 3: USING EXCEL TO LOAD DATA**
 - Industrial Data Information Systems –IDIS- (Section 5)
- 4. SESSION 4: OPTEX-GUI – LOADING MODELS**
 - Loading the Model in OPTEX-MMIS (Section 6)
 - Verification of the Model in OPTEX-MMIS (Section 7)
- 5. SESSION 5: Loading and Checking Industrial Data**
 - Implementation and Validation of IDIS- (Section 8)
- 6. SESSION 6: Solving Mathematical Models**
 - Scenarios and Families of Scenarios (Section 9)
 - Solution of Mathematical Problems (Section 10)
 - Results Information System (Section 11)
- 7. SESSION 7: SQL Servers**
 - Using SQL Servers for IDIS (Section 12)
- 8. SESSION 8: Optimization Technologies**
 - Solving Problems using C (Section 13.1)
 - Solving Problems using GAMS (Section 13.2)
 - Solving Problems using IBM OPL (Section 13.3)



TUTORIAL IMPLEMENTATION OF THE VRP PROBLEM (VEHICLE ROUTING PROBLEM)

TUTORIAL BASIC

5. SESSION 5: Loading and Checking Industrial Data

- **Implementation and Validation of IDIS (Section 8)**

IMPLEMENTATION AND VALIDATION OF THE IDIS

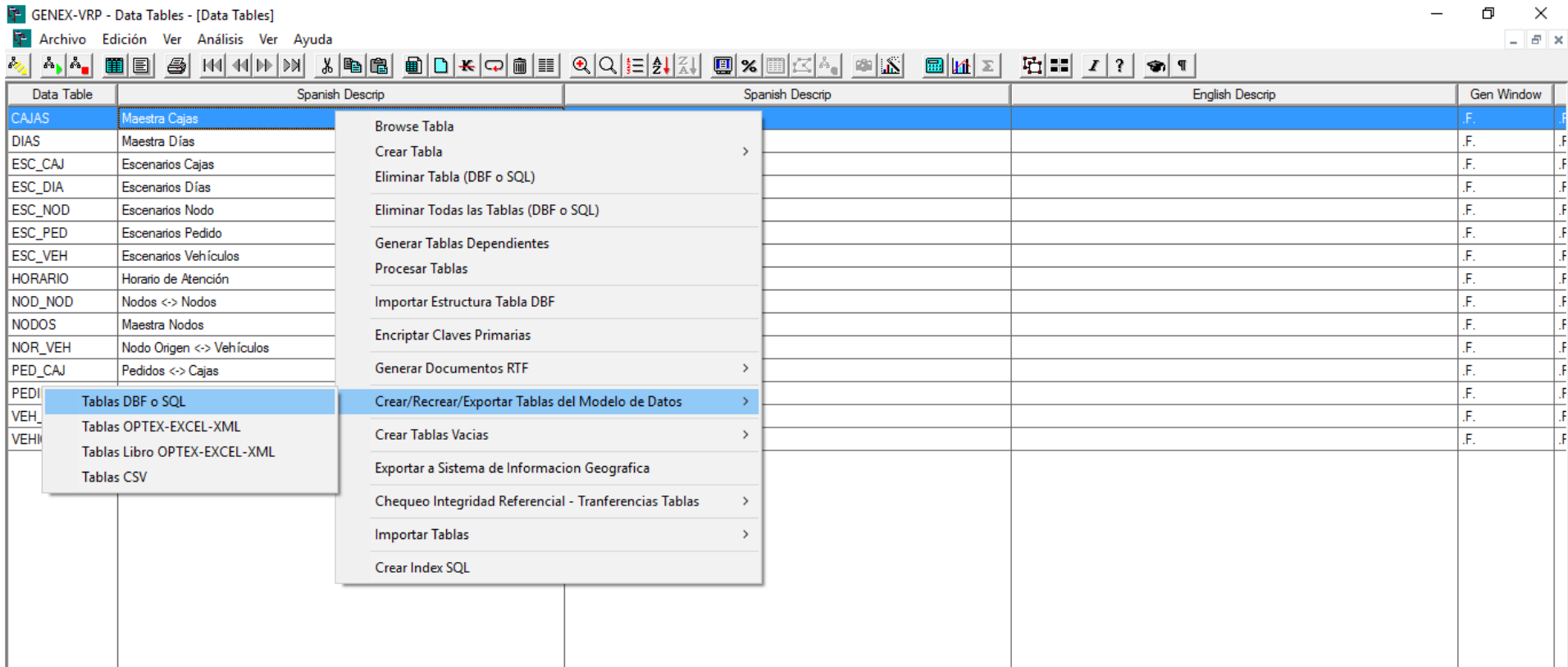
The implementation of the IDIS requires several steps for the correct operation of OPTEX-GUI, the steps are:

- **Checking of the data model of the IDIS**
- **Loading data to the template OPTEX_VRP.xls**
- **Generation of OPTEX-GUI structures**
- **Import the data to the IDIS to be accessed by OPTEX-GUI**
- **Check the integrity of the IDIS, taking into account the rules established by the modeler**

CHECKING THE DATA MODEL OF THE IDIS

Below, it is the process to review and validate the data model of the IDIS to continue once all tables that are part of the MMIS has been loaded. This process is aimed to introduce the services provided by OPTeX to facilitate implementation, correction and set up of industrial data information system. This will be followed as a guide the generated reports to access tables that contain the data model structure: CAMRE, CDBAS and DDBAS.

The first step is to proceed to create the tables that are defined in the MMIS, so must access to the table that contains Data Tables and to active with the click on the right bouton mouse of the service of creation of tables, as shown in the following image.



Data Table	Spanish Descrip	Spanish Descrip	English Descrip	Gen Window
CAJAS	Maestra Cajas			.F.
DIAS	Maestra Días			.F.
ESC_CAJ	Escenarios Cajas			.F.
ESC_DIA	Escenarios Días			.F.
ESC_NOD	Escenarios Nodo			.F.
ESC_PED	Escenarios Pedido			.F.
ESC_VEH	Escenarios Vehículos			.F.
HORARIO	Horario de Atención			.F.
NOD_NOD	Nodos <-> Nodos			.F.
NODOS	Maestra Nodos			.F.
NOR_VEH	Nodo Origen <-> Vehículos			.F.
PED_CAJ	Pedidos <-> Cajas			.F.
PEDI				.F.
VEH				.F.
VEHI				.F.

CHECKING THE DATA MODEL OF THE IDIS

The result of the process is the creation of tables and reports **CREAR_DB.LOG** and **ERROR_CREAR_DB.LOG** that contains, if any, the found errors; such as the following image presents it.

The screenshot shows a window titled "OPTEX - \ERROR_CREAR_DB.LOG" with a "Cerrar" button in the top right corner. The text inside the window is as follows:

```

Fecha de creacion del archivo: 13/12/2015 - 09:04:00
09:04:00

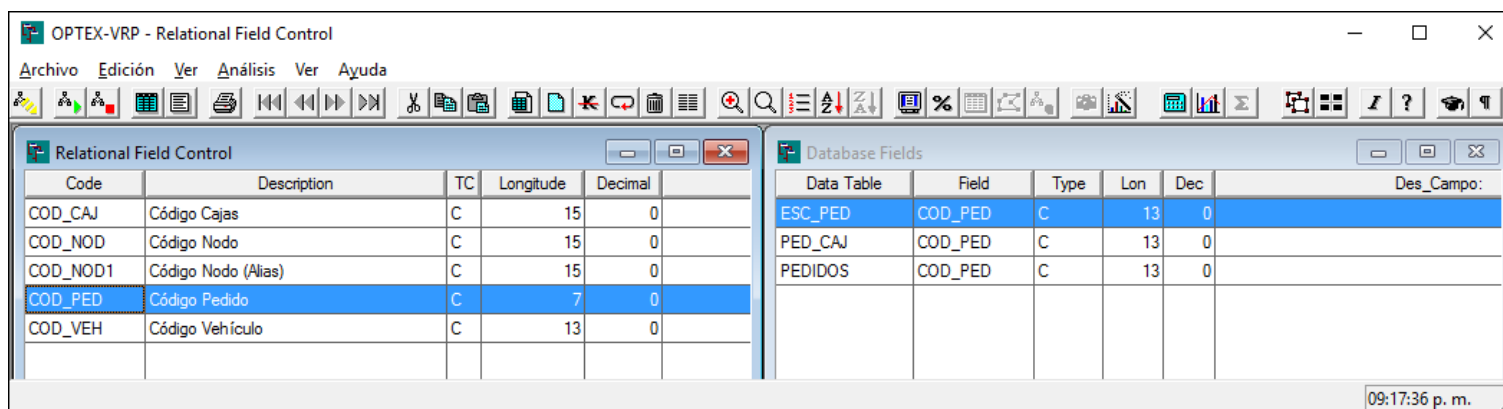
Tabla: ESC_PED - Campo: COD_PED -> ERROR-> La longitud del campo es diferente a la definida para el campo relacional.
Tabla: ESC_VEH - Campo: COD_VEH -> ERROR-> La longitud del campo es diferente a la definida para el campo relacional.
Tabla: NOR_VEH - Campo: COD_VEH -> ERROR-> La longitud del campo es diferente a la definida para el campo relacional.
Tabla: PED_CAJ - Campo: COD_PED -> ERROR-> La longitud del campo es diferente a la definida para el campo relacional.
Tabla: PEDIDOS - Campo: COD_PED -> ERROR-> La longitud del campo es diferente a la definida para el campo relacional.
Tabla: VEH_NOD - Campo: COD_VEH -> ERROR-> La longitud del campo es diferente a la definida para el campo relacional.
Tabla: VEHICULOS - Campo: COD_VEH -> ERROR-> La longitud del campo es diferente a la definida para el campo relacional.

Fecha de finalización del archivo: 13/12/2015 - 09:04:00

```


CHECKING THE DATA MODEL OF THE IDIS

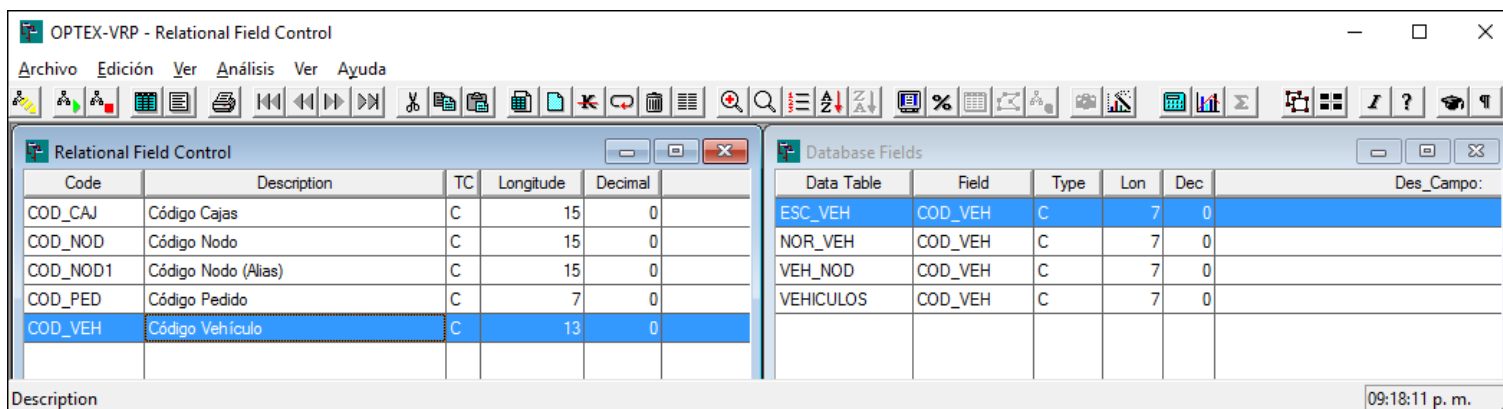
In this case, it was found inconsistencies in the length of the relational fields (keys) defined in the table CAMRE with the existing tables fields, the errors are presented for the COD_VEH and COD_PED fields. To find the errors you can access the CAMRE table and from there locate the inconsistencies; to do this access option RELATED TABLES (Tablas Relacionadas), as shown in the following image.



The screenshot shows the 'Relational Field Control' window with the 'COD_PED' field selected. The 'Database Fields' window shows that the 'COD_PED' field is used in three tables: ESC_PED, PED_CAJ, and PEDIDOS, all with a length of 13. This indicates an inconsistency with the 7-length field defined in the CAMRE table.

Code	Description	TC	Longitude	Decimal
COD_CAJ	Código Cajas	C	15	0
COD_NOD	Código Nodo	C	15	0
COD_NOD1	Código Nodo (Alias)	C	15	0
COD_PED	Código Pedido	C	7	0
COD_VEH	Código Vehículo	C	13	0

Data Table	Field	Type	Lon	Dec	Des_Campo:
ESC_PED	COD_PED	C	13	0	
PED_CAJ	COD_PED	C	13	0	
PEDIDOS	COD_PED	C	13	0	



The screenshot shows the 'Relational Field Control' window with the 'COD_VEH' field selected. The 'Database Fields' window shows that the 'COD_VEH' field is used in four tables: ESC_VEH, NOR_VEH, VEH_NOD, and VEHICULOS, all with a length of 7. This indicates an inconsistency with the 13-length field defined in the CAMRE table.

Code	Description	TC	Longitude	Decimal
COD_CAJ	Código Cajas	C	15	0
COD_NOD	Código Nodo	C	15	0
COD_NOD1	Código Nodo (Alias)	C	15	0
COD_PED	Código Pedido	C	7	0
COD_VEH	Código Vehículo	C	13	0

Data Table	Field	Type	Lon	Dec	Des_Campo:
ESC_VEH	COD_VEH	C	7	0	
NOR_VEH	COD_VEH	C	7	0	
VEH_NOD	COD_VEH	C	7	0	
VEHICULOS	COD_VEH	C	7	0	

CHECKING THE DATA MODEL OF THE IDIS

As you can see, the inconsistency is generated in the CAMRE table that has reversed lengths to COD_PED and COD_VEH. The correct OPTEX-EXCEL template is presented below.

	A	B	C	D	E	F	G	H
4	COD_NOD	Código Nodo	C		NODOS		C	15
5	COD_NOD1	Código Nodo (Alias)	C		NODOS		C	15
6	COD_VEH	Código Vehículo	C		VEHICULOS		C	7
7	COD_PED	Código Pedido	C		PEDIDOS		C	13
8								
9								

CHECKING THE DATA MODEL OF THE IDIS

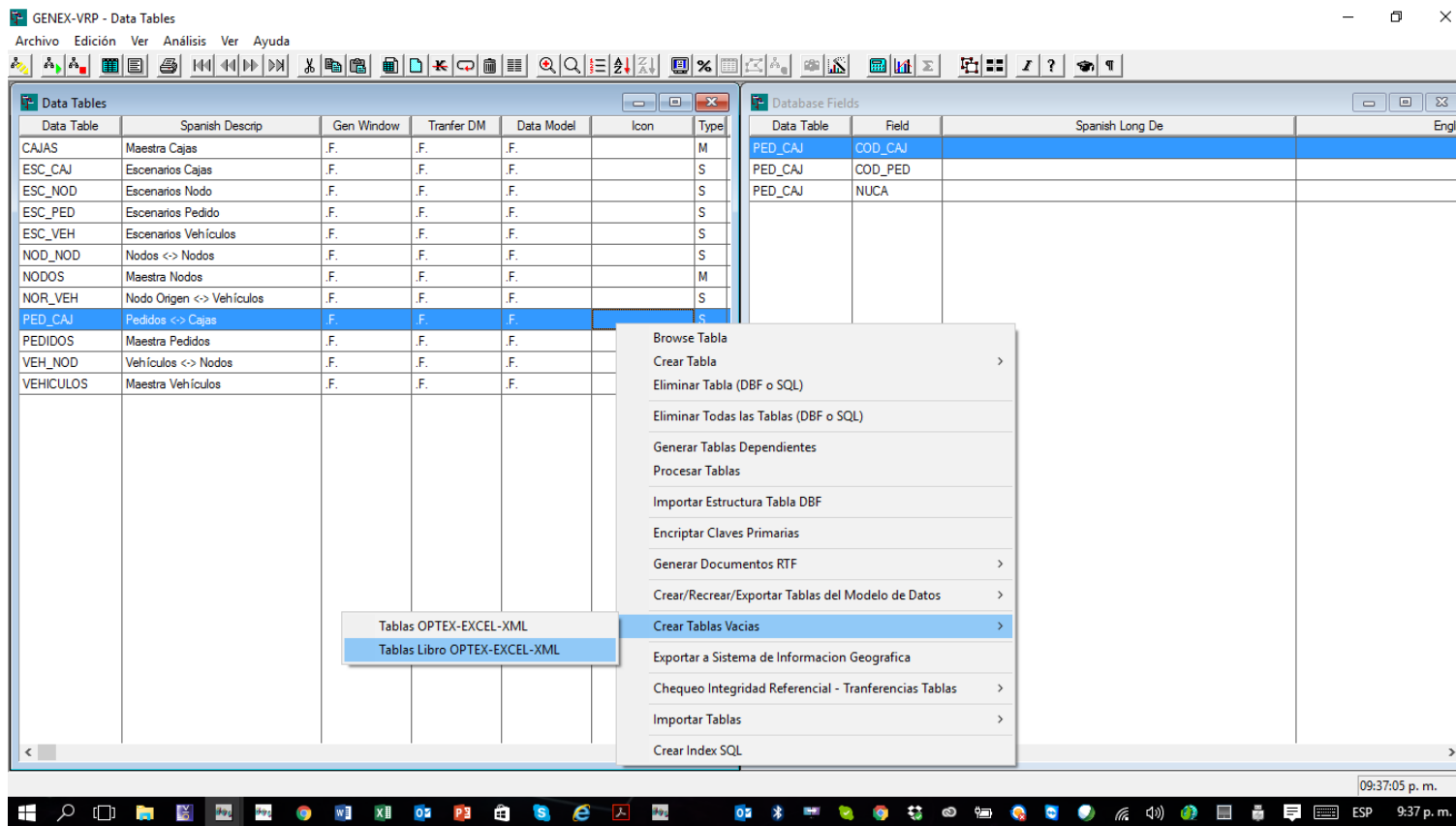
In addition, three tables included in the definition of tables that are not part of the problem should be eliminated: DIAS, ESC_DIA and HORARIOS. Below, the EXCEL template already is correct. It should be noted that although the initial location of the tables is the permanent data area (I) since this facilitates the revision of the data contained in the IDIS, later, when you go to make runs of models, it must relocate the tables in accordance with scenarios for the runs of the mathematical models.

TABLA	DESCRIPCIÓN	ÁREA	CÓDIGOS RELACIONAL	CÓDIGOS SECUNDARIOS	CONJUNTOS	PARÁMETROS
CAJAS	Maestra Cajas	I	COD_CAJ			PECA, VOCA _n
DIAS	Maestra Dias	I	COD_DIA			
NODOS	Maestra Nodos	I	COD_NOD		DEC, NOD, DEK	TSER _n
PEDIDOS	Maestra Pedidos	F	COD_PED	COD_NOD	PEC(c)	
VEHICULOS	Maestra Vehículos	I	COD_VEH		VEH	CAPP _n , CAPV _n , COVA _n , CUVE _n

TABLA	DESCRIPCIÓN	ÁREA	CÓDIGOS SECUNDARIOS	CONJUNTOS	PARÁMETROS
ESC_CAJ	Escenarios Cajas	F	COD_CAJ		
ESC_DIA	Escenarios Dias	F	COD_DIA		
ESC_NOD	Escenarios Nodos	F	COD_NOD, COD_NOD1		
ESC_PED	Escenarios Pedido	F	COD_PED		
ESC_VEH	Escenarios Vehículos	F	COD_VEH		
HORARIO	Horario de Atención	I	COD_NOD, COD_DIA	DIC(c)	HAFEC _n , HCE _n
NOD_NOD	Nodos <-> Nodos	I	COD_NOD, COD_NOD1	NOK(c), NOC(k)	DIST _n
NOR_VEH	Nodo Origen <-> Vehículos	I	COD_NOD, COD_VEH	NOV(v)	
PED_CAJ	Pedidos <-> Cajas	F	COD_PED, COD_CAJ	CAP(v)	NUCA _n
VEH_NOD	Vehículos <-> Nodos	I	COD_VEH, COD_NOD	NOV(v), VEC(c), NKV(v), VER(k)	

GENERATION OF EXCEL TEMPLATES

OPTeX provides services to generate the EXCEL templates that are required to load industrial data. This service can be performed from the table of data tables, accessing the CREATE TABLE BOOK EXCEL XML option which will be the base to load data from the IDIS with the right click of the mouse.



The screenshot shows the 'GENEX-VRP - Data Tables' application window. The main window contains a table with the following data:

Data Table	Spanish Descrip	Gen Window	Tranfer DM	Data Model	Icon	Type
CAJAS	Maestra Cajas	F.	.F.	.F.		M
ESC_CAJ	Escenarios Cajas	F.	.F.	.F.		S
ESC_NOD	Escenarios Nodo	F.	.F.	.F.		S
ESC_PED	Escenarios Pedido	F.	.F.	.F.		S
ESC_VEH	Escenarios Vehículos	F.	.F.	.F.		S
NOD_NOD	Nodos <-> Nodos	F.	.F.	.F.		S
NODOS	Maestra Nodos	F.	.F.	.F.		M
NOR_VEH	Nodo Origen <-> Vehículos	F.	.F.	.F.		S
PED_CAJ	Pedidos <-> Cajas	F.	.F.	.F.		S
PEDIDOS	Maestra Pedidos	F.	.F.	.F.		S
VEH_NOD	Vehículos <-> Nodos	F.	.F.	.F.		S
VEHICULOS	Maestra Vehículos	F.	.F.	.F.		S

The 'Database Fields' window is also open, showing the following data:

Data Table	Field	Spanish Long De	Engl
PED_CAJ	COD_CAJ		
PED_CAJ	COD_PED		
PED_CAJ	NUCA		

The context menu for 'PED_CAJ' includes the following options:

- Browse Tabla
- Crear Tabla
- Eliminar Tabla (DBF o SQL)
- Eliminar Todas las Tablas (DBF o SQL)
- Generar Tablas Dependientes
- Procesar Tablas
- Importar Estructura Tabla DBF
- Encriptar Claves Primarias
- Generar Documentos RTF
- Crear/Recrear/Exportar Tablas del Modelo de Datos
- Crear Tablas Vacias**
- Exportar a Sistema de Informacion Geografica
- Chequeo Integridad Referencial - Tranferencias Tablas
- Importar Tablas
- Crear Index SQL

A sub-menu for 'Crear Tablas Vacias' is also visible, containing:

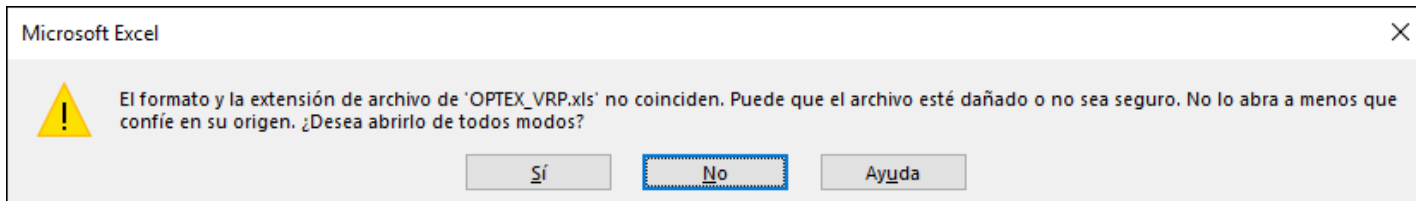
- Tablas OPTeX-EXCEL-XML
- Tablas Libro OPTeX-EXCEL-XML**

GENERATION OF EXCEL TEMPLATES

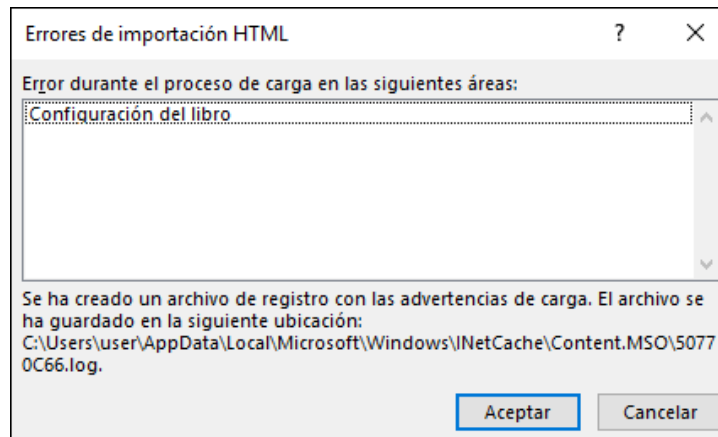
The template generated by OPT Σ X is stored in the permanent industrial data area of IDIS, the name given to the template is OPT Σ X_aaa, where aaa is the name given to the application. The template can be downloaded from the URLs:

- [http://www.doanalytics.net/Documents/OPT \$\Sigma\$ X_VRP.xls](http://www.doanalytics.net/Documents/OPTΣX_VRP.xls)
- [http://www.doanalytics.net/Documents/OPT \$\Sigma\$ X_VRP.xml](http://www.doanalytics.net/Documents/OPTΣX_VRP.xml)

The template is generated in XML format and so that it is accepted by EXCEL should be considered when you try to open it EXCEL submit the following message, to which you must respond Yes. If the extension of the book is changed to **.xml** prevents this message.

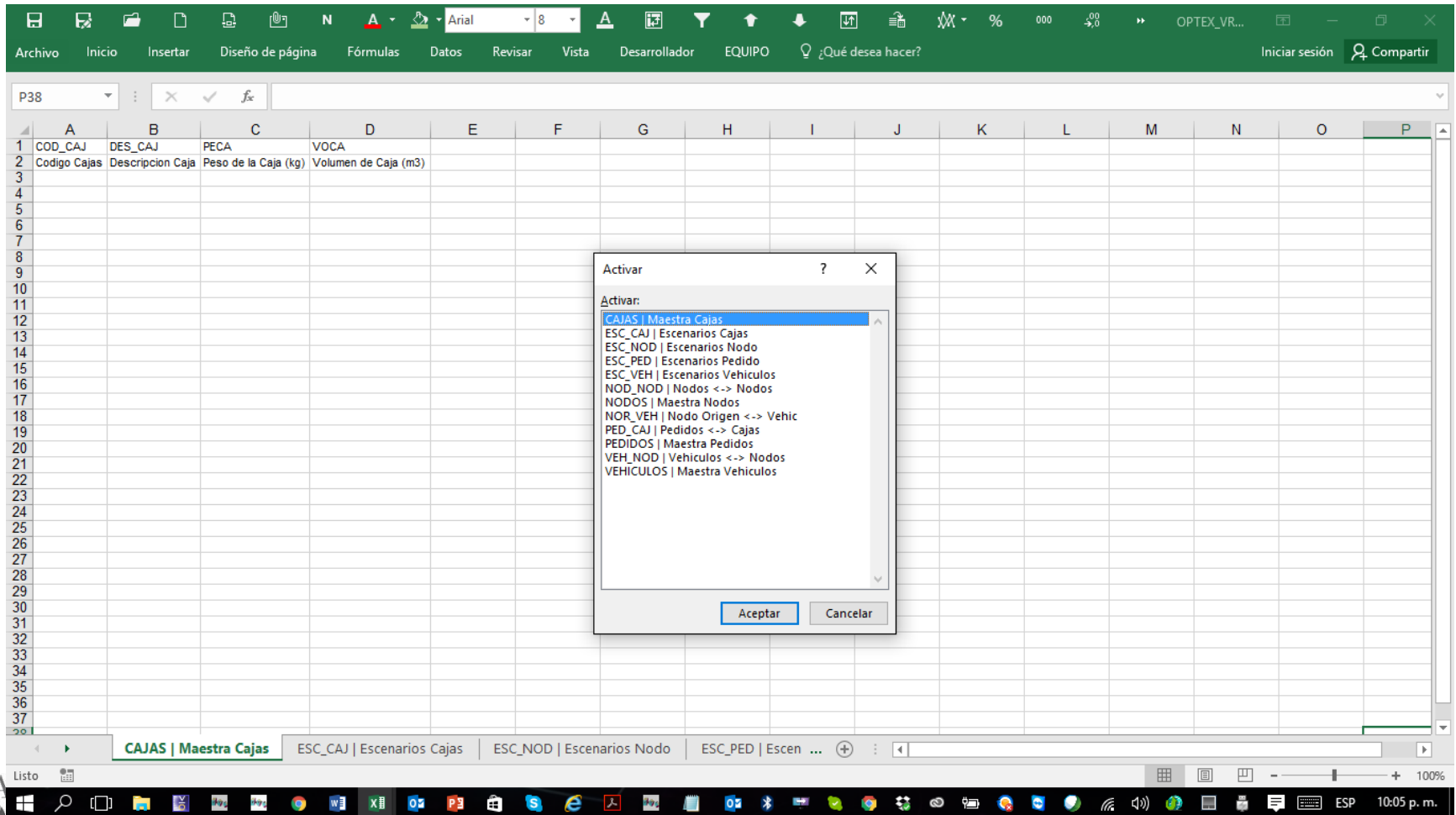


Then EXCEL will present the following window, the user must select setting of the book (Configuración del libro) and then Accept.



GENERATION OF EXCEL TEMPLATES

Finally, the user will enter the book with all the tables in the information system to load data from the IDIS. It is recommended to the user to change format to conventional EXCEL and then use OPTeX macros to export to CSV. The template includes second-row description of fields and their units, this information is taken from CDBAS and DDBAS tables from template in EXCEL.



The screenshot shows the Microsoft Excel interface. The spreadsheet has the following data in the first four columns:

1	A	B	C	D
2	COD_CAJ	DES_CAJ	PECA	VOCA
3	Codigo Cajas	Descripcion Caja	Peso de la Caja (kg)	Volumen de Caja (m3)
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
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35				
36				
37				
38				

The 'Activar' dialog box is open, showing a list of tables to activate:

- CAJAS | Maestra Cajas
- ESC_CAJ | Escenarios Cajas
- ESC_NOD | Escenarios Nodo
- ESC_PED | Escenarios Pedido
- ESC_VEH | Escenarios Vehiculos
- NOD_NOD | Nodos <-> Nodos
- NODOS | Maestra Nodos
- NOR_VEH | Nodo Origen <-> Vehic
- PED_CAJ | Pedidos <-> Cajas
- PEDIDOS | Maestra Pedidos
- VEH_NOD | Vehiculos <-> Nodos
- VEHICULOS | Maestra Vehiculos

The taskbar at the bottom shows the Windows taskbar with various application icons and the system tray displaying 'ESP 10:05 p. m.' and '100%' zoom level.

GENERATING OPTEX-GUI STRUCTURES

This process enables the generation of a GUI interface that enables the modeler and the functional user to navigate and to explore industrial data information system (IDIS). This allows to a mathematical modeler, non-expert in SQL statements, generate a user interface, fast, with basic support for maintenance and queries of the IDIS. To carry out the process you must access the service GENERATION STRUCTURES OPTEX-GUI with the right click of the mouse in the menus of OPTEX-GUI Explorer window.

GENEX-VRP - Menu Programador GENEX - [OPTEX_GUI - Menu Explorer]

Archivo Ver Herramientas Ventana Ayuda

Data Model
User Interfaz
Users

Data Model User Interfaz Users

Optimizar

- Importar Tablas Sistema Información Industrial (SIDI)
- Generar Tablas Dependientes SIDI
- Chequear Integridad SIDI
- Exportar Sistema Información Industrial (SIDI a EXCEL)
- Explorar Área de Datos
- Exportar Tablas SQL a DBF
- Explorar Tablas F3
- Importar Sistema Información Modelos Matemáticos (SIMM)
- Generar Documento Formulación (RTF)
- Chequeo Estructura Sistema Soporte de Decisiones (SSD)
- Exportar Sistema Información Modelos Matemáticos (SIMM a EXCEL)
- Explorar Área Modelos Matemáticos
- Generar Documento Modelo de Datos (RTF)
- Explorar Modelo Datos - Interfaz GUI
- Generación Estructuras OPTEX-GUI**
- Explorar Series Historicas
- Explorar Anomalias

GENEX MenuWindow 10:42:52 a. m. ESP 10:42 a. m.

GENERATING OPTeX-GUI STRUCTURES

Through this process, OPTeX load the necessary information to set up a first version of the GUI (Graphic User Interface) which is based on:

- **Exploration of the area of IDIS menus**
- **Generation of keys of ordering (indexes) to relate/link the tables of the IDIS**
- **Configuration of the container window (shell windows) to facilitate access to tables**
- **Configuration data window to control the information presented in each data window.**

In this way, OPTeX eliminates all the programming work that involves developing an interface for the functional user; however, if the modeler wishes to create windows and/or menus specialized to functional user, this is already possible because OPTeX has other alternatives for this purpose.

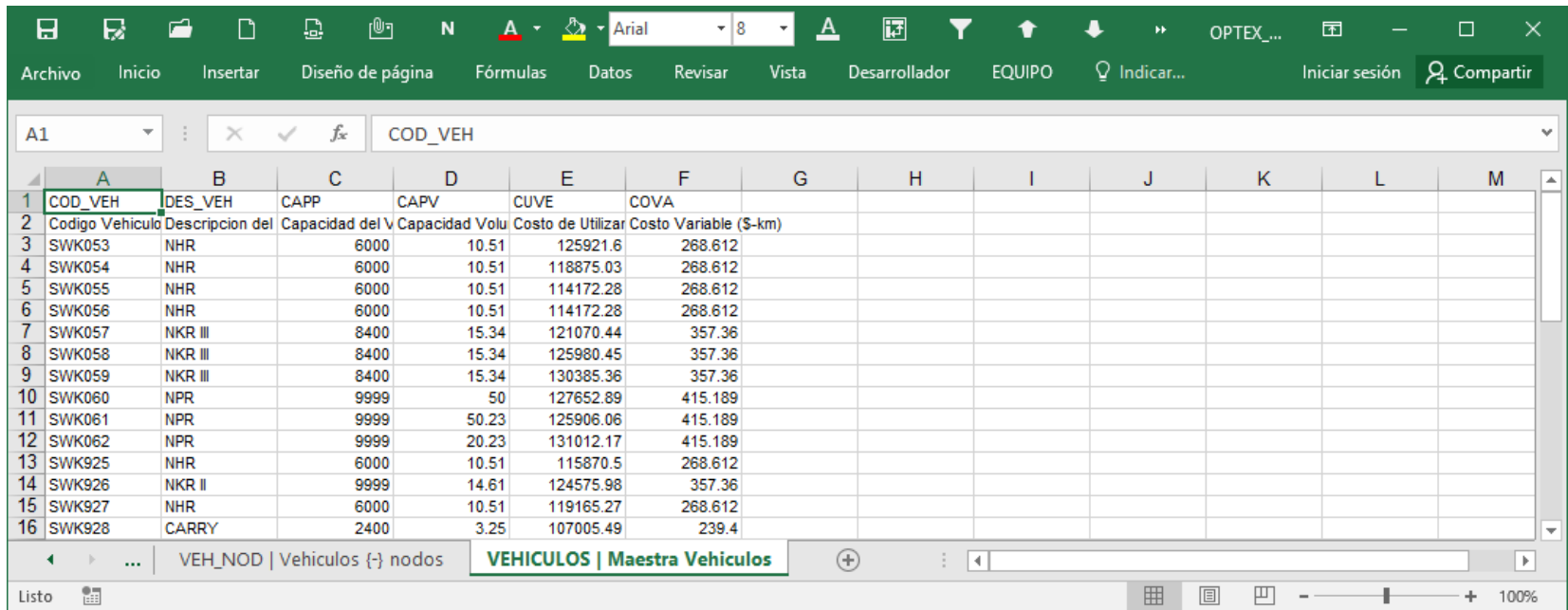
LOADING INDUSTRIAL/BUSINESS DATA

Loading data from the IDIS involves three steps:

- Loading data to the template **OPTEX_VRP.xls**
- Import the data to the IDIS to be accessed by **OPTEX-GUI**
- Check the integrity of the IDIS, taking into account the rules established by the Modeler

The last two steps will be presented, the first part of the work and the creativity of the user. The template loaded for this tutorial is linked to the URL:

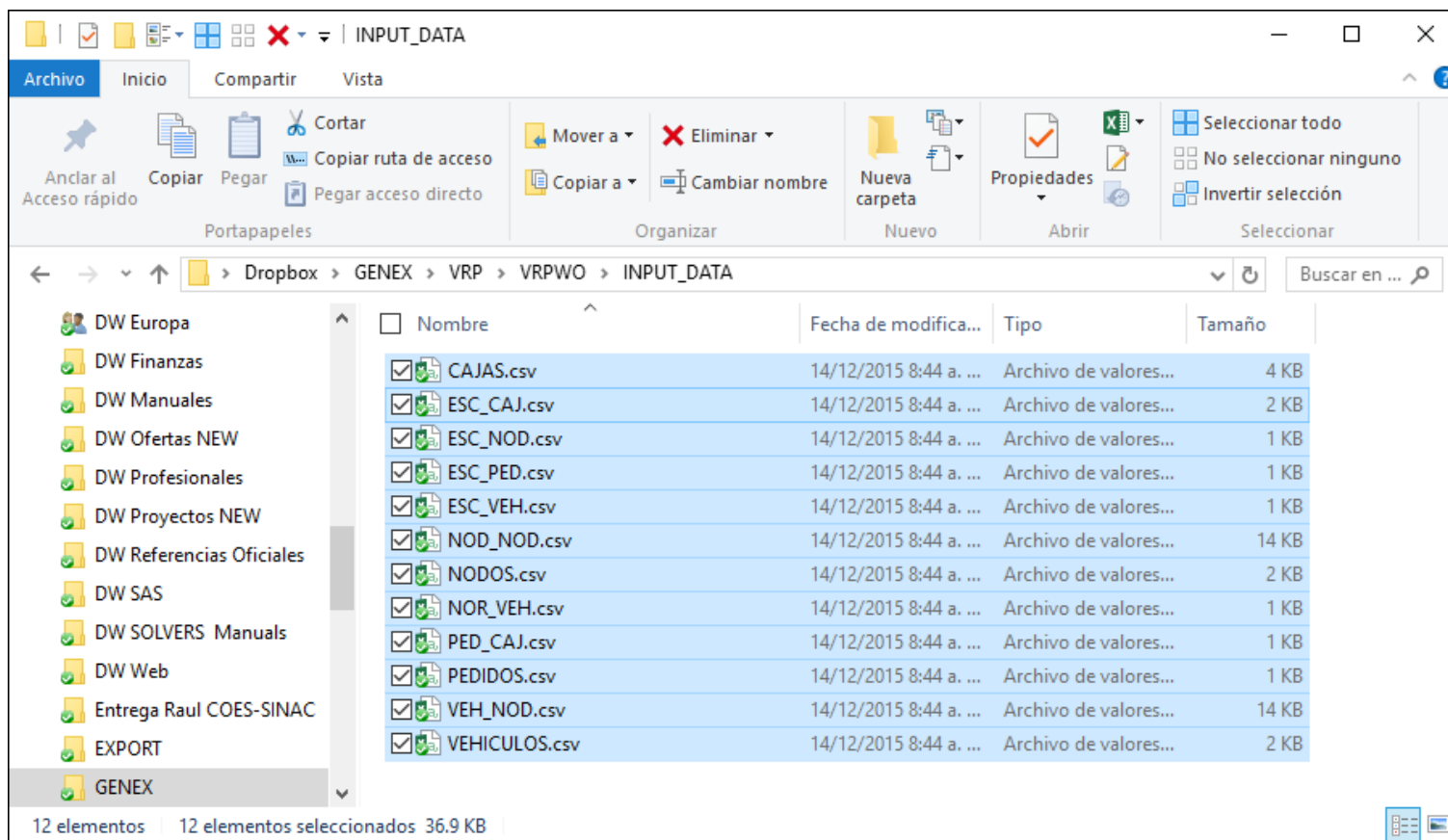
http://www.doanalytics.net/Documents/OPTEX_Plantilla_Data_VRP_1.xlsx



COD_VEH	DES_VEH	CAPP	CAPV	CUVE	COVA	
2	Codigo Vehiculo	Descripcion del	Capacidad del V	Capacidad Volu	Costo de Utilizar	Costo Variable (\$-km)
3	SWK053	NHR	6000	10.51	125921.6	268.612
4	SWK054	NHR	6000	10.51	118875.03	268.612
5	SWK055	NHR	6000	10.51	114172.28	268.612
6	SWK056	NHR	6000	10.51	114172.28	268.612
7	SWK057	NKR III	8400	15.34	121070.44	357.36
8	SWK058	NKR III	8400	15.34	125980.45	357.36
9	SWK059	NKR III	8400	15.34	130385.36	357.36
10	SWK060	NPR	9999	50	127652.89	415.189
11	SWK061	NPR	9999	50.23	125906.06	415.189
12	SWK062	NPR	9999	20.23	131012.17	415.189
13	SWK925	NHR	6000	10.51	115870.5	268.612
14	SWK926	NKR II	9999	14.61	124575.98	357.36
15	SWK927	NHR	6000	10.51	119165.27	268.612
16	SWK928	CARRY	2400	3.25	107005.49	239.4

LOADING INDUSTRIAL/BUSINESS DATA

From the EXCEL template should be to create the CSV file that will read OPTeX to load the database from the IDIS.



The screenshot shows a Windows File Explorer window titled 'INPUT_DATA'. The address bar indicates the path: 'Dropbox > GENEX > VRP > VRPWO > INPUT_DATA'. The left sidebar shows a list of folders, with 'GENEX' selected. The main pane displays a table of files, all of which are CSV files created on 14/12/2015 at 8:44 a.m. All files are selected, as indicated by checkmarks in the left column.

Nombre	Fecha de modifica...	Tipo	Tamaño
CAJAS.csv	14/12/2015 8:44 a. ...	Archivo de valores...	4 KB
ESC_CAJ.csv	14/12/2015 8:44 a. ...	Archivo de valores...	2 KB
ESC_NOD.csv	14/12/2015 8:44 a. ...	Archivo de valores...	1 KB
ESC_PED.csv	14/12/2015 8:44 a. ...	Archivo de valores...	1 KB
ESC_VEH.csv	14/12/2015 8:44 a. ...	Archivo de valores...	1 KB
NOD_NOD.csv	14/12/2015 8:44 a. ...	Archivo de valores...	14 KB
NODOS.csv	14/12/2015 8:44 a. ...	Archivo de valores...	2 KB
NOR_VEH.csv	14/12/2015 8:44 a. ...	Archivo de valores...	1 KB
PED_CAJ.csv	14/12/2015 8:44 a. ...	Archivo de valores...	1 KB
PEDIDOS.csv	14/12/2015 8:44 a. ...	Archivo de valores...	1 KB
VEH_NOD.csv	14/12/2015 8:44 a. ...	Archivo de valores...	14 KB
VEHICULOS.csv	14/12/2015 8:44 a. ...	Archivo de valores...	2 KB

At the bottom of the window, it shows '12 elementos' and '12 elementos seleccionados 36.9 KB'.

LOADING INDUSTRIAL/BUSINESS DATA

To perform massive importation, you must access to Import Tables IDIS (Importar Tablas SIDI) service.

The screenshot displays the OPTEX GUI interface. The title bar reads 'OPTEX-VRP - Menu Programador OPTEX - [OPTEX_GUI - Menu Explorer]'. The menu bar includes 'Archivo', 'Ver', 'Herramientas', 'Ventana', and 'Ayuda'. The left sidebar shows a tree view with categories: Mathematical Definitions, Advanced Concepts, Family of Scenarios, Data Model, Optimization Libraries/Program, Auxiliar Entities, and Report Configuration. The main workspace contains icons for these categories, with 'Family of Scenarios' selected. A context menu is open over the 'Family of Scenarios' icon, listing various actions. The 'Importar Tablas Sistema Información Industrial (SIDI)' option is highlighted in blue. The system tray at the bottom shows the time as 10:56:47 a. m. and the language as ESP.

OPTEX-VRP - Menu Programador OPTEX - [OPTEX_GUI - Menu Explorer]

Archivo Ver Herramientas Ventana Ayuda

Mathematical Definitions
Advanced Concepts
Family of Scenarios
Data Model
Optimization Libraries/Program
Auxiliar Entities
Report Configuration

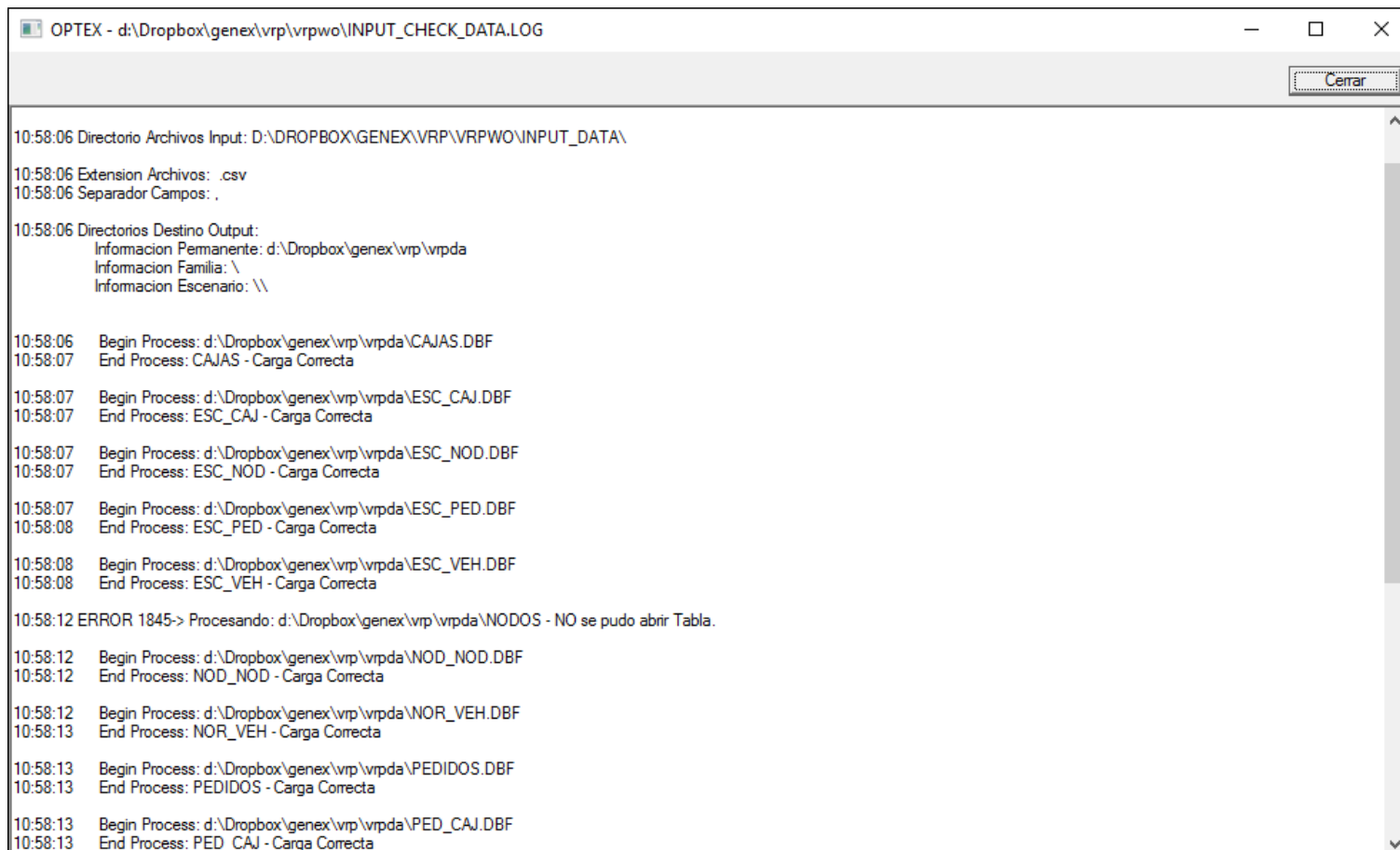
Mathematical Definitions Advanced Concepts Family of Scenarios Data Model Optimization Libraries/Program Auxiliar Entities Report Configuration

Optimizar
Importar Tablas Sistema Información Industrial (SIDI)
 Generar Tablas Dependientes SIDI
 Chequear Integridad SIDI
 Exportar Sistema Información Industrial (SIDI a EXCEL)
 Explorar Área de Datos
 Exportar Tablas SQL a DBF
 Explorar Tablas F3
 Importar Sistema Información Modelos Matemáticos (SIMM)
 Generar Documento Formulación (RTF)
 Chequeo Estructura Sistema Soporte de Decisiones (SSD)
 Exportar Sistema Información Modelos Matemáticos (SIMM a EXCEL)
 Explorar Área Modelos Matemáticos
 Generar Documento Modelo de Datos (RTF)
 Explorar Modelo Datos - Interfaz GUI
 Generación Estructuras OPTEX-GUI
 Explorar Series Historicas
 Explorar Anomalias

GENEX MenuWindow 10:56:47 a. m. ESP 10:56 a. m.

LOADING INDUSTRIAL/BUSINESS DATA

As a result of the process, OPTeX will generate the report INPUT_CHECK_DATA. LOG.



```

OPTeX - d:\Dropbox\genex\vrp\vrpwo\INPUT_CHECK_DATA.LOG
10:58:06 Directorio Archivos Input: D:\DROPBOX\GENEX\VRP\VRPWO\INPUT_DATA\
10:58:06 Extension Archivos: .csv
10:58:06 Separador Campos: .
10:58:06 Directorios Destino Output:
    Informacion Permanente: d:\Dropbox\genex\vrp\vrpda
    Informacion Familia: \
    Informacion Escenario: \
10:58:06 Begin Process: d:\Dropbox\genex\vrp\vrpda\CAJAS.DBF
10:58:07 End Process: CAJAS - Carga Correcta
10:58:07 Begin Process: d:\Dropbox\genex\vrp\vrpda\ESC_CAJ.DBF
10:58:07 End Process: ESC_CAJ - Carga Correcta
10:58:07 Begin Process: d:\Dropbox\genex\vrp\vrpda\ESC_NOD.DBF
10:58:07 End Process: ESC_NOD - Carga Correcta
10:58:07 Begin Process: d:\Dropbox\genex\vrp\vrpda\ESC_PED.DBF
10:58:08 End Process: ESC_PED - Carga Correcta
10:58:08 Begin Process: d:\Dropbox\genex\vrp\vrpda\ESC_VEH.DBF
10:58:08 End Process: ESC_VEH - Carga Correcta
10:58:12 ERROR 1845-> Procesando: d:\Dropbox\genex\vrp\vrpda\NODOS - NO se pudo abrir Tabla.
10:58:12 Begin Process: d:\Dropbox\genex\vrp\vrpda\NOD_NOD.DBF
10:58:12 End Process: NOD_NOD - Carga Correcta
10:58:12 Begin Process: d:\Dropbox\genex\vrp\vrpda\NOR_VEH.DBF
10:58:13 End Process: NOR_VEH - Carga Correcta
10:58:13 Begin Process: d:\Dropbox\genex\vrp\vrpda\PEDIDOS.DBF
10:58:13 End Process: PEDIDOS - Carga Correcta
10:58:13 Begin Process: d:\Dropbox\genex\vrp\vrpda\PED_CAJ.DBF
10:58:13 End Process: PED_CAJ - Carga Correcta
  
```

LOADING INDUSTRIAL/BUSINESS DATA

In the previous report, it is important to note that for the tables **NODOS** and **VEH_NOD** have errors, which will be reflected in reported errors in the validation of the data. Therefore, the appropriate it is to correct these errors before proceeding to the checking of the quality of the IDIS. Below, it is the problem and the solution

Below, errors and its solution are analyzed.

As a result of the process, OPTeX will generate the report **INPUT_CHECK_DATA.LOG**.

1. TABLE: NODOS

The problem lies in the fact that the key associated with the index **k** is linked to the **COD_NOD1** field which should be part of the master node table, and it is not. As the relational key **COD_NOD1** is declared in the table **CAMRE**. Solution include **COD_NOD1** in the table.

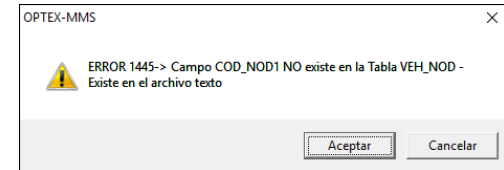
Additionally, the table node has largest number of fields to be defined: **COTA**, **COTE**, **TSER**, **COOR_X**, and **COOR_Y**. In this case **OPTeX** reports error reported. Solution include the fields in the table definition or delete the data in the table, the latter was implemented.

2. TABLA: VEH_NOD

The OPTeX report indicates that the **COD_NOD1** field is not included in the table **VEH_NOD**. Solution include such a field that is required to manage the index **k**.

	A	B	C	D	E	F	G	H	I	J	K	L
1	COD_DB	COD_CAMF	DESC_CAMPO	DESCORT_01	TPO	LONGIT	DECIMAL	COD_UN	VALIDACI	VALDO_1	VALDO_2	SEQ_GET
15	NODOS	COD_NOD	Código Nodo	Código	C	15	0					1
16	NODOS	COD_NOD1	Código Nodo Alias	Código Alias	C	15	0		D			2
17	NODOS	DES_NOD	Descripción del Nodo	Descripción	C	30	0		D			3

	A	B	C	D	E	F	G	H	I	J	K	L
1	COD_NOD	COD_NOD1	DES_NOD	TPO	Costo Penalizac	Costo Penalizacion	Tiempo de Servicio	Coordinada X (g)	Coordinada Y (gd)			
2	Código Nodo	Código Nodo(Alias)	Descripción del Tipo de Nodo									
3	8300251421-0	8300251421-0	DIX S A	ORH	100	105	0	-74.1642192	4.69460797			
4	830025638-1	830025638-1	CARREFOUR 20 DES		100	105	1.73	-74.10088	4.55879			
5	830025638-4	830025638-4	CARREFOUR CV DES		100	105	1.38	-74.06571	4.75551			
6	830025638-5	830025638-5	CARREFOUR CH DES		100	105	1.48	-74.06668	4.60251			
7	830025638-7	830025638-7	CARREFOUR CL DES		100	105	3.07	-74.063947	4.691055			
8	830025638-17	830025638-17	CARREFOUR PA DES		100	105	1.9	-74.090156	4.619205			
9	830025638-18	830025638-18	CARREFOUR PE DES		100	105	1.91	-74.16713	4.6025			
10	830025638-22	830025638-22	CARREFOUR SV DES		100	105	1.23	-74.0382	4.69096			



	A	B	C	D	E	F	G	H	I	J	K	L
1	COD_DB	COD_CAMF	DESC_CAMPO	DESCORT_01	TPO	LONGIT	DECIMAL	COD_UN	VALIDACI	VALDO_1	VALDO_2	SEQ_GET
27	VEH_NOD	COD_VEH	Código Vehículo	Código Vehículo	C	7	0		A	VEHICULOS	COD_VEH	1
28	VEH_NOD	COD_NOD	Código Nodo	Código Nodo	C	15	0		A	NODOS	COD_NOD	2
29	VEH_NOD	COD_NOD1	Código Nodo Alias	Código Nodo	C	15	0		A	NODOS	COD_NOD	3

LOADING INDUSTRIAL/BUSINESS DATA

The new templates should be to reimport the data and the models; alternatively, the errors can be corrected directly at OPTEX-GUI.

The new templates are located at the URLs:

- [http://www.doanalytics.net/Documents/OPTEX Plantilla Data VRP 2.xlsx](http://www.doanalytics.net/Documents/OPTEX_Plantilla_Data_VRP_2.xlsx)
- [http://www.doanalytics.net/Documents/OPTEX Plantilla Modelo VRP 5.xlsx](http://www.doanalytics.net/Documents/OPTEX_Plantilla_Modelo_VRP_5.xlsx)

CHECKING THE QUALITY OF DATA OF THE IDIS

The validation of the data that you enter in the mathematical models is a fundamental step which helps raise the level of reliability/quality of the data, thus avoiding possible errors in the execution of the mathematical models. You should distinguish two types of errors:

- **Integrity:** related to the relations between the different entities/objects that are part of database and mathematical models, establishing via relational keys/codes/fields of different tables; and
- **Veracity:** related to the contents of the fields that are part of tables.

OPTeX provides services to validate the previous types of error. However, it is impossible to have an automated process to ensure one hundred percent (100%) the non-existence of errors in accuracy. A simple example of a data error can be the capability in volume in a vehicle that is 10 tons and the user enters the system 9; If the entered data meets the range of validity, it is impossible to detect the previous error of veracity.

Do not detect errors in the data translates into longer time implementation of models, since errors can lead to problems in the solution of mathematical models that may be associated with different causes, for example problems of feasibility, or leak in the mathematical models (uncontrolled productions), which can be difficult/impossible for manual verification processes to detect. This problem is increased in that mathematical models are related to problems of large dimensions.

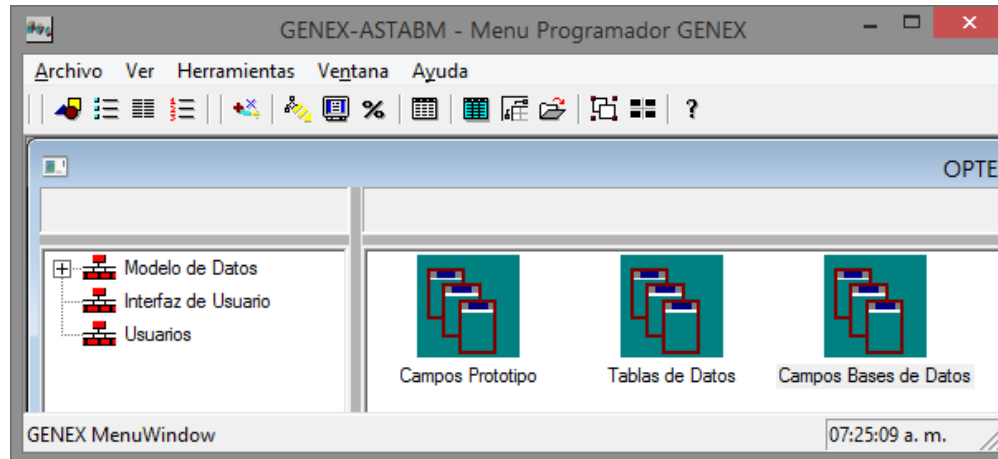
OPTeX has validation in three points of the process, in:

- Loading data to the tables;
- The composition of sets; and
- The values of the parameters.

The first control is carried out at the time of loading data in the database, the last two during the execution of the models.

CHECKING THE QUALITY OF DATA OF THE IDIS **RULES OF VALIDATION IN THE DATA MODEL**

To configure data validation processes must access the table of settings of the fields from the tables of data (DDBAS), which is done accessing the container windows Data Tables and Fields of Data Bases, OPTEX-GUI, in the OPTEX-EXCEL template on the DDBAS sheet.



CHECKING THE QUALITY OF DATA OF THE IDIS RULES OF VALIDATION IN THE DATA MODEL

The fields of a data table attributes include the Type of Validation (VALIDATION or TV), which is used to guarantee the integrity of the data. The different types of validation parameters are assigned to the auxiliary fields Parameter 1 (**VALIDO_1**) and Parameter 2 (**VALIDO_2**).

1	COD_DB	COD_CAMF	DESC_CAMPO	DESCORT_01	TIPO	LONGITU	DECIMAL	COD_UN	VALIDACI	VALIDO_1	VALIDO_2	SEQ_GET
2	Code Data Table	Field Code	Long Description	Short Description	Field Type	Longitude	Decimal	Unit Code	Type Validati	Parameter # 1	Parameter # 2	Browse Sequence
3	CAJAS	COD_CAJ	Código Cajas	Código	C	15	0		D			1
4	CAJAS	DES_CAJ	Descripción Caja	Descripción	C	10	0		D			2
7	ESC_CAJ	COD_CAJ	Código Cajas	Código Caja	C	15	0		A	CAJAS	COD_CAJ	1
8	ESC_NOD	COD_NOD	Código Nodo	Código Nodo	C	15	0		A	NODOS	COD_NOD	1
9	ESC_NOD	COD_NOD1	Código Nodo (Alias)	Código Nodo	C	15	0		A	NODOS	COD_NOD	2
10	ESC_PED	COD_PED	Código Pedido	Código Pedido	C	13	0		A	PEDIDOS	COD_PED	1
11	ESC_VEH	COD_VEH	Código Vehículo	Código Vehículo	C	7	0		A	VEHICULOS	COD_VEH	1
12	NOD_NOD	COD_NOD	Código Nodo	Nodo Origen	C	15	0		A	NODOS	COD_NOD	1
13	NOD_NOD	COD_NOD1	Código Nodo (Alias)	Nodo Destino	C	15	0		A	NODOS	COD_NOD	2
15	NODOS	COD_NOD	Código Nodo	Código	C	15	0		D			1
16	NODOS	COD_NOD1	Código Nodo Alias	Código Alias	C	15	0		D			2
17	NODOS	DES_NOD	Descripción del Nodo	Descripción	C	30	0		D			3
19	NOR_VEH	COD_NOD	Código Nodo Origen	Código Nodo	C	15	0		A	NODOS	COD_NOD	1
20	NOR_VEH	COD_VEH	Código Vehículo	Código Vehículo	C	7	0		A	VEHICULOS	COD_VEH	2
21	PED_CAJ	COD_PED	Código Pedido	Código Pedido	C	13	0		A	PEDIDOS	COD_PED	1
22	PED_CAJ	COD_CAJ	Código Cajas	Código Caja	C	15	0		A	CAJAS	COD_CAJ	2
24	PEDIDOS	COD_PED	Código Pedido	Código	C	13	0		D			1
25	PEDIDOS	DES_PED	Descripción del Pedido	Descripción	C	30	0		D			2
26	PEDIDOS	COD_NOD	Código Nodo	Código Nodo	C	15	0		A	NODOS	COD_NOD	3
27	VEH_NOD	COD_VEH	Código Vehículo	Código Vehículo	C	7	0		A	VEHICULOS	COD_VEH	1
28	VEH_NOD	COD_NOD	Código Nodo	Código Nodo	C	15	0		A	NODOS	COD_NOD	2
29	VEH_NOD	COD_NOD1	Código Nodo Alias	Código Nodo	C	15	0		A	NODOS	COD_NOD	3
30	VEHICULOS	COD_VEH	Código Vehículo	Código	C	7	0		D			1
31	VEHICULOS	DES_VEH	Descripción del Vehículo	Descripción	C	30	0		D			2

CHECKING THE QUALITY OF DATA OF THE IDIS RULES OF VALIDATION IN THE DATA MODEL

Multiple Types of Validation are implemented in OPT Σ X-GUI and all of them are intended to ensure the integrity of the relationships between the entities that are part of the information system. The template uses two types of validation A and D:

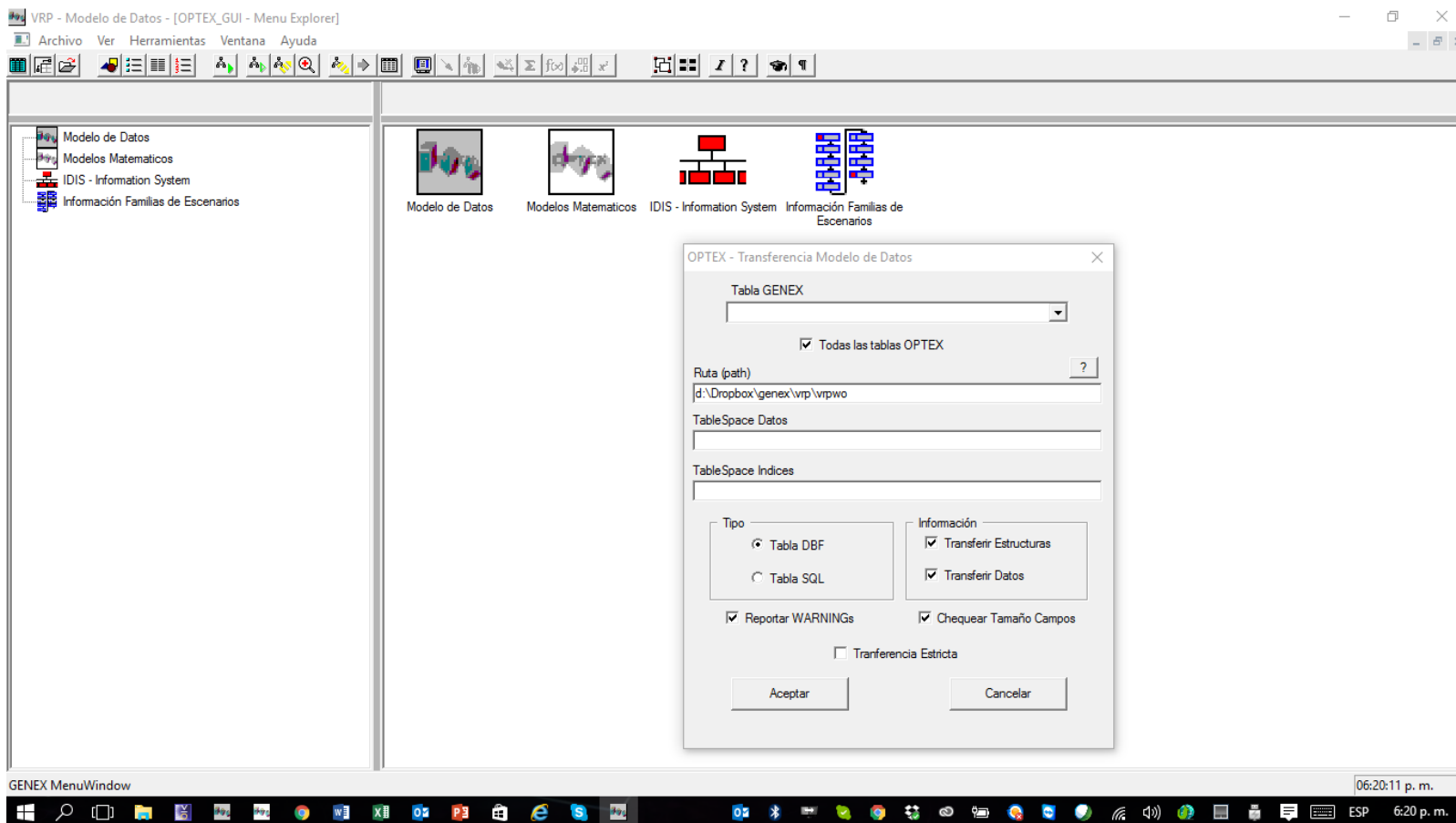
- A Referential Integrity.** Validation by the contents of a field in a table. Used in the fields of secondary tables. It is usually the way to validate the existence of the content of a relational code in the keys/codes included in the master table. It allows duplicity and empty fields.
- D Duplication:** Validation by duplication of the contents of the field in the table.

In general terms, the above rules are necessary, but there may be other additional rules to be included to ensure the solution to a mathematical model. The Manual of the Validation Data Manager examines the issue of validation of data carefully.

CHECKING THE QUALITY OF DATA OF THE IDIS

CHECKING DATA INTEGRITY

To validate data quality OPTEX has Check Integrity IDIS service, which can be accessed from OPTEX explorer via the right click of the mouse.



CHECKING THE QUALITY OF DATA OF THE IDIS

CHECKING DATA INTEGRITY

As a result, the DATA_VALIDATION.LOG report is obtained, it contains all errors reported by OPTeX taking into account validation rules implemented by the modeler.

```

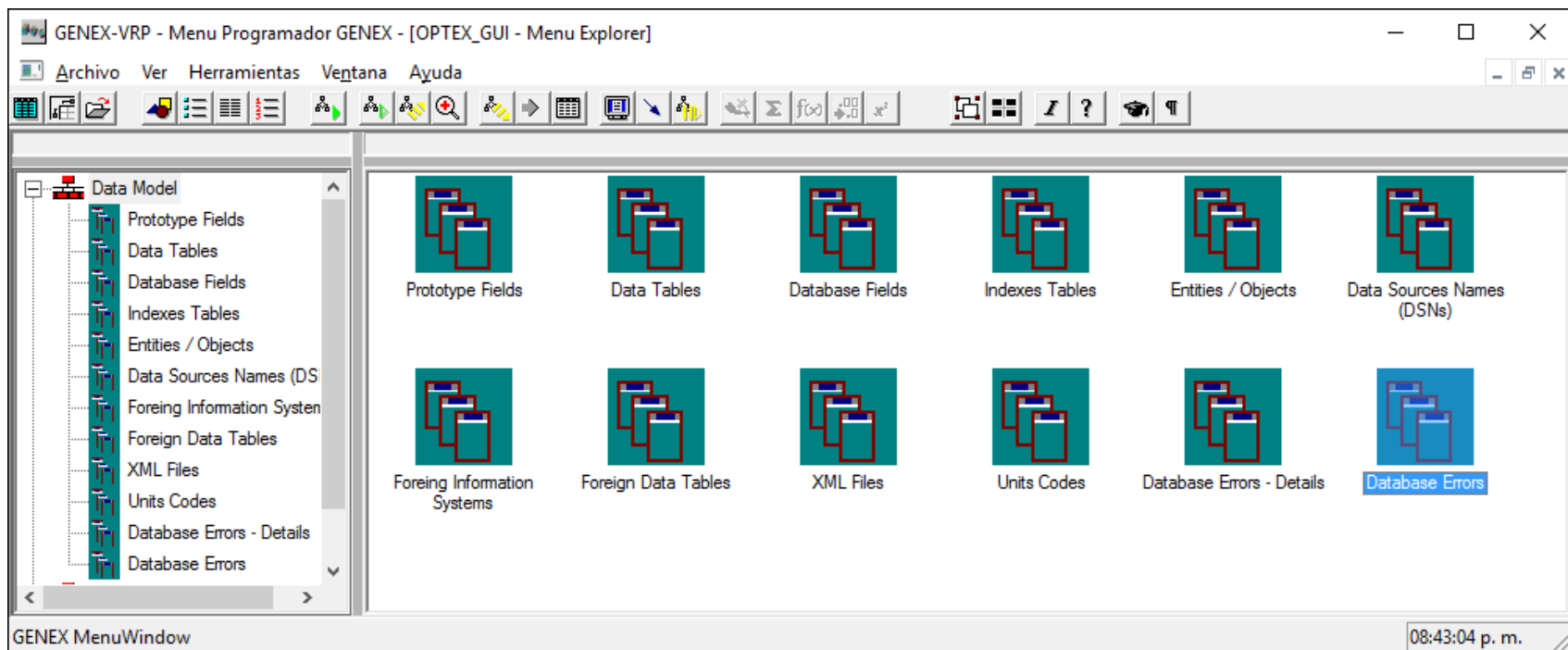
OPTeX - d:\Dropbox\genex\vrp\vrpwo\DATA_VALIDATION.LOG
-----
RECREANDO: NODOS
08:35:41 Creando campo: COD_NOD
08:35:41 Creando campo: COD_NOD1
08:35:41 Creando campo: DES_NOD
08:35:41 Creando campo: TIPO
08:35:41 Tabla Original: d:\Dropbox\genex\vrp\vrpda\NODOS.DBF - Tabla Destino: d:\Dropbox\genex\vrp\vrpwo\NODOS.DBF
08:35:41 Campo Clave: COD_NOD
REGISTRO CAMPO CONTENIDO DESCRIPCION ERROR # ERROR
08:35:41
RECREANDO: PEDIDOS
08:35:41 Creando campo: COD_PED
08:35:41 Creando campo: DES_PED
08:35:41 Creando campo: COD_NOD
08:35:41 Tabla Original: d:\Dropbox\genex\vrp\vrpda\PEDIDOS.DBF - Tabla Destino: d:\Dropbox\genex\vrp\vrpwo\PEDIDOS.DBF
08:35:41 Campo Clave: COD_PED
REGISTRO CAMPO CONTENIDO DESCRIPCION ERROR # ERROR
08:35:42
RECREANDO: VEHICULOS
08:35:42 Creando campo: COD_VEH
08:35:42 Creando campo: DES_VEH
08:35:42 Creando campo: CAPV
08:35:42 Creando campo: CAPV
08:35:42 Creando campo: CUVE
08:35:42 Creando campo: COVA
08:35:42 Tabla Original: d:\Dropbox\genex\vrp\vrpda\VEHICULOS.DBF - Tabla Destino: d:\Dropbox\genex\vrp\vrpwo\VEHICULOS.DBF
08:35:42 Campo Clave: COD_VEH
REGISTRO CAMPO CONTENIDO DESCRIPCION ERROR # ERROR
2 DES_VEH NHR Duplicidad en Campo 200
3 DES_VEH NHR Duplicidad en Campo 200
4 DES_VEH NHR Duplicidad en Campo 200
6 DES_VEH NKR III Duplicidad en Campo 200
7 DES_VEH NKR III Duplicidad en Campo 200
9 DES_VEH NPR Duplicidad en Campo 200
10 DES_VEH NPR Duplicidad en Campo 200
11 DES_VEH NHR Duplicidad en Campo 200
13 DES_VEH NHR Duplicidad en Campo 200
15 DES_VEH NHR Duplicidad en Campo 200
16 DES_VEH NKR II Duplicidad en Campo 200
17 DES_VEH NKR II Duplicidad en Campo 200
18 DES_VEH NKR II Duplicidad en Campo 200
  
```

CHECKING THE QUALITY OF DATA OF THE IDIS

CHECKING DATA INTEGRITY

In addition to the report, OPTEX generates tables with the errors that the modeler can review from OPTEX-GUI accessing to the window associated with the Data Tables.

Errors of integrity found in the different tables are then analyzed. So it is suggested to review the menu of Data Model window associated with Database Errors in which there are tables with errors and the records within each table.

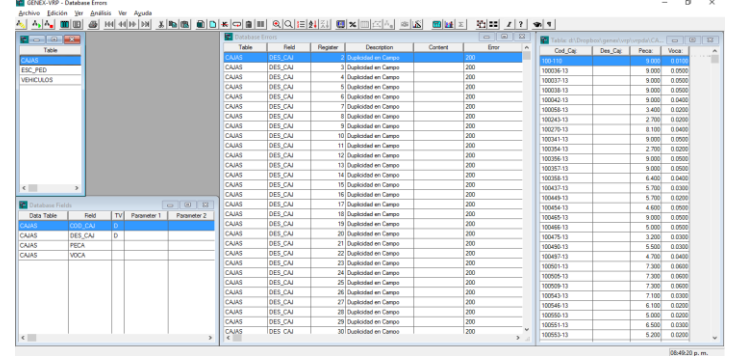


CHECKING THE QUALITY OF DATA OF THE IDIS

CHECKING DATA INTEGRITY

1. TABLE: CAJAS

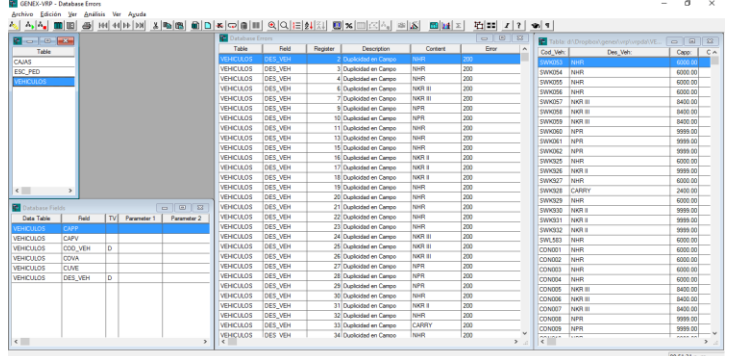
The problem lies in the fact that the description of the boxes (**DES_CAJ**), created by the "laziness" of filling the field. In this case, the field of boxes can be filled with the code of the box.



2. TABLE: ESC_PED

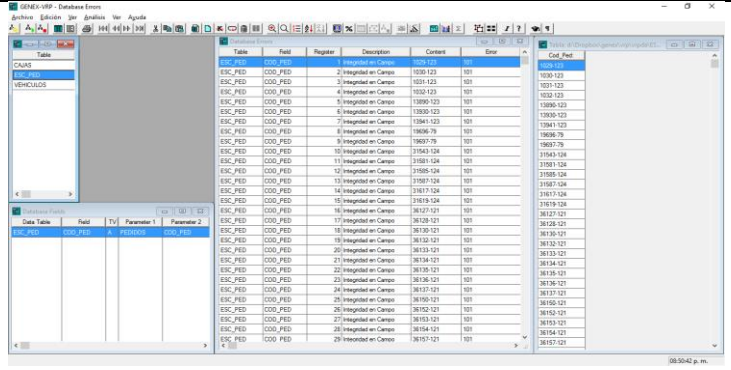
The problem lies in the fact that the order code is not defined in the master **ORDERS** table. If we review the **ORDERS** table that field is empty, therefore the solution to load the table correctly.

In addition, it is also an error that the **PED_CAJ** table is empty. This table must be created.



3. TABLE: VEHICULOS

The problem is that some descriptions of vehicles (**DES_VEH**) are repeated, creating confusion since a description must be different for each code. The solution will be concatenated codes with descriptions to generate a new description does not repeat.



Analyzing the errors databases are the report of three tables: **CAJAS**, **ESC_PED** and **VEHICULOS**. The reason for the errors is then analyzed.

CHECKING THE QUALITY OF DATA OF THE IDIS

CHECKING DATA INTEGRITY

To avoid mistakes such as those presented and improve the quality of the data, some validation rules, will be adjusted including rule F:

F Referential integrity, not to allow empty fields and requires the existence of all the codes/keys for the master table in the field in the table being validated.

This rule applies to the following couples table-field:

- **PEDIDOS - COD_CLI**: implies that they may not exist orders without a client (node) assigned and that there must be at least one order for each customer.
- **PED_CAJ - COD_PED**: implies that there has to be at least one box type assigned to each order.
- **PED_CAJ - COD_CAJ**: implies that there has to be at least one order assigned to the type of box.
- **NOR_VEH - COD_VEH**: implies that for any vehicle there must be a warehouse assigned.
- **NOD_NOD - COD_NOD**: implies that for any vehicle there is at least one node destination to which it can go.
- **NOD_NOD - COD_NOD1**: implies that for all node there is at least one origin node which can be arrived from.
- **VEH_NOD - COD_VEH**: implies that for all node there is at least one node which can go to.
- **VEH_NOD - COD_NOD**: implies that or all node there is at least one vehicle that can visit it.

CHECKING THE QUALITY OF DATA OF THE IDIS

CHECKING DATA INTEGRITY

Corrections in the data tables may be held at OPTEX-GUI and are subsequently exported to a template to keep the data in the EXCEL template.

The PEDIDOS.csv and PED_CAJ.csv tables were obtained from other sources and it was imported into the IDIS through import of text files. The tables used are available from the following URLs:

- <http://www.doanalytics.net/Documents/PEDIDOS.csv.xlsx>
- http://www.doanalytics.net/Documents/PED_CAJ.csv.xlsx

The new template, including new validations are located at the following URL:

- http://www.doanalytics.net/Documents/OPTEX_Plantilla_Modelo_VRP_6.xlsx

CHECKING THE QUALITY OF DATA OF THE IDIS

CHECKING DATA INTEGRITY

The next step is to conduct a new analysis of integrity, with new tables and new validations, resulting in the report DATA_VALIDATION_1.LOG which is located at the URL:

- http://www.doanalytics.net/Documents/DATA_VALIDATION_1.LOG

```

DATA_VALIDATION_1.LOG: Bloc de notas
Archivo Edición Formato Ver Ayuda
RECREANDO: ESC_CAJ
06:11:20 Creando campo: COD_CAJ
06:11:21 Tabla Original: d:\Dropbox\genex\vrp\vrpda\ESC_CAJ.DBF - Tabla Destino: d:\Dropbox\genex\vrp\vrpwo\ESC_CAJ.DBF
06:11:21 Campo Clave: -
REGISTRO CAMPO CONTENIDO DESCRIPCION ERROR # ERROR
06:11:21
RECREANDO: NODOS
06:11:21 Creando campo: COD_NOD
06:11:21 Creando campo: COD_NOD1
06:11:21 Creando campo: DES_NOD
06:11:21 Creando campo: TIPO
06:11:21 Tabla Original: d:\Dropbox\genex\vrp\vrpda\NODOS.DBF - Tabla Destino: d:\Dropbox\genex\vrp\vrpwo\NODOS.DBF
06:11:21 Campo Clave: COD_NOD
REGISTRO CAMPO CONTENIDO DESCRIPCION ERROR # ERROR
06:11:21
RECREANDO: PEDIDOS
06:11:21 Creando campo: COD_PED
06:11:21 Creando campo: DES_PED
06:11:21 Creando campo: COD_NOD
06:11:21 Tabla Original: d:\Dropbox\genex\vrp\vrpda\PEDIDOS.DBF - Tabla Destino: d:\Dropbox\genex\vrp\vrpwo\PEDIDOS.DBF
06:11:21 Campo Clave: COD_PED
REGISTRO CAMPO CONTENIDO DESCRIPCION ERROR # ERROR
5 COD_NOD 860007336-34 Integridad en Campo 101
6 COD_NOD 860013570-2 Integridad en Campo 101
7 COD_NOD 860013570-8 Integridad en Campo 101
8 COD_NOD 860013570-9 Integridad en Campo 101
9 COD_NOD 860013570-23 Integridad en Campo 101
10 COD_NOD 860013570-50 Integridad en Campo 101
11 COD_NOD 860013570-34 Integridad en Campo 101
12 COD_NOD 860013570-35 Integridad en Campo 101
13 COD_NOD 860013570-36 Integridad en Campo 101

```

CHECKING THE QUALITY OF DATA OF THE IDIS

CHECKING DATA INTEGRITY

1. TABLE: NOR_VEH

The problem lies in the fact that there are codes of vehicles (**COD_VEH**) for which is not assigned origin warehouse. Solution remove reported vehicles of the master **VEHICULOS** or complete the table **NOR_VEH**. Solution remove the masters existing codes.

The image shows invalid records in the **NOR_VEH** table. There is no one.

Table	Field	Registro	Description	Content	Error
NOR_VEH	COD_VEH	0	ID Maestro: CON001 NO se encuentra en Campo COD_VEH	CON001	701
NOR_VEH	COD_VEH	0	ID Maestro: CON002 NO se encuentra en Campo COD_VEH	CON002	701
NOR_VEH	COD_VEH	0	ID Maestro: CON003 NO se encuentra en Campo COD_VEH	CON003	701
NOR_VEH	COD_VEH	0	ID Maestro: CON004 NO se encuentra en Campo COD_VEH	CON004	701
NOR_VEH	COD_VEH	0	ID Maestro: CON005 NO se encuentra en Campo COD_VEH	CON005	701
NOR_VEH	COD_VEH	0	ID Maestro: CON006 NO se encuentra en Campo COD_VEH	CON006	701
NOR_VEH	COD_VEH	0	ID Maestro: CON007 NO se encuentra en Campo COD_VEH	CON007	701
NOR_VEH	COD_VEH	0	ID Maestro: CON008 NO se encuentra en Campo COD_VEH	CON008	701
NOR_VEH	COD_VEH	0	ID Maestro: CON009 NO se encuentra en Campo COD_VEH	CON009	701
NOR_VEH	COD_VEH	0	ID Maestro: CON010 NO se encuentra en Campo COD_VEH	CON010	701
NOR_VEH	COD_VEH	0	ID Maestro: CON011 NO se encuentra en Campo COD_VEH	CON011	701
NOR_VEH	COD_VEH	0	ID Maestro: CON012 NO se encuentra en Campo COD_VEH	CON012	701
NOR_VEH	COD_VEH	0	ID Maestro: CON013 NO se encuentra en Campo COD_VEH	CON013	701
NOR_VEH	COD_VEH	0	ID Maestro: CON014 NO se encuentra en Campo COD_VEH	CON014	701
NOR_VEH	COD_VEH	0	ID Maestro: CON015 NO se encuentra en Campo COD_VEH	CON015	701
NOR_VEH	COD_VEH	0	ID Maestro: CON016 NO se encuentra en Campo COD_VEH	CON016	701
NOR_VEH	COD_VEH	0	ID Maestro: CON017 NO se encuentra en Campo COD_VEH	CON017	701
NOR_VEH	COD_VEH	0	ID Maestro: CON018 NO se encuentra en Campo COD_VEH	CON018	701
NOR_VEH	COD_VEH	0	ID Maestro: CON019 NO se encuentra en Campo COD_VEH	CON019	701

2. TABLE: PED_CAJ

The problem lies in the fact that there are boxes codes (**COD_CAJ**) and codes of the orders (**COD_PED**) that are not listed in their respective master tables. Also reports that there are orders for which there are no assigned boxes. Solution delete invalid records and perform integrity analysis.

The image shows invalid records in the table **PED_CAJ**, which will be deleted.

Table	Field	Registro	Description	Content	Error
PED_CAJ	COD_CAJ	8	Integridad en Campo	163-121	101
PED_CAJ	COD_CAJ	16	Integridad en Campo	352-121	101
PED_CAJ	COD_CAJ	27	Integridad en Campo	205-121	101
PED_CAJ	COD_CAJ	45	Integridad en Campo	352-121	101
PED_CAJ	COD_CAJ	50	Integridad en Campo	205-121	101
PED_CAJ	COD_CAJ	65	Integridad en Campo	352-121	101
PED_CAJ	COD_CAJ	72	Integridad en Campo	142-121	101
PED_CAJ	COD_CAJ	78	Integridad en Campo	352-121	101
PED_CAJ	COD_CAJ	80	Integridad en Campo	252-121	101
PED_CAJ	COD_CAJ	81	Integridad en Campo	352-121	101
PED_CAJ	COD_CAJ	90	Integridad en Campo	252-121	101
PED_CAJ	COD_CAJ	91	Integridad en Campo	352-121	101
PED_CAJ	COD_CAJ	97	Integridad en Campo	205-121	101
PED_CAJ	COD_CAJ	102	Integridad en Campo	142-121	101
PED_CAJ	COD_CAJ	109	Integridad en Campo	352-121	101
PED_CAJ	COD_CAJ	110	Integridad en Campo	142-121	101
PED_CAJ	COD_CAJ	118	Integridad en Campo	252-121	101
PED_CAJ	COD_CAJ	119	Integridad en Campo	352-121	101
PED_CAJ	COD_CAJ	128	Integridad en Campo	8428920010189-1	101
PED_CAJ	COD_CAJ	129	Integridad en Campo	100001-119	101
PED_CAJ	COD_CAJ	130	Integridad en Campo	100002-119	101
PED_CAJ	COD_CAJ	131	Integridad en Campo	100002-119	101
PED_CAJ	COD_CAJ	132	Integridad en Campo	100001-119	101
PED_CAJ	COD_CAJ	133	Integridad en Campo	2250-110	101
PED_CAJ	COD_CAJ	135	Integridad en Campo	2750-110	101
PED_CAJ	COD_CAJ	137	Integridad en Campo	2750-110	101
PED_CAJ	COD_CAJ	140	Integridad en Campo	2750-110	101
PED_CAJ	COD_CAJ	141	Integridad en Campo	320-110	101
PED_CAJ	COD_CAJ	142	Integridad en Campo	340-110	101

This report presents problems of integrity for the following tables: **NOR_VEH**, **PED_CAJ**, **PEDIDOS** and **VEH_NOD**. The problems are:

CHECKING THE QUALITY OF DATA OF THE IDIS

CHECKING DATA INTEGRITY

1. TABLE: PEDIDOS

The problem lies in the fact that there are codes of clients/nodes (**COD_NOD**) that are not listed in their respective master tables. Also it is reported that there is a customer, **8300251421-0**, for which there are no orders, which is correct since this node corresponds to the warehouse. Solution delete invalid records and perform integrity analysis.

The image shows invalid records in the **ORDERS** table, which will be deleted.

The screenshot shows a database management tool interface. The main window displays the 'PEDIDOS' table with columns: Cod_Ped, Des_Ped, Cod_Nod, and a primary key icon. The table contains numerous records with various codes. A 'Database Errors' window is open on the right, listing errors for the 'PEDIDOS' table. The errors are categorized by 'Table', 'Field', 'Registro', 'Description', 'Content', and 'Error'. The errors listed are:

Table	Field	Registro	Description	Content	Error
PEDIDOS	COD_NOD	196	Integridad en Campo	890107487-15	101
PEDIDOS	COD_NOD	197	Integridad en Campo	890107487-15	101
PEDIDOS	COD_NOD	198	Integridad en Campo	890107487-24	101
PEDIDOS	COD_NOD	199	Integridad en Campo	890107487-24	101
PEDIDOS	COD_NOD	200	Integridad en Campo	890107487-40	101
PEDIDOS	COD_NOD	211	Integridad en Campo	890107487-17	101
PEDIDOS	COD_NOD	212	Integridad en Campo	890107487-17	101
PEDIDOS	COD_NOD	213	Integridad en Campo	860002095-27	101
PEDIDOS	COD_NOD	214	Integridad en Campo	860002095-3	101
PEDIDOS	COD_NOD	215	Integridad en Campo	860002095-26	101
PEDIDOS	COD_NOD	216	Integridad en Campo	860002095-62	101
PEDIDOS	COD_NOD	217	Integridad en Campo	860002095-62	101
PEDIDOS	COD_NOD	218	Integridad en Campo	860002095-27	101
PEDIDOS	COD_NOD	219	Integridad en Campo	860002095-3	101
PEDIDOS	COD_NOD	220	Integridad en Campo	860002095-74	101
PEDIDOS	COD_NOD	221	Integridad en Campo	860002095-74	101
PEDIDOS	COD_NOD	222	Integridad en Campo	860002095-74	101
PEDIDOS	COD_NOD	225	Integridad en Campo	860002095-56	101
PEDIDOS	COD_NOD	227	Integridad en Campo	860002095-56	101
PEDIDOS	COD_NOD	228	Integridad en Campo	860002095-28	101
PEDIDOS	COD_NOD	229	Integridad en Campo	860002095-28	101
PEDIDOS	COD_NOD	230	Integridad en Campo	860002095-21	101
PEDIDOS	COD_NOD	232	Integridad en Campo	860013570-16	101
PEDIDOS	COD_NOD	236	Integridad en Campo	860013570-16	101
PEDIDOS	COD_NOD	237	Integridad en Campo	860013570-47	101
PEDIDOS	COD_NOD	238	Integridad en Campo	860013570-52	101
PEDIDOS	COD_NOD	239	Integridad en Campo	860013570-50	101
PEDIDOS	COD_NOD	243	Integridad en Campo	890107487-3	101
PEDIDOS	COD_NOD	0	ID Maestro: 8300251421-0 NO se encuentra en Campo COD_NOD	8300251421-0	701

2. TABLE: VEH_NOD

The problem lies in the fact that there are codes of vehicles (**COD_VEH**) for which is not assigned origin warehouse. Solution remove the reported vehicles of the master **VEHICULOS** table or complete the **VEH_NOD** table. These coincide with reported errors for the table. Solution delete from master table the existing codes.

The image shows invalid records in the **VEH_NOD** table. There is no one.

The screenshot shows a database management tool interface. The main window displays the 'VEH_NOD' table with columns: Cod_Veh, Cod_Nod, and Cod_Nod1. The table contains numerous records with various codes. A 'Database Errors' window is open on the right, listing errors for the 'VEH_NOD' table. The errors are categorized by 'Table', 'Field', 'Registro', 'Description', 'Content', and 'Error'. The errors listed are:

Table	Field	Registro	Description	Content	Error
VEH_NOD	COD_VEH	0	ID Maestro: CON001 NO se encuentra en Campo COD_VEH	CON001	701
VEH_NOD	COD_VEH	0	ID Maestro: CON002 NO se encuentra en Campo COD_VEH	CON002	701
VEH_NOD	COD_VEH	0	ID Maestro: CON003 NO se encuentra en Campo COD_VEH	CON003	701
VEH_NOD	COD_VEH	0	ID Maestro: CON004 NO se encuentra en Campo COD_VEH	CON004	701
VEH_NOD	COD_VEH	0	ID Maestro: CON005 NO se encuentra en Campo COD_VEH	CON005	701
VEH_NOD	COD_VEH	0	ID Maestro: CON006 NO se encuentra en Campo COD_VEH	CON006	701
VEH_NOD	COD_VEH	0	ID Maestro: CON007 NO se encuentra en Campo COD_VEH	CON007	701
VEH_NOD	COD_VEH	0	ID Maestro: CON008 NO se encuentra en Campo COD_VEH	CON008	701
VEH_NOD	COD_VEH	0	ID Maestro: CON009 NO se encuentra en Campo COD_VEH	CON009	701
VEH_NOD	COD_VEH	0	ID Maestro: CON010 NO se encuentra en Campo COD_VEH	CON010	701
VEH_NOD	COD_VEH	0	ID Maestro: CON011 NO se encuentra en Campo COD_VEH	CON011	701
VEH_NOD	COD_VEH	0	ID Maestro: CON012 NO se encuentra en Campo COD_VEH	CON012	701
VEH_NOD	COD_VEH	0	ID Maestro: CON013 NO se encuentra en Campo COD_VEH	CON013	701
VEH_NOD	COD_VEH	0	ID Maestro: CON014 NO se encuentra en Campo COD_VEH	CON014	701
VEH_NOD	COD_VEH	0	ID Maestro: CON015 NO se encuentra en Campo COD_VEH	CON015	701
VEH_NOD	COD_VEH	0	ID Maestro: CON016 NO se encuentra en Campo COD_VEH	CON016	701
VEH_NOD	COD_VEH	0	ID Maestro: CON017 NO se encuentra en Campo COD_VEH	CON017	701
VEH_NOD	COD_VEH	0	ID Maestro: CON018 NO se encuentra en Campo COD_VEH	CON018	701
VEH_NOD	COD_VEH	0	ID Maestro: CON019 NO se encuentra en Campo COD_VEH	CON019	701

CHECKING THE QUALITY OF DATA OF THE IDIS CHECKING DATA INTEGRITY

When settings are made there are still errors in the PED_CAJ table.

1. TABLA: PED_CAJ

The problem lies in the fact that codes of the orders (**COD_PED**) that are not listed in the master table, this is caused by the elimination of codes of orders in the **ORDERS TABLE**. Solution delete invalid records.

There are also orders for which there are no boxes in the table **PED_CAJ**. Solution delete invalid orders and return to the analysis of integrity.

The image shows invalid records in the table **PED_CAJ**, which will be deleted.

The screenshot shows the GENEX-VRP Database Errors window. It displays a list of errors for the PED_CAJ table. The errors are categorized by type and include details such as the field involved, the register number, a description of the error, the content value, and an error code.

Table	Field	Register	Description	Content	Error
PED_CAJ	COD_PED	1040	Integridad en Campo	7115190-13	101
PED_CAJ	COD_PED	1041	Integridad en Campo	7115190-13	101
PED_CAJ	COD_PED	1042	Integridad en Campo	7115190-13	101
PED_CAJ	COD_PED	1043	Integridad en Campo	7115191-13	101
PED_CAJ	COD_PED	1044	Integridad en Campo	7115191-13	101
PED_CAJ	COD_PED	1045	Integridad en Campo	7115192-13	101
PED_CAJ	COD_PED	1046	Integridad en Campo	7115203-13	101
PED_CAJ	COD_PED	1047	Integridad en Campo	7115203-13	101
PED_CAJ	COD_PED	1048	Integridad en Campo	7115203-13	101
PED_CAJ	COD_PED	1049	Integridad en Campo	7115203-13	101
PED_CAJ	COD_PED	1050	Integridad en Campo	7115203-13	101
PED_CAJ	COD_PED	1051	Integridad en Campo	7115203-13	101
PED_CAJ	COD_PED	1052	Integridad en Campo	7115203-13	101
PED_CAJ	COD_PED	1053	Integridad en Campo	7115203-13	101
PED_CAJ	COD_PED	1054	Integridad en Campo	7115203-13	101
PED_CAJ	COD_PED	1055	Integridad en Campo	7115203-13	101
PED_CAJ	COD_PED	1056	Integridad en Campo	7115203-13	101
PED_CAJ	COD_PED	1057	Integridad en Campo	7115203-13	101
PED_CAJ	COD_PED	1058	Integridad en Campo	7115203-13	101
PED_CAJ	COD_PED	1059	Integridad en Campo	7115204-13	101
PED_CAJ	COD_PED	1060	Integridad en Campo	7115204-13	101
PED_CAJ	COD_PED	1068	Integridad en Campo	96271-110	101
PED_CAJ	COD_PED	1069	Integridad en Campo	96271-110	101
PED_CAJ	COD_PED	1076	Integridad en Campo	99028-40	101
PED_CAJ	COD_PED	0	ID Maestro: 36185-121 NO se encuentra en Campo COD_PED	36185-121	701
PED_CAJ	COD_PED	0	ID Maestro: 7115198-13 NO se encuentra en Campo COD_PED	7115198-13	701
PED_CAJ	COD_PED	0	ID Maestro: 7115200-13 NO se encuentra en Campo COD_PED	7115200-13	701
PED_CAJ	COD_PED	0	ID Maestro: 7115201-13 NO se encuentra en Campo COD_PED	7115201-13	701
PED_CAJ	COD_PED	0	ID Maestro: 7604-69 NO se encuentra en Campo COD_PED	7604-69	701

CHECKING THE QUALITY OF DATA OF THE IDIS

CHECKING DATA INTEGRITY

After these adjustments, are new inconsistencies. This shows that to have a database with quality data, is not a trivial task. In the following, the tutorial does not present in detail processes made up to have an integrity error-free database. Correction methodology is presented it so far.

Now that you have an error-free database you can proceed to make the model runs. It should be noted that:

- **A system with integrity errors can produce correct solutions**
- **A system without integrity errors can produce incorrect solutions**

The real gain is that when it has been verified the integrity of the information **the modeler and functional user are aware of the quality of the data that are handling.**

CHECKING THE QUALITY OF DATA OF THE IDIS

CHECKING DATA INTEGRITY

Once you have the correct data in the IDIS (tables in DBF format), it is possible to export it to an EXCEL template or to CSV files; this can be performed from various points in OPTEX, the following picture is the access to the process from the table of Data Tables.

The screenshot shows the 'GENEX-VRP - Data Tables - [Data Tables]' window. The table below is the 'Data Tables' grid:

Data Table	Spanish Descrip	Gen Window	Tranfer DM	Data Model	Icon	Type	Area	Table Generator	Directory	DSN	Key DSN	User DSN
CAJAS	Maestra Cajas	.F.	.F.	.F.		M	I					
ESC_CAJ	Escenarios Cajas	.F.	.F.	.F.		S	I					
ESC_NOD	Escenarios Nodo	.F.	.F.	.F.		S	I					
ESC_PED	Escenarios Pedido	.F.	.F.	.F.		S	I					
ESC_VEH	Escenarios Vehículos	.F.	.F.	.F.		S	I					
NOD_NOD	Nodos <-> Nodos	.F.	.F.	.F.		S	I					
NODOS	Maestra Nodos	.F.	.F.	.F.		M	I					
NOR_VEH	Nodo Origen <-> Vehículos	.F.	.F.	.F.		S	I					
PED_CAJ	Pedidos <-> Cajas	.F.	.F.	.F.		S	I					
PEDIDOS	Maestra Pedidos	.F.	.F.	.F.		M	I					
VEH_NOD	Vehículos <-> Nodos	.F.	.F.	.F.		S	I					
VEHICULOS	Maestra Vehículos	.F.	.F.	.F.		M	I					

The context menu for the selected 'VEH_NOD' table includes the following options:

- Browse Tabla
- Crear Tabla
- Eliminar Tabla (DBF o SQL)
- Eliminar Todas las Tablas (DBF o SQL)
- Generar Tablas Dependientes
- Procesar Tablas
- Importar Estructura Tabla DBF
- Encriptar Claves Primarias
- Generar Documentos RTF
- Crear/Recrear/Exportar Tablas del Modelo de Datos** (highlighted)
- Crear Tablas Vacias
- Exportar a Sistema de Informacion Geografica
- Chequeo Integridad Referencial - Tranferencias Tablas
- Importar Tablas
- Crear Index SQL

The sub-menu for 'Crear/Recrear/Exportar Tablas del Modelo de Datos' includes:

- Tablas DBF o SQL
- Tablas OPTEX-EXCEL-XML
- Tablas Libro OPTEX-EXCEL-XML** (highlighted)
- Tablas CSV



Analytics

"the computer-based mathematical modeling is the greatest invention of all times"

Herbert Simon
First Winner of Nobel Prize in Economics (1978)

"for his pioneering research into the decision-making process within economic organizations"