



**XXIVth World
Road Congress
Mexico 2011**
Mexico City 2011.



EXPERIENCIA DE NICARAGUA EN EL USO DE HDM-4

ING. GERMAN CRUZ R.

DEPARTAMENTO DE PLANIFICACION
FONDO DE MANTENIMIENTO VIAL

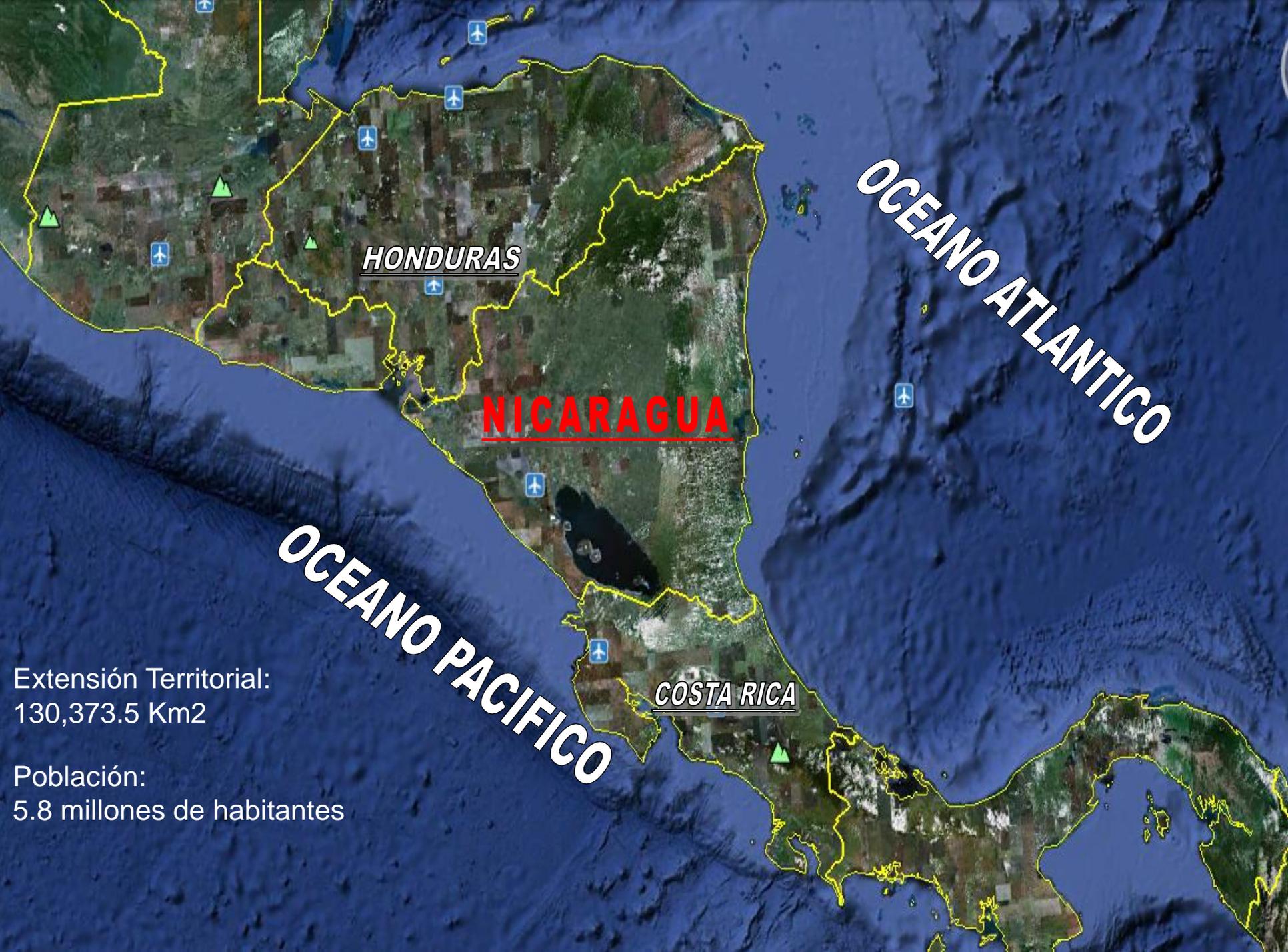
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HONDURAS

NICARAGUA

COSTA RICA

OCEANO ATLANTICO

OCEANO PACIFICO

Extensión Territorial:
130,373.5 Km²

Población:
5.8 millones de habitantes



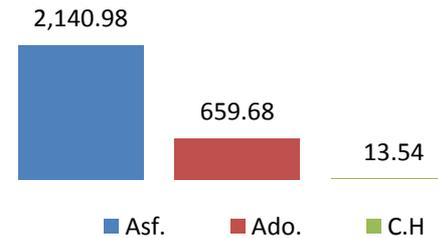


RED VIAL DE NICARAGUA

Red Vial Nacional: 22,111.05 Km

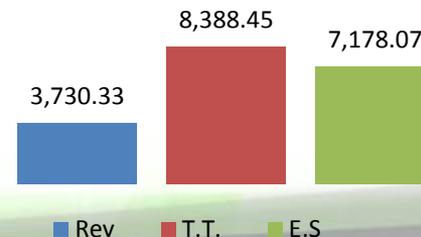
Pavimentadas: 2,814.208 Km (12.73%)

| Superficie | Longitud km | % |
|-------------|-------------|--------|
| Asfaltado | 2,140.98 | 9.68 % |
| Adoquinado | 659. 68 | 2.98% |
| Concreto H. | 13.54 | 0.06% |



No Pavimentados: 19,296.84 Km (87.27%)

| Superficie | Longitud km | % |
|---------------|-------------|---------|
| Revestidos | 3,730.33 | 16.87 % |
| Todo Tiempo | 8,388.45 | 37.94% |
| Estación Seca | 7,178.07 | 32.46% |





RED VIAL DE NICARAGUA

| Superficie de Rodamiento Km | Red Vial Nacional (Km) | Red Vial Básica (Km) |
|----------------------------------|------------------------|----------------------|
| Adoquin | 659.69 | 585.96 |
| Asfalto | 2,140.98 | 2,140.98 |
| Concreto Hidráulico | 13.54 | 13.10 |
| No Pavimentados | 19,296.84 | 5,250.88 |
| Total | 22,111.05 | 7,990.92 |
| % de la Red Vial Nacional | | 36.14% |
| % de la Red Vial Básica | | |

Parque Vehicular: 435,148; 75Veh/1000Hab

% Crecimiento : 5%

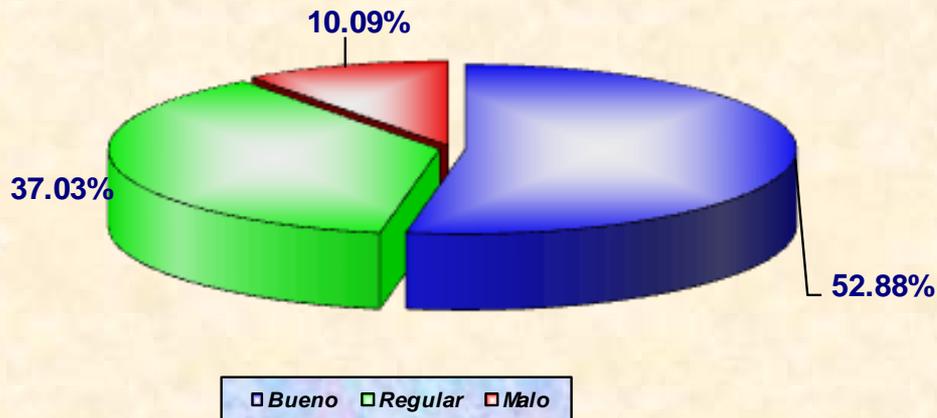




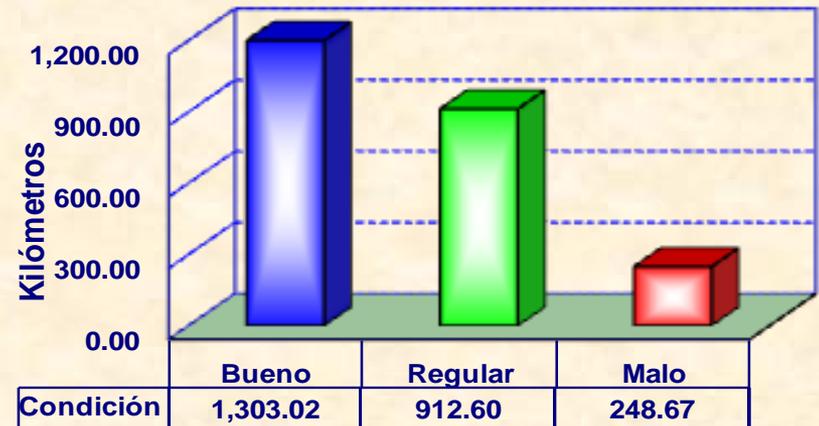
SISTEMA DE ADMINISTRACIÓN DE PAVIMENTOS

CONDICION DE LA RED VIAL PAVIMENTADA.

Condición de la Red Vial Pavimentada con superficie asfaltadas
Año 2011



Cantidad de Kilómetros Estudiados de la Red Vial Pavimentada con supeficie Asfaltada 2011



Tramos inspeccionados: 95.29%.

No inspeccionados: 4.71%.





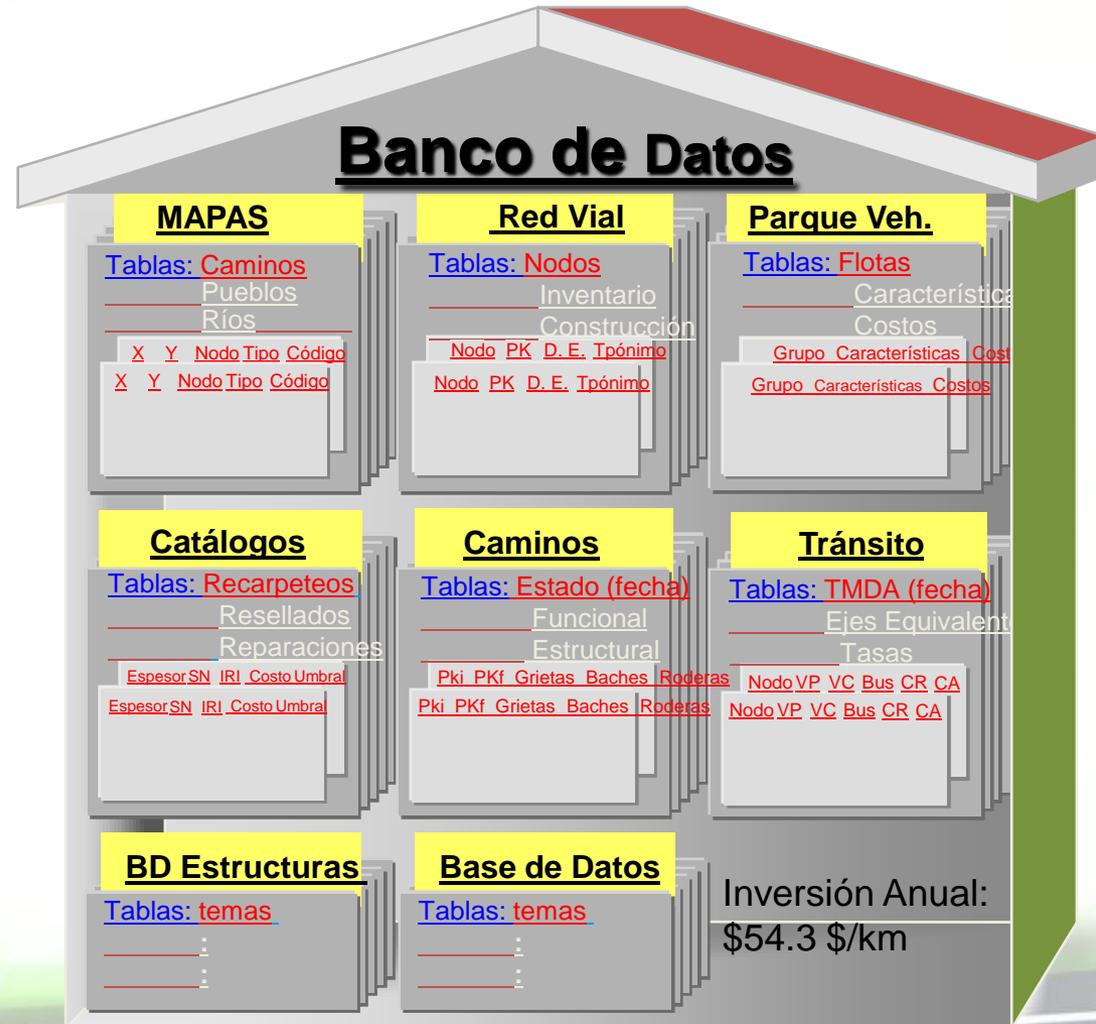
VALOR ESTIMADO DEL PATRIMONIO DE LA RED VIAL BASICA DE NICARAGUA





SISTEMA DE ADMINISTRACIÓN DE PAVIMENTOS

El Sistema de Administración de Pavimentos (PMS - Pavement Management System), fue creado a través de cooperación de Dinamarca en 1996, implementando una base de datos con el sistema basado en procedimientos desarrollados con el HDM-III.





SISTEMA DE ADMINISTRACIÓN DE PAVIMENTOS

Conteos de tráfico



Medidas de deflexión



Inspección visual



Control de pesos





SISTEMA DE ADMINISTRACIÓN DE PAVIMENTOS

ESTUDIOS DE IRREGULARIDAD



Z-250 (Dipstick)



Nivel y mira Topográfica.



Merlin.

Walking Profiler



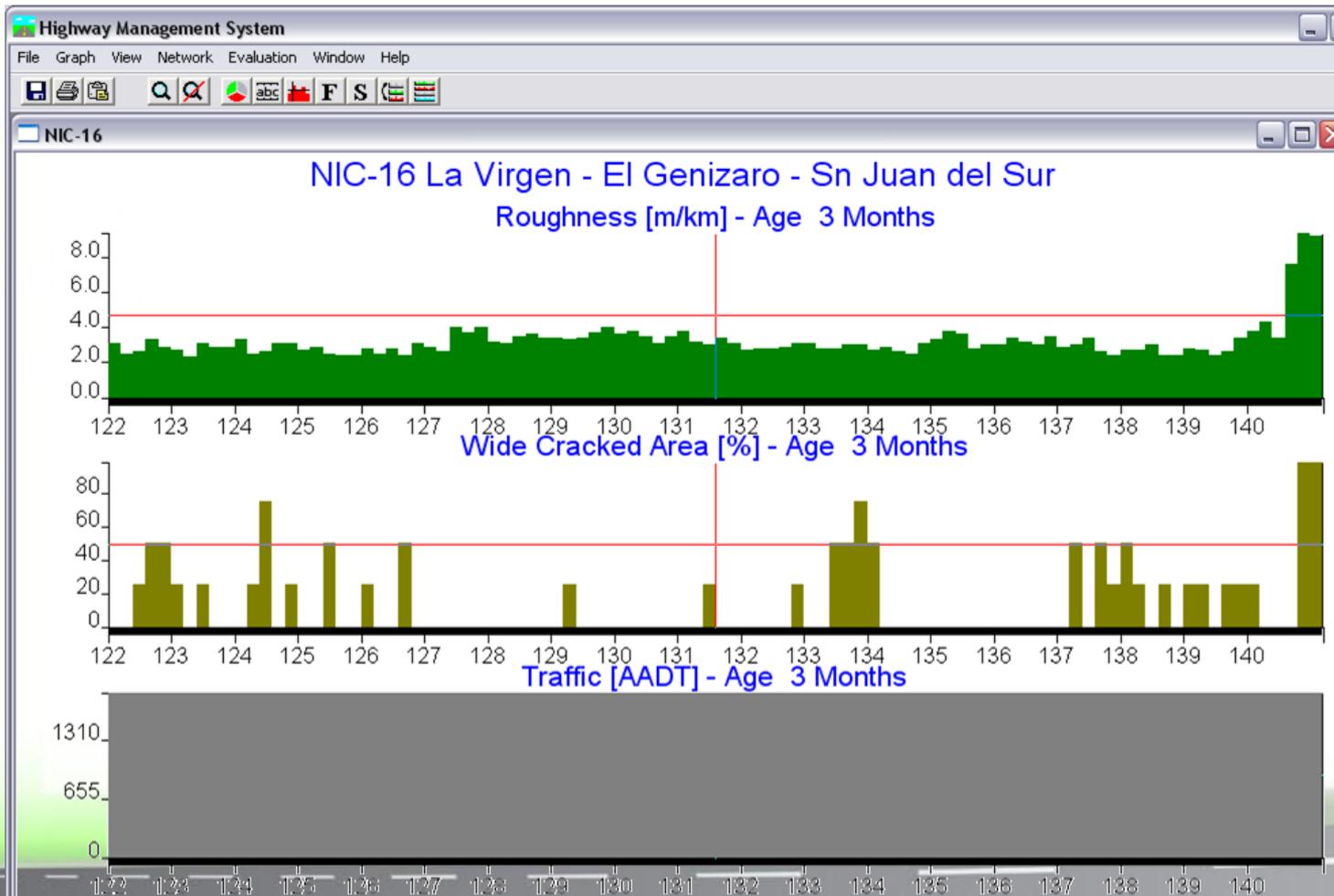
Tipo Respuesta (ROMDAS)





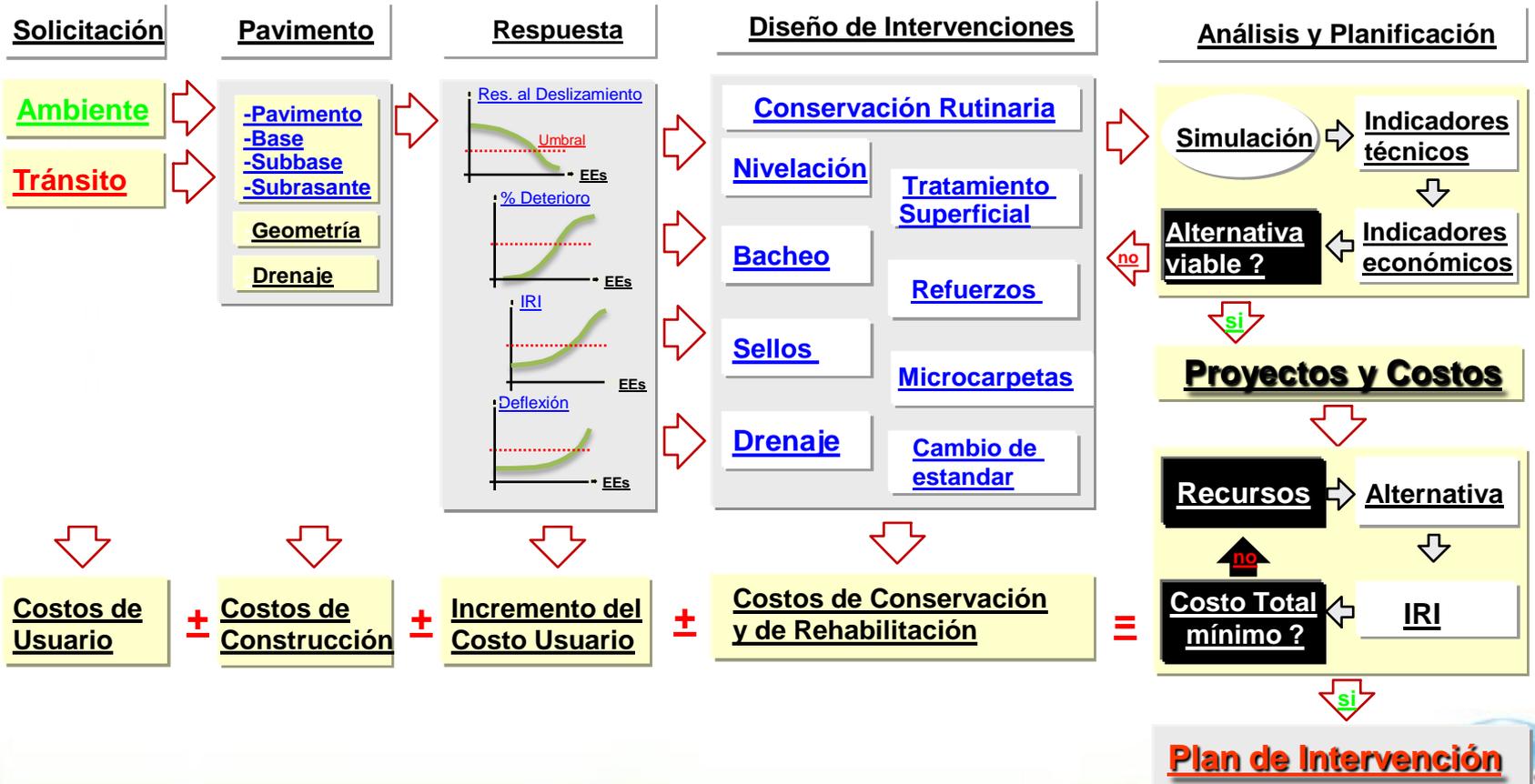
SISTEMA DE ADMINISTRACIÓN DE PAVIMENTOS

BASE DE DATOS – SECCIONES HOMOGENEAS





Flujo de la gestión áreas de 'toma de decisiones'





SISTEMA DE ADMINISTRACIÓN DE PAVIMENTOS

En el año 2007 se adquiere la licencia del HDM-4 y se implementa a través de una Consultoría financiada por el Gobierno de Dinamarca, para la migración del HDM-III al HDM-4.

Objetivos:

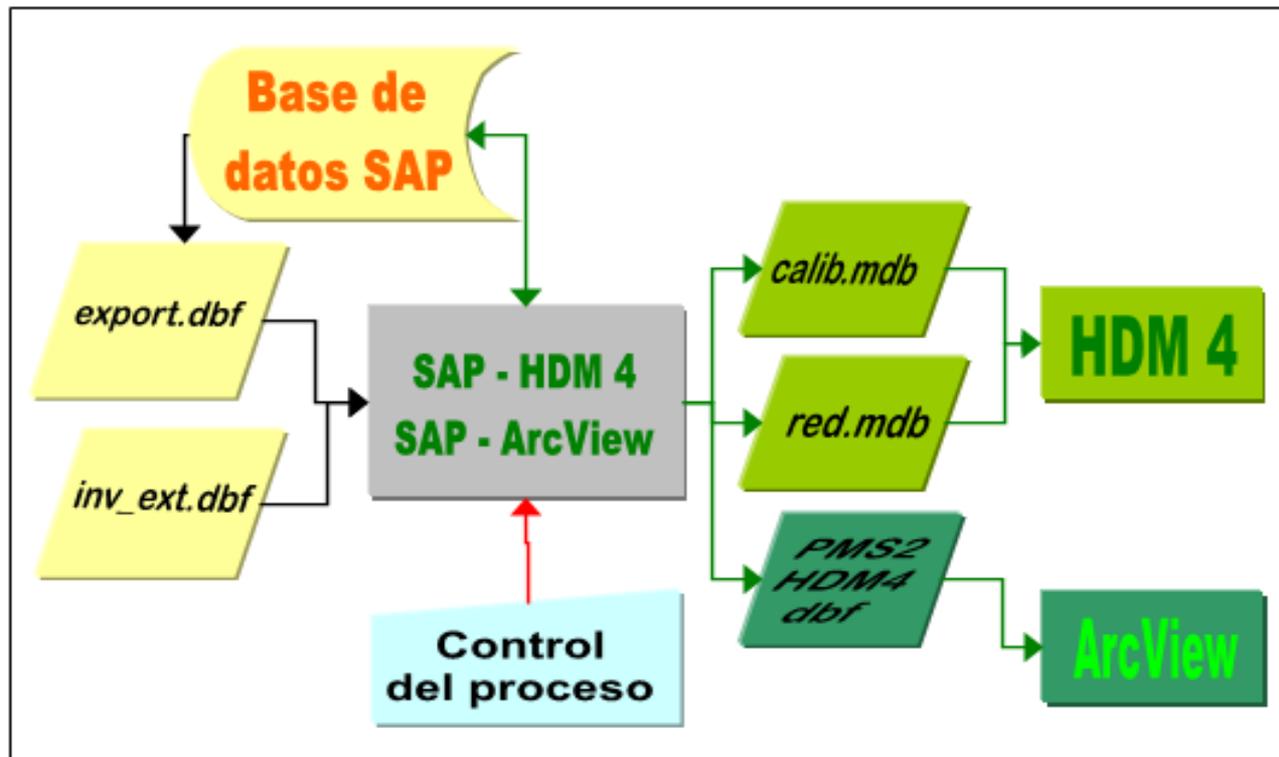
1. Modernizar y fortalecer el PMS.
2. Desarrollo de una interfaz de transferencia de la BD al HDM-4 y una aplicación para la representación de resultados a través de mapas.





NICARAGUA Y EL HDM

INTERFAZ DEL USUARIO BASE DE DATOS – HDM-4





NICARAGUA Y EL HDM CONFIGURACIÓN

FLOTA VEHICULAR

Vehicle Fleet: voc2010 - Definition Data

| Name | Class | Data Last Modified | Base Type | Category |
|-----------------------|-----------|--------------------|-----------|----------|
| Auto | Passeng | | | |
| Bus | Buses | | | |
| Camion Liviano | Trucks | | | |
| Camion Medio | Trucks | | | |
| Camion Pesado | Trucks | | | |
| Camion Remolque 4 | Trucks | | | |
| Camion Remolque 5 | Trucks | | | |
| Camion Semiremolque 4 | Trucks | | | |
| Camion Semiremolque 5 | Trucks | | | |
| Camioneta | Utilities | | | |
| Jeep | Utilities | | | |
| Micro bus | Buses | | | |
| Mini Bus | Buses | | | |
| Moto | Motorcy | | | |

Vehicle Attributes: Auto

Definition | Basic Characteristics | Economic Unit Costs

Vehicle resources

| | | | | | |
|-------------------|---------|---------------------|------------------|----------|---|
| New vehicle: | 12398.2 | Maintenance labour: | 2.43 | per hour | |
| Replacement tyre: | 66.97 | Crew wages: | 0.36 | per hour | |
| Fuel: | 0.44 | per litre | Annual overhead: | 205.65 | |
| Lubricating oil: | 3.38 | per litre | Annual interest: | 12 | % |

Time Value

| | | | | | |
|------------------------------|------|----------|--------|---|----------|
| Passenger: working time: | 1.1 | per hour | Cargo: | 1 | per hour |
| Passenger: non-working time: | 0.28 | per hour | | | |

All costs should be expressed in the fleet currency - US Dollar

The average purchase cost of a new vehicle of this type

For Help, press F1



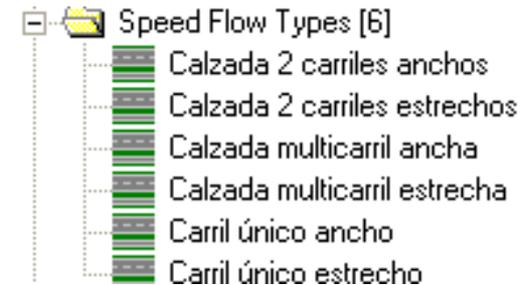


NICARAGUA Y EL HDM CONFIGURACIÓN

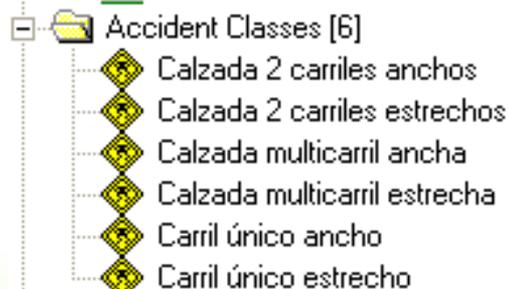
MODELO DE TRÁNSITO



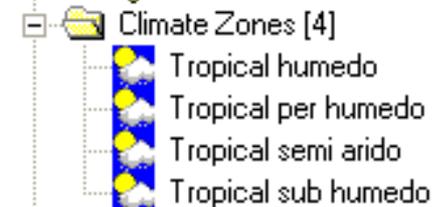
TIPO DE VELOCIDADES



TIPOS DE ACCIDENTES



ZONAS CLIMÁTICAS





NICARAGUA Y EL HDM

POLITICAS DE CONSERVACION Y CRITERIOS

➤ Alternativas de Mantenimiento en Pavimentos Asfálticos

| ACTIVIDADES | ALTERNATIVAS | | | | | | CRITERIOS DE INTERVENCIÓN | COSTO UNITARIO |
|--------------------------------|--------------|---|---|---|---|---|---|----------------------------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | | |
| Limpieza derecho de vía | √ | √ | √ | √ | √ | √ | Anual | 950\$/km |
| Limpieza de drenaje | √ | √ | √ | √ | √ | √ | Anual | 180\$/km |
| Bacheo bituminoso | √ | √ | √ | √ | √ | √ | Anual | 22.12\$/m2 (50mm profundidad) |
| Sellado de grietas | √ | √ | √ | √ | √ | √ | Agrietamiento \geq 5%; | 2.2\$/m2 |
| Tratamiento superficial simple | | √ | | | | | Intervalo \geq 3 años Agrietamiento \geq 5%; | 3.14\$/m2 |
| Doble tratamiento superficial | | | √ | | | | Intervalo \geq 3 años Agrietamiento \geq 5%; | 5.9\$/m2 |
| Micropavimento | | | | √ | | | Intervalo \geq 3 años Agrietamiento \geq 5% | 243.36\$/Ton |
| Refuerzo de 30mm | | | | | √ | | IRI > 3.5 Agrietamiento \geq 5% | 13.27\$/m2 |
| Refuerzo de 50mm | | | | | | √ | IRI > 3.5 Agrietamiento \geq 5% | 22.12\$/m2 |





NICARAGUA Y EL HDM

POLITICAS DE CONSERVACION Y CRITERIOS

➤ Alternativas en Caminos No Pavimentados

| ACTIVIDADES | ALTERNATIVAS | | | | CRITERIOS DE INTERVENCIÓN | COSTO UNITARIO |
|--------------------------------|--------------|---|---|---|---|----------------|
| | 1 | 2 | 3 | 4 | | |
| Limpieza de derecho de vía | ✓ | ✓ | ✓ | ✓ | Anual | 950\$/Km*año |
| Limpieza de drenajes | ✓ | ✓ | ✓ | ✓ | Anual | 152\$/km |
| Reparación de zonas inestables | ✓ | ✓ | ✓ | ✓ | Pérd. anual de mat. > 10% Espesor de mat. <= 100mm | 15.2\$/m3 |
| Nivelación | | ✓ | ✓ | ✓ | Anual | 4125\$/km |
| Reposición de balasto 100mm | | | ✓ | | IRI >= 14 Espesor <= 40mm | 21.23\$/m3 |
| Reposición de balasto 150mm | | | | ✓ | IRI >= 14 Espesor <= 40mm | 21.23\$/m3 |

* Relación costo financiero - costo económico (0.85)





NICARAGUA Y EL HDM

El HDM-4, a facilitado la toma de decisiones por medio del análisis y optimización de inversiones destinadas al mantenimiento, rehabilitación y reconstrucción de carreteras principalmente a través de:

- Análisis a nivel de proyectos.
- Análisis de programas de mantenimiento.

Sin embargo durante el tiempo que se ha utilizado esta herramienta, se pueden observar algunas limitaciones.





NICARAGUA Y EL HDM

¿QUE OBSERVAMOS EN HDM-4?





NICARAGUA Y EL HDM

OBSERVACIONES A LA HERRAMIENTA

FILTRO POR TRÁFICO Y ESTRUCTURA NO FUNCIONA

The screenshot shows the HDM software interface. On the left is a vertical toolbar with icons for 'Define Programme Details', 'Specify Alternatives', 'Generate Programme', 'Perform Budget Optimisation', and 'Generate Reports'. The main window has a 'General' tab and a 'Study Sections' sub-tab. It contains a table with columns: 'Include in study', 'Group', 'ID', 'Des', and 'Traffic Growth'. The table lists 20 sections, all with 'Include in study' checked. A red circle highlights the 'Select by Criteria...' button at the bottom of the table. Overlaid on the table is the 'Network Section Selection' dialog box. This dialog has several sections: 'Pavement' with 'Surface class' and 'Structural Adequacy' dropdowns (both set to 'ALL', with a red arrow pointing to the 'Structural Adequacy' dropdown); 'Speed Flow Type' with a 'Type' dropdown (set to 'ALL'); 'Traffic' with a 'Traffic volume' dropdown (set to 'Medium', with a red arrow pointing to it); and 'Geometry' with input fields for 'Rise & Fall', 'Horiz curvature', and 'Carriageway width'. At the bottom of the dialog are 'Selection Mode' options: 'Add to currently selected sections' (unselected) and 'Replace currently selected sections' (selected). Buttons for 'Select...', 'Accept selections', and 'Cancel' are on the right side of the dialog.

| Include in study | Group | ID | Des | Traffic Growth |
|-------------------------------------|-------|------------|------------|----------------|
| <input checked="" type="checkbox"/> | | 0101010001 | 010-101-00 | |
| <input checked="" type="checkbox"/> | | 0101020001 | 010-102-00 | |
| <input checked="" type="checkbox"/> | | 0101030001 | 010-103-00 | |
| <input checked="" type="checkbox"/> | | 0101070001 | 010-107-00 | |
| <input checked="" type="checkbox"/> | | 0101090001 | 010-109-00 | |
| <input checked="" type="checkbox"/> | | 0101100001 | 010-110-00 | |
| <input checked="" type="checkbox"/> | | 0101110001 | 010-111-00 | |
| <input checked="" type="checkbox"/> | | 0101130001 | 010-113-00 | |
| <input checked="" type="checkbox"/> | | 0101155291 | 010-115-52 | |
| <input checked="" type="checkbox"/> | | 0101155671 | 010-115-56 | |
| <input checked="" type="checkbox"/> | | 0101240001 | 010-124-00 | |
| <input checked="" type="checkbox"/> | | 0101270001 | 010-127-00 | |
| <input checked="" type="checkbox"/> | | 010760001 | 010-76-000 | |
| <input checked="" type="checkbox"/> | | 010770001 | 010-77-000 | |
| <input checked="" type="checkbox"/> | | 010800001 | 010-80-000 | |
| <input checked="" type="checkbox"/> | | 010810001 | 010-81-000 | |
| <input checked="" type="checkbox"/> | | 010840001 | 010-84-000 | |
| <input checked="" type="checkbox"/> | | 010850001 | 010-85-000 | |
| <input checked="" type="checkbox"/> | | 010860001 | 010-86-000 | |
| <input checked="" type="checkbox"/> | | 010900001 | 010-90-000 | |
| <input checked="" type="checkbox"/> | | 010910001 | 010-91-000 | |

The 'Selected Sections' dialog box is shown. It has a title bar 'Selected Sections' and a close button. Below the title bar, it says 'Number of sections selected was 0'. There is a large empty rectangular area labeled 'Sections Selected' in the center, with a red '???????' written inside it. At the bottom of the dialog are three buttons: 'OK', 'Continue Selection', and 'Cancel'. Below the buttons, it says 'Close the dialog and accept any changes'.





NICARAGUA Y EL HDM

OBSERVACIONES A LA HERRAMIENTA

Section: 010-92-086-1

Definition | Geometry | Pavement | Condition | Other | Motorised Traffic | Asset Valuation

Surfacing

Pavement type: Asphalt Mix on Asphalt Pavement

Material type: Asphaltic Concrete

Most recent surfacing thickness: 5 mm

Previous/old surfacing thickness: 25 mm

Strength

Calculated Dry season model parameters

SNP: 3.50 DEF: 0.88 mm

[1] Structural Number: 2.45

Subgrade CBR: 8 %

Dry Season Wet Season

SNP Calculator Wizard - Step 2 of 3

Step 2: Define required parameters to calculate SNP using FWD data:

FWD data specified for:

Dry Season

Wet Season

FWD Readings

Central deflection at 700kPa: 2 mm

La determinación del SNP se limita a la deflexión central del FWD.

< Atrás | Siguiente > | Cancelar

Data collected during the Wet Season

CALCULO DEL SNP

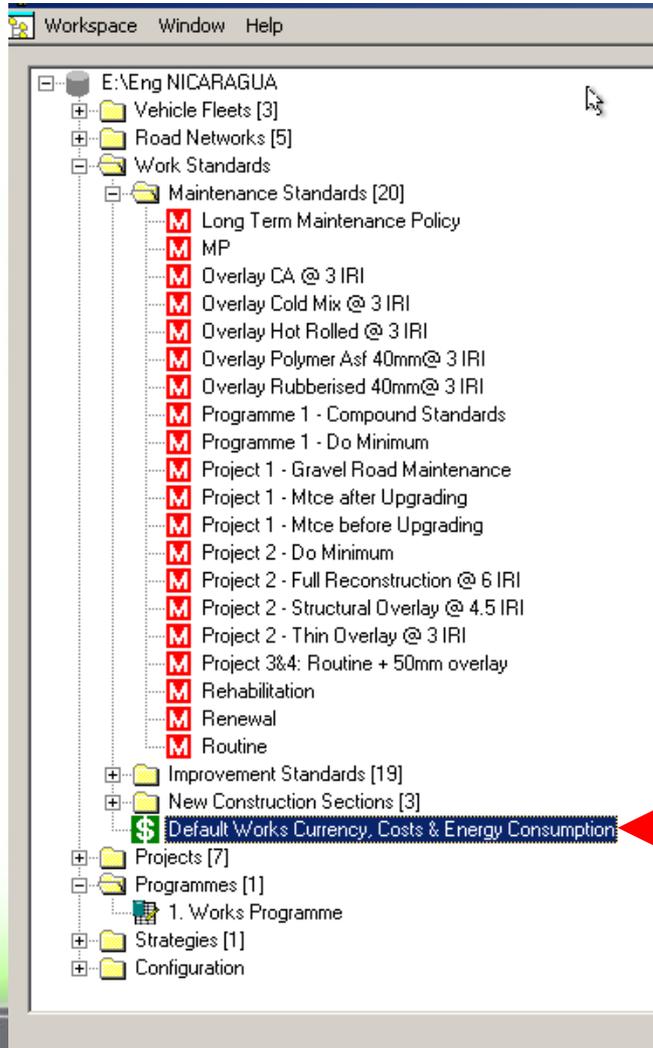
El FWD permite obtener información de módulos elástico que podría aprovecharse.





NICARAGUA Y EL HDM

OBSERVACIONES A LA HERRAMIENTA



Default Works Currency, Costs and Energy Consumption

| Operation | Economic Unit Cost | Financial Unit Cost | Units | Budget Heading |
|-----------------|--------------------|---------------------|--------------------|----------------|
| M Crack Sealing | 0.00 | 0.00 | per m ² | Recurrent |
| M Patching | 0.00 | 0.00 | per m ² | Recurrent |
| M Edge Repair | 0.00 | 0.00 | per m ² | Recurrent |
| M Fog Seal | 0.00 | 0.00 | per m ² | Recurrent |
| M Drainage | 0.00 | 0.00 | per km | Recurrent |
| M Slurry Seal | 0.00 | 0.00 | per m ² | Capital |
| M Rejuvenation | 0.00 | 0.00 | per m ² | Recurrent |
| M Thin Overlay | 0.00 | 0.00 | per m ² | Capital |

Currency: US Dollar [OK] [Cancel] [Energy >>]

LA ACTUALIZACION DE LO
COSTOS UNITARIOS EN LA TABLA
« **DEFAULT WORK CURRENCY** »
NO FLUYE A LAS ACTIVIDADES DE
MANTENIMIENTO





NICARAGUA Y EL HDM

OBSERVACIONES A LA HERRAMIENTA

Maintenance Works Item: Grading every 6 months

General | Design | Intervention | Costs | Effects | Asset Valuation

Intervention Trigger Expression

Interval >= 180 Day(s)

Accept

Add an intervention criterion

HDM - 4 Road Works Summary (by Section)

HIGHWAY DEVELOPMENT & MANAGEMENT

Study Name: 1a. Upgrading a gravel road (by project) - without sensit
Run Date: 26-08-2011
Currency: US Dollar

Note: only sections that have works triggered are displayed.

Section: Town A to Town B
Alternative: Base Alternative
Sensitivity: Base Sensitivity Scenario
Surface Class: Unsealed
Length: 20.00km
Road Class: Secondary or Main
Width: 7.00m

OK

| Year | Description | Code | Economic Cost | Financial Cost | Work Quantity |
|------|-----------------------------|--------|---------------|----------------|-----------------|
| 2006 | Grading every 6 months | GRADE6 | 28,800.0 | 36,000.0 | 40.00 km |
| | Spot regravel @ depth<100mm | SPG100 | 18,374.1 | 22,048.9 | 1,931.17 cu. m |
| 2007 | Grading every 6 months | GRADE6 | 28,800.0 | 36,000.0 | 40.00 km |
| | Gravel Resurface at 50mm | RESURF | 189,355.9 | 227,227.1 | 15,779.66 cu. m |
| | Prep. Spot Regravelling | | 0.0 | 0.0 | 0.00 cu. m |
| 2008 | Grading every 6 months | GRADE6 | 28,800.0 | 36,000.0 | 40.00 km |
| 2009 | Grading every 6 months | GRADE6 | 28,800.0 | 36,000.0 | 40.00 km |
| | Spot regravel @ depth<100mm | SPG100 | 19,526.2 | 23,431.5 | 1,627.18 cu. m |
| 2010 | Grading every 6 months | GRADE6 | 28,800.0 | 36,000.0 | 40.00 km |
| | Gravel Resurface at 50mm | RESURF | 175,782.5 | 210,939.0 | 14,648.54 cu. m |
| | Prep. Spot Regravelling | | 0.0 | 0.0 | 0.00 cu. m |



NICARAGUA Y EL HDM

OBSERVACIONES A LA HERRAMIENTA

Maintenance Works Item: Grading every 12 months

General Design Intervention Costs Effects Asset

Intervention Trigger Expression

Interval >= 365 Day(s)

LA ACTIVIDAD DE MANTENIMIENTO EN SUPERFICIE REVESTIDA «GRIDING» CON FRECUENCIA DE 365 DIAS, HDM NO LA APLICA CORRECTAMENTE

Add an intervention criterion

HDM - 4

HIGHWAY DEVELOPMENT & MANAGEMENT

Road Works Summary (by Section)

Study Name: 1a. Upgrading a gravel road (by project) - without sensit
 Run Date: 02-09-2011
 Currency: US Dollar

Note: only sections that have works triggered are displayed.

Section: Town A to Town B
 Alternative: Base Alternative
 Sensitivity: Base Sensitivity Scenario
 Surface Class: Unsealed
 Length: 20.00km

Road Class: Secondary or Main
 Width: 7.00m

INCORRECTO

| Year | Description | Code | Economic Cost | Financial Cost | Work Quantity |
|------|-----------------------------|--------|---------------|----------------|-----------------|
| 2006 | Grading every 12 months | GRADE6 | 28,800.0 | 36,000.0 | 40.00 km |
| | Spot regravel @ depth<100mm | SPG100 | 18,374.1 | 22,048.9 | 1,531.17 cu. m |
| 2007 | Grading every 12 months | GRADE6 | 28,800.0 | 36,000.0 | 40.00 km |
| | Gravel Resurface at 50mm | RESURF | 189,355.9 | 227,227.1 | 15,779.66 cu. m |
| | Prep. Spot Regravelling | | 0.0 | 0.0 | 0.00 cu. m |
| 2008 | Grading every 12 months | GRADE6 | 28,800.0 | 36,000.0 | 40.00 km |
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| | Spot regravel @ depth<100mm | SPG100 | 19,526.2 | 23,431.5 | 1,627.18 cu. m |
| 2010 | Grading every 12 months | GRADE6 | 28,800.0 | 36,000.0 | 40.00 km |
| | Gravel Resurface at 50mm | RESURF | 175,782.5 | 210,939.0 | 14,648.54 cu. m |

ANALISIS DE SENSIBILIDAD

H D M - 4 Road Agency and User Cost Streams (Undiscounted)

H D M - 4 Comparison of Cost Streams (Undiscounted)

Section: Emp. El Grajinan - Rivas NIC-2 064.71-066.20
Alternative: Manto. Rut + Ref.40mm
Sensitivity: Base Sensitivity Scenario

Sect ID: NIC-2 064.71-066.20 Road Class: Troncal principal
 Length: 1.49 km Width: 6.60 m Rise+Fall: 5.00 m/km Curvature

| Year | Increase in Road Agency Costs | | | Savings in | | |
|---------------|-------------------------------|-----------------|---------------|-----------------------------|--------------|----------------------|
| | Capital Works | Recurrent Works | Special Works | Normal (+ Diverted) Traffic | | |
| | | | | MT VOC | MT Time | HMT Time & Operation |
| 2012 | 0.098 | -0.003 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2013 | 0.000 | -0.014 | 0.000 | 0.007 | 0.000 | 0.000 |
| 2014 | 0.000 | -0.014 | 0.000 | 0.014 | 0.000 | 0.000 |
| 2015 | 0.000 | -0.014 | 0.000 | 0.027 | 0.001 | 0.000 |
| 2016 | 0.000 | 0.030 | 0.000 | 0.046 | 0.001 | 0.000 |
| 2017 | 0.000 | -0.014 | 0.000 | 0.070 | 0.003 | 0.000 |
| 2018 | 0.000 | -0.011 | 0.000 | 0.101 | 0.005 | 0.000 |
| 2019 | 0.000 | -0.011 | 0.000 | 0.138 | 0.010 | 0.000 |
| 2020 | 0.000 | -0.014 | 0.000 | 0.186 | 0.019 | 0.000 |
| 2021 | 0.000 | 0.033 | 0.000 | 0.248 | 0.033 | 0.000 |
| 2022 | 0.000 | -0.011 | 0.000 | 0.327 | 0.053 | 0.000 |
| Total: | 0.098 | -0.042 | 0.000 | 1.165 | 0.126 | 0.000 |

H D M - 4

HIGHWAY DEVELOPMENT & MANAGEMENT

Comparison of Cost Streams

Study Name: **Nandaime - Peñas Blancas**
 Run Date: **19-09-2011**
 Currency: **US Dollar (millions)**
 Discount rate: **12.00 %**

Section: Emp. El Grajinan - Rivas NIC-2 064.71-066.20
Alternative: Manto. Rut + Ref.40mm
Sensitivity: 20% Costo -20% Ben

Sect ID: NIC-2 064.71-066.20 Road Class: Troncal principal
 Length: 1.49 km Width: 6.60 m Rise+Fall: 5.00 m/km Curvature

| Year | Increase in Road Agency Costs | | | Savings in | | |
|---------------|-------------------------------|-----------------|---------------|-----------------------------|--------------|----------------------|
| | Capital Works | Recurrent Works | Special Works | Normal (+ Diverted) Traffic | | |
| | | | | MT VOC | MT Time | HMT Time & Operation |
| 2012 | 0.117 | -0.004 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2013 | 0.000 | -0.017 | 0.000 | 0.007 | 0.000 | 0.000 |
| 2014 | 0.000 | -0.016 | 0.000 | 0.014 | 0.000 | 0.000 |
| 2015 | 0.000 | -0.017 | 0.000 | 0.027 | 0.001 | 0.000 |
| 2016 | 0.000 | 0.036 | 0.000 | 0.046 | 0.001 | 0.000 |
| 2017 | 0.000 | -0.017 | 0.000 | 0.070 | 0.003 | 0.000 |
| 2018 | 0.000 | -0.013 | 0.000 | 0.101 | 0.005 | 0.000 |
| 2019 | 0.000 | -0.013 | 0.000 | 0.138 | 0.010 | 0.000 |
| 2020 | 0.000 | -0.017 | 0.000 | 0.186 | 0.019 | 0.000 |
| 2021 | 0.000 | 0.040 | 0.000 | 0.248 | 0.033 | 0.000 |
| 2022 | 0.000 | -0.013 | 0.000 | 0.327 | 0.053 | 0.000 |
| Total: | 0.117 | -0.050 | 0.000 | 1.165 | 0.126 | 0.000 |





OBSERVACIONES A LA HERRAMIENTA

HDM - 4

HIGHWAY DEVELOPMENT & MANAGEMENT

Average Roughness by Section (Graph)

Study Name: 2. Paved Road Rehabilitation

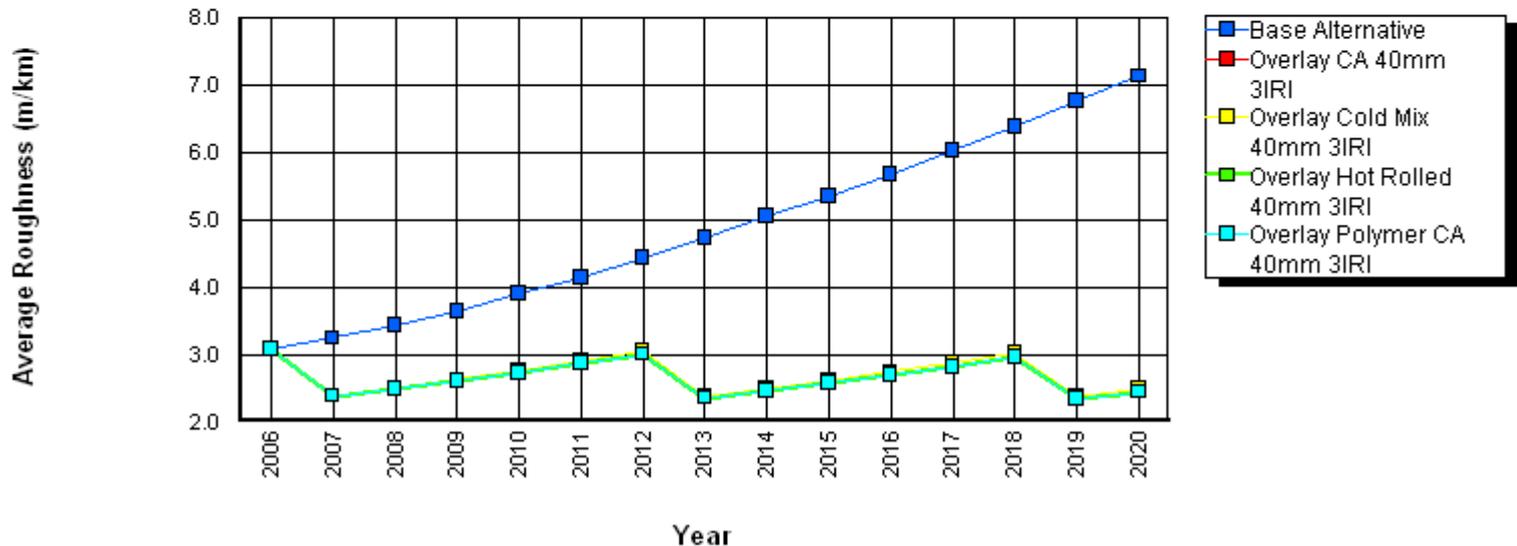
Run Date: 09-09-2011

Section: M Traffic, IRI-3.0, Fair, 2-lane
Sensitivity: No Sensitivity Analysis Conducted

ID: M-Fair-2
Rise + Fall: 25.00m/km

Road Class: Primary or Trunk
Width: 7.00m

Length: 1.00km
Crossrate: 40.00deg/km



EL PROGRESO DE LA RUGOSIDAD NO MUESTRA DIFERENCIA





NICARAGUA Y EL HDM

OBSERVACIONES A LA HERRAMIENTA

The screenshot shows two overlapping windows from a software application. The top window, titled "Maintenance Works Item: Cepillado", has tabs for "General", "Intervention", "Costs", "Effects", and "Asset Valuation". The "Intervention" tab is active, showing an "Intervention Trigger Expression" table with one row containing "Faulting >= 0.96 mm". To the right of this table are two buttons: "Add New Criterion..." (circled in red) and "Edit Criterion...".

The bottom window, titled "Add Intervention Criterion", is open over the top one. It has a section "Intervene When" with a dropdown menu set to "Interval" and a text box for "Year(s)". Below this is a "Parameter select" section with two radio buttons: "select from the" (selected) and "select from all available intervention parameters". A dropdown menu is open, showing options: "Interval", "Roughness", "Roughness", "Two-way AADT", and "Year". Two red arrows point to the "Roughness" options in the dropdown. At the bottom of the dialog are "OK" and "Cancel" buttons.

**CRITERIO ROGUSIDAD
DUPLICADO**





NICARAGUA Y EL HDM

OBSERVACIONES A LA HERRAMIENTA

Improvement Standard: JPCP

General Design Intervention Costs Construction Pavement Geometry Effects Asset Valuation

Surface Layer

Surface thickness: 180 mm **Edit Surface Layer Details...**

Base Layer Slab temperature

Base Thickness Modulus Permeability

Subgrade Subgrade K, modulus of

Concrete Surface Layer (JPCP no dowels)

Misc

Joint sealing: Silicon

OK

Cancel

Concrete

Slab length: [] m

E concrete: 29000 MPa

Rupture modulus: 4.2 MPa

adm4

The Slab Length must be in the range 3 to 10 m

Acceptar

Cancel

View/edit details of the s

EL RANGO DE LOSAS QUE SE PUEDEN ANALIZAR ES DE 3M A 10M, LO QUE DEJA SIN APLICACIÓN LA EVALUACIÓN DE LOSAS CORTAS



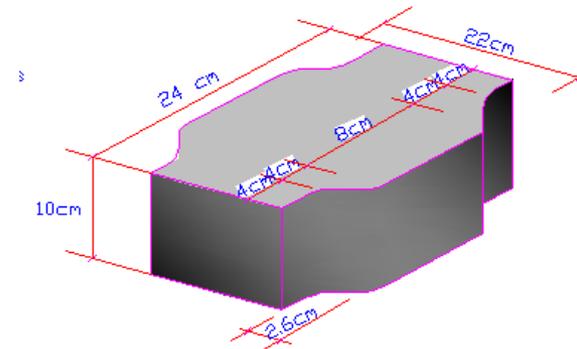


NICARAGUA Y EL HDM

ADOQUINADOS



En la actualidad existen 659.69 km de carreteras adoquinadas representando un 23.44% de la Red Vial Pavimentada Nacional.



En los próximos 3 años se ha programado la construcción de 88km de caminos adoquinados a través de un 5to convenio de crédito con el financiamiento del Banco Mundial.

En HDM-4, aún no es posible la modelación de este tipo de pavimento.





NICARAGUA Y EL HDM

REPORTES

DESPUES DE LA EVALUACION. ARCHIVOS DEL PROYECTO

| Name | Date modified | Type | Size |
|---|-----------------------|----------------------|-------------------|
|  eventlog | 26/08/2011 03:50 ... | File folder | |
|  New folder | 26/08/2011 03:50 ... | File folder | |
|  ebm network.net | 15/05/2009 02:03 ... | NET File | 1,438 KB |
|  HDM-4 RunStatus | 16/08/2011 09:58 a... | Text Document | 4 KB |
|  objects | 26/08/2011 01:39 ... | DAT File | 148,809 KB |
|  objects.idx | 26/08/2011 01:39 ... | IDX File | 36,653 KB |
|  RunData | 26/08/2011 03:50 ... | Microsoft Access ... | <u>417,812 KB</u> |



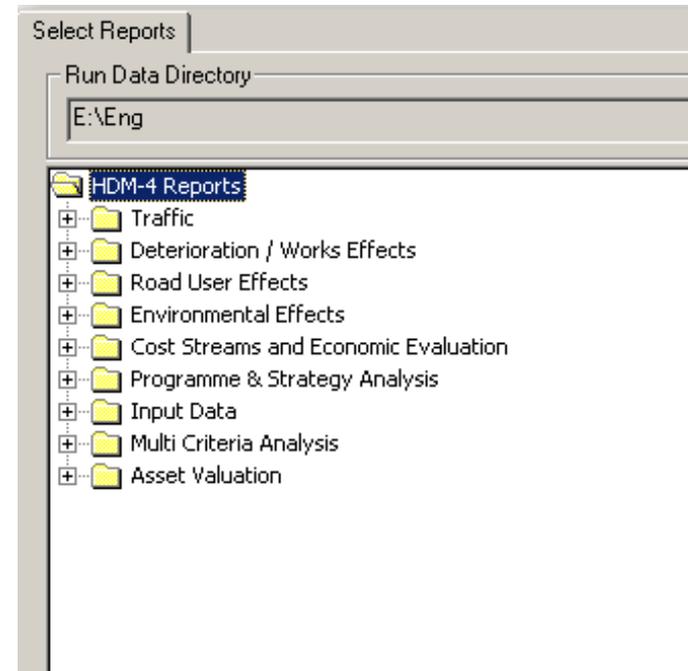


NICARAGUA Y EL HDM

REPORTES

EN HDM-4 NO SE ENCUENTRAN AGREGADOS LOS SIGUIENTES REPORTES:

1. HDM-4 Template (Portrait)_MDB
2. HDM-4 Template (Landscape)_MDB
3. EBM Template_MDB
4. EBM Template Mappings_MDB
5. EBM Template (Using Existing Names)_MDB
- **6. Project Cash Flow Summary (Discounted)**
- **7. Budget Scenario - Average Roughness MDB**



EL PANEL DE HDM CONTIENE 105 REPORTES, SIN EMBARGO LA **CARPETA** “**REPORT**” CONTIENE 112. LA EXTENSION DE LOS ARCHIVOS ES RPT
FORMATO CRYTAL REPORT.





NICARAGUA Y EL HDM

REPORTES

IMAGEN DEL «PROJECT CASH FLOW» .
 C:\Archivos de programa\HDM-4 Version 2\Reports\English

HDM - 4 Project Cash Flow Summary (Discounted)

HIGHWAY DEVELOPMENT & MANAGEMENT

Study Name: PAV2011
 Run Date: 20-07-2011
 Currency: US Dollar (millions)

Option: RUT+REF30MM

| Year | Base Case | | | | | Project Case | | | | | Net Benefit |
|---------------|---------------|------------------|------------------|--------------|------------------|----------------|------------------|------------------|-------------|------------------|---------------|
| | Agency Costs | MT VOC | MT Travel Time | Accidents | Total Costs | Agency Costs | MT VOC | MT Travel Time | Accidents | Total Costs | |
| 2012 | 2.199 | 652.714 | 221.994 | 0.000 | 876.908 | 47.539 | 652.465 | 221.993 | 0.00 | 921.998 | -45.09 |
| 2013 | 2.284 | 624.353 | 207.226 | 0.000 | 833.844 | 15.648 | 600.558 | 202.542 | 0.00 | 818.748 | 15.10 |
| 2014 | 2.105 | 585.534 | 193.829 | 0.000 | 791.468 | 9.945 | 558.980 | 187.253 | 0.00 | 756.059 | 35.41 |
| 2015 | 1.901 | 551.213 | 180.932 | 0.000 | 744.045 | 13.440 | 513.920 | 171.695 | 0.00 | 699.047 | 45.00 |
| 2016 | 1.780 | 541.618 | 172.875 | 0.000 | 716.253 | 10.655 | 476.531 | 158.482 | 0.00 | 645.668 | 70.59 |
| 2017 | 1.674 | 521.467 | 165.522 | 0.000 | 688.663 | 3.519 | 440.400 | 146.647 | 0.00 | 590.555 | 98.10 |
| 2018 | 1.486 | 504.673 | 159.204 | 0.000 | 665.373 | 8.480 | 409.683 | 135.665 | 0.00 | 553.828 | 111.54 |
| 2019 | 1.342 | 475.024 | 150.480 | 0.000 | 626.845 | 6.933 | 372.678 | 123.273 | 0.00 | 502.984 | 123.86 |
| 2020 | 1.208 | 449.984 | 142.087 | 0.000 | 593.279 | 8.811 | 342.227 | 112.915 | 0.00 | 463.953 | 129.33 |
| 2021 | 1.103 | 429.482 | 134.793 | 0.000 | 564.368 | 6.020 | 317.880 | 104.347 | 0.00 | 429.246 | 135.12 |
| Total: | 17.051 | 5,355.082 | 1,726.833 | 0.000 | 7,101.046 | 130.872 | 4,665.282 | 1,564.793 | 0.00 | 6,380.956 | 720.09 |





NICARAGUA Y EL HDM

REPORTES

IMAGEN DEL «BUDGET AVERAGE ROUGHNESS»

HDM - 4

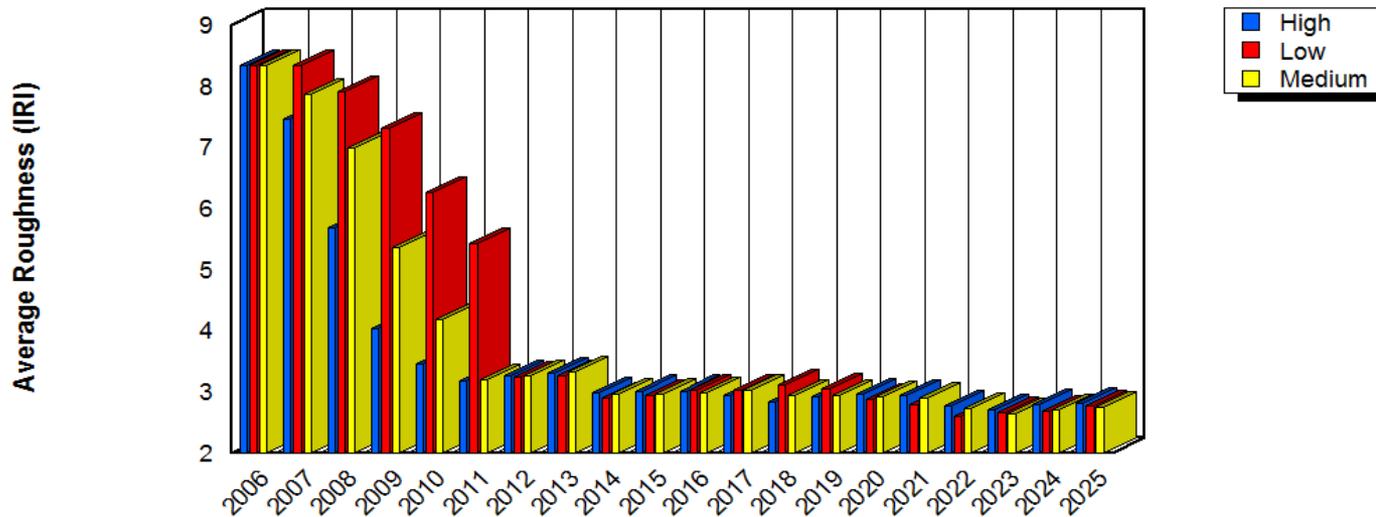
ROADWAY DEVELOPMENT & MANAGEMENT

Budget Scenario - Average Roughness_MDB

Study Name: Long Term Network Needs

Run Date: 01-09-2011

Annual Average Roughness for the network grouped by Budget Scenario (weighted by length)





NICARAGUA Y EL HDM

REPORTES GENERALMENTE SON MUY EXTENSOS

Programs Analysis

1 of 678 | 94% | Total: 6780 | 100% | 6780 of 6780

Preview

Annual Emissions Summary

HDM - 4 Emissions Summary
HIGHWAY DEVELOPMENT & MANAGEMENT

Study Name: FOMAV2012
Run Date: 22-07-2011

Section: Aeropuerto Internacional - Zona Franca NIC-1 011.10-012.72
Alternative: Base Alternative
Sensitivity: No Sensitivity Analysis Conducted

Sect ID: NIC-1 011.10-012.72 Road Class: Troncal principal
Length: 1.62m Width: 10.20m Rise+Fall: 11.00m/km Curvature: 14.00 deg/km

| Year | Annual Emission Quantities in tonnes | | | | | | |
|------|--------------------------------------|--------------------|-------------------|---------------------|--------------------|------------------|---------|
| | Hydrocarbon HC | Carbon monoxide CO | Nitrous oxide NOx | Sulphur dioxide SO2 | Carbon dioxide CO2 | Particulates Par | Lead Pb |
| 2012 | 24.97 | 28.18 | 88.15 | 3.54 | 5,815.93 | 11.30 | 0.34 |
| 2013 | 22.62 | 25.57 | 79.91 | 3.21 | 5,309.16 | 10.24 | 0.31 |
| 2014 | 22.62 | 25.57 | 79.91 | 3.21 | 5,309.14 | 10.24 | 0.31 |
| 2015 | 22.62 | 25.57 | 79.91 | 3.21 | 5,309.13 | 10.24 | 0.31 |
| 2016 | 22.62 | 25.57 | 79.91 | 3.21 | 5,309.12 | 10.24 | 0.31 |
| 2017 | 22.62 | 25.57 | 79.91 | 3.21 | 5,309.12 | 10.24 | 0.31 |
| 2018 | 22.62 | 25.57 | 79.91 | 3.21 | 5,309.11 | 10.24 | 0.31 |
| 2019 | 22.62 | 25.57 | 79.91 | 3.21 | 5,309.11 | 10.24 | 0.31 |
| 2020 | 22.62 | 25.57 | 79.91 | 3.21 | 5,309.11 | 10.24 | 0.31 |
| 2021 | 22.62 | 25.57 | 79.91 | 3.21 | 5,309.10 | 10.24 | 0.31 |





NICARAGUA Y EL HDM

**¿COMO CONSOLIDAR INFORMACION
DE FORMA FACIL Y RAPIDO?**





NICARAGUA Y EL HDM

REPORTE



MACROS PARA GENERAR REPORTES DE EVALUACIONES CON HDM-4

EN PRUEBA.

1. RESULTADOS DE EMISIONES DE GASES POR ALTERNATIVA Y PARA EL PROGRAMA.
2. INDICADORES ECONOMICOS POR ALTERNATIVA
3. AHORROS EN LOS COSTOS DE LOS USUARIOS POR TRAMOS Y PARA EL PROGRAMA

VERSION 0.1

GERMAN CRUZ R.
MANAGUA, NICARAGUA 2011





NICARAGUA Y EL HDM

REPORTES DINAMICOS

EMISIONES DE GASES EN TONELADAS POR CADA TRAMO VIAL

ALT.OPTIMA (Todas) ▾

| Tramo | SECCION ID | Alternativa Manto | Suma de HC | Suma de CO | Suma de NOx | Suma de SO2 | Suma de CO2 | Suma de PAR | Suma de Pb |
|--|----------------------|----------------------------|------------|------------|-------------|-------------|-------------|-------------|------------|
| Aeropuerto Internacional - Zona Franca NIC-1 011.10-012.72 | NIC-1 011.10-012.72 | Base Alternative | 228.55 | 258.31 | 807.34 | 32.43 | 53598.03 | 103.46 | 3.13 |
| | | Manto. Rut. + DTS | 226.51 | 256.33 | 800.49 | 32.14 | 53239.55 | 102.55 | 3.13 |
| | | Manto. Rut. + Microcarpeta | 227.86 | 257.62 | 805.06 | 32.34 | 53478.12 | 103.19 | 3.13 |
| | | Manto. Rut. + Ref. 30mm | 222.13 | 252.42 | 785.45 | 31.48 | 52462.02 | 100.53 | 3.13 |
| | | Manto. Rut. + Ref. 50mm | 220.26 | 250.79 | 779.16 | 31.2 | 52141.5 | 99.7 | 3.13 |
| | | Manto. Rut. + TS | 227.88 | 257.63 | 805.08 | 32.32 | 53481.52 | 103.18 | 3.13 |
| Boaco - Emp. La Subasta NIC-9 090.25-098.26 | NIC-9 090.25-098.26 | Base Alternative | 100.48 | 93.51 | 322.85 | 14.43 | 15613.51 | 43.29 | 0.35 |
| | | Manto. Rut. + DTS | 95.27 | 92.81 | 303.25 | 13.49 | 14642.17 | 40.55 | 0.34 |
| | | Manto. Rut. + Microcarpeta | 95.43 | 93.02 | 303.75 | 13.53 | 14666.92 | 40.61 | 0.34 |
| | | Manto. Rut. + Ref. 30mm | 94.69 | 92.16 | 301.37 | 13.42 | 14549.78 | 40.3 | 0.34 |
| | | Manto. Rut. + Ref. 50mm | 94.57 | 92.05 | 301.03 | 13.4 | 14532.14 | 40.26 | 0.34 |
| | | Manto. Rut. + TS | 95.07 | 92.59 | 302.58 | 13.48 | 14609.2 | 40.44 | 0.34 |
| Camoapa - Rancho Rojo NIC-17 115.10-119.70 | NIC-17 115.10-119.70 | Base Alternative | 20.62 | 28.93 | 65.09 | 2.58 | 4002.02 | 8.18 | 0.22 |
| | | Manto. Rut. + DTS | 20.44 | 28.72 | 64.5 | 2.56 | 3967.36 | 8.11 | 0.21 |
| | | Manto. Rut. + Microcarpeta | 20.49 | 28.78 | 64.6 | 2.56 | 3972.5 | 8.12 | 0.21 |
| | | Manto. Rut. + Ref. 30mm | 20.26 | 28.39 | 63.94 | 2.55 | 3934.4 | 8.06 | 0.21 |
| | | Manto. Rut. + Ref. 50mm | 20.18 | 28.27 | 63.78 | 2.55 | 3924.69 | 8.03 | 0.21 |
| | | Manto. Rut. + TS | 20.49 | 28.8 | 64.62 | 2.56 | 3974.75 | 8.13 | 0.21 |
| Chinandega (Rotonda) - Ranchería NIC-24B 131.90-151.0 | NIC-24B 131.90-151.0 | Base Alternative | 682.28 | 723.49 | 2136.54 | 92.37 | 107902.12 | 274.75 | 3.58 |
| | | Manto. Rut. + DTS | 684.79 | 859.31 | 2053.29 | 86.75 | 105688.67 | 259.61 | 3.96 |
| | | Manto. Rut. + Microcarpeta | 687.65 | 862.02 | 2062.3 | 87.16 | 106095.16 | 260.78 | 3.97 |
| | | Manto. Rut. + Ref. 30mm | 682.21 | 857.27 | 2044.94 | 86.38 | 105326.52 | 258.5 | 3.95 |
| | | Manto. Rut. + Ref. 50mm | 680.01 | 854.92 | 2038.09 | 86.06 | 105011.33 | 257.61 | 3.94 |
| | | Manto. Rut. + TS | 684.81 | 859.34 | 2053.32 | 86.74 | 105692.3 | 259.62 | 3.96 |
| Ciudad Darío - La Uva NN-78 088.86-091.60 | NN-78 088.86-091.60 | Base Alternative | 29.35 | 34 | 104.74 | 4.2 | 6842.43 | 13.66 | 0.38 |
| | | Manto. Rut. + DTS | 30.88 | 40.95 | 106.88 | 4.21 | 6837.59 | 13.68 | 0.38 |



NICARAGUA Y EL HDM

REPORTE DE INDICADORES ECONOMICOS POR TRAMO VIAL INTERACTUANDO CON TABLAS DINAMICAS

INDICADORES ECONOMICOS POR ALTERNATIVA DE MANTENIMIENTO

MEJOR OPCION (Todas)

| SECCION ID | NOMBRE DE LA CARRETERA | TPDA | ALTERNATIVA | VALOR PRESENTE DE LOS COSTO AGENCIA (RAC) | VALOR PRESENTE DE LOS COSTO CAPITAL (CAP) | INCREMENTO COSTO AGENCIA | REDUCCION COSTO DE LOS | BENEFICIO EXOGENO | VAN | VAN/RAC | VAN/CAP | %TIR | B/C |
|--|------------------------|-------|----------------------------|---|---|--------------------------|------------------------|-------------------|------|---------|---------|--------|-------|
| Paso a Desnivel Portezuelo - Sem foro El Danci NIC-1 005.31- | | | | | | | | | | | | | |
| NIC-1 005.31-006.31 | 006.31 | 50182 | Base Alternative | 0.03 | - | | | | | | | | |
| | | | Manto. Rut. + DTS | 0.11 | 0.09 | 0.08 | 2.27 | - | 2.19 | 20.26 | 24.94 | 450.50 | 21.26 |
| | | | Manto. Rut. + Microcarpeta | 0.16 | 0.13 | 0.14 | 2.22 | - | 2.08 | 12.76 | 15.44 | 466.57 | 13.76 |
| | | | Manto. Rut. + Ref. 30mm | 0.24 | 0.22 | 0.21 | 2.99 | - | 2.78 | 11.66 | 12.64 | 356.35 | 12.66 |
| | | | Manto. Rut. + Ref. 50mm | 0.27 | 0.25 | 0.24 | 3.14 | - | 2.90 | 10.90 | 11.75 | 284.95 | 11.90 |
| | | | Manto. Rut. + TS | 0.09 | 0.06 | 0.06 | 2.24 | - | 2.18 | 25.21 | 35.23 | 808.13 | 26.21 |
| Semaforo El Dancing - Sem foro La Subasta NIC-1 | | | | | | | | | | | | | |
| NIC-1 006.31-008.47 | | 34572 | Base Alternative | 0.06 | - | | | | | | | | |
| | | | Manto. Rut. + DTS | 0.24 | 0.19 | 0.18 | 5.13 | - | 4.95 | 20.95 | 26.05 | 465.62 | 21.95 |
| | | | Manto. Rut. + Microcarpeta | 0.35 | 0.29 | 0.30 | 5.02 | - | 4.72 | 13.32 | 16.21 | 483.29 | 14.32 |
| | | | Manto. Rut. + Ref. 30mm | 0.52 | 0.48 | 0.46 | 6.86 | - | 6.40 | 12.35 | 13.46 | 373.14 | 13.35 |
| | | | Manto. Rut. + Ref. 50mm | 0.58 | 0.53 | 0.52 | 7.20 | - | 6.68 | 11.58 | 12.54 | 299.76 | 12.58 |
| | | | Manto. Rut. + TS | 0.19 | 0.13 | 0.13 | 5.05 | - | 4.91 | 25.66 | 36.75 | 827.69 | 26.66 |
| Semaforo La Subasta - Aeropuerto Internacional NIC- | | | | | | | | | | | | | |
| NIC-1 008.47-011.10 | 1 008.47-011.10 | 34572 | Base Alternative | 0.08 | - | | | | | | | | |
| | | | Manto. Rut. + DTS | 0.30 | 0.23 | 0.22 | 3.26 | - | 3.04 | 10.21 | 13.14 | 291.60 | 11.21 |
| | | | Manto. Rut. + Microcarpeta | 0.44 | 0.35 | 0.36 | 2.88 | - | 2.52 | 5.74 | 7.11 | 264.29 | 6.74 |
| | | | Manto. Rut. + Ref. 30mm | 0.85 | 0.79 | 0.77 | 6.47 | - | 5.70 | 6.72 | 7.26 | 272.60 | 7.72 |
| | | | Manto. Rut. + Ref. 50mm | 0.87 | 0.81 | 0.80 | 7.63 | - | 6.83 | 7.81 | 8.45 | 265.71 | 8.81 |
| | | | Manto. Rut. + TS | 0.24 | 0.16 | 0.16 | 2.48 | - | 2.32 | 9.53 | 14.25 | 422.20 | 10.53 |
| Aeropuerto Internacional - | | | | | | | | | | | | | |



CONCLUSIONES

El HDM-4 es una herramienta utilizada en la planeación anual del mantenimiento y en la evaluación de la rentabilidad de los proyectos de inversión.

Facilita la toma de decisiones, y permite la identificación de prioridades a corto y mediano plazo.

Brinda un panorama de la condición de la red, para diferentes escenarios presupuestarios, respecto a una situación actual.

No es posible modelar algunos tipos de superficie incluidas en el HDM-4.





CONCLUSIONES

Existe un cantidad importante de km pavimentados con adoquín, los cuales no pueden ser analizados con HDM-4, de igual manera el análisis de pavimentos con losas menores a 3mt.

La dificultad en el manejo de la información con los reportes que se presentan en el HDM-4, puede mejorarse desarrollando aplicaciones sencillas que permitan personalizarla.

Los resultados de las evaluaciones con HDM-4, se potencializan interrelacionando con mapas temáticos anuales o multianuales a través del SIG.

Actualización de los manuales de la edición en idioma **ESPAÑOL**, para las versiones posteriores a la 1.3

