

# PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

## Authors:

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Rio Pipeline - 2011

## PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

The execution of **FEED (front-end engineering and design)** services require detailed knowledge of the pipeline track surface.

The geometric project aims to **identify and define** the surface quantitative **occurrences** and the materials for hiring.

The interferences are usually surveyed and identified by planimetric coordinates and presented in the form of specific **reports and drawings in the 1:1000 and 1:200 H/V scales.**

## PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

The Interference Map was developed as a management tool for the monitoring, control and provision of information for both the **Contracted and Contracting** Parties.

The definition of the tasks, the work logistics and the decision making are facilitated when the **elements of interest** are **spatially** represented in a single environment with appropriate scale, allowing in this way the visualization of the whole.

## PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

### 1 - Project Schematic Map

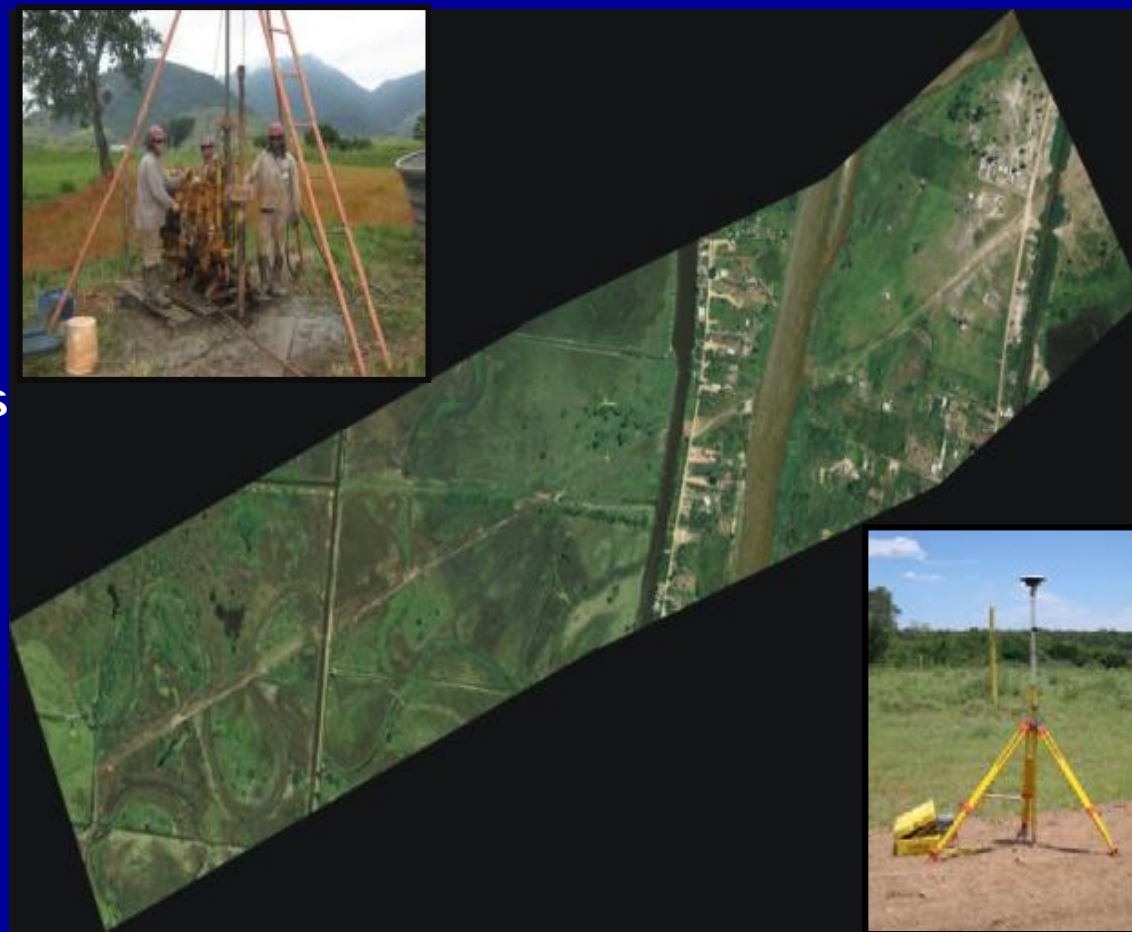
**Objective:** Schedule and monitor the implementation of field services: Crossings, Cross rivers, Surveys, APP's, Wetlands, etc.;

#### Advantages:

Logistics

Visualization

Team Distribution.



Aerial image.

## PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL



**Samplings**



**Topobatimetry**



**Additional Topography**










**Crossing Studies**



# PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

## Interference Survey

ITEM	ESTACAS	INTERFERENCIAS	DESCRIÇÃO	COORDENADA N	COORDENADA E	REGISTRO FOTOGRAFICO
1	0+000	Área Petrobras	Área do lançador de 18"	9.435.166	700.747	 
2	0+220	Outras interferências / Cruzamento duto	Cerca / Adutora / Dutos	9.435.004	700.904	   
3	0+420	Cruzamento duto / Outras interferências	Adutora / Poste	9.434.878	701.053	 

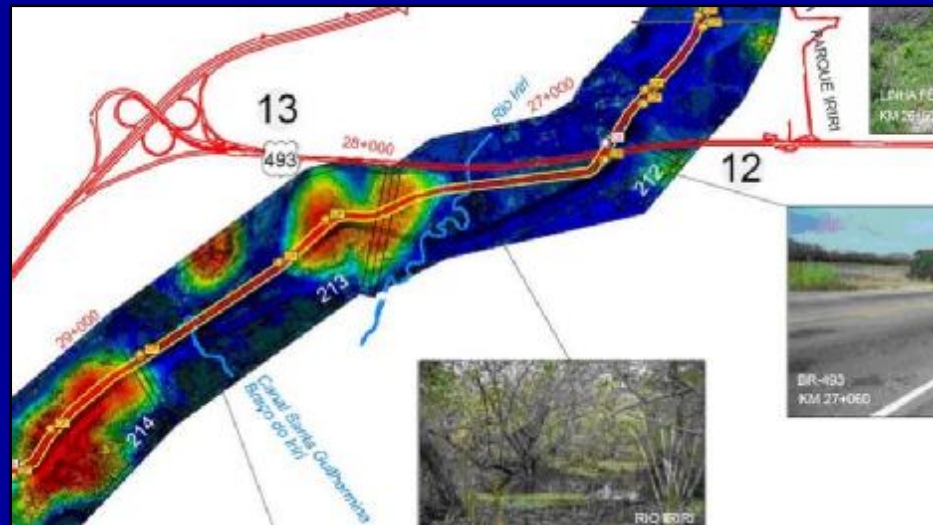
## PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

### 2 – Interference Map

(first evolution- by means of hypsometric image)

Ø **Objective:** Plan the activities (**MD Scope**), its logistics and control;

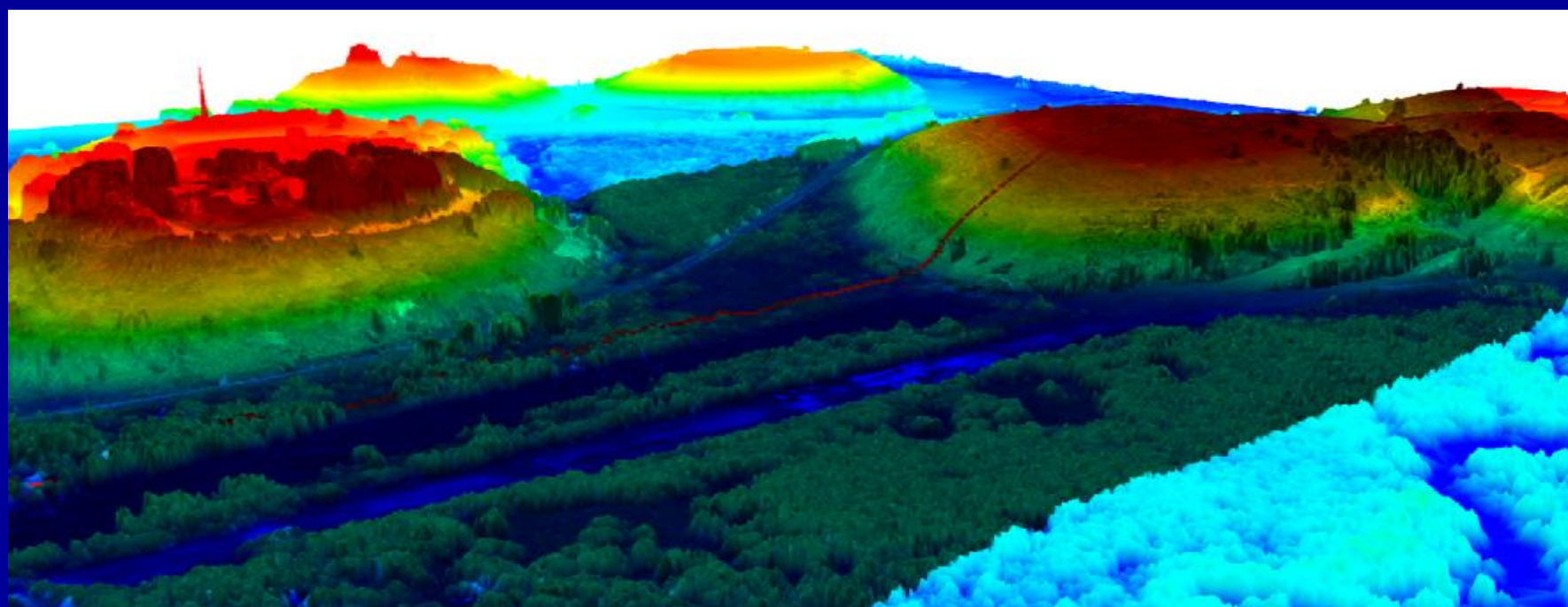
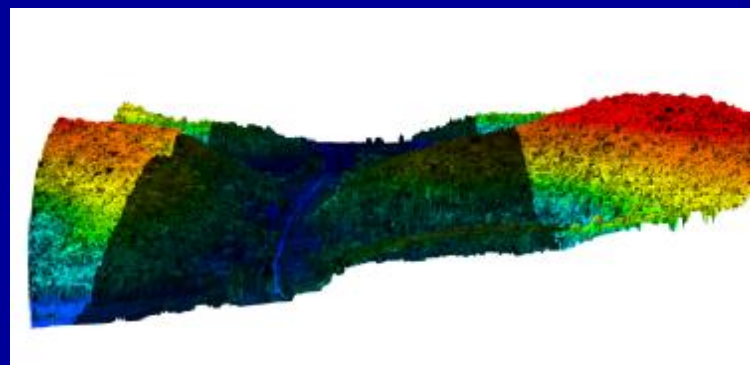
Ø **Advantages:** Possibility of relief information cross-checking, with the surface occurrences and their technical requirements of the project.



Detail on Interference Map, based on the Hypsometric image.

## PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

- Track Study for Pipelines



Hypsometric Image



## PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

The **elements that can be represented on the interference** map:

- Ø Accesses/Service Paths;
- Ø Existing and Designed Street Construction Layout
- Ø Debris;
- Ø Optical Fiber;
- Ø Highways/ Railways;
- Ø Critical Points;
- Ø Pipeline Crossings;
- Ø Designed Valves;
- Ø Flooded / Floodable Areas;
- Ø Geotechnical Works;
- Ø Municipality Limits;
- Ø Constructive Method;
- Ø Passages;
- Ø Crossings;
- Ø Supportability Points;
- Ø Water Mains;
- Ø Hydrology;
- Ø Right-of-Way Guidelines;
- Ø Transmission Lines;
- Ø Noteworthy Points;
- Ø Valves and complements;
- Ø Preclusion Areas;
- Ø Geotechnical Units;
- Ø Bridges;
- Ø Vegetation;
- Ø Outcrops.
- Ø

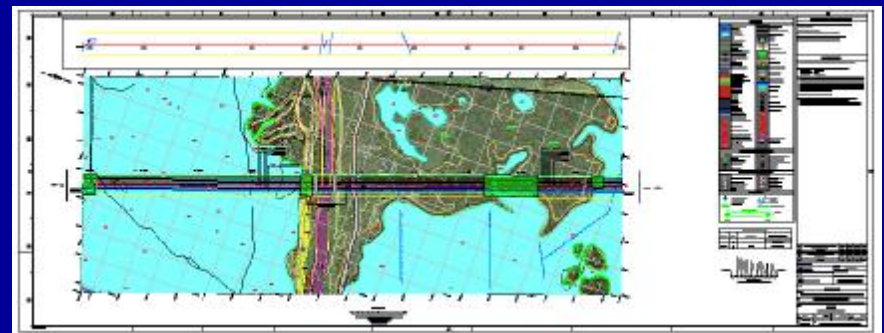
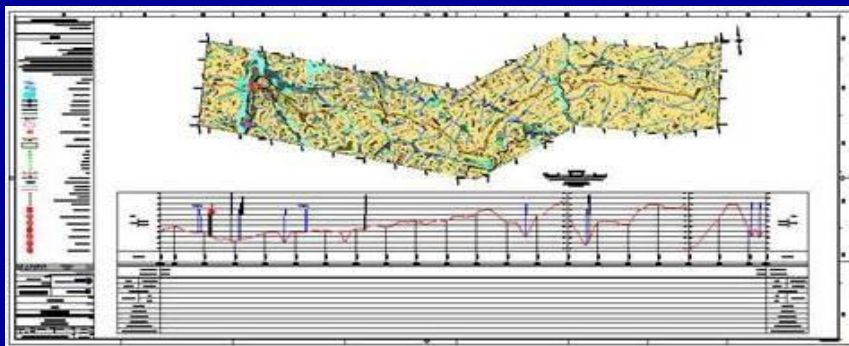
## PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

### 3 - Project Follow-Up Map

(second evolution— insertion of project elements)

Ø **Objective:** Management and presentation of the contract services, in **tables and graphs** containing the project numbers and their relative positions in the single line form.

Ø **Advantages:** Feed Project presentation in a single document.

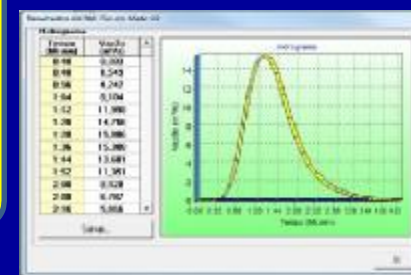
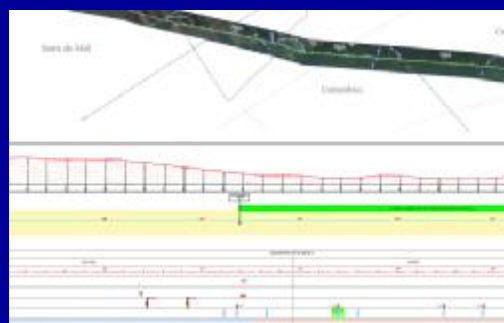
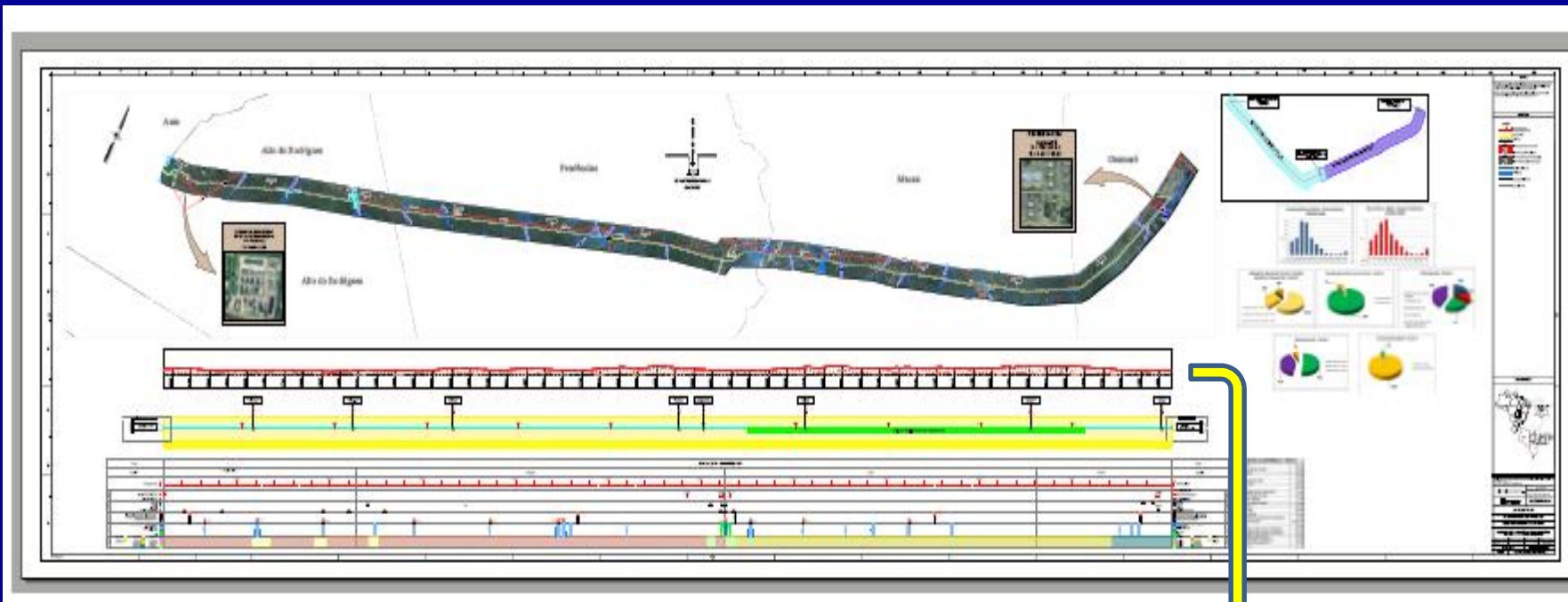






# PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

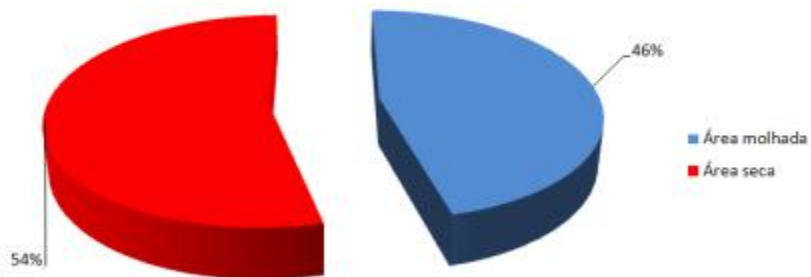
## Follow-Up Map



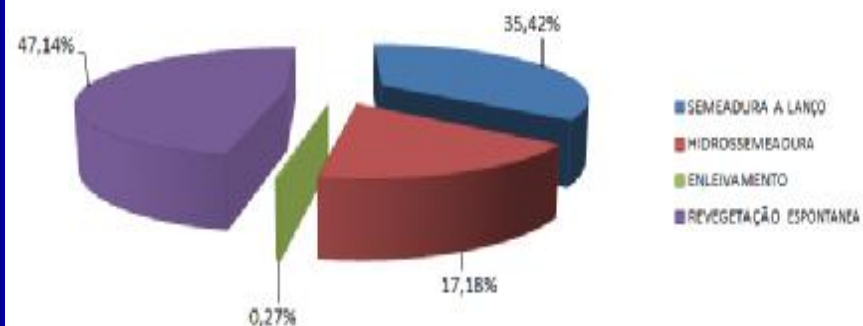


# PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

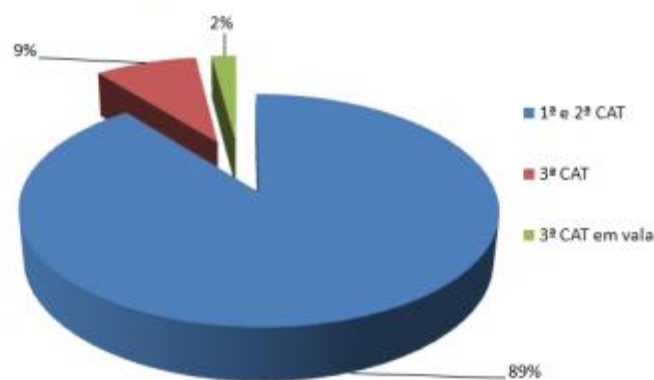
Área seca / molhada



Revestimento Vegetal



Movimentação de Material - Cortes



Project Graphs.

# PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

The screenshot shows a web browser window with the URL `192.168.3.129:8080/atividade/paginas/atividades/page.php?pagina=pcm/pcm.php&id_menu=36,35`. The page has a navigation menu with items: Principal, Serviços, Clientes, Coordenadores, PCM, and Logout. The breadcrumb trail is "Você está em: Principal > PCM > Cadastrar". The main heading is "PCM - CADASTRAR". Below the heading are five buttons: "Cadastrar", "Listar", "Pesquisar", "Editar", and "Excluir". The form contains the following fields:

- Interferência:
- Estaca provisória:
- N. ponto PCM:
- Extensão prevista:
- Observações:
- Data levantamento:
- Ext. levantada:

An "Enviar" button is located at the bottom of the form.

**DATA BASE - Activities Control System- To Register**

# PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

Controle de atividades

192.168.3.129:8080/atividade/paginas/atividades/page.php?pagina=pcm/listar.php&id\_menu=37,35

Cidovias de Curitiba ESTEID - INTRANET

Principal Serviços Clientes Coordenadores PCM Logout

Você está em: Principal > PCM > Listar

**PCM - LISTAR**

Cadastrar Listar Pesquisar Editar Excluir

ID	Interferência	Estaca Provisória	Extensão prevista	Observações	Data levantamento	Ext. levantada
2	LANÇADOR / RECEBEDOR	1	150	Canto do Amaro (Início do Trecho)	2011-02-23	158
4	CRUZAMENTO DE DUTOS	2.020	150	-	2011-02-18	240
5	CRUZAMENTO DE RODOVIA	9 959	150	Diversos apiários (caixa de coleta de mel dentro da pista) Os Marcos laterais da faixa distam 10m deixando entender que a faixa teria só 10m de largura. A vegetação está praticamente tomando a pista. RN-016.	2011-02-07	170
7	CRUZAMENTO DE RODOVIA RN-012	23	150	-	2011-02-15	180

Anterior | [1] | Próxima

**DATA BASE - Activities Control System - Registered**

## 4 – GIS – Geographic Information System

(third evolution– management tool)




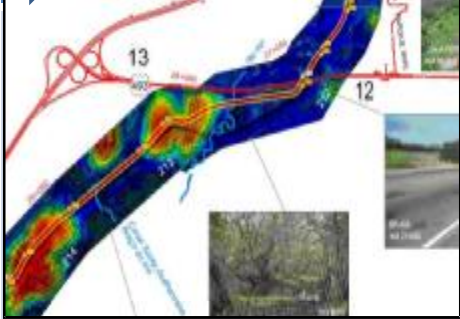
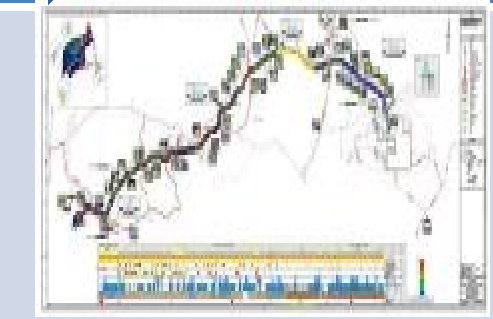

Project Follow-up Map Consolidation as a management tool for  
**Linear Project**




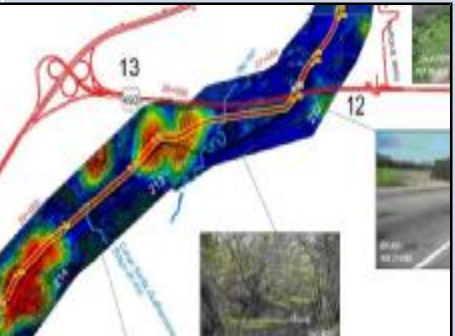
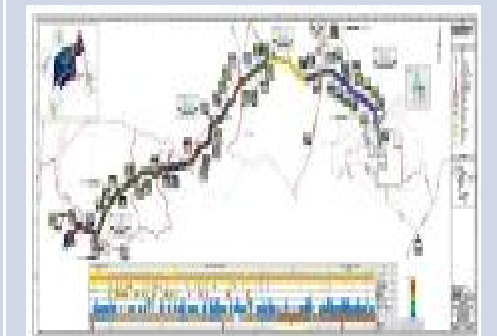

Quick visualization of the work stages and progress



# PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

Project Schematic Map	Interference Map	Project Follow-up Map	GIS
			
<p><b>Objective:</b> Field work logistics</p>	<p><b>Objective:</b> Project activities planning</p>	<p><b>Objective:</b> Technical information presentation</p>	<p><b>Objective:</b> Management Tool</p>
<p><b>Data used:</b> Coordinates of the access roads, crossings, intersections, hindering areas, etc.</p>	<p><b>Data used:</b> Interference from the previous model, drilling points, PCM, GPR and SBP surveys, complementary topography, panoramic and hypsometric images.</p>	<p><b>Data used:</b> Spatial localization of the project elements and qualification and quantification in tabular format, represented in the same document.</p>	<p><b>Data used:</b> Project Follow-up Map data consolidation in Georeferenced platform.</p>

# PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

Project Schematic Map	Interference Map	Project Follow-up Map	GIS
			
<p><b>Context:</b> COMPERJ-REDUC/TECAM FEED Services</p>	<p><b>Context:</b> COMPERJ-REDUC/TECAM FEED Services</p>	<p><b>Context:</b> COMPERJ-REDUC/TECAM FEED Services</p>	<p><b>Context:</b> Linear Works Services</p>
<p><b>Cartographic Base:</b> Pipeline Mosaic at 1:10.000 scale.</p>	<p><b>Cartographic Base:</b> Composition Image(Hypsometric + LASER Signal Intensity) 1:1.000</p>	<p><b>Cartographic Base:</b> Composition Image(Hypsometric + LASER Signal Intensity) 1:1.000 - data base</p>	<p><b>Cartographic Base:</b> - Composition image 1:1.000. Vector data base available.  <b>Data Base:</b> Work information</p>

# 4 – GIS

**Objective:** Allow the linking of **geo-referenced images** and **documents** in order to keep the manager informed of all ongoing activities.

**Advantages:** **User friendly** environment, using free software. **Immediate update, quick and easy**, without the need to send files to the database.

In order to meet this purpose, **two areas** were created, one with a view of the map data (**images and vectors**) and another one for follow-up services.

In the **graphic area**, vector data and images are available for the viewing of the cartographic base. Access to the system is performed by a browser without the need to install specific plugins and without the need for users to send files every data update.

# MAPA DE INTERFERÊNCIAS DA FAIXA DE DUTOS: UMA FERRAMENTA GERENCIAL

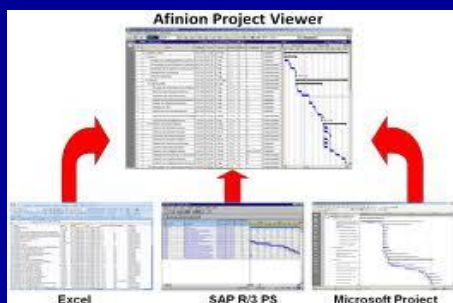
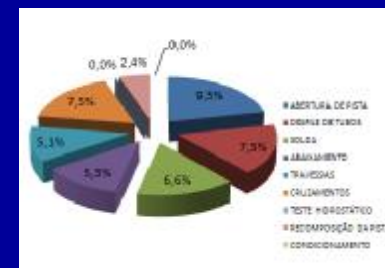
Field data



Communication

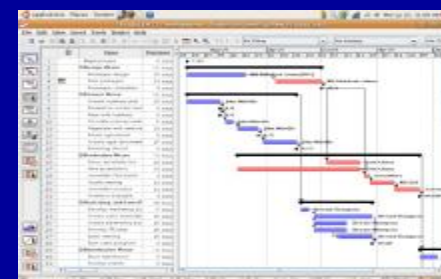


Management



Design data

Supervision  
And  
Planning



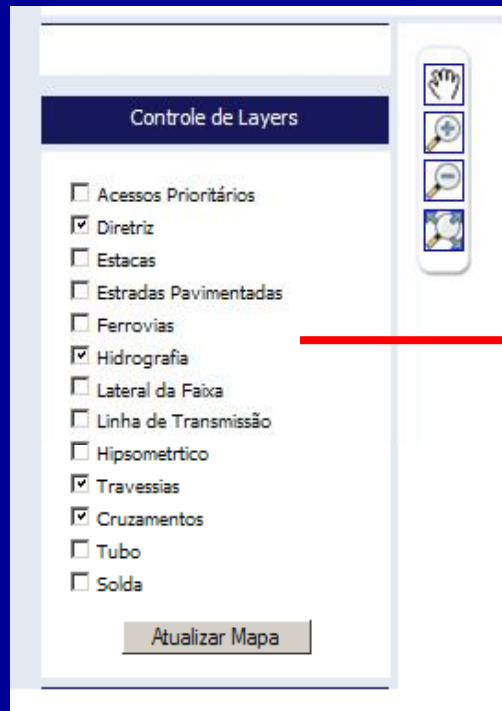


# PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

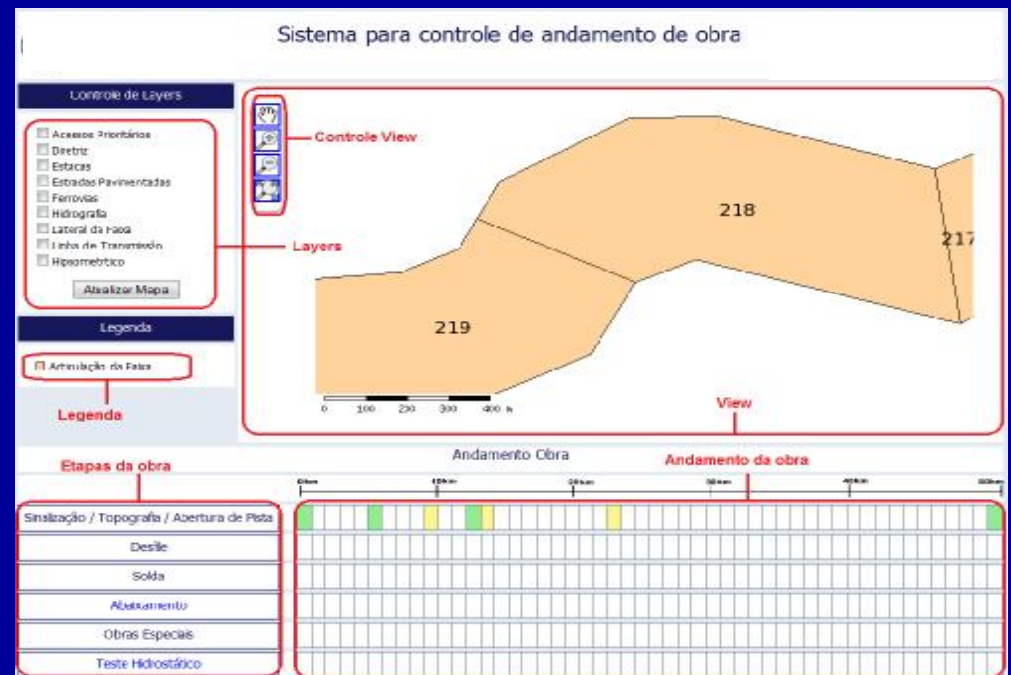
## Layers Control

- Main Accesses
- XGuidelines
- Stacks
- Paved Roads
- Railway
- Hydrography
- Track Side
- Transmission Line
- Hypsometric
- Passages
- Crossings
- Pipeline
- Welding

## Update Map



## MANAGEMENT TOOL



**GIS – User Friendly – Spatial Visualization of the Work**

**Example chosen – Construction Stage and Pipeline Assembly**



## PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

**Layers:** Layers **control** area (enables and disables).

**Legend:** Informs the active **layers style**.

**Work stages:** Shows the **work stages** being followed up by the system. Every stage contains links for **further information**.

**Work development:** Provides quick visualization of the work development, where each color determines the activity status.

**Green:** FINISHED

**Yellow:** IN PROGRESS

**White:** NOT STARTED

**Red:** STOPPED

# PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

## Work Stages

**Phases:** Area for the indication of steps followed up by the system.

**Phases Development:** Area for quick visualization of the progress of steps, where each color determines the status of the activity.

**Green:** FINISHED  
**White:** NOT STARTED

**Yellow:** IN PROGRESS  
**Red:** STOPED

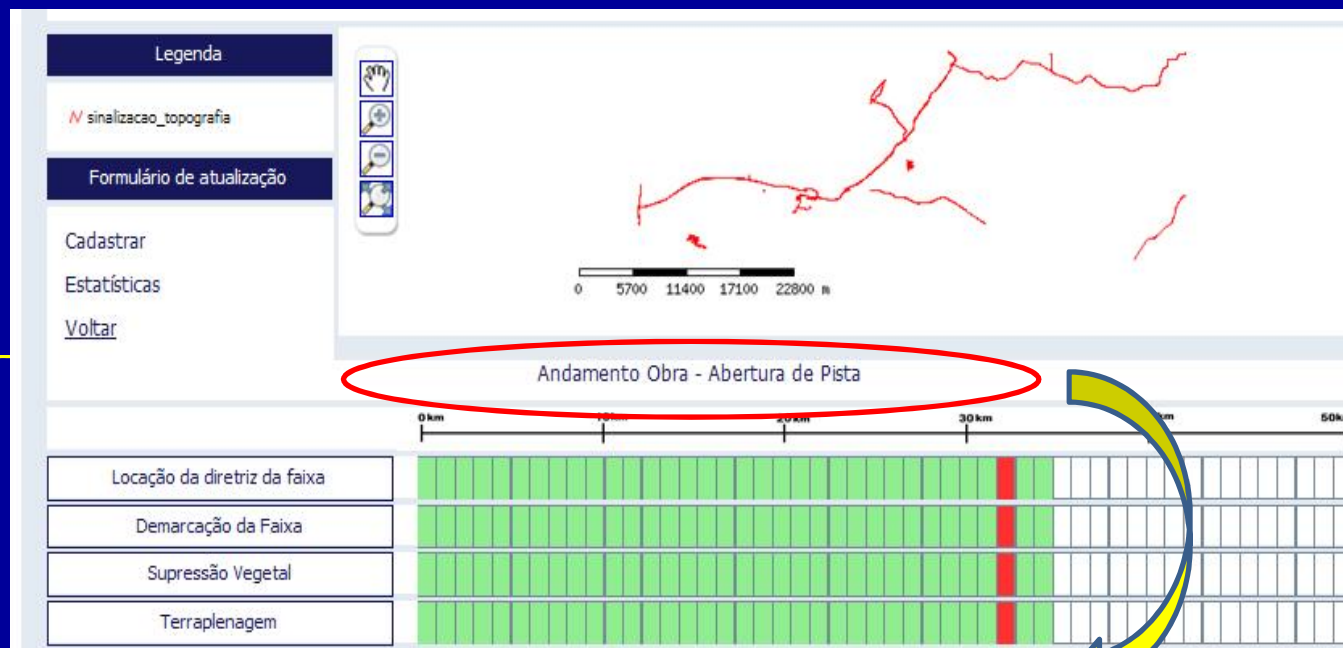
### Legend

Topography Signaling

### Updating Form

Register  
Statistics  
Back

Track guideline localization  
Track Limitation  
Vegetal Removal  
Earthmoving



Work Progress – Track Opening

# PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

## Work progress control system



## General track articulation



# PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

## Stages:

- Ø Track Opening;
- Ø Pipeline Alignment;
- Ø Welding;
- Ø Sinking;
- Ø Rivers crossing;
- Ø Roads Crossing;
- Ø Hydrostatic Test;
- Ø Track Recomposition;
- Ø Conditioning.

Nº	FASES
1	ABERTURA DE PISTA
2	DESFILE DE TUBOS
3	SOLDA
4	ABAIXAMENTO
5	TRAVESSIAS
6	CRUZAMENTOS
7	TESTE HIDROSTÁTICO
8	RECOMPOSIÇÃO DA PISTA
9	CONDICIONAMENTO

## Productivity:

ØKm run

ØPercentage by KM

## Data Input Example: Track Opening Stage

Cadastro: Abertura de Pista

KM: 36 ▾

Localização da diretriz da faixa: **800m realizado**

Demarcação da Faixa: **500m realizado**

Supressão Vegetal:

Observação:  **habilita a inserir observação**

Terraplenagem:

Observação:

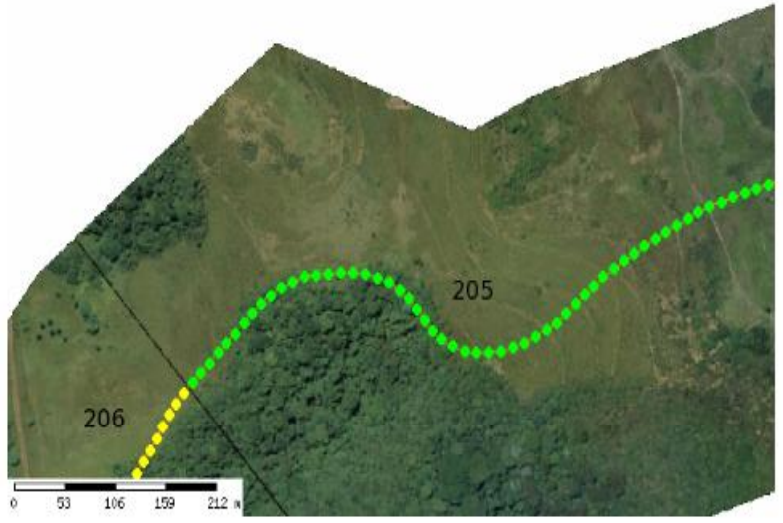
# PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

sair

Controle de Layers

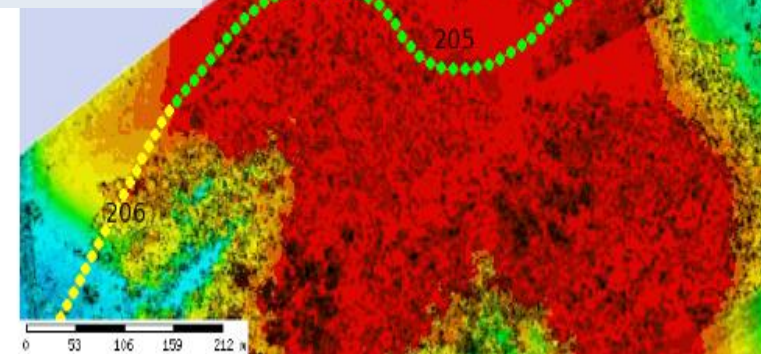
- Acessos Proprietários
- Diretriz
- Estacas
- Estacas Pavimentadas
- Ferragens
- Hidrografia
- Lateral da Faixa
- Linha de Transmissão
- Hipométrico
- Imagem
- Travessias
- Cruzamentos
- Abaixamento de Tubos
- Solka

Atualizar Mapa



- Estacas
- Estacas Pavimentadas
- Ferragens
- Hidrografia
- Lateral da Faixa
- Linha de Transmissão
- Hipométrico
- Imagem
- Travessias
- Cruzamentos
- Abaixamento de Tubos
- Solka

Atualizar Mapa



# PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

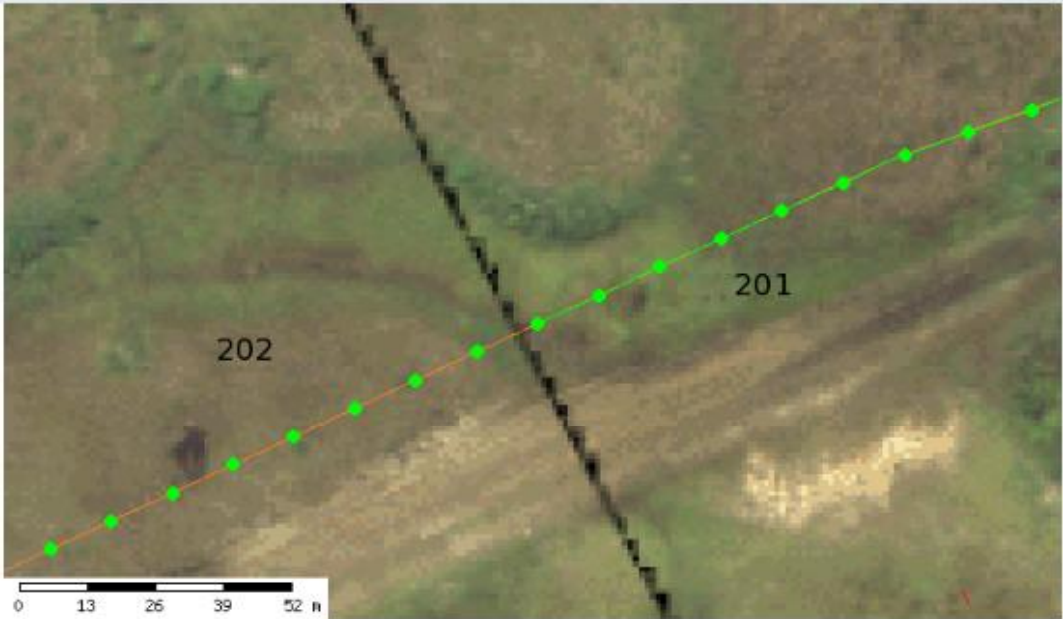
sair

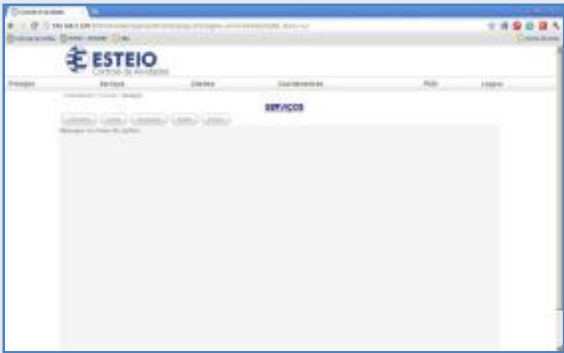
Controle de Layers

- Acessos Prioritários
- Diretriz
- Estacas
- Estradas Pavimentadas
- Ferrovias
- Hidrografia
- Lateral da Faixa
- Linha de Transmissão
- Hipsometrico
- Imagem
- Travessias
- Cruzamentos
- Abaixamento de Tubos
- Solda

Legenda

- Articulação da Faixa
- Estacas TXT
- ~ Diretriz
- x Estacas
- ~ Abaixamento de Tubos Finalizado
- ~ Abaixamento de Tubos Pendente
- ~ Abaixamento de Tubos Andamento









# PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL



Register

Statistics

Back

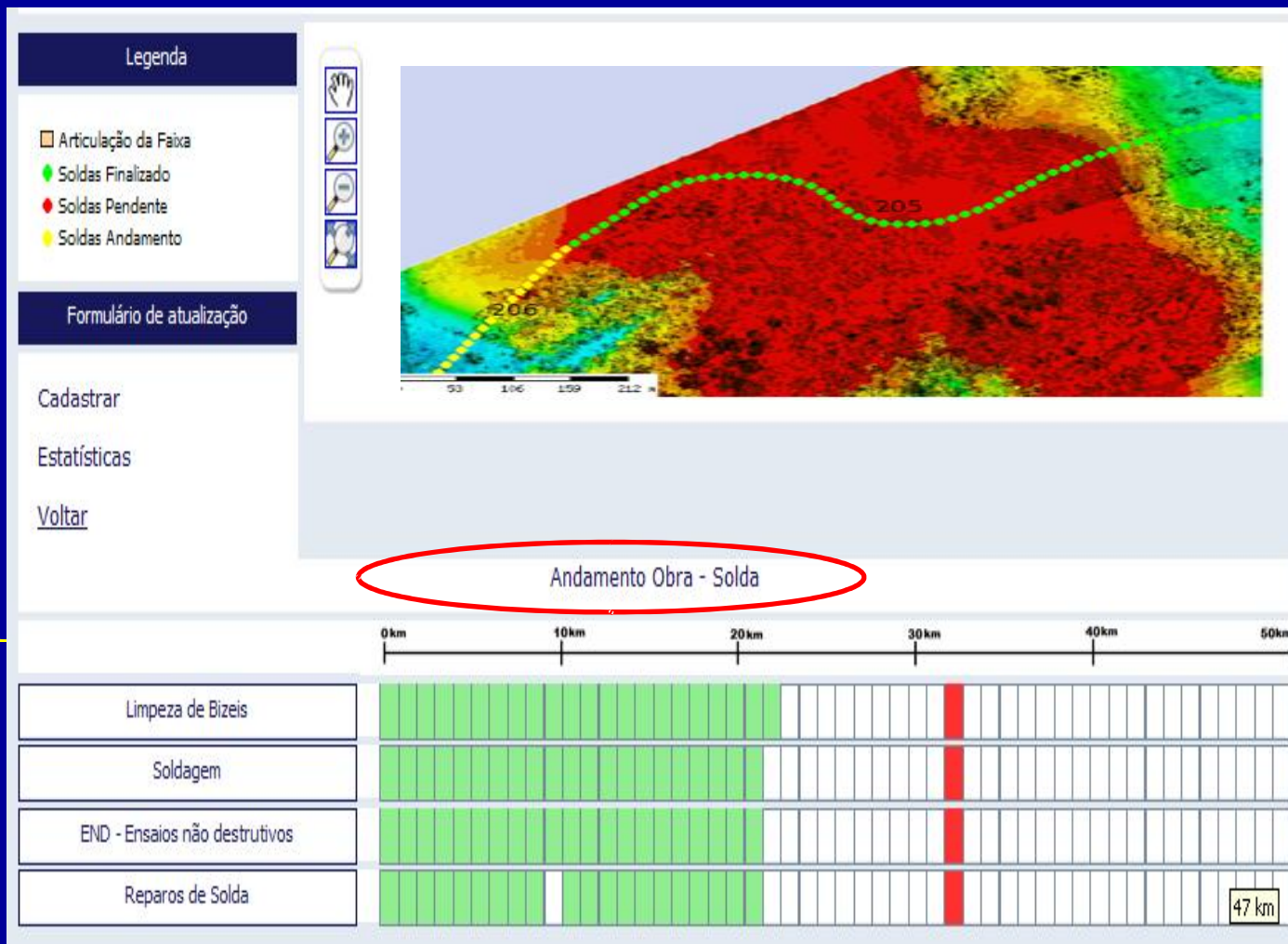
Bevel Cleaning

Welding

NDT – Non-Destructive

Tests

Welding Repair



Work Progress – Welding



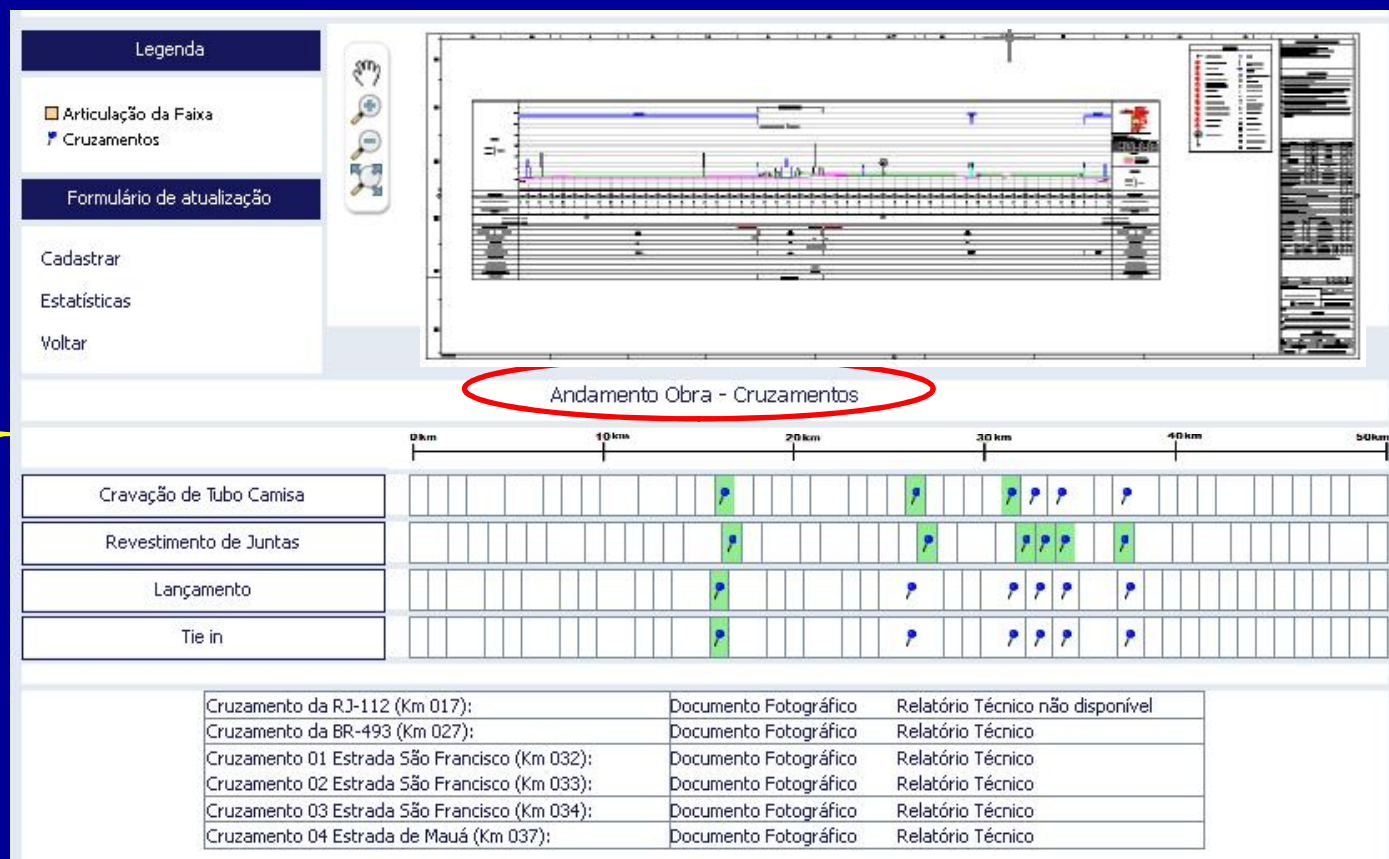


# PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

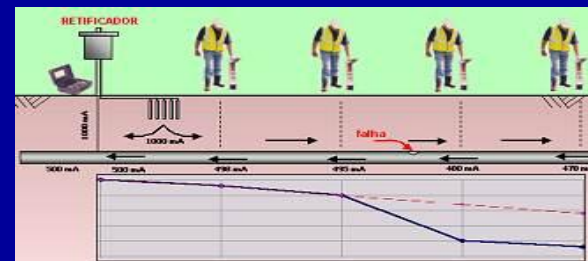
## Work Progress – Crossings

Register  
 Statistics  
 Back

Sleeve Pipe Ramming  
 Gasket Coating  
 Launching  
 Tie in



Field data



# PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

## Work Progress - Passages

**Legenda**

- Articulação da Faixa
- Travessias

**Formulário de atualização**

Cadastrar

Estatísticas

Voltar

29 km

	0 km	10 km	20 km	30 km	40 km	50 km
Revestimento de Juntas	🚩	🚩	🚩	🚩	🚩	🚩
Lançamento	🚩	🚩	🚩	🚩	🚩	🚩
Cobertura	🚩	🚩	🚩	🚩	🚩	🚩
THS	🚩	🚩	🚩	🚩	🚩	🚩

Travessia do Rio Macacu (Km 001):	Documento Fotográfico	Relatório Técnico não disponível
Travessia do Rio Guapiaçu (Km 007):	Documento Fotográfico	Relatório Técnico
Travessia do Rio Guapimirim (Km 011):	Documento Fotográfico	Relatório Técnico
Travessia do Canal Santa Guilhermina - Braço Iriri (Km 028):	Documento Fotográfico	Relatório Técnico
Travessia do Rio Suruí (Km 032):	Documento Fotográfico	Relatório Técnico
Travessia do Rio Estrela (Km 044):	Documento Fotográfico	Relatório Técnico

Register Statistics Back

Gasket Coating  
 Launching  
 Covering  
 THS

Macacu River (km 001):	Photographic Doc	Technical Report NA
Guapiaçu River (km 007):	Photographic Doc	Technical Report
Guapimirim River (011):	Photographic Doc	Technical Report
Santa Guilhermina– Iriri Arm (km 028):	Photographic Doc	Technical Report
Suruí River (km 032):	Photographic Doc	Technical Report
Estrela River (km 044):	Photographic Doc	Technical Report

# PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

Topography Signaling

Updating Form

Register

Statistics

Back

Test

The screenshot shows a web application interface for pipeline management. On the left is a sidebar with navigation options: 'Legenda', 'sinalizacao\_topografia', 'Formulário de atualização', 'Cadastrar', 'Estatísticas', 'Voltar', and 'Teste'. The main content area features 'Gauge Information' (Serial number: 863097, Model: 2008A/DP21, Message store: kg/cm2, Units: kg/cm2) and 'Run Info' (Start time: 3/24/08 12:05:51 AM, Stop time: 3/24/08 12:14:19 AM, Logging Interval: 12). Below this is a 'Pressure' graph showing pressure over time (0 to 600 seconds). At the bottom, a progress bar shows the work progress for 'Andamento Obra - Teste Hidrostático' (circled in red) over a 50km distance.

Work Progress – Hydrostatic Test

# PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

Topography Signaling

Updating Form

Register

Statistics

Back

Grooves

Lateral and Cross Drainage

Sowing

Fence Repair and Track

Signaling

Owner Approval

Legenda

N sinalizacao\_topografia

Formulário de atualização

Cadastrar

Estatísticas

Voltar

0 5700 11400 17100 22800 m

BR PETROBRAS

DESENVOLVIMENTO DE PROJETO COMERCIAL E OPERACIONAL DE TUBARÃO DO OLEODUTO CARACARAÍBAS - SUDOESTE 07/04/07  
 CONTRATO Nº 1188/0700002

RELATÓRIO DO PLANO AMBIENTAL DE SERVIÇOS - PAS  
 Anexo II - Ações e Medidas Mitigadoras Recomendadas  
 REV 0

PETROBRAS S.A. - PETROBRAS S.A. - PETROBRAS S.A.  
 Rua Dr. Américo Buarque de Gusmão, 110 - Ilhéus - Bahia  
 CEP: 45600-000

ESTEIO

Andamento Obra - Recomposição de Pista

	0km	10km	20km	30km	40km	50km	60km
Leiras	█		█				
Drenagem Lateral e Transversal	█		█				
Semeadura	█		█				
Reestab. de cerca e Sinalização de Faixa	█		█				
Nada Consta Proprietário	█		█				

Work Progress – Track Rearrangement



# PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

Topography Signaling

Updating Form

Register

Statistics

Back

Line Inertization

Legenda

W sinalizacao\_topografia

Formulário de atualização

Cadastrar

Estatísticas

Voltar

Andamento Obra - Condicionamento

0km 10km 20km 30km 40km 50km

Inertização da Linha

Work Progress – Conditioning



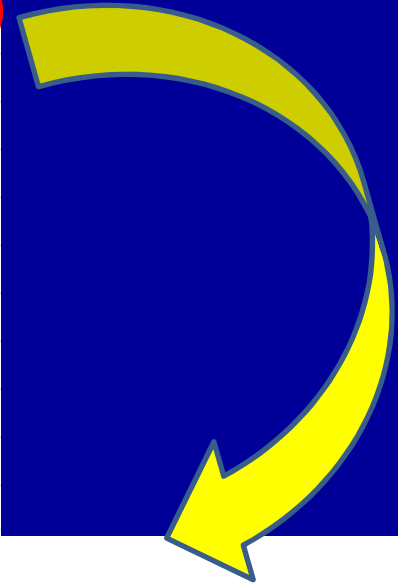
# PIPELINE RIGHT-OF-WAY INTERFERENCE MAP: A MANAGEMENT TOOL

## Statistics



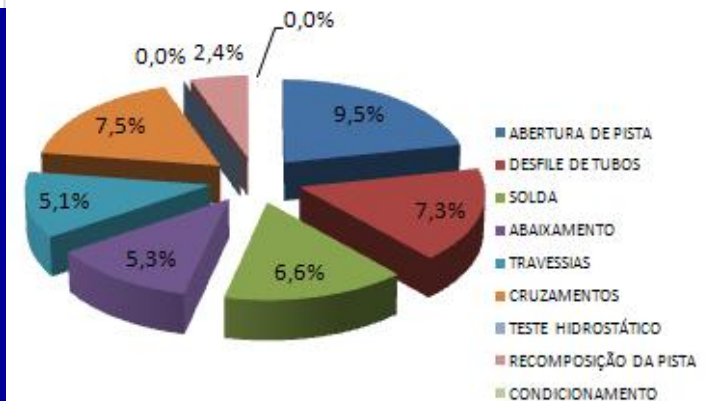
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ETAPA DA OBRA - CONSTRUÇÃO E MONTAGEM DE DUTOS									
N°	FASES	Cronograma Previsto Linha Base		Cronograma Realizado			Ferramenta Gerencial S.I.G.		
		Dias	% Obra	Dias	% por fase	% obra	% Avanço Físico	km / un. executada	% REALIZADO
1	ABERTURA DE PISTA	124	14,34%	78	62,90%	9,02%	66,00%	33,00	9,46%
2	DESFILE DE TUBOS	121	13,99%	65	53,72%	7,51%	52,38%	26,19	7,33%
3	SOLDA	136	15,72%	49	36,03%	5,66%	41,90%	20,95	6,59%
4	ABAIXAMENTO	142	16,42%	40	28,17%	4,62%	32,00%	16,00	5,25%
5	TRAVESSIAS	89	10,29%	52	58,43%	6,01%	50,00%	3,00	5,14%
6	CRUZAMENTOS	137	15,84%	52	37,96%	6,01%	47,50%	2,85	7,52%
7	TESTE HIDROSTÁTICO	32	3,70%	0	0,00%	0,00%	0,00%	0,00	0,00%
8	RECOMPOSIÇÃO DA PISTA	74	8,55%	24	32,43%	2,77%	27,60%	13,80	2,36%
9	CONDICIONAMENTO	10	1,16%	0	0,00%	0,00%	0,00%	0,00	0,00%
			100,00%						44%
Total Previsto Obra 240 dias				Avanço Previsto Obra dias corridos					



## Statistics

## Graphs

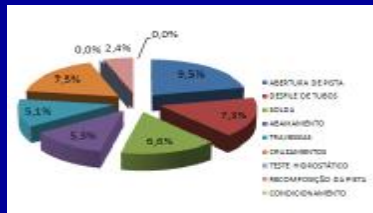


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## Stage- Pipeline Assembly Construction

Comparative table- schedule and physical progress  
 Management Tool

- Track Opening
- Alignment
- Welding
- Lowering
- Sinking
- Passages
- Crossings
- Hydrostatic Test
- Track Rearrangement
- Conditioning



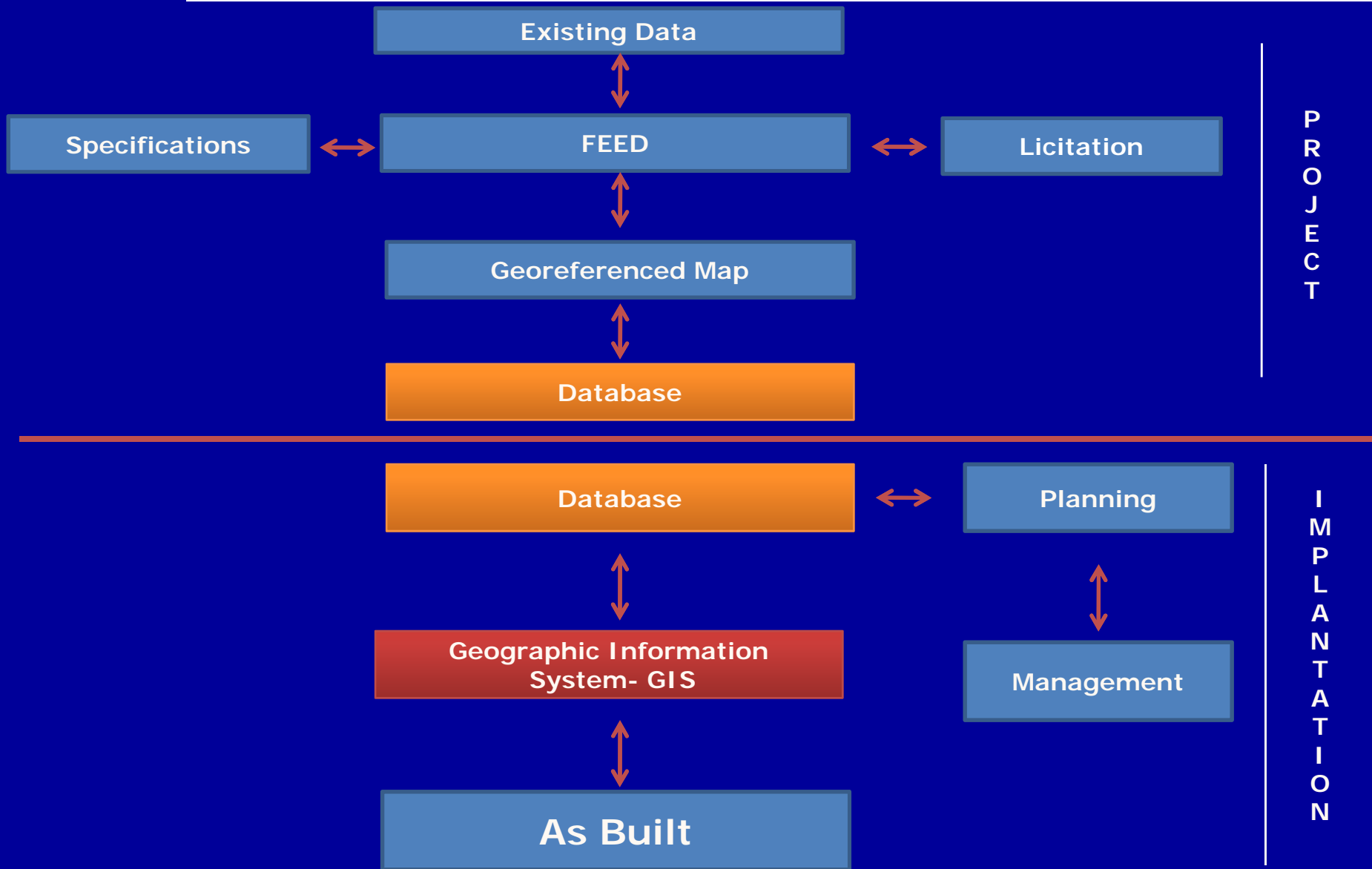
Resumo da Obra [Voltar](#)

ETAPA DA OBRA - CONSTRUÇÃO E MONTAGEM DE DUTOS						
Nº	Fases	Linha Base Cronograma Previsto		Ferramenta Gerencial SIG		
		Dias	% Obra	% Avanço Físico	KM / Unidade Executada	% OBRA REALIZADO
1	ABERTURA DE PISTA	124	14.30 %	66 %	33	9.44 %
2	DESFILE DE TUBOS	121	13.96 %	52.75 %	26.375	7.36 %
3	SOLDA	139	16.03 %	41.9 %	20.95	6.72 %
4	ABAIXAMENTO	138	15.92 %	32 %	16	5.09 %
5	TRAVESSIAS	133	15.34 %	50 %	3	7.67 %
6	CRUZAMENTOS	128	14.76 %	48 %	2.85	7.08 %
7	TESTE HIDROSTÁTICO	32	3.69 %	0 %	0	0 %
8	RECOMPOSIÇÃO DA PISTA	42	4.84 %	27.6 %	13.8	1.34 %
9	CONDICIONAMENTO	10	1.15 %	0 %	0	0 %
<b>TOTAL</b>			<b>100 %</b>			<b>44.70 %</b>

OBRA REALIZADO

Fase	Porcentagem
ABERTURA DE PISTA	9.44%
DESFILE DE TUBOS	7.36%
SOLDA	6.72%
ABAIXAMENTO	5.09%
TRAVESSIAS	7.67%
CRUZAMENTOS	7.08%
TESTE HIDROSTÁTICO	0%
RECOMPOSIÇÃO DA PISTA	1.34%
CONDICIONAMENTO	0%
A INICIAR	55.3%

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### Conclusion

#### Consolidation of the Project Follow-up Map as a management tool for Linear Works:

- üWork planning and logistics;
- üWork progress simulation.
- üRecord of the evolution and of the physical progress of the work;
- üAnalysis / evaluation of the teams productivity ;
- üAnticipation of possible problems in the work;
- üDecision making;
- üInformation consistency;
- üWork general follow-up;
- üData Book libraries;
- üPreparation for As Built;
- üWork optimization;
- üDaily follow-up of the production, even when away from work, in a faster way;



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