



# AZAR PASSILLO INTERNATIONAL GROUP.

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## Road Pavement Maintenance and Rehabilitation

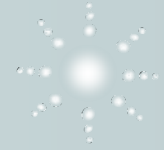
# **Genral Contractor**



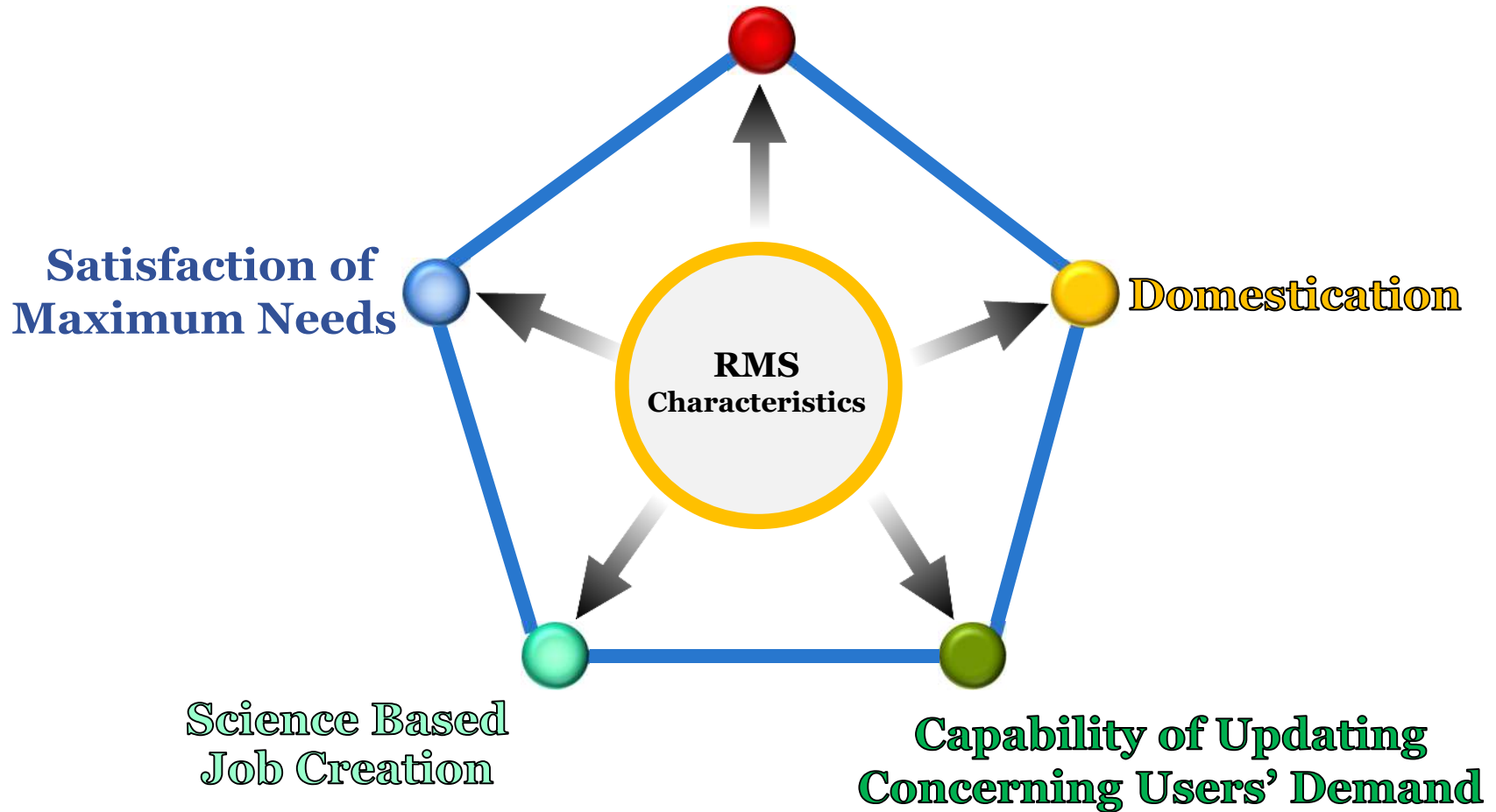
# ***Road Management System***

## **Definition:**

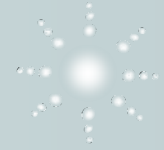
***RMS is a tool for assisting the decision making on the basis of a logic procedure in different levels of management and engineering.***



## Utilization of the State of Art knowledge



# *Design, Implementation and Development of Road Management System*







## Data Analysis and Process

1642 51500 کیلومتر پایان: 0 کیلومتر شروع: ..... « قایمیه » رفت « فارس » تقاطع دشت ارژن - قایمیه رفت

7.6 سرعت: 1000 تصحیح اندازه گیری: 30 تنظیمات تصاویر: FL FR BL BR R I JPEG اولویت بندی: لکهش عرضی: لکهش طولی: لکهش سطح راه:

تصویر جلو چپ تصویر عقب راست تصویر جلو راست

تصاویر ماهواره ای نقشه

700.00 مقیاس نقشه: Map5 بل آبرو ل منطقه ل منطقه ل طولی بل طولی بل منطقه

عوارض نقطه ای

کیلومتر	کد مشخصه	نوع عارضه
۷۱۳۰	155410009FCa000730	آبرو
۱۱۹۰	155410009FCa001190	آبرو
۱۲۲۳۰	155410009FCa001330	آبرو
۱۵۱۰	155410009FCa001510	آبرو

عوارض خطی

کیلومتر	کیلومتر پایان	کد مشخصه	نوع عارضه
۴۵۰	۶۹۰	155410009FCa000450	زهکش طولی
۷۰۰	۹۸۰	155410009FCa000700	زهکش طولی
۹۹۰	۱۱۹۰	155410009FCa000990	زهکش طولی
۱۲۰۰	۱۲۳۰	155410009FCa001200	زهکش، طاق،

نمودار یازدهمیل طولی

# Implementation Procedure of Pavement Management System



## Climatic Condition Data



## Traffic Data



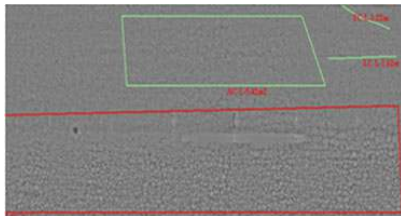
## Pavement Inventory

شناسنامه روسازی									
مشخصات کلی									
نام پروژه	شماره پروژه	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک
نام پروژه	شماره پروژه	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک
نام پروژه	شماره پروژه	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک
نام پروژه	شماره پروژه	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک
نام پروژه	شماره پروژه	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک
نام پروژه	شماره پروژه	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک
نام پروژه	شماره پروژه	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک
نام پروژه	شماره پروژه	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک	شماره پلاک

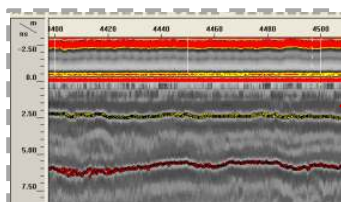
## Pavement Roughness Data



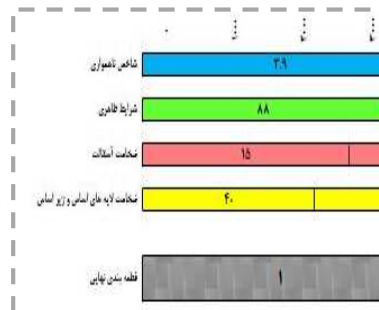
## Pavement Visual Distresses



## Pavement Layers Thicknesses



## Pavement Sectioning



## Allocation of M&R Strategies and Cost Estimation



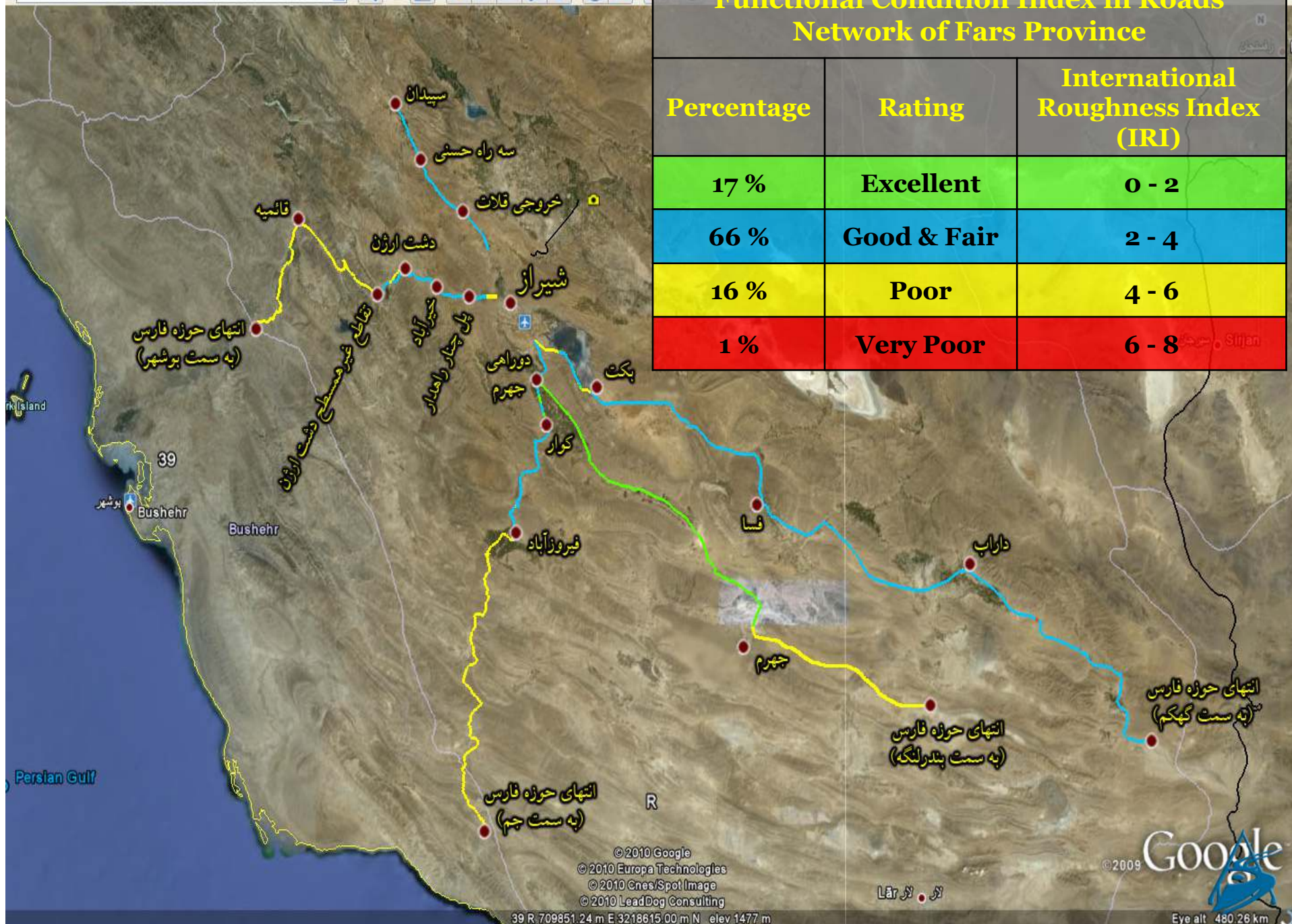
## Prioritization of Road Network



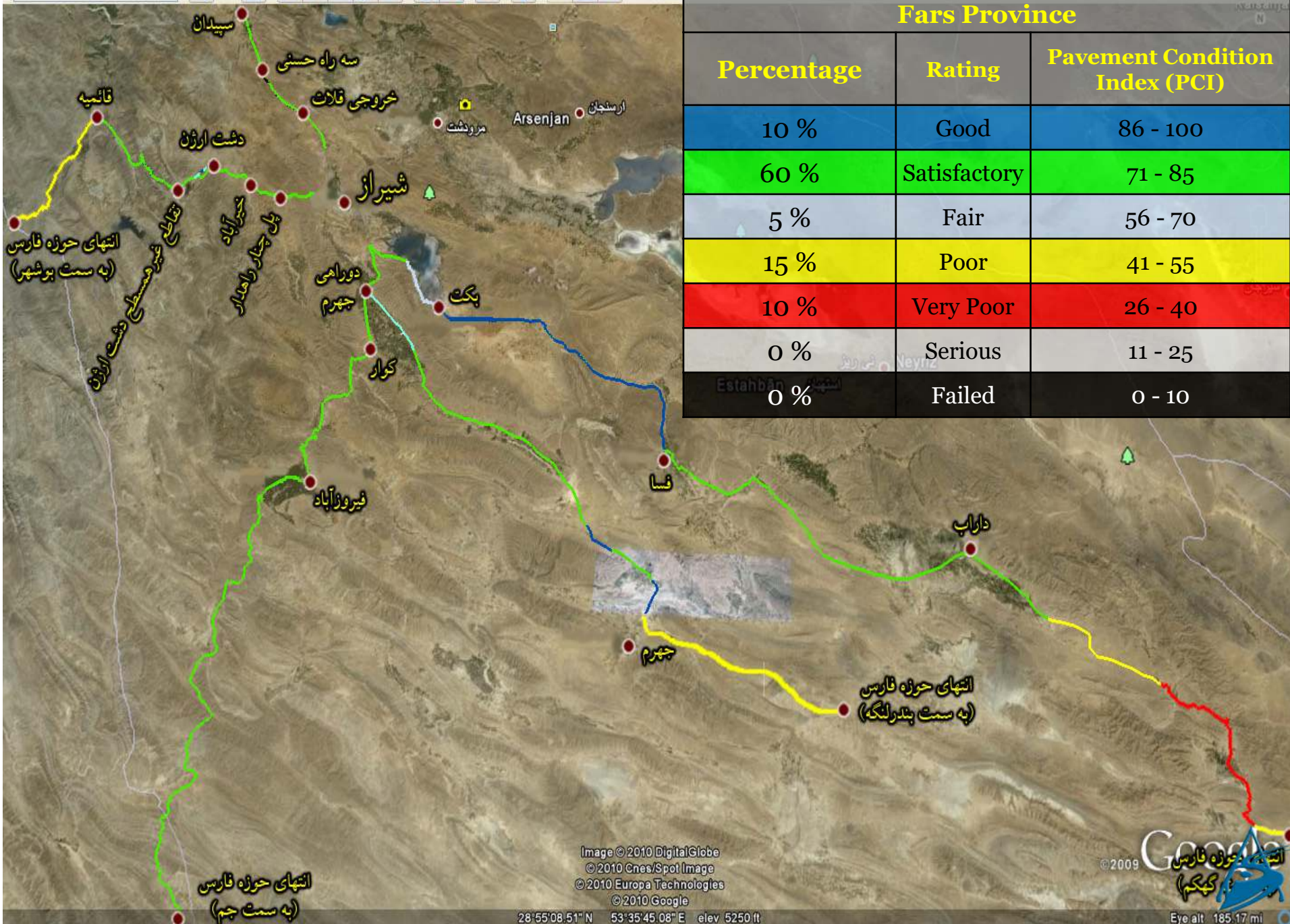


## Functional Condition Index in Roads Network of Fars Province

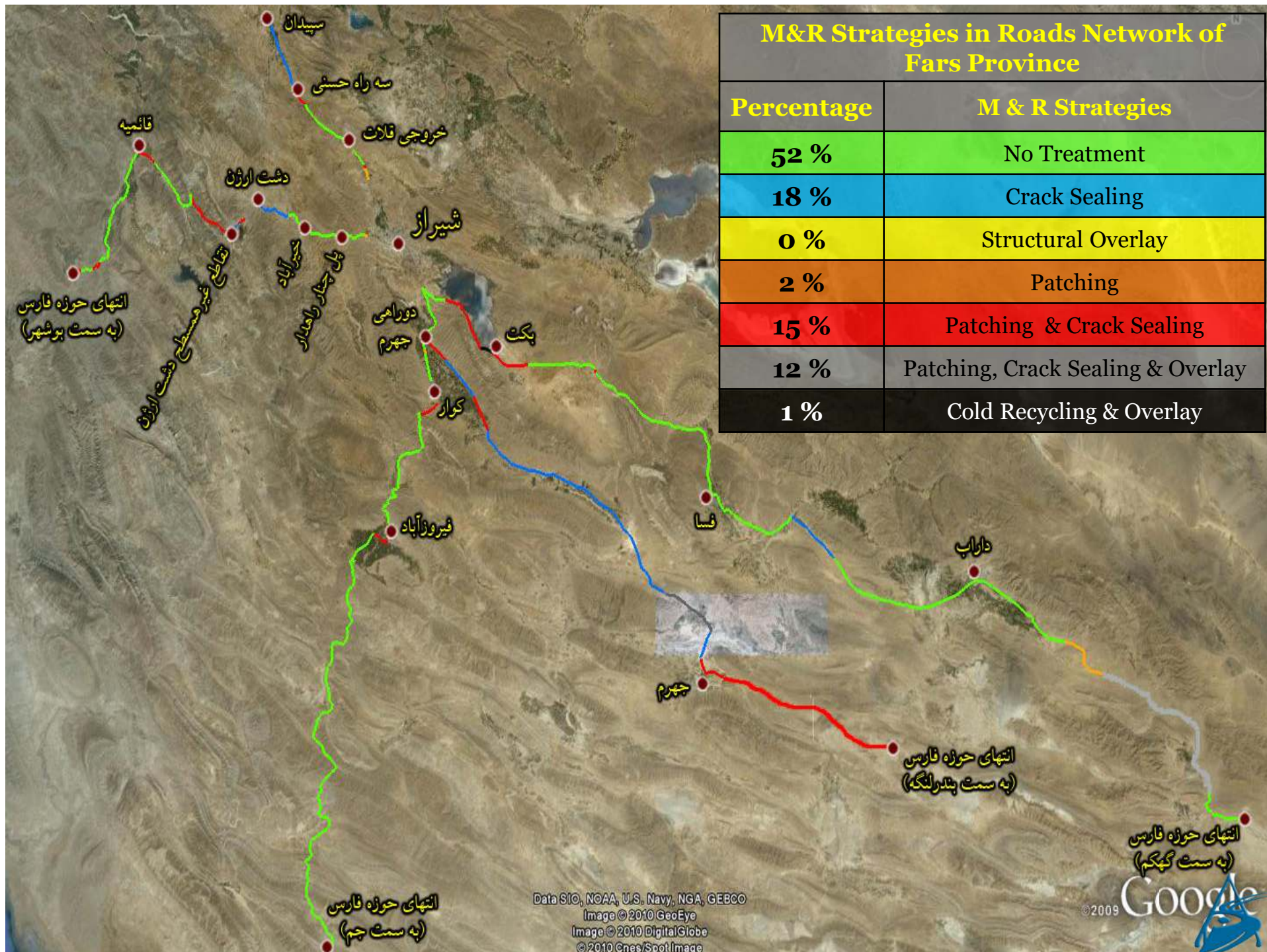
Percentage	Rating	International Roughness Index (IRI)
17 %	Excellent	0 - 2
66 %	Good & Fair	2 - 4
16 %	Poor	4 - 6
1 %	Very Poor	6 - 8







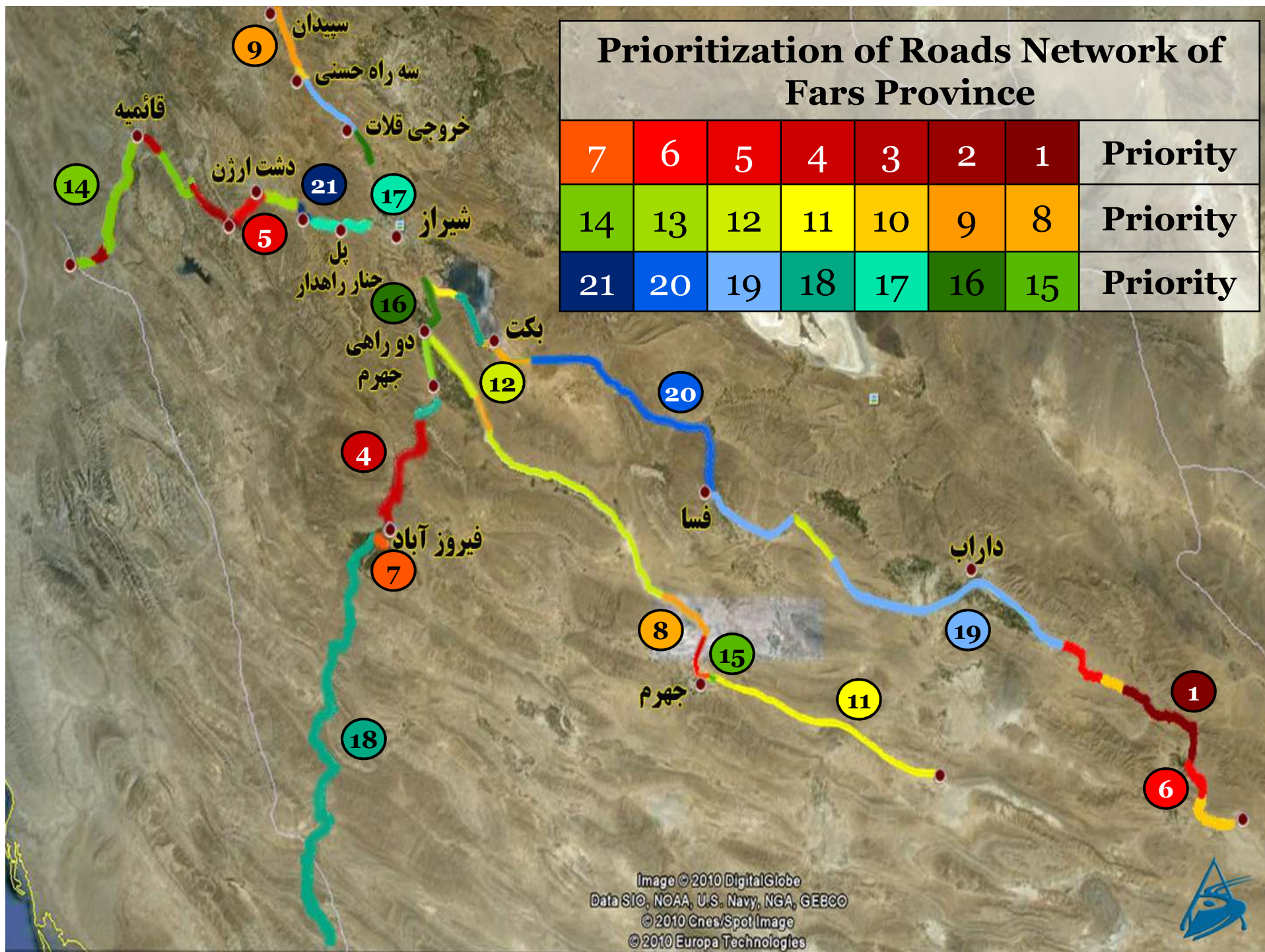






## Prioritization of Roads Network of Fars Province

7	6	5	4	3	2	1	Priority
14	13	12	11	10	9	8	Priority
21	20	19	18	17	16	15	Priority

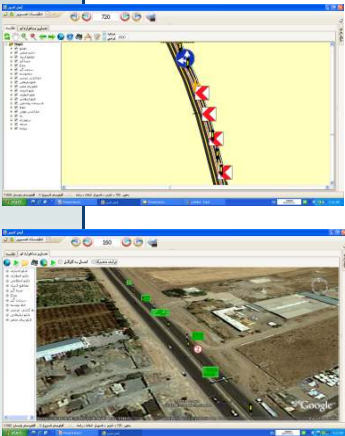




# Implementation Procedure of Safety Management System



## Collection of Current Condition Data



## Mechanistic Surveying of Road safety



## Determination and Placement of Needed Signs

ردیف	نوع	محل	توضیحات
۱	خطی	در ابتدای پهنای مسیر	خطی
۲	خطی	در ابتدای پهنای مسیر	خطی
۳	خطی	در ابتدای پهنای مسیر	خطی
۴	خطی	در ابتدای پهنای مسیر	خطی
۵	خطی	در ابتدای پهنای مسیر	خطی
۶	خطی	در ابتدای پهنای مسیر	خطی
۷	خطی	در ابتدای پهنای مسیر	خطی
۸	خطی	در ابتدای پهنای مسیر	خطی
۹	خطی	در ابتدای پهنای مسیر	خطی
۱۰	خطی	در ابتدای پهنای مسیر	خطی

## First Sectioning



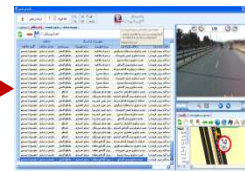
## Accidents Analysis



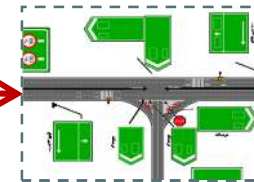
## Analysis and Final Sectioning



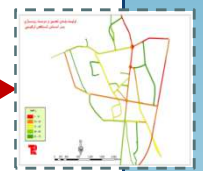
## Presenting the Short and Long Term Solutions



## Designing the Corrective Plans and Cost Estimation



## Prioritization





### Distribution of Road Safety Management System Budget

## The Used Indexes to Prioritize The Hazardous Sections of Fars Province Roads Network

Group	Point	Index	Unit	Range					Reference
Hazards	45	Safety Prioritization Score (SPS)	-	64 < SPS < 100 45	36 < SPS <64 35	16 < SPS < 36 25	4 < SPS < 16 15	0 < SPS < 4 10	
Traffic Condition	10	Volume to Capacity Ratio (V/C)	-	./6 < 10	./4 < < ./6 8	./25 < < ./4 6	< ./25 4	< ./25 2	Code 161
	5	Annual Average Daily Traffic (AADT)	vehicle	5 *10 <sup>4</sup> < 5	10 <sup>4</sup> < X < 5*10 <sup>4</sup> 4	10 <sup>3</sup> < X < 10 <sup>4</sup> 3	<10 <sup>3</sup> 1	<10 <sup>3</sup> 1	Code 234
				Freeway 10	Highway 8	Main Road 6	Secondary Road 4		
	10	Road Type	-						Code 161
Climatic Condition	5	Climatic Condition	Average of Temperature and Precipitation	Cold 5	Hot 3	Mild 1			
Economic & political Condition	5	Economic, Social and Political Importance	-	Special 5	Ordinary 0				
	10	Cost of Making Safe	10 <sup>6</sup> IRR	< 150 10	150 < X < 700 6	700 > 2			
Road Side Usage	10	Pedestrain Daily Traffic	person	High 10	Medium 6	Low 3			
Total	100								

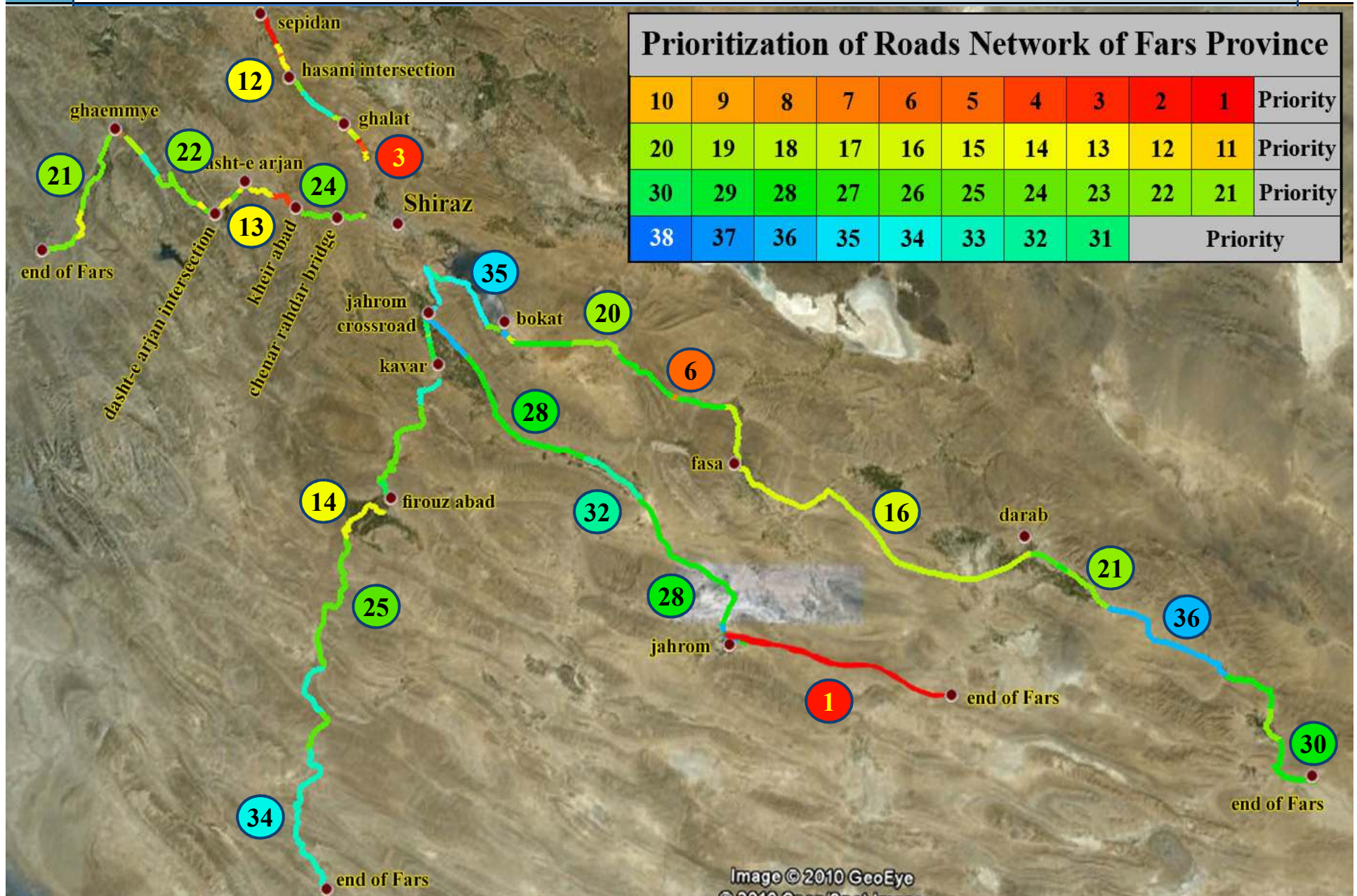
# Prioritization

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**Prioritization of Roads Network of Fars Province**

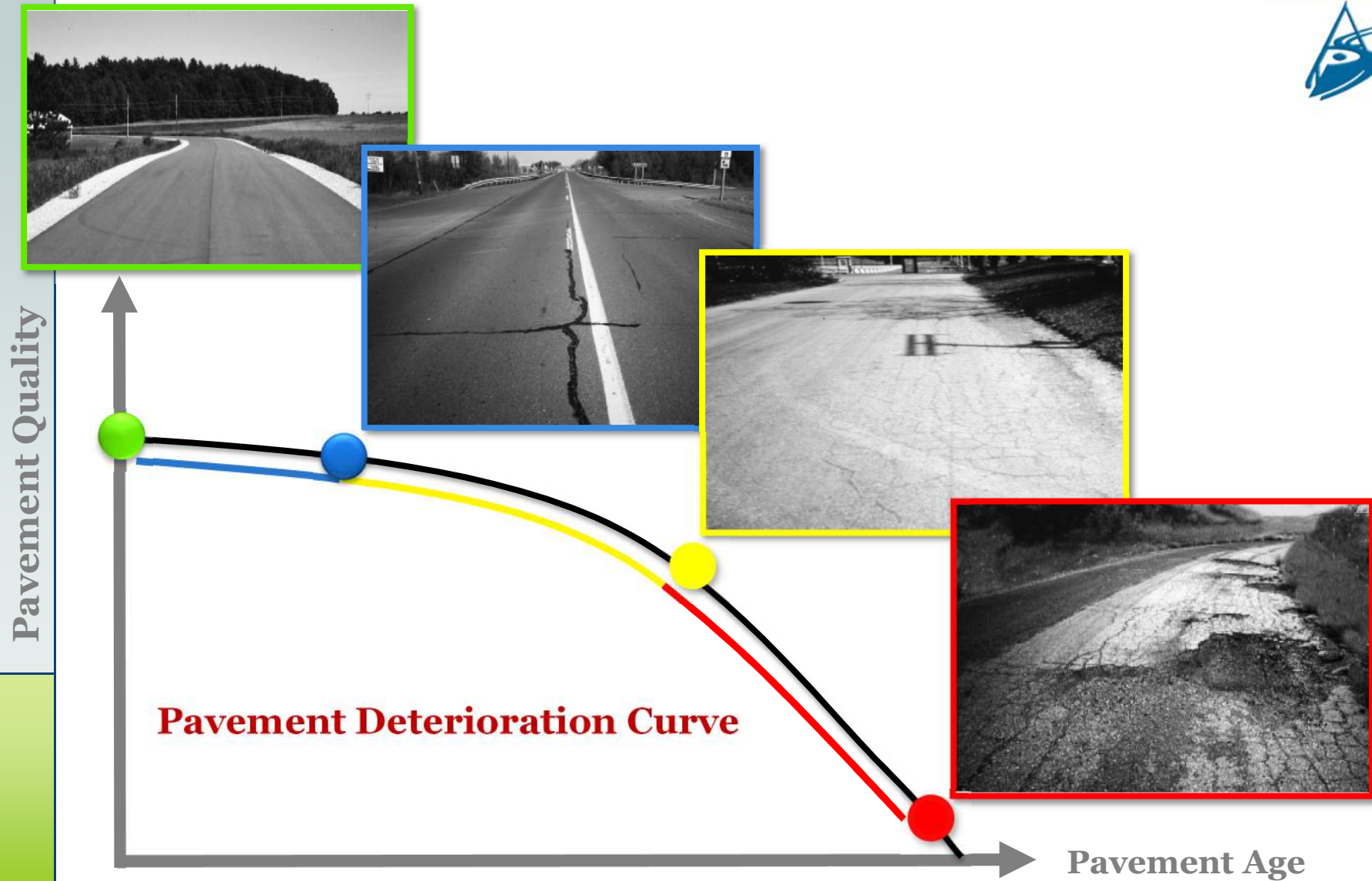
10	9	8	7	6	5	4	3	2	1	Priority
20	19	18	17	16	15	14	13	12	11	Priority
30	29	28	27	26	25	24	23	22	21	Priority
38	37	36	35	34	33	32	31	Priority		





# Pavement Deterioration with Time Passing

(Loading and Climatic Condition)

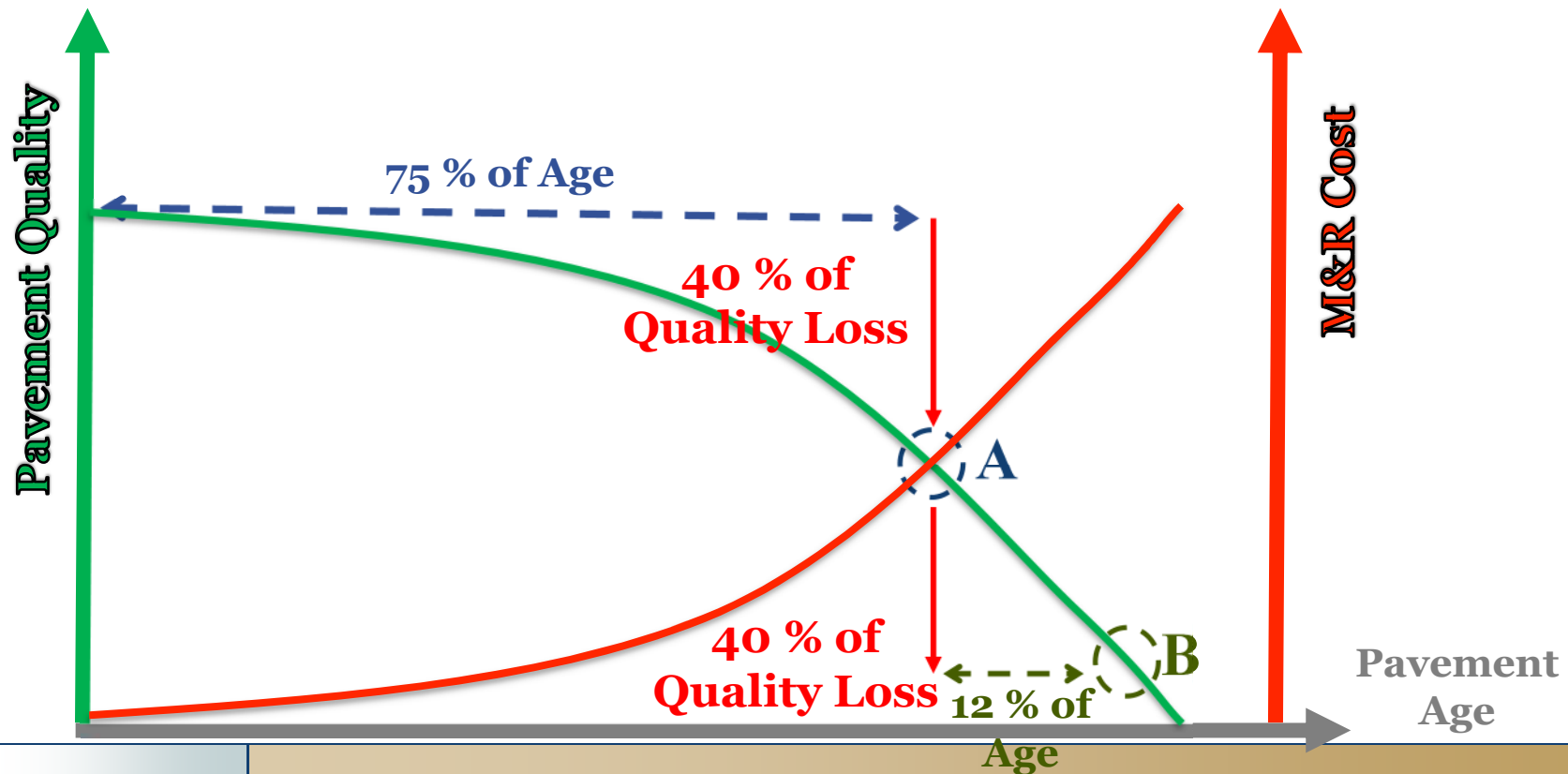


# The Necessity of Determining the Optimum Time for Pavement Maintenance and Repair (M&R)

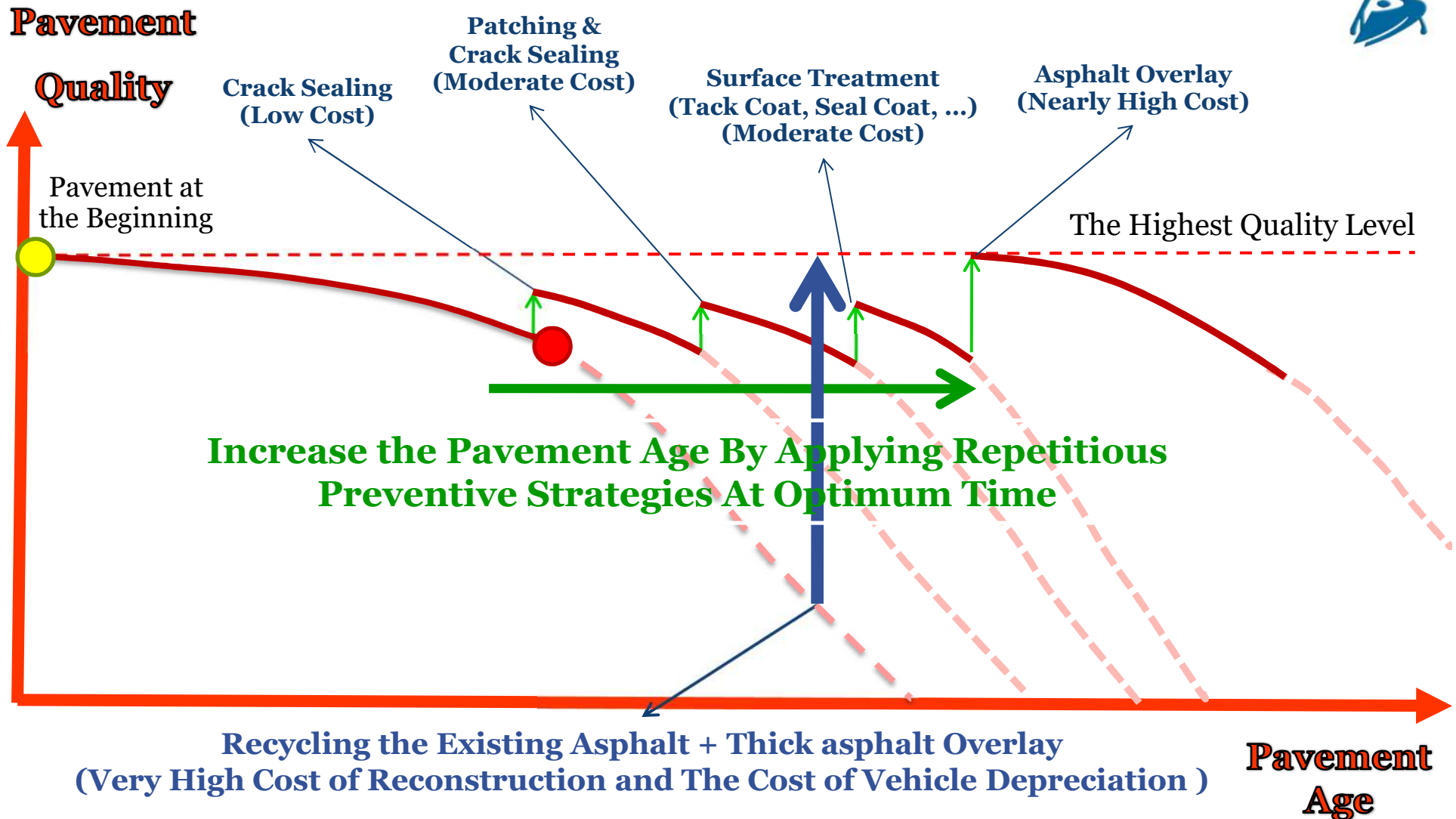
The severity of pavement quality loss will increase by the factor of **6** after point **A**.

At Point **A** → M & R Cost = **1** Unit

At Point **B** → M & R Cost = **4** Unit



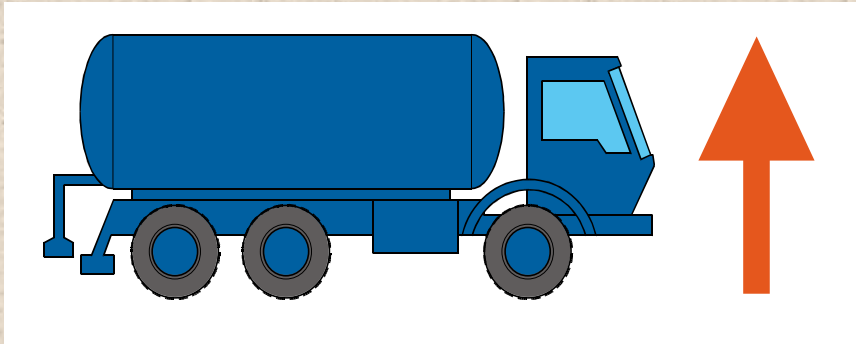
# The Influence of Preventive Strategies (Efficient with Low Cost) on Pavement Age Improvement





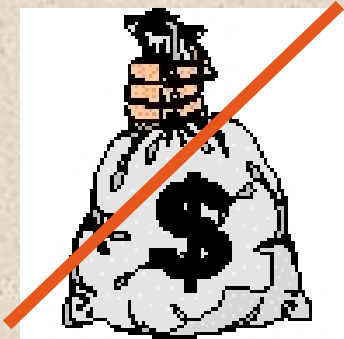
# Road deterioration

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Rising Traffic

+



Less money available  
per km of road

=



Deterioration of roads increasing

Higher axle loads = increasing damage = less money available per km



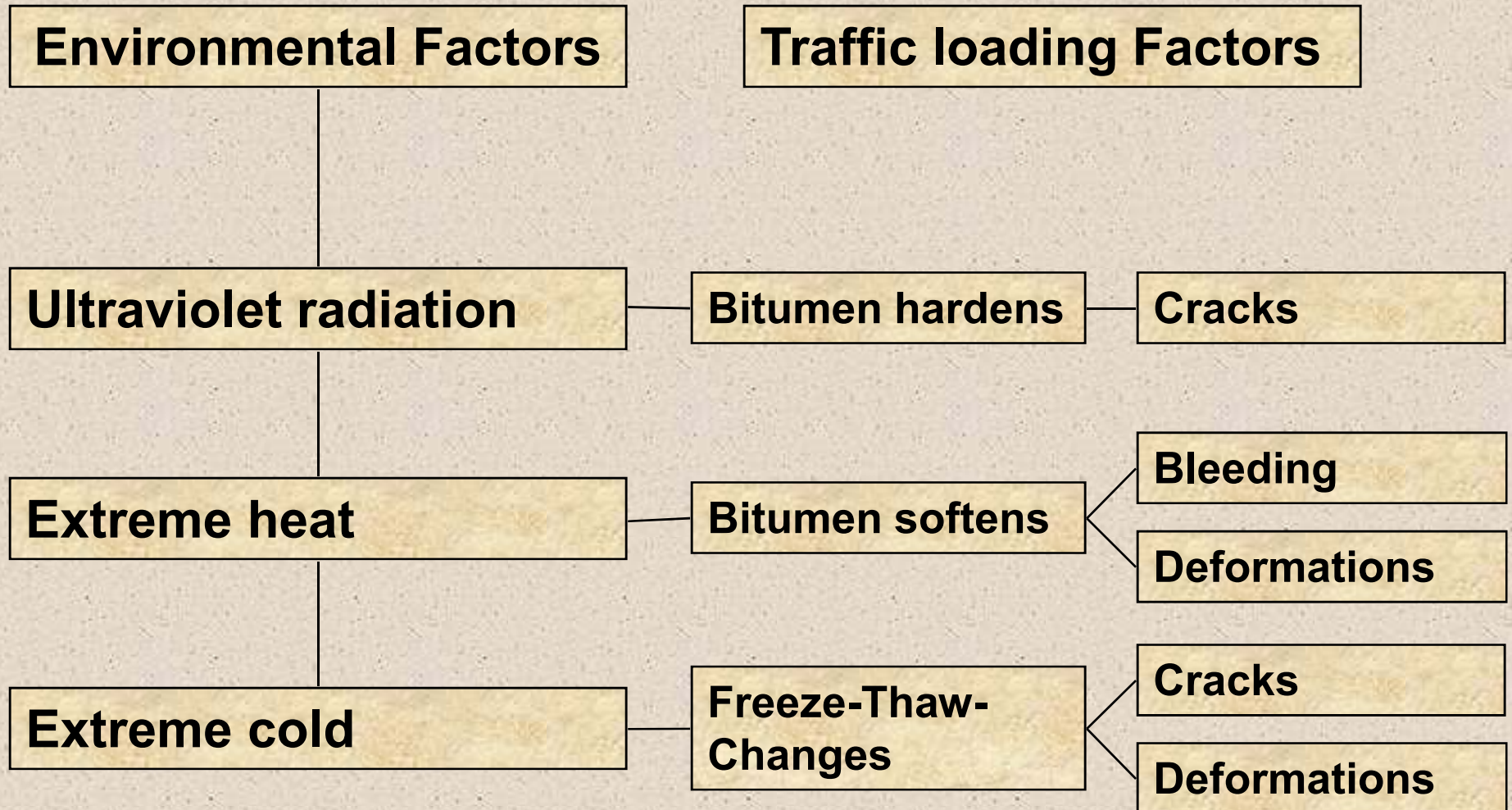
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## • Pavement deterioration

- Maintenance and Structural Rehabilitation
- Cold In-Situ Recycling
- Cold In-Plant Recycling
- Pavement Investigation and Design
- Examples of Cold Recycling

# Road deterioration

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# Road deterioration

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# Road deterioration

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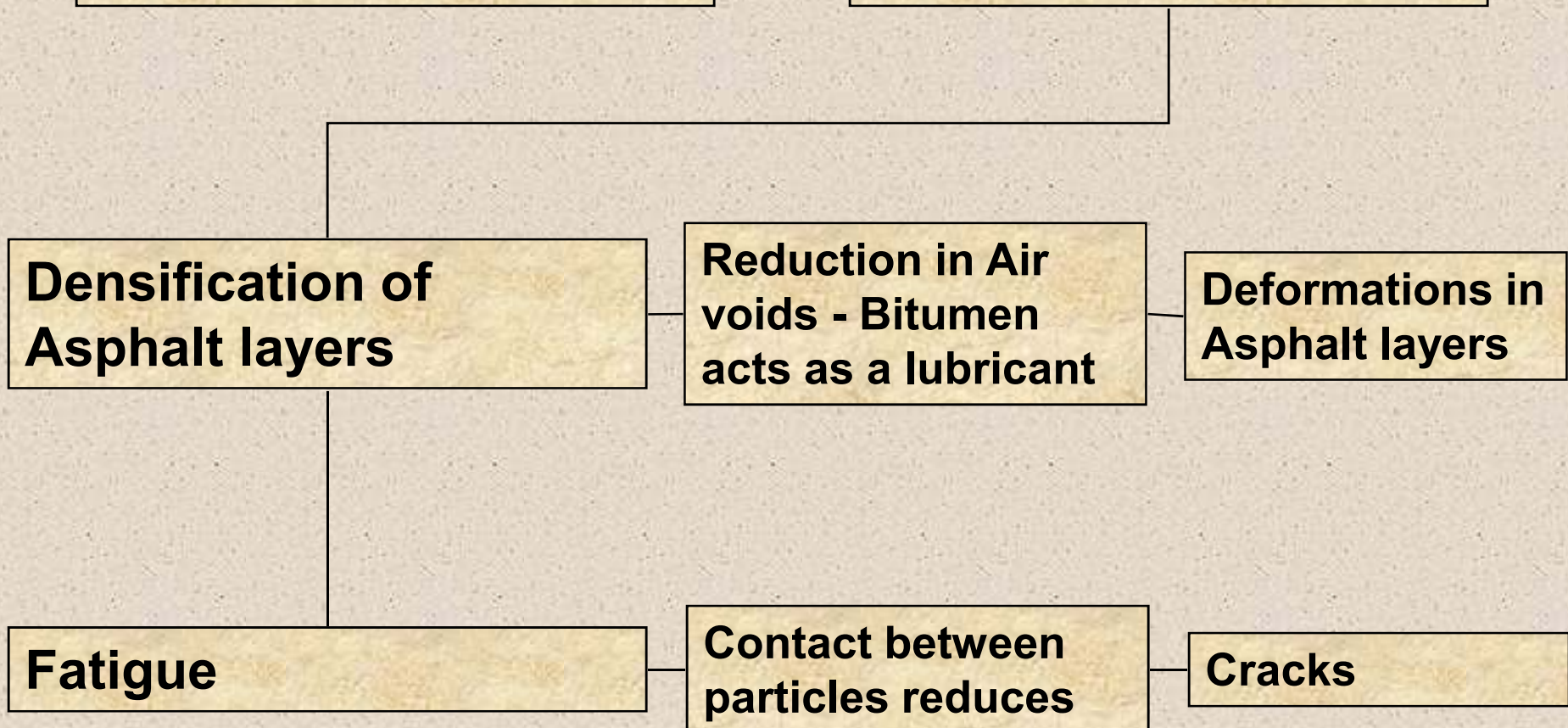
# Road deterioration

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**Environmental Factors**

**Traffic loading Factors**



# Road deterioration

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- Soil Stabilisation
- Pavement deterioration
- **Maintenance and Structural Rehabilitation**
- Cold In-Situ Recycling
- Cold In-Plant Recycling
- Pavement Investigation and Design
- Examples of Cold Recycling



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## Methods :

**Thin asphalt overlay**

Quick method, Elevation problems

**Mill and replace**

Quick method with modern Milling machines and pavers

**Thin layer hot recycling**

Quick method with modern hot recycling equipment and materials are being reused

# Pavement maintenance

Methods:

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## Thin asphalt overlay

Quick method, Elevation problems



## Mill and replace

Quick method with modern Milling machines and pavers



## Thin layer hot recycling

Quick method with modern hot recycling equipment and materials are being reused



(HIPAR)



# HOT RECYCLER

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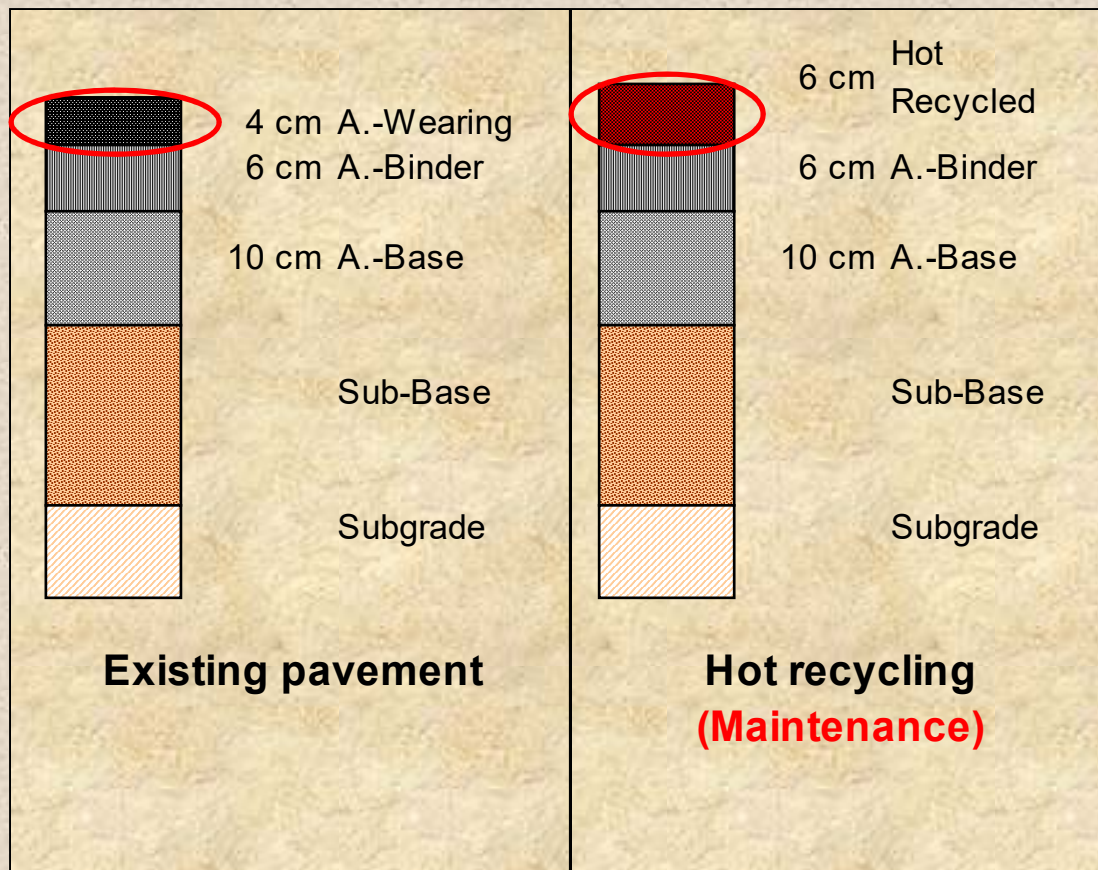
# Panel Heating Machine

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# Pavement maintenance/ Structural rehabilitation

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**Difference between maintenance and  
structural rehabilitation**



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## Methods :

### **Total reconstruction**

Expensive, Long construction time,  
Traffic accomodation

### **Thick asphalt overlays**

Relatively quick method, elevation  
problems

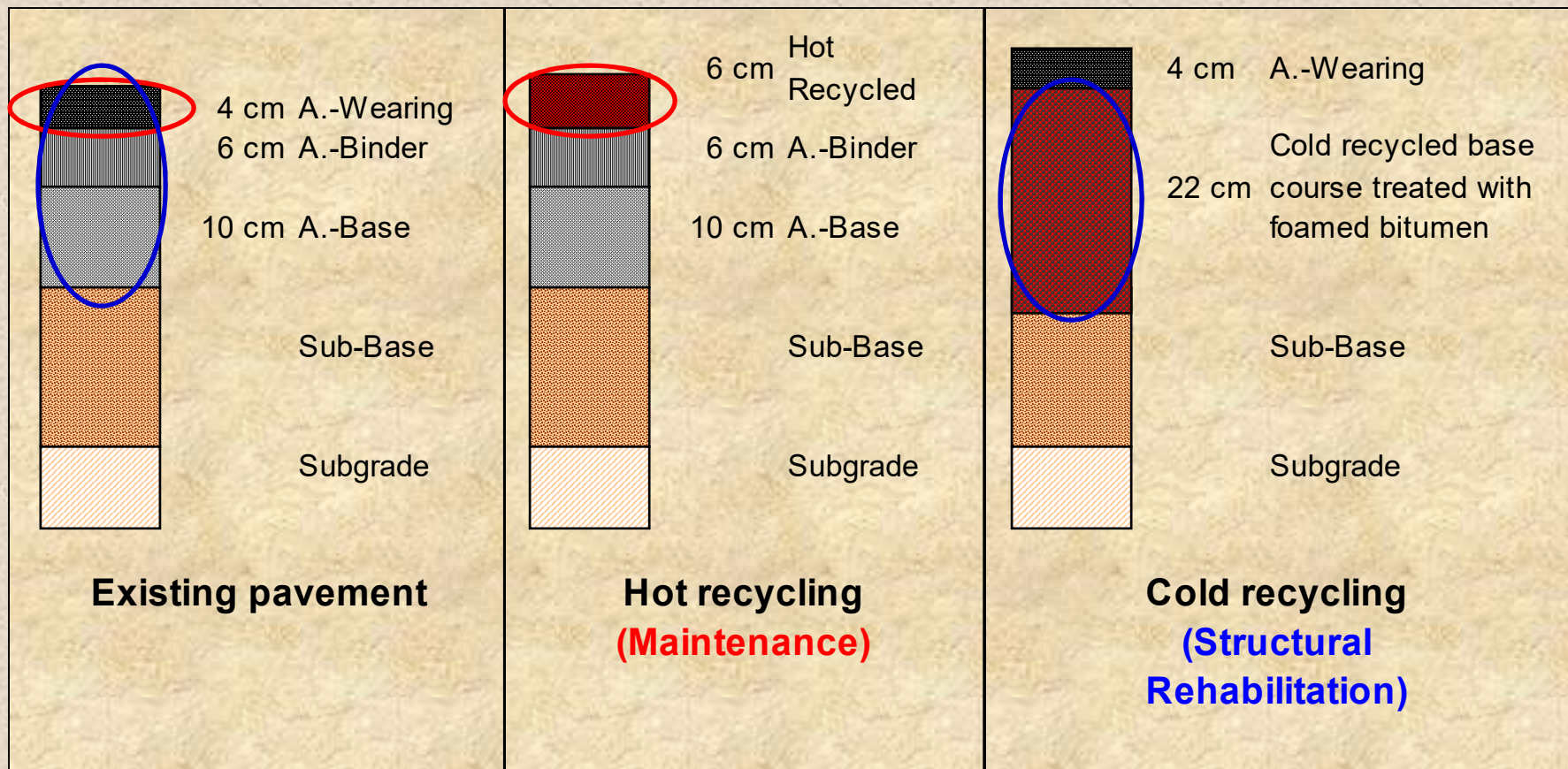
### **Deep cold recycling**

Price effective, Environmently  
friendly, Quick



# Pavement maintenance/ Structural rehabilitation

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**Difference between maintenance and  
structural rehabilitation**

# Structural rehabilitation

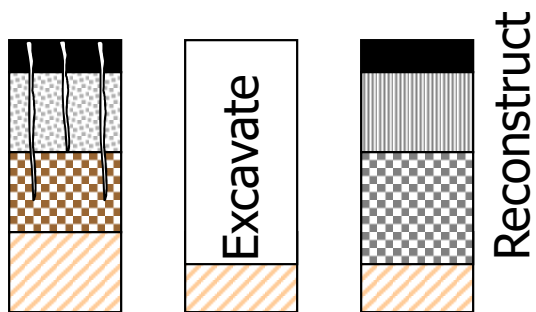
Methods:

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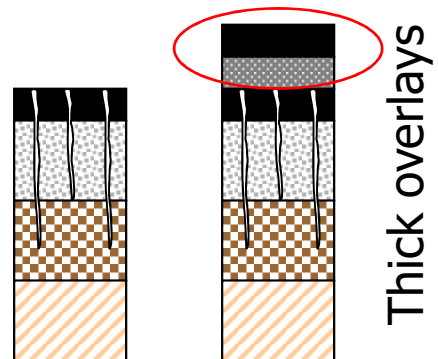
## Total reconstruction

Expensive,  
Long construction time,  
Traffic accomodation



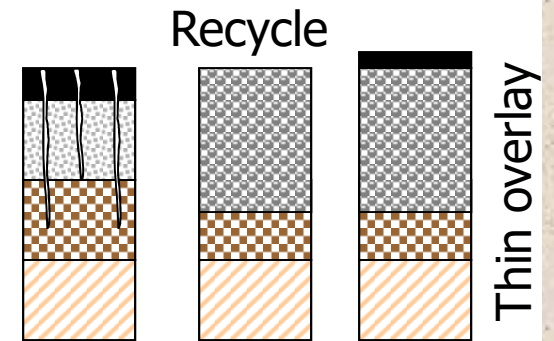
## Thick asphalt overlays

Relatively quick method,  
elevation problems,  
reflection cracks



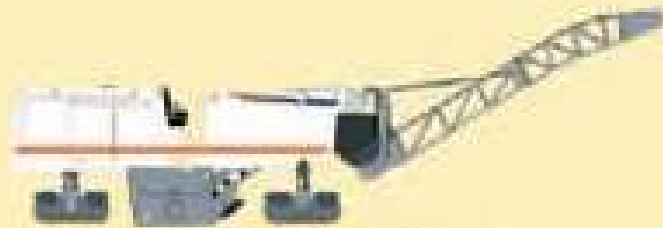
## Deep cold recycling

Price effective,  
Environmently friendly,  
Quick



# Thick asphalt overlays

Mill off all sphalt



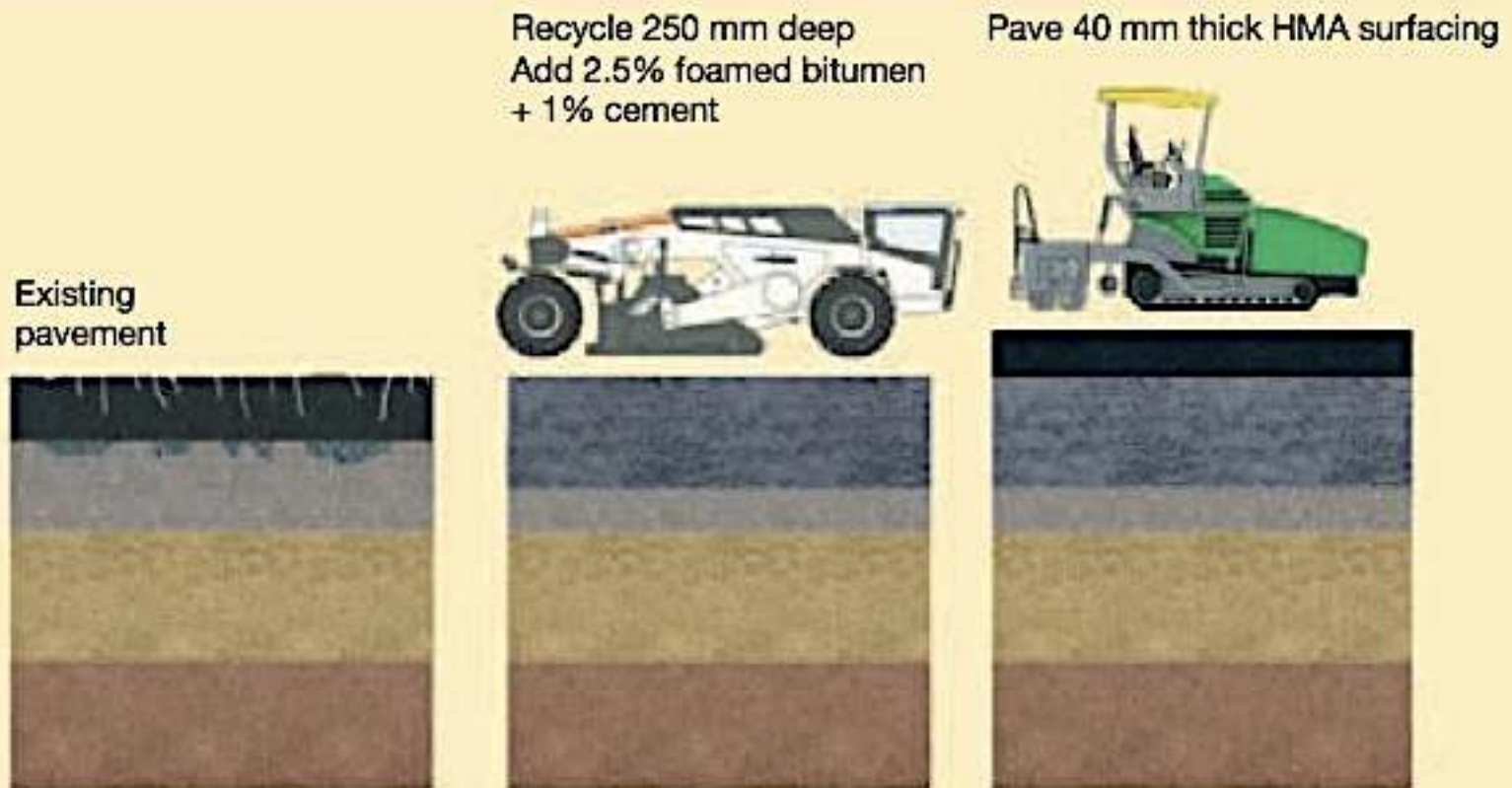
Replace asphalt





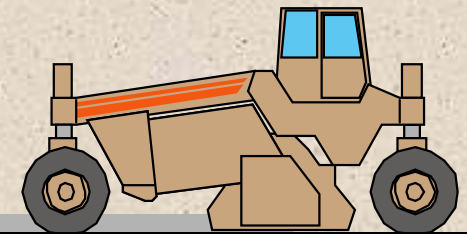
- Soil Stabilisation
- Pavement deterioration
- Maintenance and Structural Rehabilitation
- **Cold In-Situ Recycling**
- **Cold In-Plant Recycling**
- **Pavement Investigation and Design**
- **Examples of Cold Recycling**

# In Situ Deep cold recycling

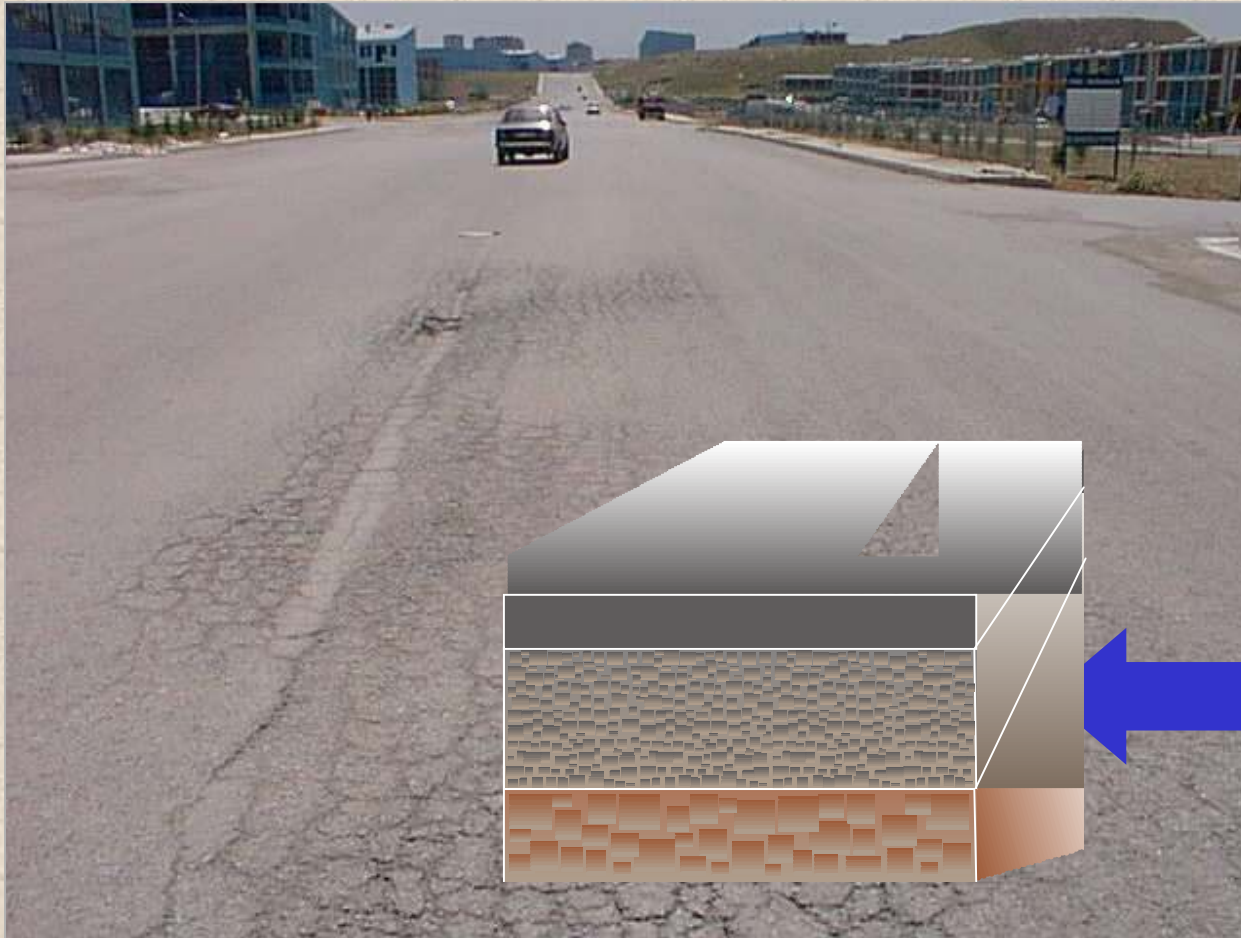


# Cold recycling in situ

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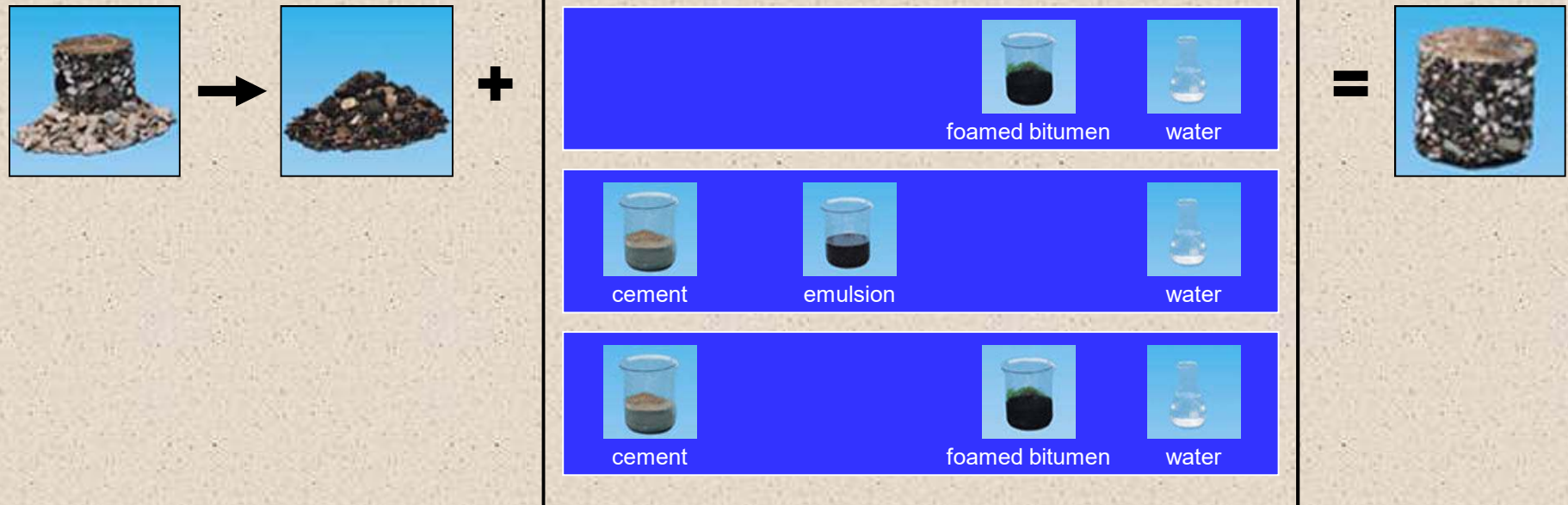


**Upper  
Pavement  
Layers**

**Typical Pavement for Cold Recycling**

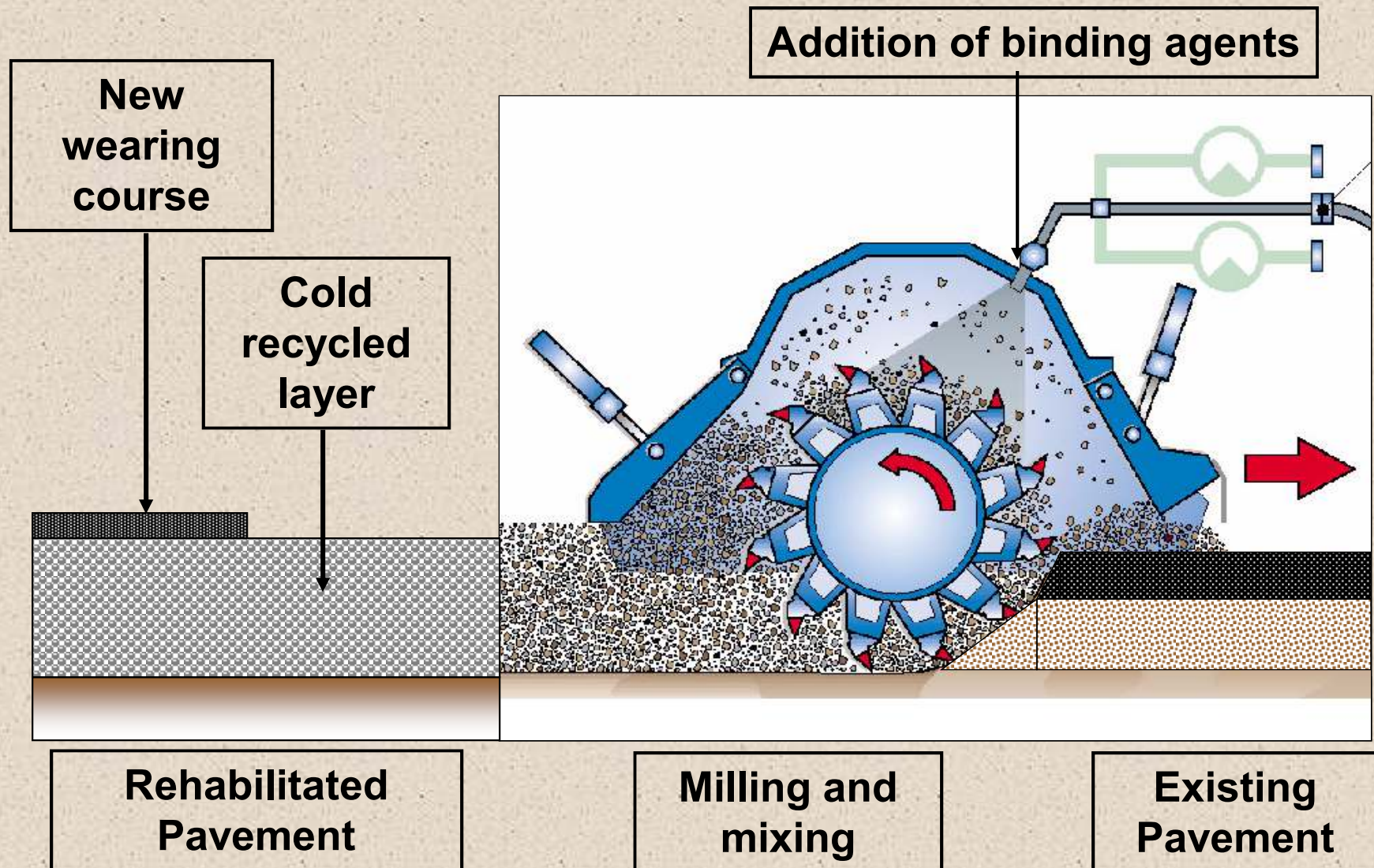
# Cold recycling in situ

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# Cold recycling in situ

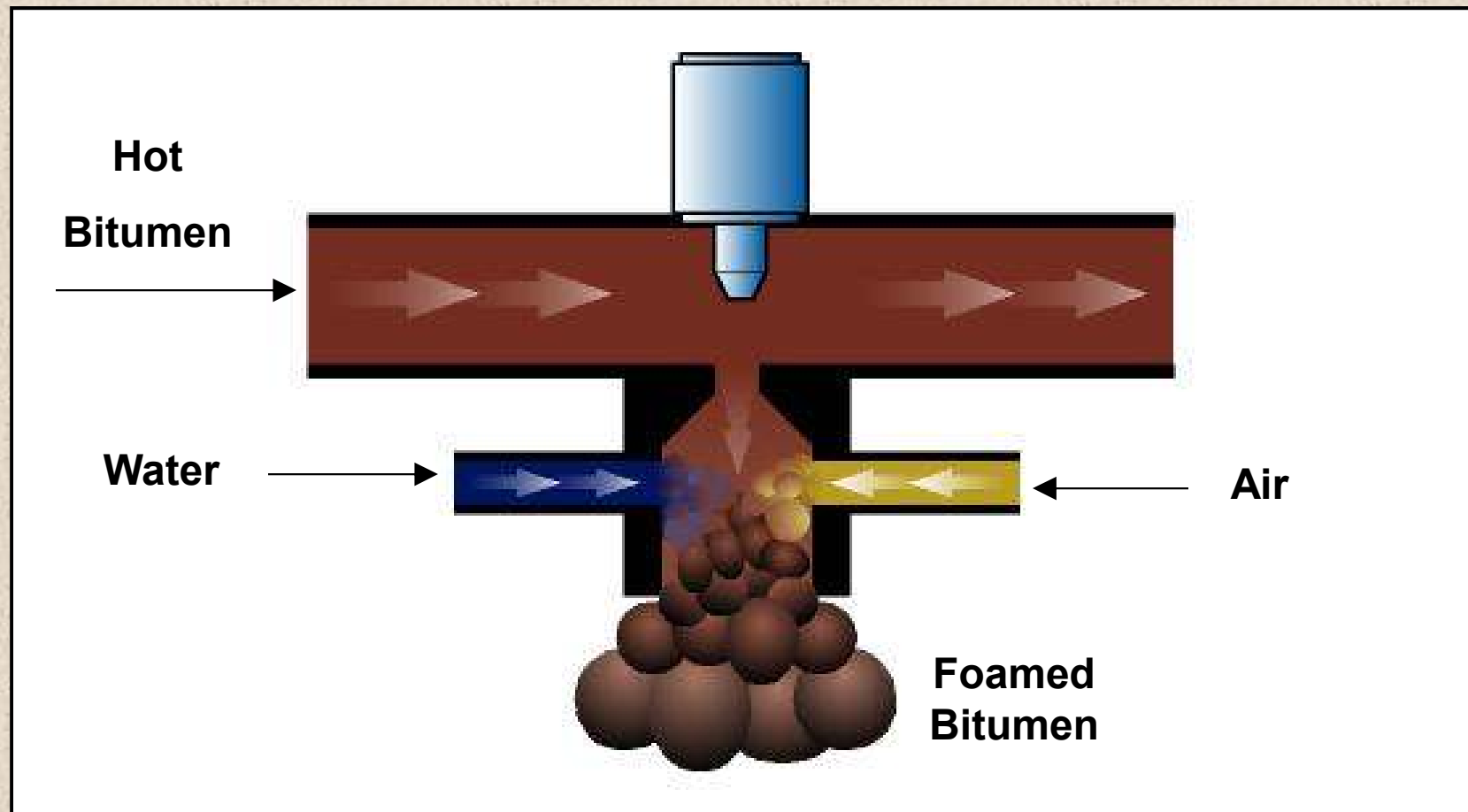
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# ***Cold recycling***

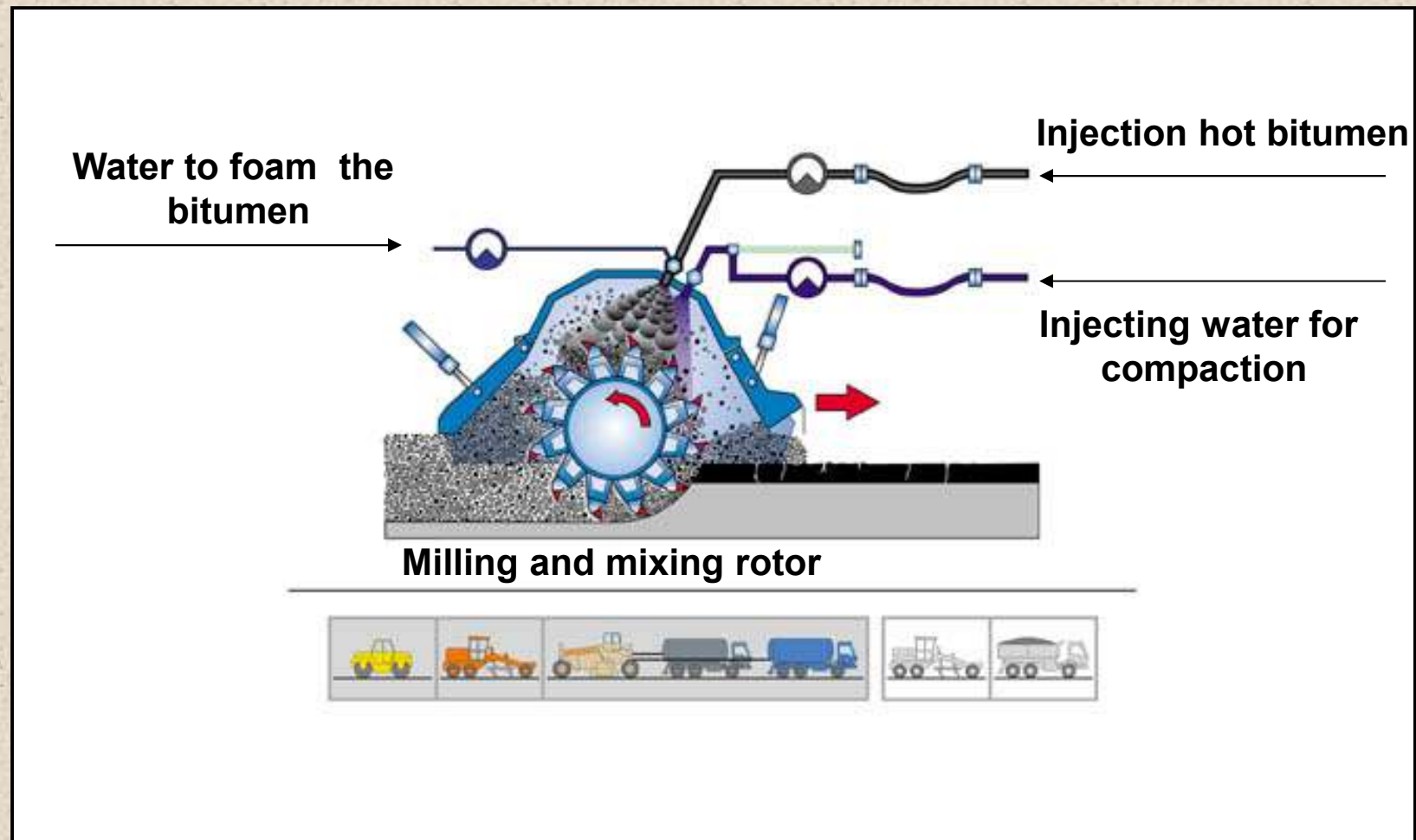
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**2 - 3% cold water injected into the hot bitumen will produce foam with an expansion of 10 to 20 times of the original volume**

# ***Cold recycling in situ***

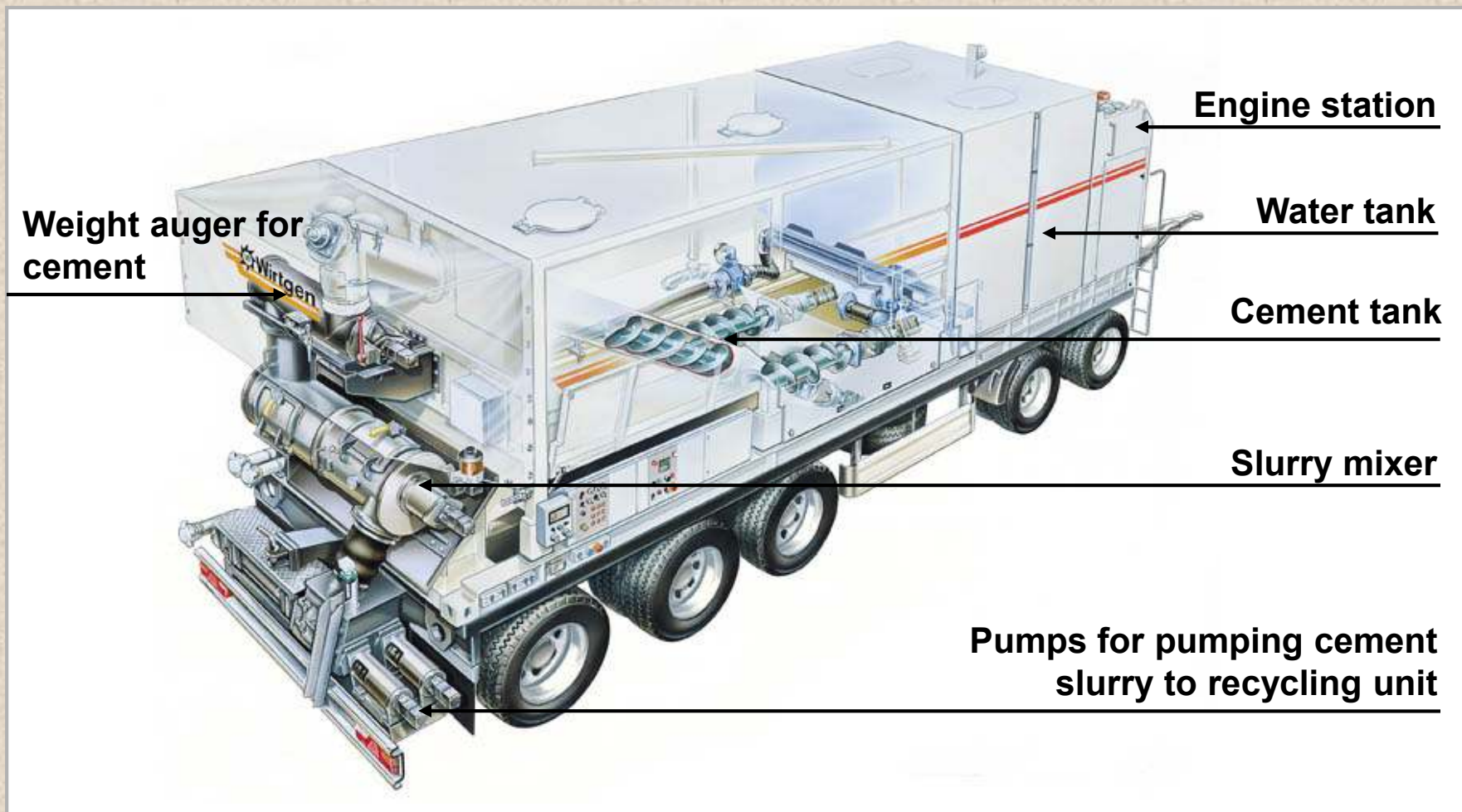
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**Schematic showing the process and machines used for cold recycling with foam bitumen**

# Cement slurry mixer WM 1000

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**Schematic representation of the mobile cement slurry mixer**



## Treatment in-situ

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**The mixed cement slurry is pumped directly into the Recycler WR 2500**

# ***Cold recycling in situ***

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**Cold recycling the asphalt and granular base layers by adding cement, water and foamed bitumen**



# ***Cold recycling in situ***

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**Upgrading an unbound gravel road  
by cold recycling with foamed bitumen**



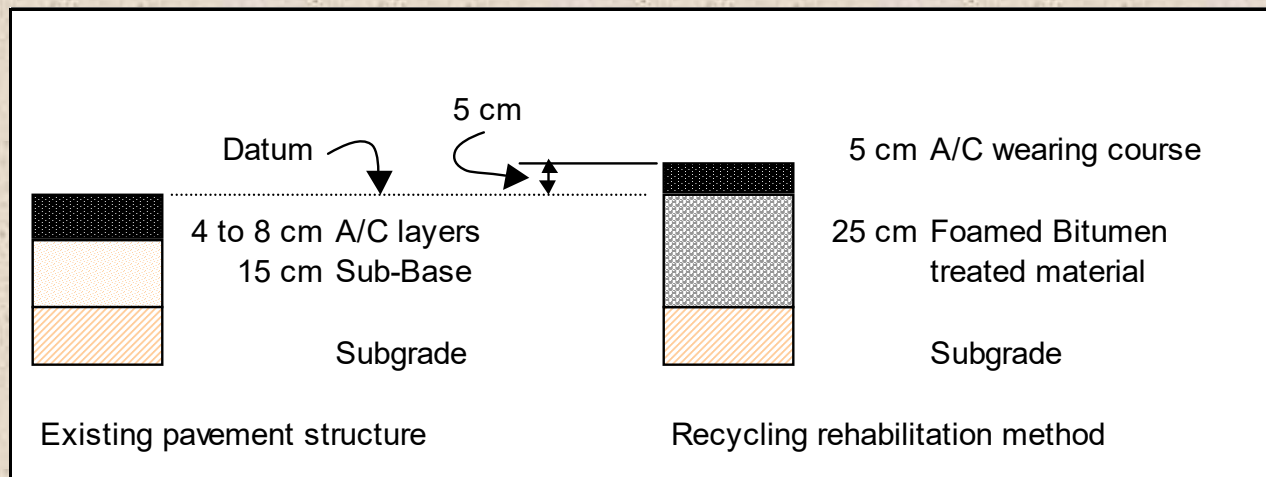
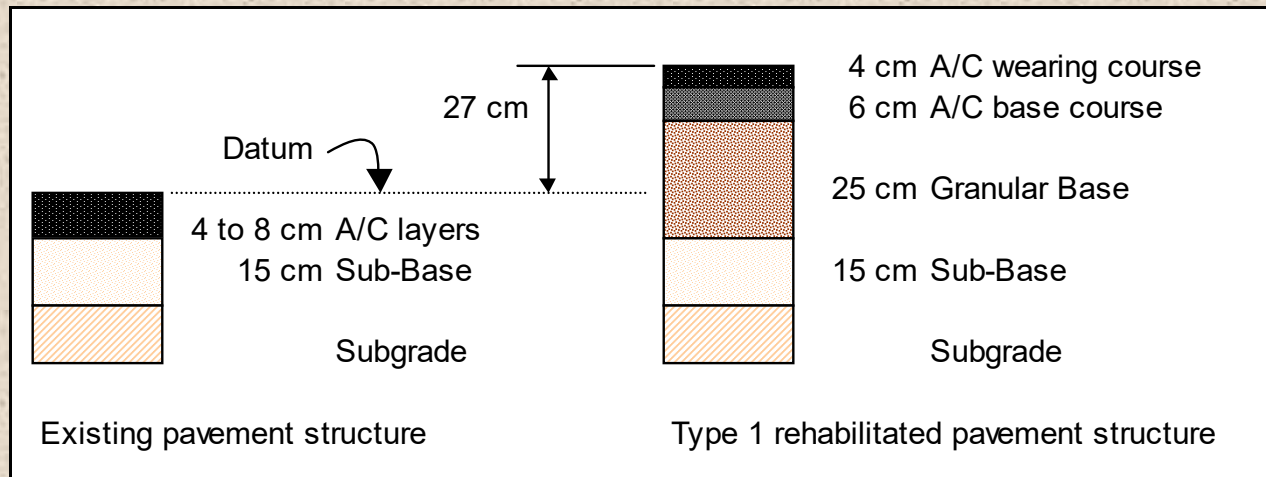
## ***Cold recycling in situ***

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**Deteriorated Road -  
Longitudinal, Transverse and Crocodile cracking evident**

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# *Cold recycling in situ*

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**Milling of the existing layer and then the recycling  
of asphalt and selected layers could start**





- Soil Stabilisation
- Pavement deterioration
- Maintenance and Structural Rehabilitation
- Cold In-Situ Recycling
- **Cold In-Plant Recycling**
- Pavement Investigation and Design
- Examples of Cold Recycling

## Cold In-Plant Recycling



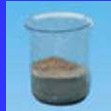
# Cold in plant recycling Binding Agents

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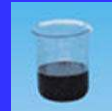
## stabilizing agents



cement



water



emulsion



water



foamed bitumen



water



cement



emulsion



water



cement



foamed bitumen



water

=

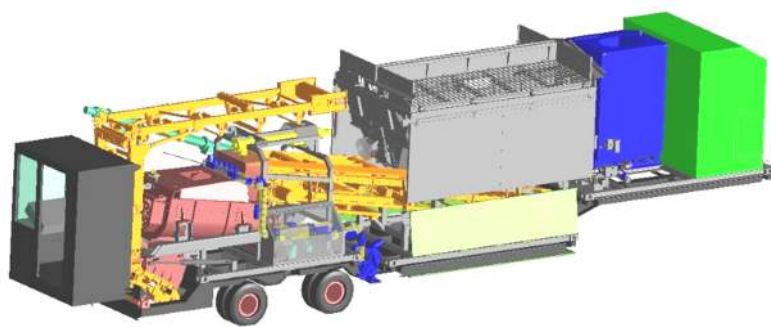




# Cold Mixing Plant KMA 220

## Technical Specifications

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Transport configuration



Twin-shaft pug mixer	220 t / h
----------------------	-----------

Aggregate Hopper	2 x 6 m <sup>3</sup>
------------------	----------------------

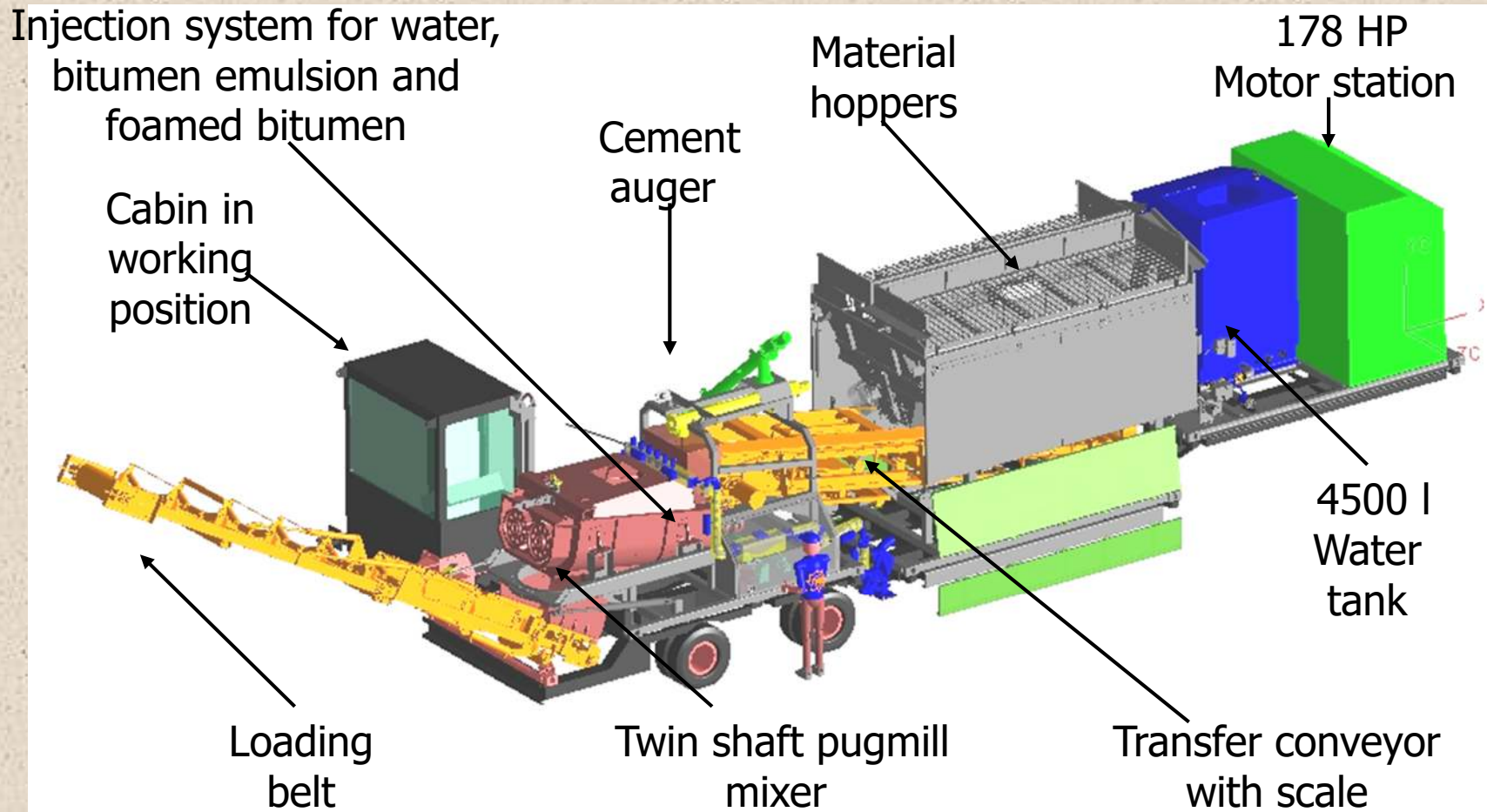
Transport	13,4 m x 2,5 m x 4,0 m
-----------	------------------------

Transport weight	30 t
------------------	------

Power Output	131 kW / 178 PS
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# Cold Mixing Plant KMA 200 Components

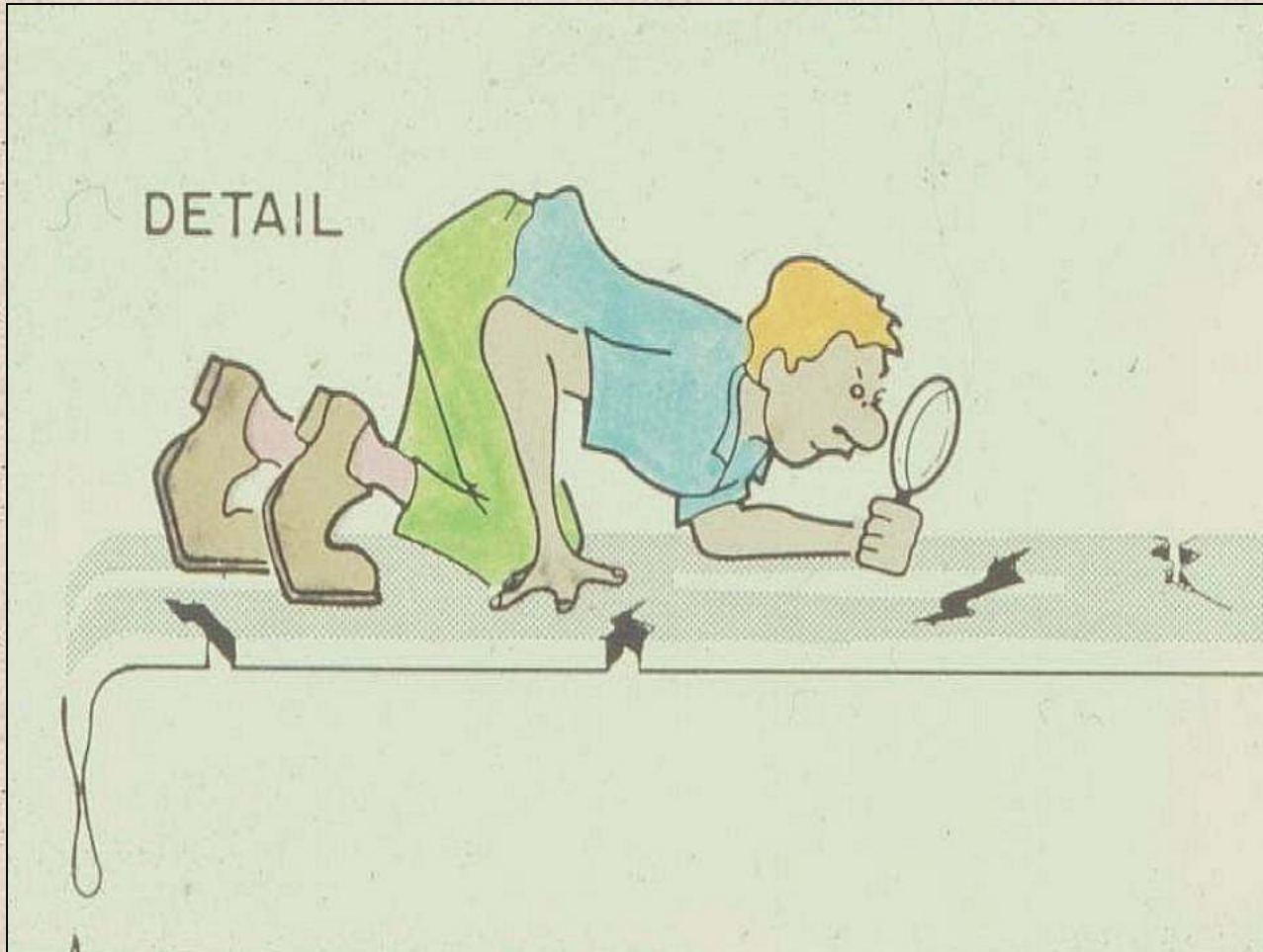
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All components on one low-bed trailer

# Pavement Investigation

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# Pavement Investigation

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## Walking, Looking



## Recording damage



## Project Data

- Length = ?
- Width = ?
- Damage patterns, etc

## Visual Assessment and available information

Historical records, etc.

# Pavement Investigation

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## Milling Testpit



## Investigating Layers



## Test pits

Reasonably quick and cost effective method to check pavement buildup. Details like compaction, moisture content, type of material and thickness of layers can be determined. The material from the existing layers are then also used for laboratory testing.



# Pavement Investigation

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**Core drilling**



**Core sample**



## Core Samples

**Very quick, cost effective, and little disturbance to traffic**





## Plate bearing test



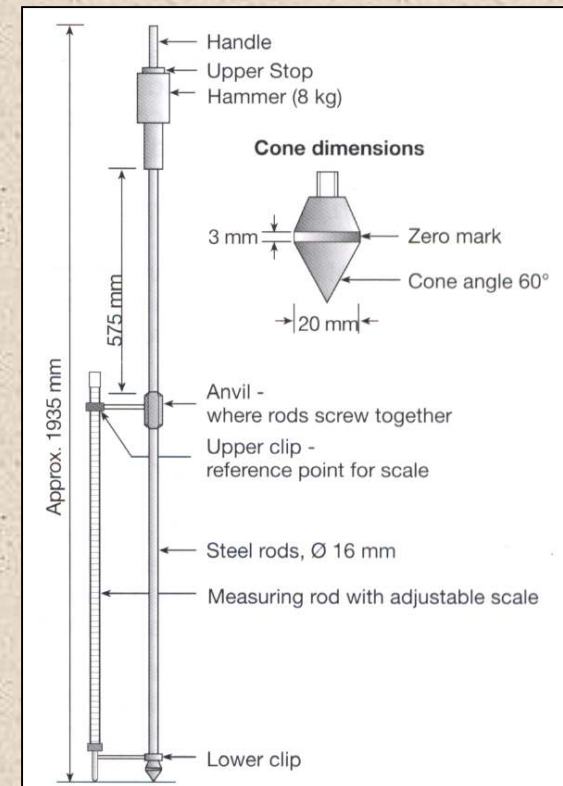
## Plate bearing test

reasonably quick method of determining the soundness and strength of the entire existing pavement structure



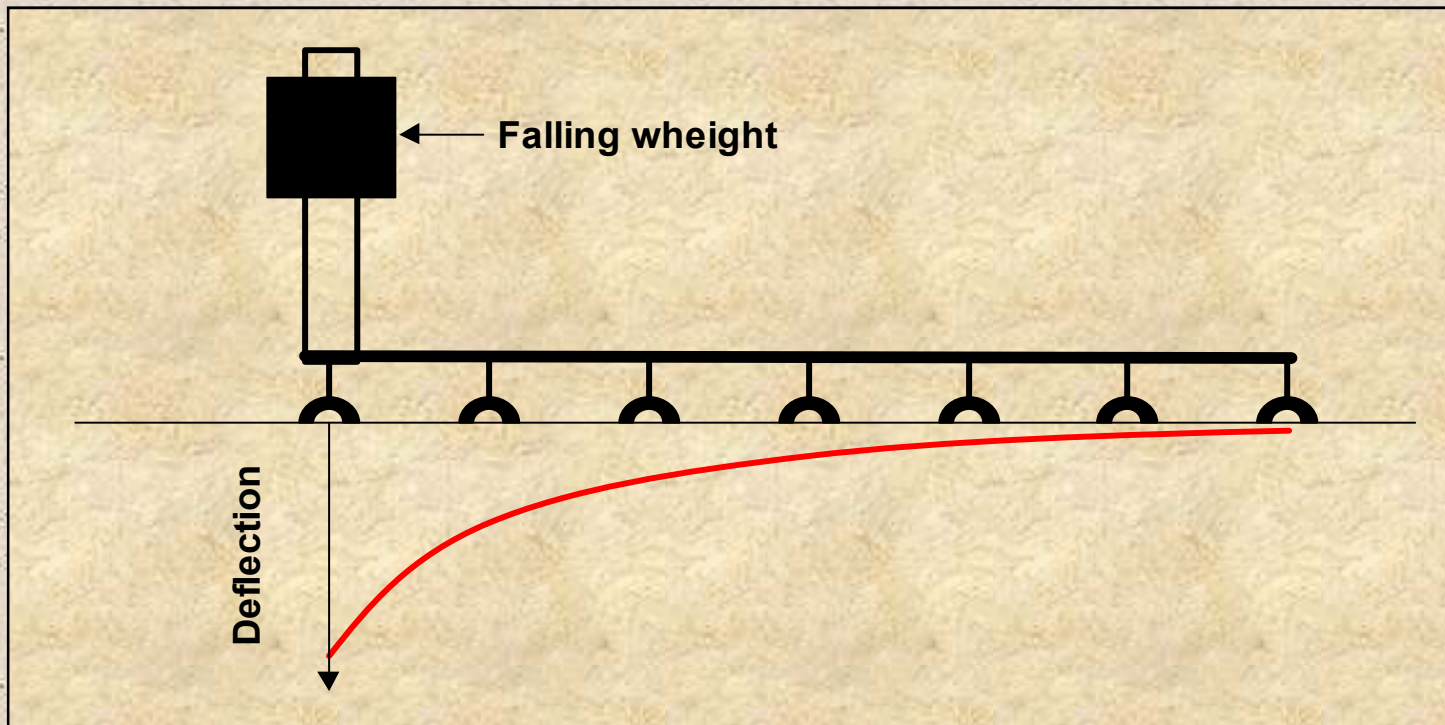
# Pavement Investigation

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## Dynamic Cone Penetrometer

very quick method of determining the soundness, strength and thickness of each layer. Results can be used for design method.



## Deflection measurements

with the falling weight deflectometer (FWD) the deflection bowl radius is determined for the entire pavement structure. Results are used for the deflection design method.



**Emirates Road**

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## **Job Site Reports**

### **Recycling in Situ Method**

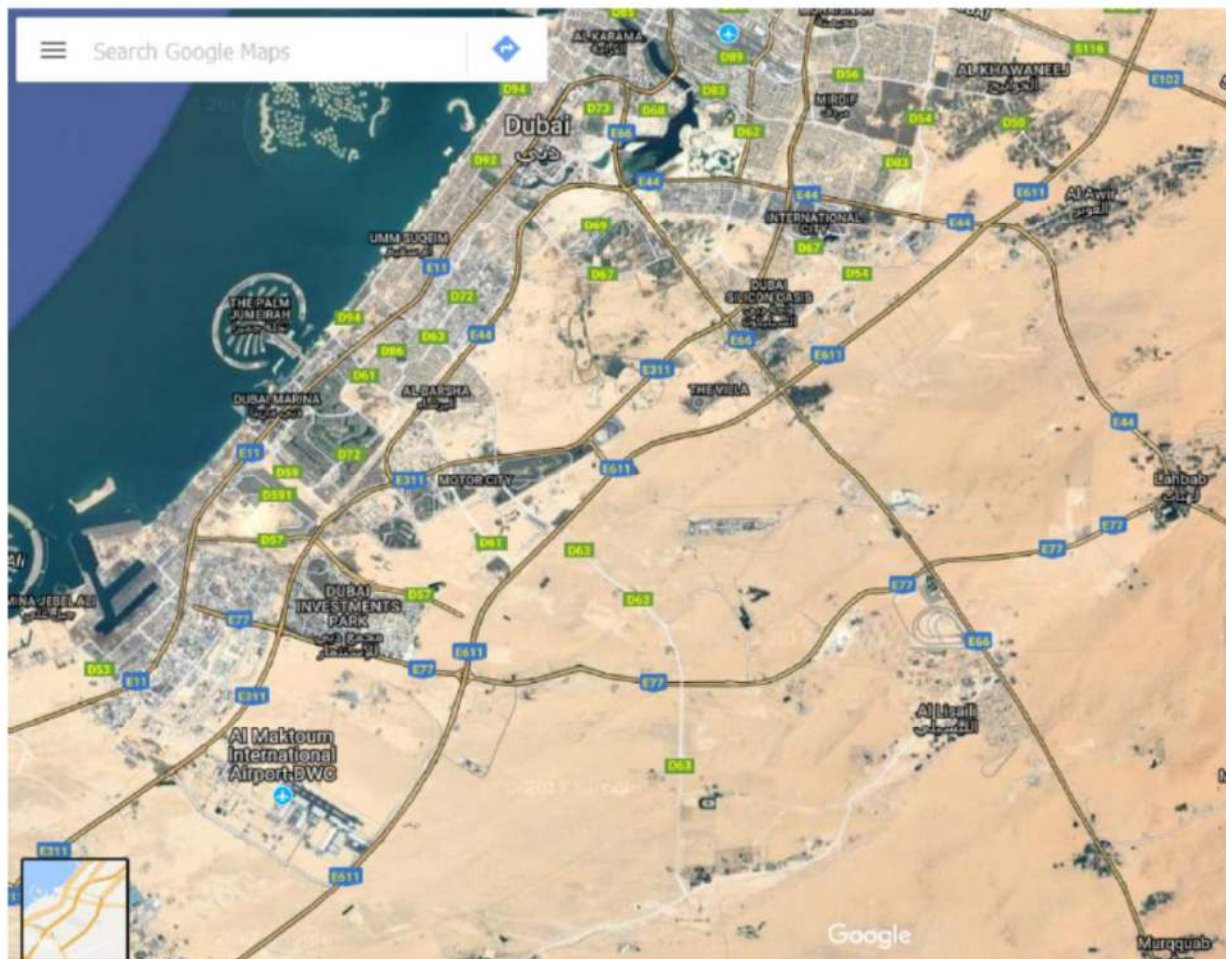
# **Rehabilitation of Emirates Road(E-611)**

# Emirates Road

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***Length: 29.5 Km - Width: 4 m***



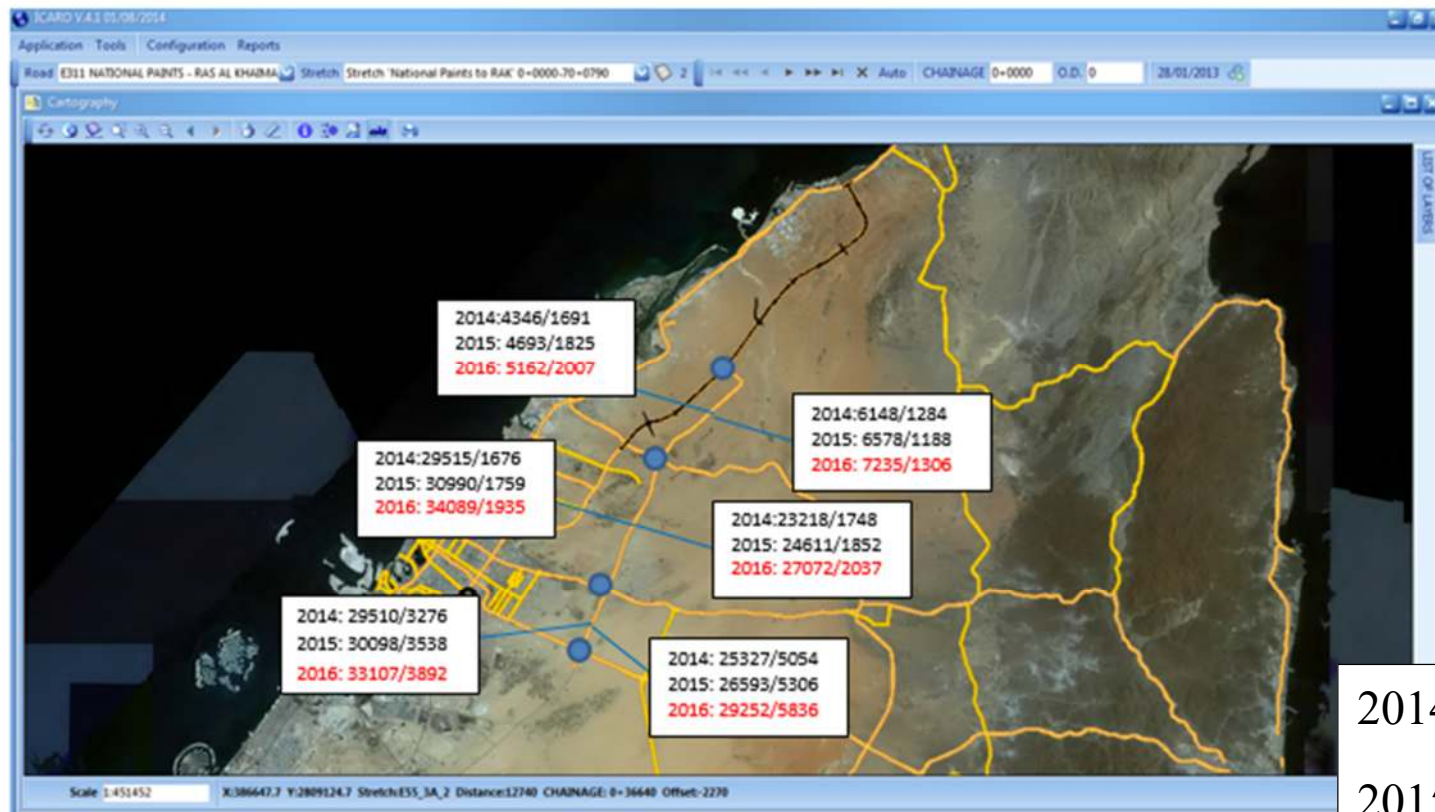
# Highway project in Emirates

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## TRAFFIC VOLUMES PER ROAD

Road E-611 (Emirates Road) (Kalba road – E88 – E55 – E311)



2014: ADT / HWADT

2015: ADT / HWADT

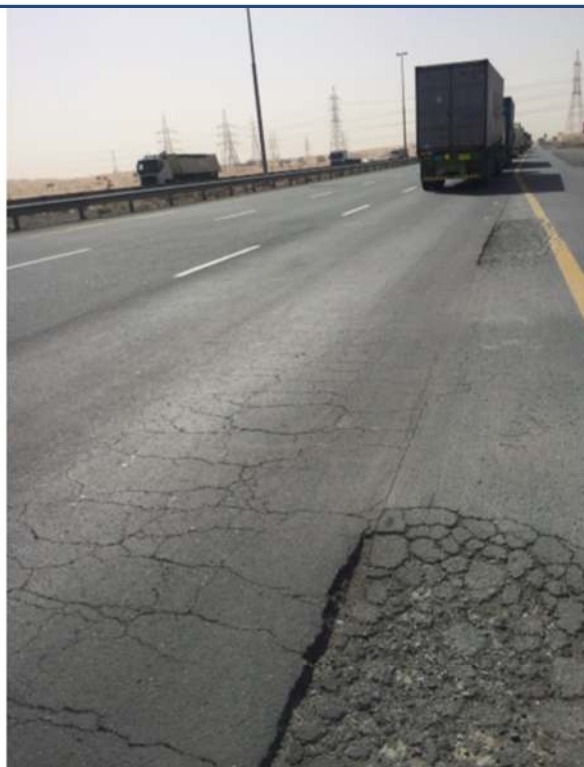
2016: ADT / HWADT



# Highway project in Emirates



## Evaluation of existing Distress

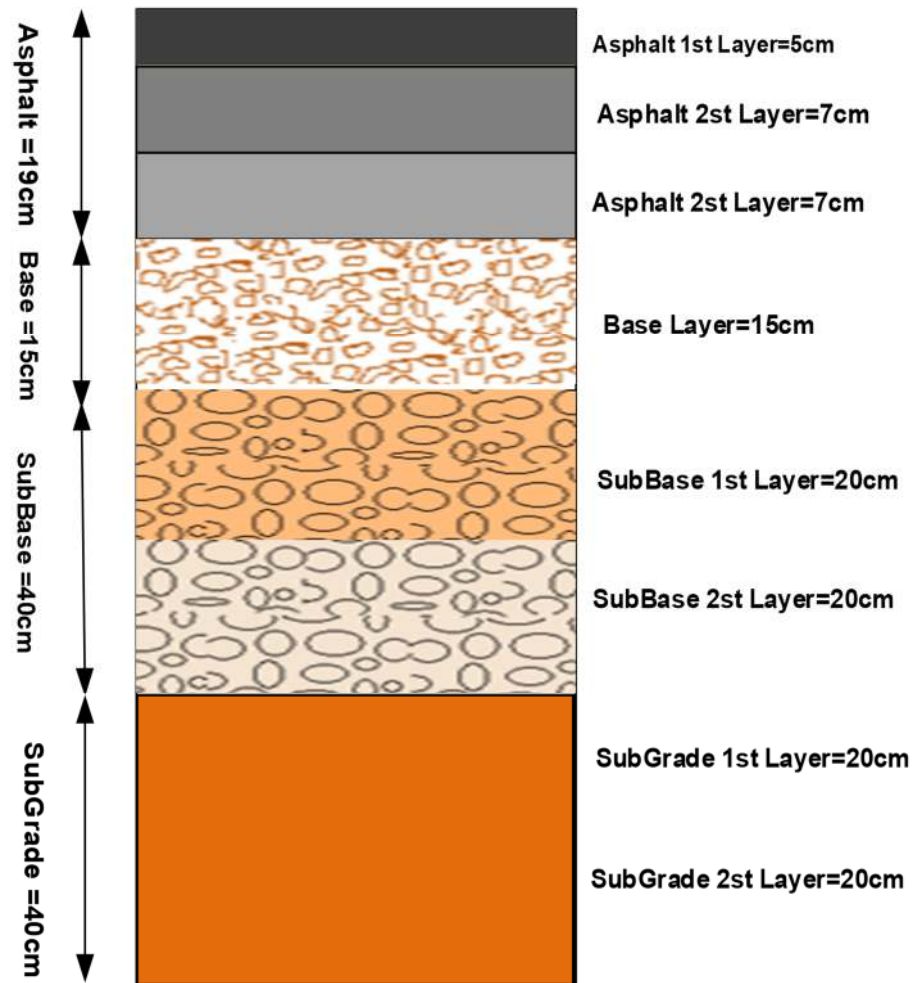


The major distress of road pavement is alligator cracking (Fatigue cracking )

# Highway project in Emirates



## Evaluation of road pavement





# Highway project in Emirates



## Evaluation of road pavement





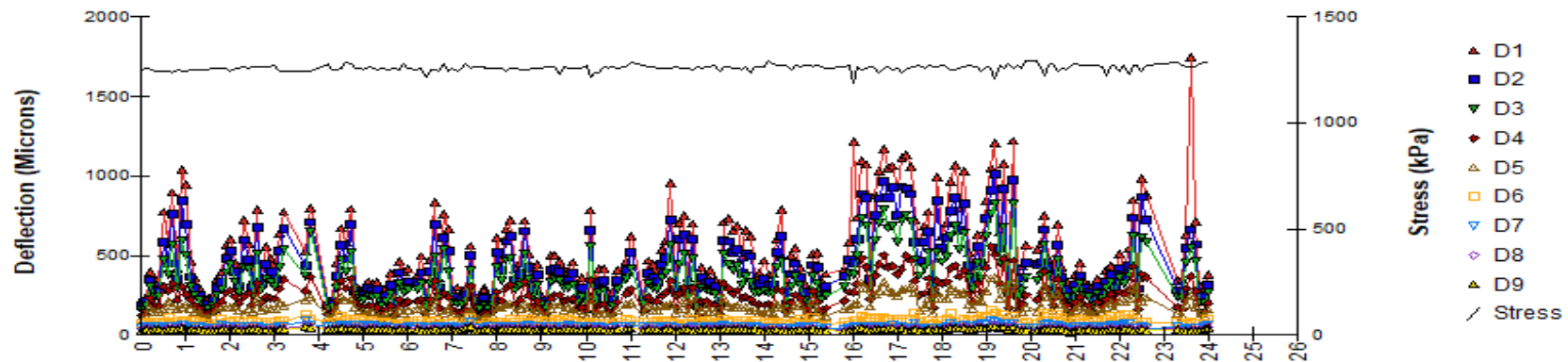
# Highway project in Emirates



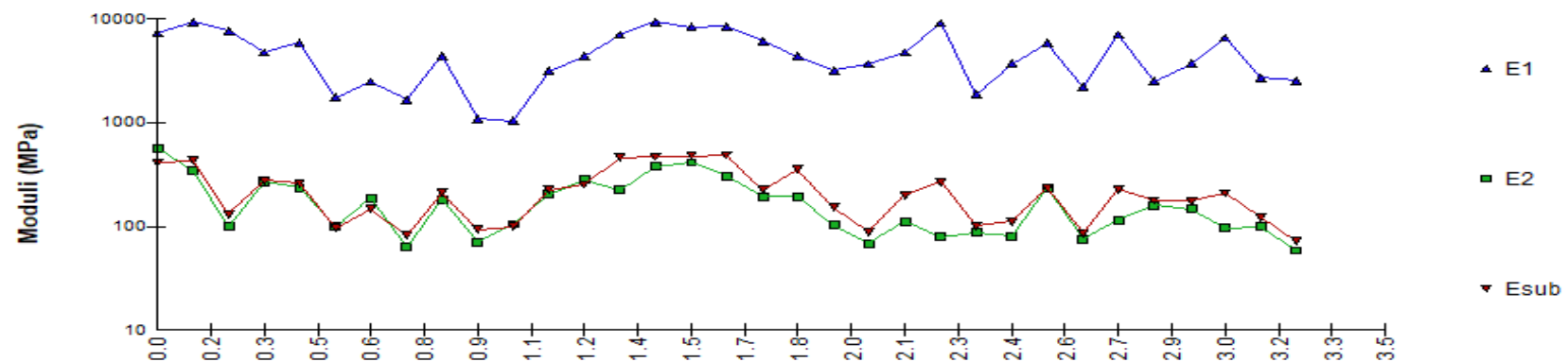
## Non-Distractive Test



Measured deflections and load

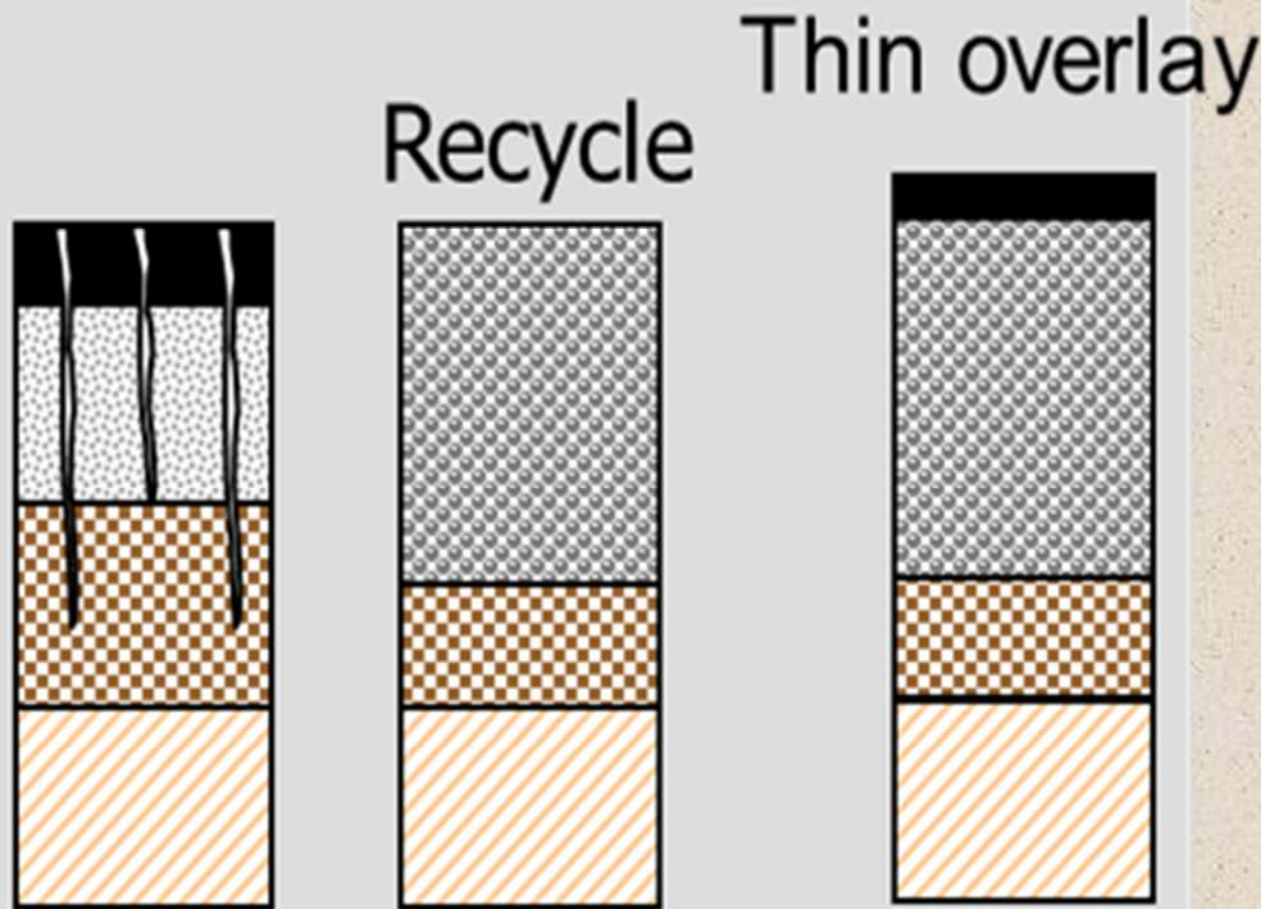


Elastic Moduli





## Road rehabilitation Options



# Highway project in Emirates



## Road rehabilitation Options

1 <sup>st</sup> Level	<b>A.C Modified With Polymer</b>	5cm
2 <sup>nd</sup> Level	<b>A.C BASE COURSE</b>	7cm
3 <sup>rd</sup> Level	<b>Recycled layer (with 6% cement )</b>	25cm
4 <sup>th</sup> Level	<b>Sub Base</b>	37cm
5 <sup>th</sup> Level	<b>Infinite sub-grade</b>	

Option 1

1 <sup>st</sup> Level	<b>A.C Modified With Polymer</b>	5cm
2 <sup>nd</sup> Level	<b>A.C BASE COURSE</b>	6cm
3 <sup>rd</sup> Level	<b>Recycled layer (with 6% cement )</b>	15cm
4 <sup>th</sup> Level	<b>Recycled layer (with 4% cement )</b>	20cm
5 <sup>th</sup> Level	<b>Sub Base</b>	28cm
6 <sup>th</sup> Level	<b>Infinite sub-grade</b>	

Option 2

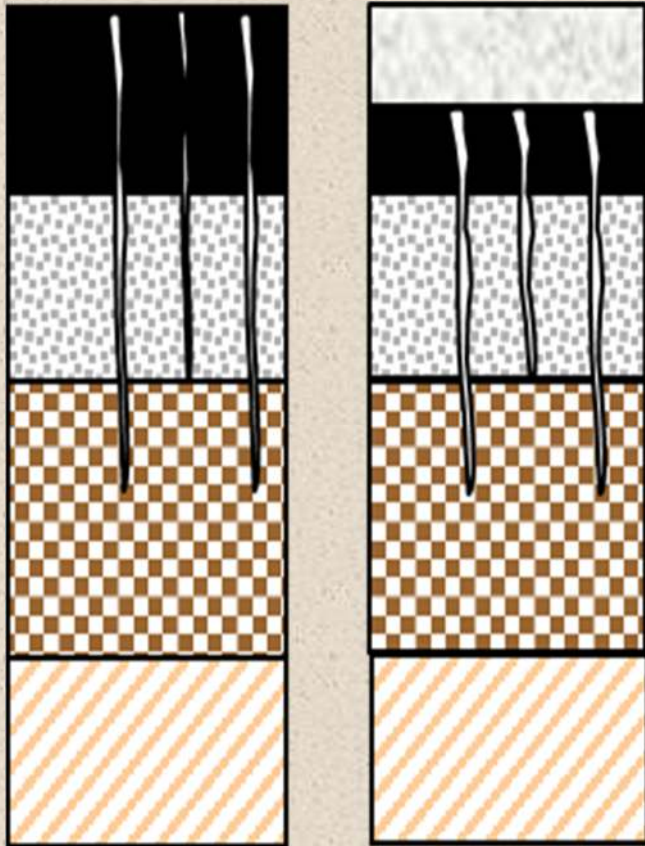


# Highway project in Emirates



## First Step-Milling

**Milling 13cm**



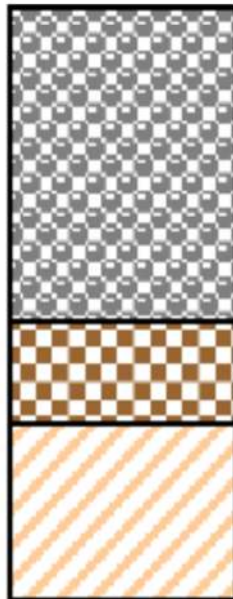
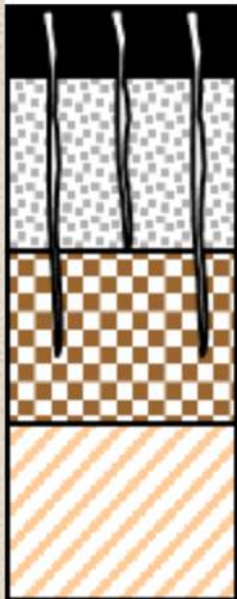
# Highway project in Emirates



## Cold Recycling With Cement

Option 1

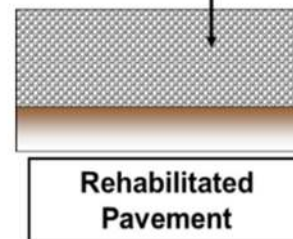
Recycling 25 cm with 6%



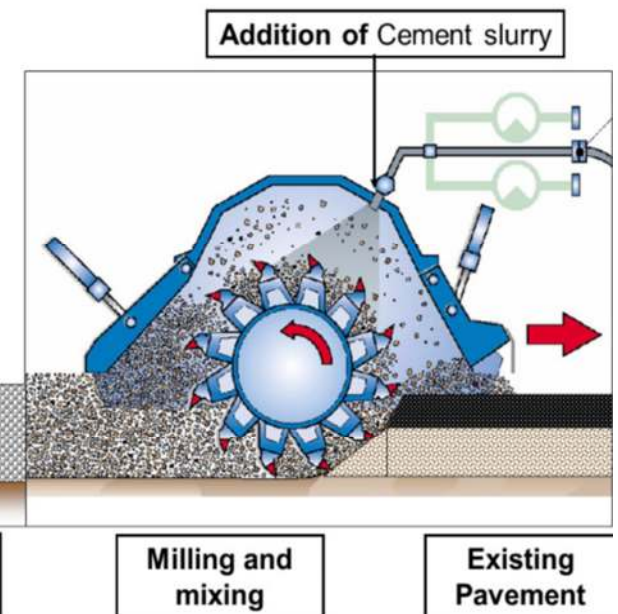
Option 2



Cold  
recycled  
layer



Rehabilitated  
Pavement



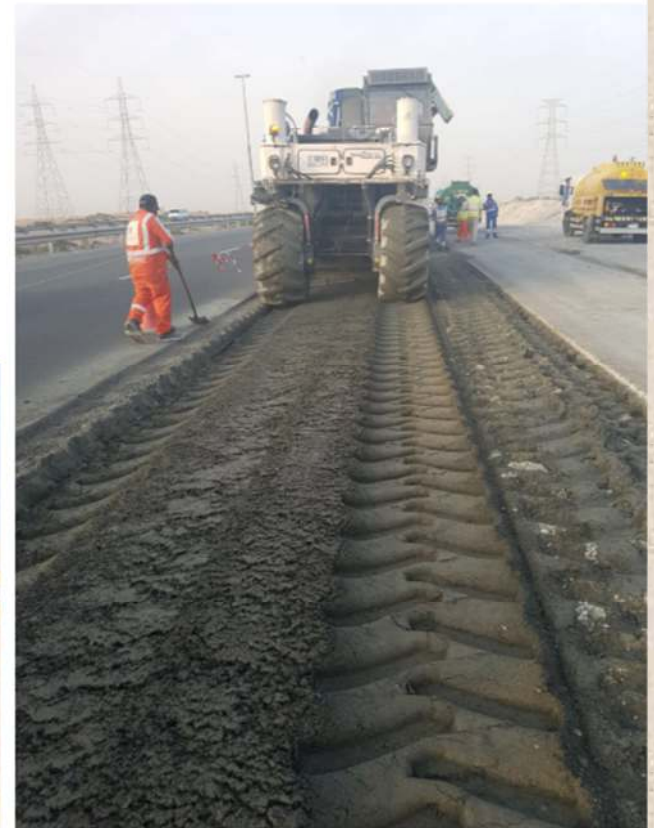
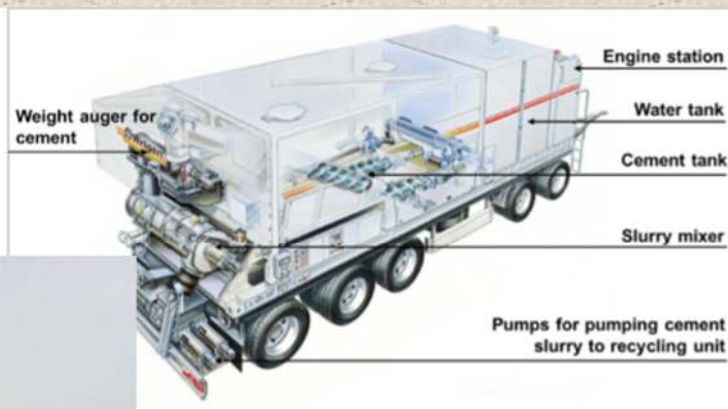
Existing  
Pavement



# Highway project in Emirates



## Cold Recycling With Cement





# Highway project in Emirates



Leveling. Final Compaction And AC overlay



# Highway project in Emirates



Leveling. Final Compaction And AC overlay





# Highway project in Emirates



Operation in the shortest time







# Highway project in Emirates





# Highway project in Emirates

19% 6:09 etisalat

وزارة تطوير البنية التحتية

الأعلى الأحدث الأشخاص الصور مقاطع الفيديو

الورشة... [instagram.com/p/BiLq0mKA\\_ok/](https://www.instagram.com/p/BiLq0mKA_ok/)

BARQ\_TRAF... 2018/4/23 ✓  
أعلنت وزارة تطوير البنية التحتية، عن إغلاقها الحارة البطيئة (اليمين) على شارع الإمارات من مخرج جسر الزبير لغاية جسر رقم 7 وذلك بالاتجاه من رأس الخيمة إلى دبي، ابتداء من اليوم الاثنين 23 أبريل ولمدة أسبوع، بهدف تنفيذ أعمال الصيانة الدورية للطبقة الاسفلتية.

البرق الإمارات  
برق الطرق

المتجهين الى دبي  
الحارة المغلقة

2 2 2

وزارة تطوير البنية التحتية 2018/4/24 ✓  
بحضور سعادة المهندس حسن محمد جمعة المنصوري وكيل #وزارة\_تطوير\_البنية\_التيحتية عقدت #الوزارة ممثلة... [instagram.com/p/Bh9Enf\\_gV5k/](https://www.instagram.com/p/Bh9Enf_gV5k/)

2 2 2

Home Search Notifications Mail

19% 6:09 etisalat

وزارة تطوير البنية التحتية

الأعلى الأحدث الأشخاص الصور مقاطع الفيديو

#خدمة\_الكثرونية #خدمات #الطرق #مشاريع #مشروع [instagram.com/p/...#tender services-#eBh5o\\_alAj7O/](https://www.instagram.com/p/...#tender services-#eBh5o_alAj7O/)

1 يوم... @newsemar... ✓  
تطبيق تقنية إعادة تدوير الأسفلت في تنفيذ وصيانة الطرق الاتحادية الإماراتية باشرت وزارة تطوير البنية التحتية الإماراتية استخدام مشروع إعادة تدوير الأسفلت البارد في موقع المشروع نفسه، وإصلاح ونهية التربة، والاستغناء عن استخدام ونقل مواد جديدة الى الموقع... [emaratyah.ae/891239.html](http://emaratyah.ae/891239.html)

الإماراتية

BOMAG

2 2 2

SKGEP 2018/4/24 ✓  
@moiduae #Repost

بحضور سعادة المهندس حسن محمد جمعة المنصوري

Home Search Notifications Mail

# Reasons for Cold Recycling



## Cost Saving

- Reduction or Elimination of transporting materials
- Re-use of materials
- Personnel cost saving due to significant shorter construction time
- Energy saving as no heating of materials is required

## Time Saving

- Modern Recyclers capable of high production rates - 8000 m<sup>2</sup> / day are possible
- Less risk of accidents if construction time is reduced



# Highlights of Cold Recycling



- **Environmental:** Reuse of materials
- **Layer quality:** Stabilising agents are accurately added by microprocessor
- **Structural integrity:** The problem is addressed
- **Short construction time:** Wirtgen recyclers capable of high production
- **Traffic safety:** Recycling train can be accommodated in one lane
- **Road widening:** Roads are easily widened with the existing available materials
- **Cost saving:** Usually 20 % to 30 % cost saving compared to conventional methods



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**Any  
questions?**

