

Appendix 5 - AFNOR French Standard XP P 98-333 "Small Trenches"

Draft Proposal for Comments



French Standard

XP P 98-333
June 2009Classification index: **P 98-333****ICS: 93.020; 93.080.10**

Roadways and ancillaries

Small trenches

E: Roadways and ancillaries — Small trenches

D: Fahrbahnen und Nebenanlagen — Kleine Gräben

Experimental standard

published by AFNOR in June 2009.

Observations on this experimental standard must be sent to AFNOR before 30 June 2011.

Correspondence

On the date of publication of this document, there are no international or European works on the same subject.

Analysis

This document defines the digging of small trenches, i.e. opening the excavations, filling and rebuilding the roadway further to the installation or maintenance of underground networks.

This document only applies to networks that are laid using the small, open trenches method. This technique only applies to networks whose dimensions and specific safety and operating constraints so permit.

Descriptors

International Technical Thesaurus: roadway, urban conurbation, earthworks, opening, back filling, excavation, maintenance, pavement, underground conduit, dimension, installation, constraint, material, conditions of execution, safety, conditions of use, control, reference to standards.

Modifications

Corrections

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Foreword

When writing the standard NF P 98-331, which covers trenches whose dimensions allow for the use of conventional methods both for the excavation and the back filling, and usually for compacting, the possibility was raised of including prescriptions for small trenches, of which a few examples existed for experimental purposes at the time.

Since then, the growth of communications networks as part of programmes to install digital equipment in the regions, has prompted operators to look for more economical techniques that limit the scale of civil engineering works and allow for rapid execution.

Despite some proven successes, the absence of any rules adapted to this trend has left the way open for practices that offer only limited guarantees in terms of quality and durability. Also, both the roadways management authorities and the operators would like to establish a normative framework.

The purpose of this new document is to define the rules of good practice to be obeyed by operators and that are referred to by the regulations of the management authorities in the fields concerned.

Introduction

The management of roadways demands coordination and technical coherence between the different operators from the public and private sectors due to the legal, technical environmental and economic constraints applying to the execution of trenches. Regulations that are specific to each local authority or operator, plus the absence of any rules specific to small trenches have created the need for this document.

Contractors working on roadways must abide by the regulatory texts, the clauses of this document completed by the prescriptions of the procedure for the coordination of works and the clauses of the roadways regulation or corresponding document.

1 Scope

This document applies to the techniques and constraints relating to the digging and filling of small trenches (coverage between 0.30 m and 0.80 m, width between 0.05 m and 0.30 m), and the reconstruction of the road surfaces and ancillaries, both within and outside conurbations, as a part of works to open excavations, back filling and reconstruction made necessary by the installation or maintenance of networks.

The distinction is made between two types of small trenches according to their width "w":

- micro-trenches: $0.05\text{ m} < w < 0.15\text{ m}$
- mini-trenches: $0.15\text{ m} < w < 0.30\text{ m}$

This document does not apply to networks that are laid using methods other than the small, open trenches method.

This document applies to works conducted by, or on behalf of, the following parties or organizations:

- the owners or managers of the public or private domain
- the commissioning authorities or managers of networks who may be licensees of the roadway or rightful holders to the roadway.

The method used to lay networks in small, open trenches applies to networks whose technical constraints and regulatory requirements, in particular with regard to safety, are compatible with the use of this technique. In particular, the requirements of the decree of 13 July 2000 for gas distribution networks, the decree of 4 August 2006 for networks for hazardous products, the decree of 6 December 1982 for urban heating networks and the decree of 17 May 2001 for the distribution of electric power must be met.



2 Normative references

This document contains the requirements of other publications by dated or undated reference. These normative references are mentioned in the appropriate places in the text and the publications are listed here below. For dated references, any later amendments or revisions of any one of these publications only apply to this document if they have been incorporated by amendment or revision. For undated references, the latest edition of the publication to which reference is made shall apply (including the amendments).

NF EN 206-1, *Concrete— Part 1: Specification, performance, production and conformity* (classification index: P 18-325-1).

NF EN 1338, *Concrete paving blocks — Requirements and test methods* (classification index: P 98-

338). NF EN 1339, *Concrete paving flags — Requirements and test methods* (classification index: P 98-339).

NF EN 1340, *Concrete kerb units — Requirements and test methods* (classification index: P 98-340).

NF EN 1341, *Slabs of natural stone for external paving — Requirements and test methods* (classification index: P 98-341).

NF EN 1342, *Setts of natural stone for external paving — Requirements and test methods* (classification index: P 98-342).

NF EN 1343, *Kerbs of natural stone for external paving — Requirements and test methods* (classification index: P 98-343).

NF EN 1344, *Clay pavers — Requirements and test methods* (classification index: P 98-344).

NF EN 1610, *Construction and testing of drains and sewers* (classification index: P 16-125).

NF EN 1744-1, *Tests for chemical properties of aggregates — Part 1: Chemical analysis* (classification index: P 18-660-1).

NF EN 12457-2, *Characterization of waste — Leaching — Compliance test for leaching of granular waste materials and sludges — Part 2: One stage batch test at a liquid to solid ratio of 10 k/kg for materials with particle size below 4 mm (without or with size reduction)* (classification index: X 30-402-2).

NF EN 12613, *Plastics warning devices for underground cables and pipelines with visual characteristics* (classification index: P 98-338).

NF EN 12620+A1, *Aggregates for concrete* (classification index: P 18-601).

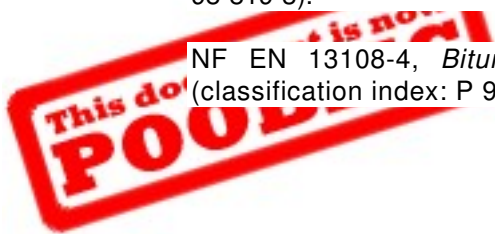
NF EN 13043, *Aggregates for bituminous mixtures and surface treatments for roads, airfields and other trafficked areas* (classification index: P 18-602).

NF EN 13108-1, *Bituminous mixtures— Material specifications— Part 1: Asphalt Concrete* (classification index: P 98-819-1).

NF EN 13108-2, *Bituminous mixtures— Material specifications— Part 2: Asphalt Concrete for very thin layers* (classification index: P 98-819-2).

NF EN 13108-3, *Bituminous mixtures— Material specifications— Part 3: Soft Asphalt* (classification index: P 98-819-3).

NF EN 13108-4, *Bituminous mixtures— Material specifications— Part 4: Hot Rolled Asphalt* (classification index: P 98-819-4).



NF EN 13108-5, *Bituminous mixtures— Material specifications— Part 5: Stone mastic asphalt* (classification index: P 98-819-5).

NF EN 13108-6, *Bituminous mixtures— Material specifications— Part 6: Mastic Asphalt* (classification index: P 98-819-6).

NF EN 13108-7, *Bituminous mixtures— Material specifications— Part 7: Porous Asphalt* (classification index: P 98-819-7).

NF EN 13108-20, *Bituminous mixtures— Material specifications— Part 20: Type Testing* (classification index: P 98-819-20).

NF EN 13108-21, *Bituminous mixtures— Material specifications— Part 21: Factory Production Control* (classification index: P 98-819-21).

NF EN 13139, *Aggregates for mortar* (classification index: P 18-139).

NF EN 13242, *Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction* (classification index: P 18-242).

NF EN 13285, *Unbound mixtures — Specification* (classification index: P 98-845).

NF EN 13286-3, *Unbound and hydraulically bound mixtures — Part 3: Test methods for laboratory reference density and water content - Vibrocompression with controlled parameters* (classification index: P 98-846-3).

NF EN 13286-41, *Unbound and hydraulically bound mixtures— Part 41: Test method for the determination of the compressive strength of hydraulically bound mixtures* (classification index: P 98-846-41).

NF B 10-601, *Quarry products — Natural stones — General requirements for the use of natural stones*.

NF P 11-300, *Earthworks — Classification of materials for use in the construction of embankments and capping layers of road infrastructure*.

XP P 16-003, *Works close to networks: prevention of damage and its consequences*.

XP P 18-545, *Aggregates — Definition, conformity and codification*.

XP P 18-581, *Aggregates — Rapid dosing of water-soluble sulphates — Spectrometric method*.

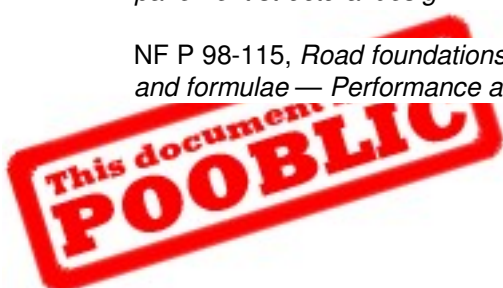
NF P 94-061-1, *Soils: Investigations and Tests — Determination of unit weight of in-place material — Part 1: Direct transmission probe gammadensimeter method*.

XP P 94-063, *Soils: Investigations and Tests — Measuring compaction quality — Method using constant energy dynamic penetrometer — Penetrometer calibration principle and method — Processing of results — Interpretation*.

XP P 94-105, *Soils: Investigations and Tests — Measuring compaction quality — Method using variable energy dynamic penetrometer — Penetrometer calibration principle and method — Processing of results — Interpretation*.

NF P 98-082, *Pavements Earthworks — Road pavement structural design — Road traffic evaluation for pavement structural design*.

NF P 98-115, *Road foundations — Construction of pavement structures — Components — Mix components and formulae — Performance and control*.



NF P 98-121, *Road foundations — Gravel-emulsion — Definition — Classification — Characteristics— Production — Use.*

NF P 98-150-1, *Hydrocarbonated bituminous mixes — Execution of road foundations, binders and road surfaces — Part 1: Hot hydrocarbonated bituminous mixes — Components, formulation, production, transport, use and on-site inspection.*

NF P 98-160, *Road surfaces — Superficial wear surface — Specification.* NF P 98-170, *Cement concrete roadways — Execution and control.*

NF P 98-231 -2, *Roadway tests — Behaviour of materials not treated with hydrocarbonated binders when compacted — Part 2: Compacting test with giratory shear press.*

NF P98-306, *Manufactured concrete products — Concrete garden slabs*

NF P 98-331, *Roadways and ancillaries — Trenches: digging, filling, rebuilding.*

NF P 98-332, *Roadways and ancillaries — Rules for the distance between underground networks and proximity of networks to plant life.*

NF P 98-335, *Urban roadways — Use of concrete slabs and flags, clay slabs and natural stone slabs and flags.*

NF P 98-340/CN, *Concrete kerb parts — Requirements and test methods — National addendum to NF EN 1340: Industrial concrete products — Kerbs and gutters — Profiles.*

NF P 98-705, *Road construction and maintenance equipment — Compactors — Terminology and commercial specifications.*

NF P 98-736, *Road construction and maintenance equipment — Compactors — Classification.*

3 Installation rules

3.1 General constraints

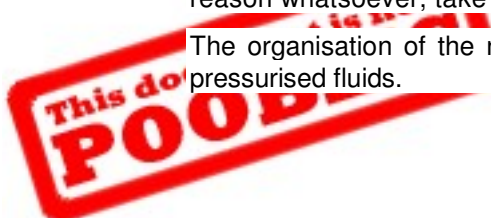
The route of the trench is defined according to the following:

- the main use and the status of the roadway
- The administrative and regulatory prescriptions
- the technical constraints of the networks and, sometimes, of the equipment used to conduct the works
- the existing underground networks
- the technical prescriptions of the transport and distribution networks, and of the connections
- the available adjacent space (verges, car parks, pavements, service roads)
- plant life.

The transport and distribution networks and connections are installed either under the roadway or not, depending on the technical and operational constraints of each network.

In addition to the installation constraints between networks and the rules of proximity, the longitudinal ducts that include underground works that can be inspected must be positioned such that the operations, for any reason whatsoever, take account of the operational conditions of the roadway.

The organisation of the network coordination must also take account of access to the cut-off devices for pressurised fluids.



3.2 Constraints applying to underground works in the vicinity of networks

Any operator that has to conduct works next to or near underground works, including conduits and cables belonging to the various network operators, must abide by the regulations in force.

In all cases, refer to the standard NF P 98-332.

3.2.1 Special precautions for the creation of longitudinal trenches

The longitudinal trench must not be in the immediate vicinity of constructions, so as not to destabilise them. A minimum of 0.30 m must be left between the edge of the trench and a building or a wall.

3.2.2 Proximity between networks and trees

Refer to the standard NF P 98-332

4 Terms and definitions

For the purposes of this document, the following terms and definitions shall apply.

4.1 Underground network

All the parts (conduits, manholes, cables, ducts, chambers, etc.) used either to distribute fluids or energy (gas, electricity, lighting, etc.), or to distribute or exchange information (telecommunications, cable television, remote management, signalling, etc.)

4.2 Coating zone

In the case of backfill by traditional means, this zone corresponds to the coating (including the bed face) of the conduit or network. The coating must be executed according to the state of the art, since it guarantees the durability of the conduit or network, and of the excavation.

4.3 Back fill

Use of fill in the zone between the bottom of the excavation and the structure or the road surface.

4.4 Self-compacting material

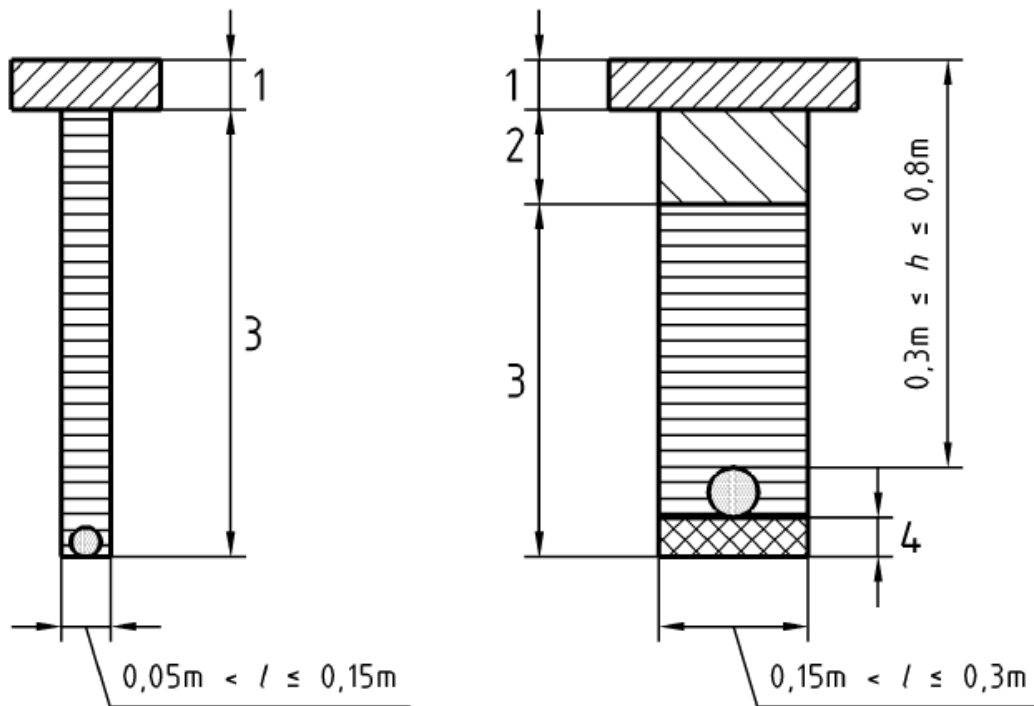
A family of materials used to fill trenches for the installation of underground networks, corresponding to all hydraulic materials (i.e. materials that harden in contact with water) formulated to obtain, without any human or mechanical intervention, the physical, chemical and mechanical properties that allow for:

- when fresh, correct filling (no gaps) around the network and in the entire filled zone
- when set, a behaviour that is compatible with the nature, function and workings of the networks and the normal use of the roadway.



4.5 Constitution of a trench

The different zones that make up a small trench are described in Figure 1. The materials used must meet the properties of use indicated in Table 1.



Key

- 1 Surface layer
- 2 Foundation (possible)
- 3 Fill
- 4 Bed face (possible)

Figure 1 — typical cross-sections of micro- and mini-trenches

Table 1 — The zones of the trench and their properties

Zones	Definition	Properties
Trench bottom	Natural terrain or road surface material.	Flatness and bearing capacity adapted to the network and the compacting of the fill material.
Fill	The actual fill, up to the bed face or the surface layer.	Stability capable of guaranteeing a stable trench over time. Protection of the network. Not frost-proof (low upper protection). Ability to withstand dynamic stress due to traffic.
Foundation	Reconstitution of the roadway foundation. If filled with self-compacting material, possibility to replace the foundation materials and, temporarily, the surface layer.	Ability to withstand stress due to traffic.
Surface	Regarding the surface: topsoil, grass, modular elements, surface coatings, bituminous mixes, concrete.	Appearance (consistency with the visual environment, geometry). For pavements and roadways: — resistance to stress due to traffic (mechanical resistance, resistance to abrasion) — resistance to slippage and skidding (adherence, roughness) — resistance to climatic attacks: — impermeability — low noise level — easy to maintain

5 Techniques used to dig and fill the trenches

5.1 Opening the excavation

5.1.1 Cutting or removing the surface coating

Coatings that can be cut: sharp and straight cuts are made using special equipment that also excavates at the same time.

Modular coatings: slabs or flags must be removed and stored with care.

5.1.2 Dimensions of the excavation

The trenches are dug vertically. The dimensions must respect the values below:

- depth such that the coverage is equal to or greater than 0.30 m and equal to or less than 0.80 m beneath the level of the finished soil (roadway, car park, etc.)
- width greater than 0.05 m and equal to or less than 0.30 m.



5.1.3 Excavations

Equipment

The means used to dig the trench must be adapted to the type of terrain and the environmental constraints. Equipment that is specifically designed for this type of work includes: wheel ditchers, either with loading belts, or suction systems, or side discharge of debris, chain diggers with loading belts, mechanical mini-excavators, suction-based earthworking equipment (preceded by the cutting equipment).

Safety and access

Irrespective of the width of the trench, safe passage must be provided for pedestrians and vehicles that may cross the trench.

Shoring and shielding the trenches

This type of excavation does not usually require shoring or shielding.

Nevertheless, if special constraints apply that justify the shoring of the soil, a special study can be conducted to size the shielding.

The protective equipment is sized and selected according to:

- the nature of the terrain (cohesion, angle of friction, sensitivity to water, dip of the layers)
- the presence of a water table (pumping, piping)
- overloads that may exist at the peak of the trenches (traffic)
- risks resulting from the possible decompression of the terrain.

Excavations in water

If water is present, the trenches must be dried. A study must be conducted of the following points:

- the pumping equipment to be used (pumping in the excavation or lowering of the table)
- the shielding equipment to be used (solid type)
- piping and the risks of decompression of the terrains by entrainment of the filler.

Bottom of the excavation (or of the trench)

The bottom of the excavation is designed and executed in accordance with the constraints of the network to be installed, in order to provide sufficient load bearing capacity, with the absence of any hard spots, for the installation of the networks and the fill. Depending on the constraints, a bed face may be necessary.

5.2 Fill

The filling of small trenches involves technical difficulties that require:

- the use of fill **materials** that are adapted to the zone of the trench (Table 2):
 - or self-compacting materials that must be placed in a non-decompacted trench
 - or compactable materials if the width of the trench so permits (width greater than 15 cm in order to use compacting wheels or plates). In this case, the selected material must be capable of coating the networks or another coating material must be defined
- the use of **materials** adapted to filling, both for the installation and compacting, where appropriate.



Table 2 — Selection of fill materials according to the location of the trench**Table 2a — Micro-trenches** (width between 5 cm and 15 cm)

	Green areas	Pavements and verges	Roadways and zones for traffic or parking
Re-use of extracted materials	Yes	No	No
Substitution with traditional materials, including recycled materials	No	No	No
Substitution with self-compacting materials ^{a)}	No	Yes	Yes
<i>a) Self-compacting materials can be made from extracted materials if the quality permits. In this case, the choice must be justified both technically and economically.</i>			

Table 2b — Mini-trenches (width between 15 and 30 cm)

	Green areas	Pavements and verges	Roadways and zones for traffic or parking
Re-use of extracted materials	Yes	Yes	No
Substitution with traditional materials, including recycled materials	Yes	Yes^{c)}	Yes ^{c)}
Substitution with self-compacting materials ^{b)}	No	Yes	Yes ^{d)}
<i>a) Application of the specification of the standard NFP 98-331. b) Self-compacting materials can be made from extracted materials if the quality permits. In this case, the choice must be justified both technically and economically. c) Never in the road foundations, d) Usable in the foundation layer for traffic up to 150 trucks/day as per paragraph 6.3.1.</i>			

If the specifications included in this document are respected, filling the trench can be followed by the definitive reconstruction of the roadway, without any intermediate reconstruction.

If self-compacting materials are used as filler, in view of the absence of energy for compacting, the trench must be filled within four hours, apart from in the connection zones, in order to allow for the phenomenon of soil compression.

6 Prescriptions relating to filler materials

When technically and economically possible, the materials extracted from the site are used, with or without treatment, under the conditions specified in 5.2.

6.1 General

- Traditional materials: see standard NF P 98-331, paragraph 6.2.
- Re-used extracted materials: see standard NF P 98-331, paragraph 6.2.
- Self-compacting filler materials: the 0/D granulometry of the aggregates used must be such that D is equal to or less than 1/10 of the width of the trench. They must also meet the following conditions:
 - self-compacting, drainable materials: they require the walls of the trench to be sufficiently permeable to allow excess water to be evacuated, while avoiding any risk of harm to the structure of the existing road surface and in the surrounding environment of the works (basements, underground car parks, etc.)
 - self-compacting, non-drainable materials: can be used, irrespective of the characteristics of the walls of the trench (permeable or impermeable).

If there is a water table, the choice of the filler materials must take account of the permeability of the environment to avoid the creation of draining zones.



6.2 Origin of materials and conditions of use

The materials are of different origins. The table below shows the conditions of use.

Table 3 — Origin of materials and conditions of use

Case	Origin of materials	Characterisation	Conditions of use
1	Natural materials (re-use or substitution)	NF P 11-300: classification by nature and state	Compliance with the properties, as per paragraph 4.5 Use and compacting possible Non-polluting Non-aggressive for the networks
2	Industrial sub-products	NF P 11-300: risks for the environment	Compliance with the properties, as per paragraph 4.5 Non-polluting Non-aggressive for the networks
3	Manufactured or recycled materials, with continuous granularity	Partly or fully crushed materials, insensitive to water: difficulty in compacting DC1, DC2 , DC3 Other materials: NF P 11-300	Compliance with the properties, as per paragraph 4.5 Use and compacting possible Non-polluting Non-aggressive for the networks
4	Manufactured products with a granulometry of d/D (e.g.: 5/15) made of non-evolutive materials D verifying the specifications of 6.1	Granulometry	Compliance with the properties, as per paragraph 4.5 Only in coating zone The grains are installed and compacted using suitable mechanical means Non-polluting Non-aggressive for the networks
5	Self-compacting materials	Product information sheet (manufacturer) Environmental risks (nearby works, ecosystem)	Compliance with the properties, as per paragraph 4.5 Material unloaded from a mixer truck or an on-site mixer Possible anchoring of the networks in the coating zone Non-polluting Non-aggressive for the networks Compatible with the surrounding soil (for drainable materials) Refer to the specific conditions of use



6.3 Characteristics of fill materials according to the main families of roadway structures

When using conventional fill materials, refer to the standard NF P 98-331. The properties of self-compacting materials must allow them:

- to be sufficiently rigid to withstand traffic
- to not be too rigid in order:
 - to remain coherent with the materials of the walls
 - to allow for easy re-excavation
- to possess kinetic qualities that allow for use with traffic according to the customer's schedule
- to form a sufficient platform if the structure of the roadway is reformed in an identical manner

6.3.1 Scope of use

Traditional roadways

The table below shows the compatibility of fill materials according to the nature of the surrounding roadway in order to provide a homogeneous structure.

Self-compacting materials:

- in micro-trenches, the same material is used to fill the entire trench (apart from the road surface)
- in mini-trenches, the same method is generally used.

These hypotheses usually apply for traffic up to 150 trucks/day (T3). Above this level, special studies must be conducted.

Table 4 — Scope of use of fill materials according to the type of trench

Soft, bituminous roadways and roadways treated with hydraulic binders	Unbound materials	Self-compacting, drainable	Self-compacting, non-drainable
Micro-trench	No	No	Yes
Mini-trench	Yes ^{a)}	Yes	Yes
a) Unbound materials cannot be used as the bed face for bituminous or treated structures.			

Specific roadways

- Paved or flagged roadways:
 - the use of micro-trenches is not recommended, unless special studies are made into the dismantling of the modular elements
 - mini-trenches can be used, provided that the dismantling of the modular elements is provided for
- concrete roadways
 - in this case, the trench is filled with materials with a resistance that is equivalent to that of the existing materials.



6.3.2 Resistance to compression

Self-compacting materials must meet the following conditions according to the nature and quality of the walls (R_{c28} = resistance to compression after 28 days):

— homogeneous roadways (on a single site):

- soft roadways: $0.7 \text{ MPa} < R_{c28} < 2 \text{ MPa}$
- thick bituminous roadways, roadways treated with hydraulic binders: $1.5 \text{ MPa} < R_{c28} < 4 \text{ MPa}$

— heterogeneous roadways (on a single site, e.g. urban roadways): $0.7 \text{ MPa} < R_{c28} < 2 \text{ MPa}$.

The resistance to compression is measured as per the standard NF EN 13286-41.

6.3.3 Re-excavatability

If $R_{c28} < 2 \text{ MPa}$, re-excavation is performed using light mechanical equipment.

Manual re-excavation is sufficient if $R_{c28} < 0.7 \text{ MPa}$.

6.3.4 Re-opening to traffic

The thoroughfare can be re-opened to traffic and pedestrians after one of the following parameters has been checked in the most recently filled zone.

Table 5 — Criteria for re-opening to traffic

Kelly ball ^{a)}	Panda penetrometer (or similar) (standard XP P 94-105)	Proctor needle (at a pressure of 0.7 MPa) (ASTM D 1558)
diameter < 80 mm	peak resistance > 1.5 MPa	sinkage > 10 mm
<i>a) The diameter of the trace is determined using two tests. Each test is conducted by releasing the ball five times in the same place. The Kelly balls complies with the standard ASTM C360-92, which has been annulled.</i>		

6.4 Warning device

A warning device with properties that comply with the standard NF EN 12613 and colours that comply with the standard NF P 98-332 is installed in the trench during filling operations, in the case of filling with compacting, in order to warn the operator and identify the networks in the event of future excavations. In the case of filling with bound self-compacting materials, the warning is given by colouring the coating zone in order to indicate the presence of a network throughout the duration of its use.

6.5 Control operations — Conformity of the material

The checks indicated below must be made during the execution of the works. The following tests are made when using self-compacting fill materials:

— when the material is delivered to the site:

- spread test
- air content (for products containing an air entrainment agent)

The thresholds for approval will be jointly defined by the customer and the supplier of the material, according to the information used to identify the material for use on the site.



- for the opening to traffic of trenches filled with self-compacting, drainable or non-drainable, materials in order to check that the minimum safety requirements are met, in accordance with the conditions of 6.3.4.

When using conventional fill materials, refer to the standard NF P 98-331. For road surfaces made of bituminous mixes, refer to the standard NF P 98-150-1.

7 Rebuilding the roadway and its ancillaries

7.1 Materials used to rebuild roads, pavements and verges

7.1.1 General requirements

The structure of the rebuilt roadway must offer the same level of service as the initial roadway.

Supplies of aggregates, binders and other components of these materials, and supplies of miscellaneous products, must comply with the standards applying to the corresponding products.

The main two methods used to rebuild roadways and ancillaries are:

- immediate reconstruction of the definitive structure
- definitive reconstruction of the foundations, if present, and temporary reconstruction of the road surface, which is rebuilt definitively at a later date.

7.1.2 Materials used in the body of the roadway (excluding surface materials)

If the body of the roadway is made of conventional materials, refer to the standard NF P 98-331.

If the body of the roadway is made of self-compacting materials, they must meet the requirements specified in article 6.

7.1.3 Surface reconstruction materials

The materials must meet the specifications of the standard NF P 98-331.

The surfaces of green spaces, pavements and verges must be rebuilt to the initial level of quality, using materials with equivalent properties and the same appearance as the materials in place prior to the works, made and used in accordance with the corresponding standards.

The road surfaces are made of bituminous coating at least as thick as the surface layers in place, and no thinner than 4 cm, except for roadways made of concrete, asphalt or modular products, in which case the rebuilt surface layer must be identical to the existing one.

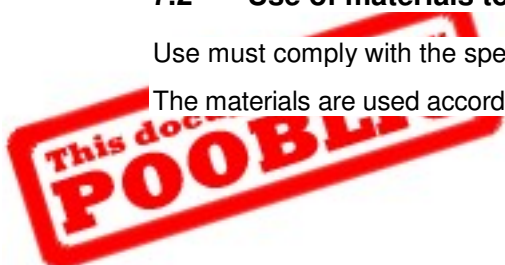
7.1.4 Materials used for temporary reconstruction

In the case of temporary reconstruction, the surface layer can be made of materials that are different from those used for the definitive reconstruction: gravel-bitumen, gravel-emulsion, cold-storable coatings, superficial coatings, paving stones, etc. The temporary surface must be capable of withstanding the traffic during the provisional phase (no more than one year) and prevent water from entering the body of the roadway and follow any deformations.

7.2 Use of materials to rebuild roadways, pavements and verges

Use must comply with the specifications of the standards NF P 98-150-1 or NF P 98-335.

The materials are used according to the product standards, while abiding by the specifications below.



7.2.1 Materials for the body of roadways, pavements and verges

Use in accordance with the conditions specified by the standard NF P 98-331.

7.2.2 Materials used to rebuild roadway surfaces

Bituminous mixes used for road surfaces are applied across a width of more than 0.10 m on either sides of the edges of the trench after compacting.

The thickness is the same as that of the surface layers of the roadway, and no thinner than 4 cm.

A tack coat is always applied, possible with a hand-held gun. The edges of the lips are coated with bitumen emulsion. The bituminous mix is laid on the trench either using suitable mechanical equipment or manually. The layer is compacted with a vibrating roller, the last pass being made without any vibrations. (NF EN 13108).

Superficial coatings must not be applied to self-compacting materials.

8 Checks — Acceptance

The following tests are made when using self-compacting materials:

- measurements of resistance to compression after 28 days on samples of the material taken during the refilling of the trench
- measurements specified in paragraphs 6.5 and 6.3.4.

If conventional compacted fill materials are used, refer to paragraph 6.2.7. of the standard NF P 98-331.



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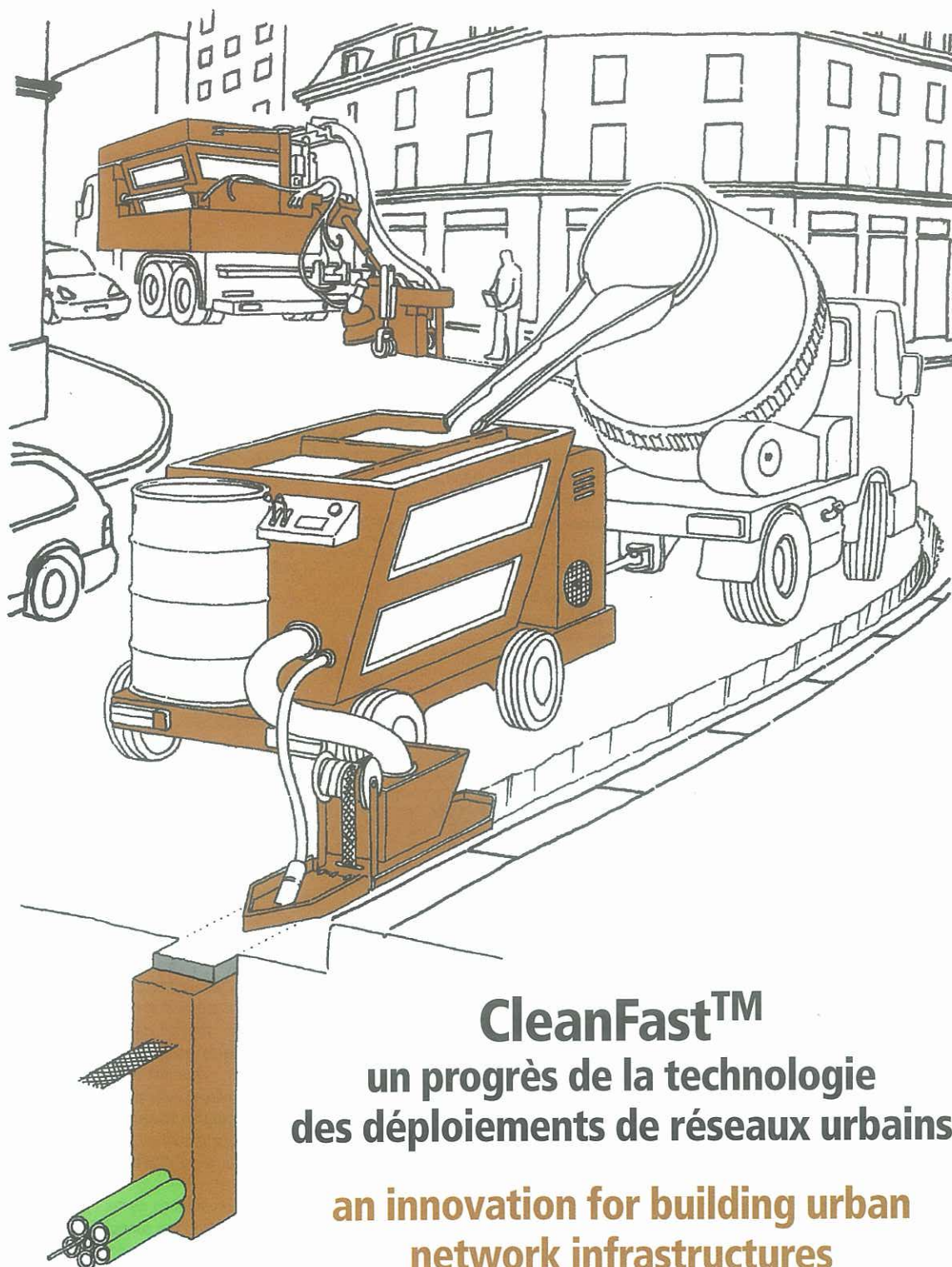
Appendix 6 - Extract of "La Revue Generale des Routes"

Draft Proposal for Comments



Revue Générale des Routes

VOIRIE ▶ ÉQUIPEMENTS ▶ AUTOROUTES ▶ AÉROPORTS



CleanFast™

**un progrès de la technologie
des déploiements de réseaux urbains**

**an innovation for building urban
network infrastructures**

Voirie et réseaux urbains, un mariage intelligent

Pose en tranchée étroite à faible profondeur sous chaussée

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Urban networks and Roads, a clever marriage

Installation in Narrow & Shallow Trench under street

► Introduction

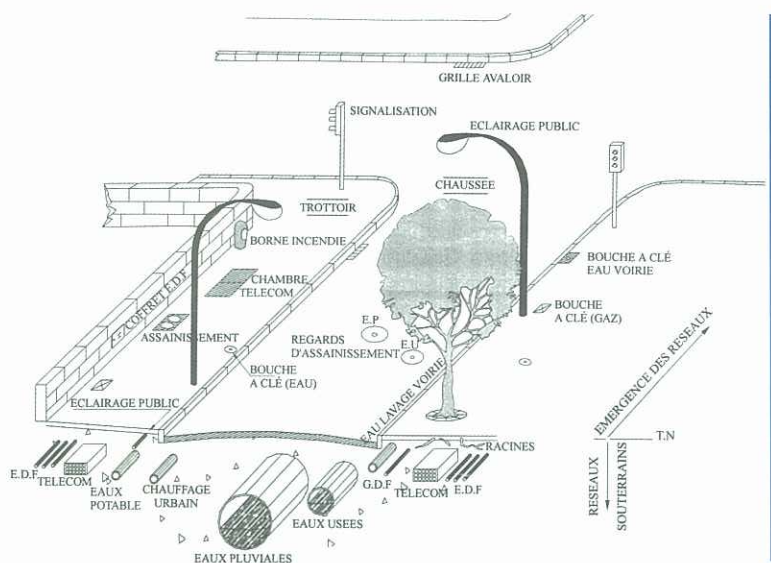
Longtemps considérée comme lieu de conflit entre ses différents usagers, la voirie urbaine est plutôt vécue aujourd'hui comme lieu de partage entre tous ses acteurs. Ce partage se décline dans la dimension horizontale avec de nouvelles organisations de l'espace favorisant une cohabitation harmonieuse des usagers au sein d'un parti d'aménagement (voies de transports collectifs de surface, voies de circulation douce, piétons, deux-roues, suivant la logique des plans de déplacements urbains - PDU). Le découpage existe aussi dans la dimension verticale avec l'occupation du sur-sol et du sous-sol par le mobilier, les plantations, l'éclairage et la signalisation, et surtout les réseaux enterrés nécessaires à l'activité humaine et économique (fluides, énergie, communications, etc.) – (figure 1). Cette activité « réseau », qui sépare elle-même un espace rare, génère par son entretien, sa réhabilitation et sa modernisation, de fréquentes interventions sous voiries qui se concrétisent par des ouvertures de fouille et des tranchées dans les revêtements et structures des voiries et autres plates-formes. Leur nombre est très important, puisque dans les grandes villes, plusieurs dizaines de milliers d'événements de voiries sont à gérer chaque année suivant une procédure organisationnelle et technique très stricte (procédure de coordination, règlement de voirie, arrêts de circulation, etc.) dont plus de la moitié concerne des tranchées et des branchements.

Sous leur forme classique de conception et d'exécution, les tranchées, qui sont aujourd'hui de mieux en mieux remblayées, n'en demeurent pas moins des blessures et des cicatrices opérées dans les structures et le revêtement. Les statistiques globales montrent qu'elles réduisent significativement la pérennité et la durée de vie des ouvrages correspondant à une perte du patrimoine en infrastructure viaire de l'ordre de 25 %. La décohésion des sols et des matériaux en paroi, la géométrie des découpes, les liaisons entre matériaux frettés en place et matériaux remaniés, l'exiguïté des surfaces et des emprises limitant la puissance des engins, la question de plus en plus aiguë des vibrations, du bruit en ville sont autant de raisons pour lesquelles des dégradations peuvent apparaître, surtout lorsque les sollicitations sont élevées (trafic lourd et canalisé des bus, par exemple).

Outre les sujétions techniques, l'action en milieu urbain est aujourd'hui largement conditionnée par l'environnement et la réduction des nuisances. Les qualités d'usage priment sur les qualités techniques qui sont considérées comme des pré-requis. Les méthodes d'exploitation et de coordination les plus avancées sont celles qui se fondent sur la minimisation de la gêne des populations

► Introduction

For a long time, urban roads have been considered as a source of conflict between the different users. Today, it is more seen as an asset to be shared between all people concerned. This sharing exists in the horizontal dimension with a new spatial organization enabling a harmonious cohabitation of users through a development plan (surface collective transportation services, soft circulation lanes, pedestrians, cycles, etc). This sharing also exist in the vertical dimension with the occupation over ground and underground by urban furniture, plantings, lightning system, road signs and, most important, the buried networks essential to human and economic activity (fluids, power, communications, etc.) as shown in Figure 1.



▲ Figure 1

This "network" activity occupies a rare and limited space and generates through its maintenance, rehabilitation and modernization a lot of under road intervention. This results in numerous opening of access holes and trenches in pavements, road structures and other urban surfaces for displacement. In large cities it can be dozens of thousands of road events that should be managed according to a strict organizational and technical procedures (coordination, regulations, temporary traffic modifications, etc.) and half of those are about trenches and connections.

Even if they are today better filled due to sound technical rules spreading efficiently, the classical approach of conception and construction of trenches results in "wounds" and "scars" in the road structure and paving. The global

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Urban networks and Roads, a clever Marriage Installation in Narrow & Shallow Trench under street

- ● ● en déplacement ou riveraines (accessibilité, traficabilité, bruit, qualité eaux et des écoulements, etc.).

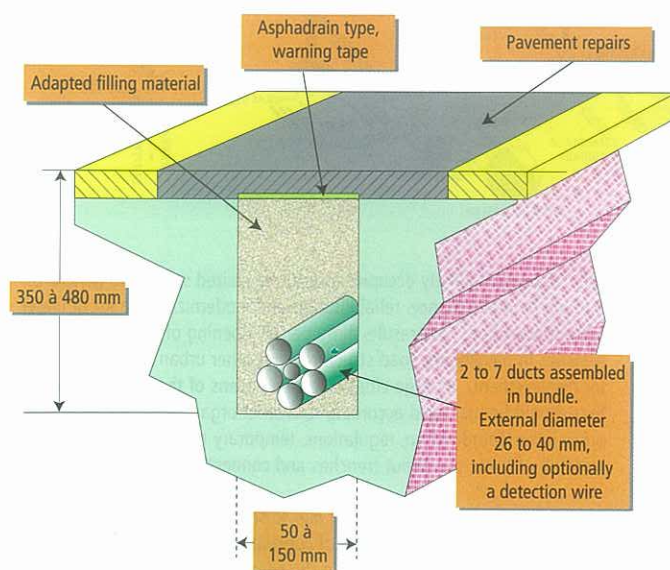
A ces divers titres, toute méthode qui dispose d'atouts pour réduire les difficultés des sujétions techniques précitées, tout en diminuant simultanément la gêne par le biais d'une exécution et d'une remise en service rapide, assortie des qualités fonctionnelles des structures et revêtements remaniés, présente un grand intérêt. La complexité urbaine nécessite d'avoir une vision de plus en plus intégrée et systématique pour créer et maintenir dans la durée des espaces publics de qualité. Le cercle vertueux du moins de gêne et de nuisance pour produire une solution plus efficiente techniquement et économiquement est à mettre en exergue.

Dans le cas présent, le procédé de micro-tranchage urbain est le fruit d'une démarche elle-même globale et intégrée, appliquée au domaine de la pose de câbles de télécommunications dans la voirie : la méthode, le matériel, le matériau, l'exploitation, le contrôle relèvent d'un concept et d'un applicatif cohérents, respectant tant la machine et ses flux de déblai et remblai, que le travail des hommes. L'unité d'action est l'unité de temps. L'usager et le riverain retrouvent leur rue, leur trottoir, leur espace de déplacement très peu de temps après l'intervention (de quelques dizaines de minutes à quelques heures). La notion de réfection définitive immédiate prend ici tout son sens, conformément au descriptif présenté ci-après.

► Rappels

L'emprunt longitudinal des voiries pour l'implantation des réseaux n'est communément admis que dans le cas de trottoirs trop encombrés. La couverture sur l'ouvrage est alors de 80 cm minimum, avec des exigences importantes sur la qualité de la réfection de la tranchée et de la couche de surface, afin de garantir l'absence de déformation en surface et la bonne tenue de la couche de roulement.

La forte demande des communautés urbaines en termes de réseaux de télécommunication, associée à l'évolution des techniques de tranchage et à l'apparition de matériaux de remblai technique, a laissé entrevoir la possibilité d'utiliser les couches superficielles de la chaussée (fond de fouille à 40 cm environ) comme ressource nouvelle afin de mettre en œuvre rapidement et de façon contrôlée (garantissant l'intégrité de la chaussée) des canalisations multitubulaires à des coûts inférieurs aux techniques traditionnelles (figure 2).



► Figure 2
Schéma de principe
d'une nouvelle
approche des
couches superficielles
de la chaussée
► Principle sketch
of a new approach
of superficial layers
of road

statistics show that trenches reduce significantly the life expectancy of roads and this results in a loss of asset value of infrastructures to the order of 25%. The soil and material decohesion at the trench face, the opening geometry, the bonding between the in-place compacted materials and the disturbed materials, the limited accessible surface limiting the power of earth moving equipment and the growing problem of vibration and noise in town all explain that degradations show up, specially when stresses are important (heavy and funneled bus traffic for instance).

On top of technical imperatives, environmental issues and reduction of annoyance more and more influence interventions in the city. The usage qualities surpass the technical qualities that are only considered as prerequisites. The most advanced coordination and exploitation methods are based on the minimization of annoyance to travelers and neighborhood people (accessibility, circulation, noise, quality of water and streams, etc.).

For all those reasons, any method proposing advantages to reduce the technical problems mentioned before, while reducing at the same time the nuisance by a fast execution and return to service combined with functional qualities for the reworked structures and paving, deserves real interest. The urban complexity requires a more and more integrated and systematic vision to create and maintain over time quality public space. The virtuous circle of less annoyance to produce a more technically and economically efficient solution should be underlined. The urban micro-trenching method presented here is the result of a global and integrated approach applied to the telecom cable installation in roads. The method, the equipment, the materials, the exploitation and quality control are all parts of a coherent concept and application; Both machine flow of excavation and filing and crew work is placed in a unity of action and time. The user and the neighborhood get back their road, sidewalks and moving space very short time after intervention (some quarter of hours to some hours). The notion of immediate final repairs takes here all its meaning, as detailed below.

► Reminder

The use of longitudinal roads to install networks is accepted only when sidewalks are too congested. In this case, the minimal cover over the network is 80 cm with stringent rules on the trench filling and the surface layer to avoid any deformation and ensure a proper longevity of the pavement.

The sustained demand of urban communities for telecom networks combined with the evolution of trenching techniques and the development of technical filling materials lead to consider the use of the superficial layer of the road (depth of trench around 40 cm) as a new resource able to allow a fast but controlled (ensuring the road integrity) deployment of multiple duct systems at lower cost than traditional techniques, as shown in Figure 2.

► Presentation of concept

Each day, opening as much as 800 meters of trench, laying bundled duct, back filling and returning the street to traffic with a demobilization of equipment not later than 5 PM.

Constraints to Integrate

> For the road system manager

- > High rate of realization to reduce nuisance to traffic
- > Homogenous and controlled laying conditions ensuring the quality of the restored road
- > Fast return to traffic

► Présentation du concept

Chaque jour, ouvrir jusqu'à 800 mètres de tranchées, poser les fourreaux, remblayer et restituer la chaussée à la circulation, même en présence de fort trafic, pour une démobilitation à 17 h.

Ensemble des contraintes à intégrer

> Pour le gestionnaire de voirie

- >> Cadences importantes de réalisation pour une gêne moindre au trafic
- >> Conditions homogènes et contrôlées de pose garantissant la qualité de la chaussée restituée
- >> Restitution rapide à la circulation

> Pour les maîtres d'ouvrage

- >> Coûts de construction
- >> Ouvrage sécurisé de performances au moins identiques à celles obtenues de façon traditionnelle
- >> Respect des normes de sécurité et d'environnement

> Pour les concessionnaires

- >> Ne pas entraver la ré-intervention sur les ouvrages à proximité

> Pour les riverains

- >> Minimiser les nuisances induites par le chantier

> Pour les usagers de la voirie

- >> Minimiser les restrictions de circulation pendant les heures de pointe.

► Matériaux et techniques

Ces enjeux ont conduit à l'utilisation de matériaux et d'équipements existants ou ayant fait l'objet d'adaptations spécifiques pour répondre à des critères de production industrielle : cadences importantes, modes et qualités contrôlés, aléas réduits, nuisances minimisées, évacuation et tri des déchets.

Canalisation

L'utilisation de la micro-tranchée est optimisée avec la pose de fourreaux en faisceaux, qui permettent d'installer un maximum de tubes dans la tranchée, d'avoir une canalisation stable et de faciliter l'enrobage, améliorant ainsi les caractéristiques mécaniques de la canalisation.

Excavation

La micro-trancheuse utilisée permet l'évacuation simultanée des déblais pour mise en décharge contrôlée, assure une coupe propre et permet des cadences de pose de 400 à 800 ml/jour avec évacuation journalière totale du chantier et limitation de l'encombrement sur une demi-chaussée.

Remblai

La tranchée est remblayée au moyen d'un matériau fourni par l'industrie du béton prêt à l'emploi (BPE). Il est autocompactant, non essorable, à acquisition rapide de portance et ré-excavable. Le type de produit choisi garantit le comblement des vides, l'enrobage de la canalisation et un comportement homogène avec le reste de la chaussée (photo 1).

Lors d'essais expérimentaux, en condition chantier, des cadences importantes de remblai ont été obtenues (200 mètres linéaires remblayés en moins de 20 minutes), et le délai de restitution de la chaussée réduit à 1 à 2 heures après comblement.

> For the builder

- >> Construction cost
- >> Secured construction with at least identical performance of those obtained with traditional techniques
- >> Compliance with Standards and environment

> For the network operators

- >> Do not impair the re-intervention on the near-by installations

> For the neighborhood

- >> Minimize the annoyance induced by the construction site

> For the user of road

- >> Minimize the restriction to traffic, especially during peak traffic time

► Materials and Techniques

These stakes drive the use of both existing and specifically adapted equipment and materials to meet industrial production criteria: high rate / controlled method and quality / minimized loss time hazards / minimized nuisance / waste management and sorting.

Bundled Multiple Ducts

The use of the micro-trench is optimized with the installation of bundled multiple ducts, which permit to maximize the number of ducts placed, to obtain a stable duct line and to facilitate the complete coating by the filling material. All these contribute to improve the mechanical characteristics of the duct bundle.

Excavation

The micro-trenching machine utilized here allows simultaneously 1) removal of cut material for controlled disposal; 2) obtaining a neat cut trench; 3) reaching 400 to 800 linear meter of installation per day. This rate is achieved while using only a half-lane on the street during works and a complete evacuation of the site at the end of the day.

Filling Material

The trench is filled up with a filling material supplied by the ready-mix industry. It is a re-excavable self-compacting, without bleeding, material with rapid load



▲ Photo 1

Apparence de la micro-tranchée comblée, après le rabotage superficiel précédant la réflexion définitive de la couche de roulement

▲ Appearance of the fill up micro-trench, after superficial scarification preceding the final repair to the pavement

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Réfection de la couche de roulement

La réfection définitive immédiate est actuellement effectuée au moyen de la traditionnelle technique du rabotage (largeur 1 m, épaisseur 50 mm), suivie d'un enrobé à chaud. C'est la meilleure garantie pour lui rendre ses qualités en termes de résistance à la compression, de souplesse et d'aspect.

► Organisation et mise en œuvre

> Préparation étude et détection

La mise en œuvre de ce processus doit impérativement être intégrée dès la phase d'étude et inclure :

- >> une campagne de détection non destructive des réseaux existants,
- >> une gestion rigoureuse des arrêts de circulation et de stationnement afin de libérer journalièrement les longs tronçons projetés,
- >> l'exécution des réfections définitives de voirie dans la continuité.

> Composition du train de pose (hors réfection)

(Figure 3)

► Enjeux et perspectives

Il est clair que l'enjeu du développement de cette technique est lié à la mutualisation de la canalisation posée afin de valoriser au mieux la ressource exploitée.

Cet élément doit être pris en compte par les gestionnaires de voirie lors de l'attribution des permissions aux maîtres d'œuvre concernés ou lorsque les collectivités déploient ou délèguent le déploiement d'infrastructures telecom.

> Réseaux câblés

Le développement rationnel de cette technique peut être une alternative pour la mise à disposition rapide de l'infrastructure fibre. Elle donne à l'opérateur désireux de constituer un réseau câblé une souplesse en termes de déploiement du réseau de distribution secondaire et de commercialisation en rendant accessible dans un délai court les poches de raccordement projetées.

> Route intelligente

Dans la ligne des réseaux arrêt d'urgence (RAU), panneaux à messages variables (PMV), boucles de comptage, signalisation tricolore, il y a lieu de parier dans les années à venir sur une augmentation de l'instrumentation des chaussées, la route intelligente devenant le support privilégié des autoroutes de l'information.

bearing development. This type of material guarantees a complete filling of all voids, a complete coating of the duct bundle and it also provides a homogenous behavior with the surrounding road structure (photo 1).

Experimental trials in field conditions shown that high rate of trench filling was possible (200 linear meters fill up within 20 minutes) with a return to service of the road between 1 and 2 hours after filling.

Pavement Repair

The final repair of the pavement is done with the traditional method of scarification (1 m wide, 50 mm thick) before laying a hot bituminous concrete. At this stage, it is the best way to ensure a proper restoration of the quality of strength, flexibility and appearance.

► Organization and construction

Preparation, studies, and localization

The use of this method should be integrated upstream, at the conception phase, and requires:

- > A systematic non-destructive localization of the existing networks.
- > A rigorous management of the traffic and parking interdiction permits in order to free up the long sections that are planned daily
- > The definitive repairs to the pavement without additional delay.

Organization of the working spread (without pavement repair)

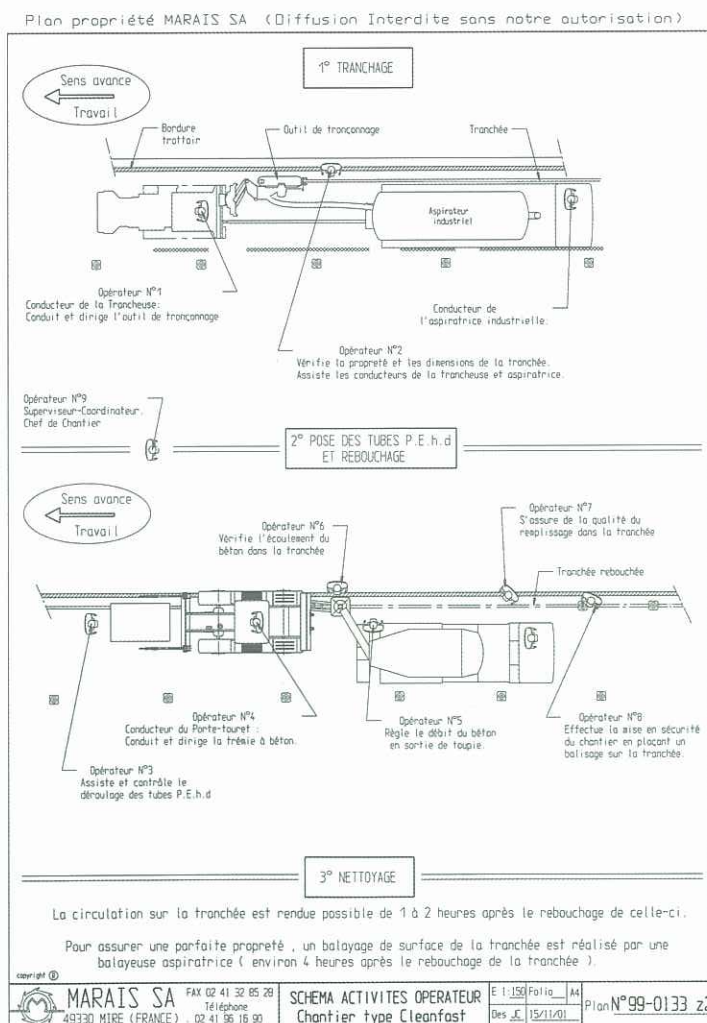
A typical working spread is detailed on Figure 3.

► Stakes and Perspectives

It is clear that the stakes for developing this approach are linked to a mutual sharing of the bundled multiple ducts to maximize the valorization of the exploited resource. The road system managers should consider this element when attributing the work permits to builders or when a city deploys or delegates deployment of telecom infrastructures.

> Cable Networks

The rational deployment of this technique can be an alternative to permit a rapid access to the optic



▲ Figure 3
Atelier de pose type
▲ Typical work spread

► Conclusion

Ce concept de tranchée étroite, peu profonde, appliqué en milieu cohésif et sollicité, remblayée par un matériau autocompactant, excavable et rapidement circulaire, ouvre les portes à une nouvelle tranche d'occupation du domaine public souterrain pour certains réseaux de communication : téléphonie, signalisation, exploitation, etc. A l'heure où l'on pressent une augmentation significative des réseaux qualitativement et quantitativement et où l'on devra nécessairement mieux organiser et valoriser cette ressource rare qu'est l'occupation du domaine public dans toutes ses dimensions, il est particulièrement intéressant de valoriser l'espace des couches inférieures des voiries. La chaussée multifonctions correspond à un concept renouvelé de l'approche traditionnelle de la voirie. On sait maintenant stocker et filtrer de l'eau dans les couches de chaussées « réservoir » lorsque cela s'avère utile ; on sait créer des chaussées peu bruyantes qui absorbent et dissipent les bruits de surface du véhicule en roulement ; on sait gérer des revêtements intégrant de plus en plus de boucles et capteurs pour mieux exploiter nos voiries. Demain, le concept de route intelligente conduira à implanter dans nos chaussées des équipements filaires et des capteurs plus nombreux. La voirie urbaine remet souvent en cause nos conceptions traditionnelles et oblige à repenser globalement les affectations avec de nouvelles priorités. Nul doute que le procédé de micro-tranchage urbain fasse partie de ces nouvelles données de la voirie urbaine. Son développement sera d'autant plus assuré que le partage, largement évoqué dans cet article, s'appliquera également aux occupants des gaines implantées et que les outils d'aide à la connaissance précise et à la gestion du sous-sol seront bien maîtrisés par les gestionnaires des infrastructures urbaines et enfin que les réalisations et les suivis soient aussi exemplaires que possible. ●

fiber network. It gives to the operator wishing to build a cable network an additional flexibility for the deployment of the secondary distribution network. For the commercialization, it can make sectors accessible to be connected within a short delay.

> Intelligent Road

In line with the development of Emergency Stop Networks, Variable Message Road Signs, Vehicle Counting Detectors and Traffic Light Systems, it is most probable that coming years will see an increase in the road instrumentation, the intelligent road becoming the preferred support for the information highway.

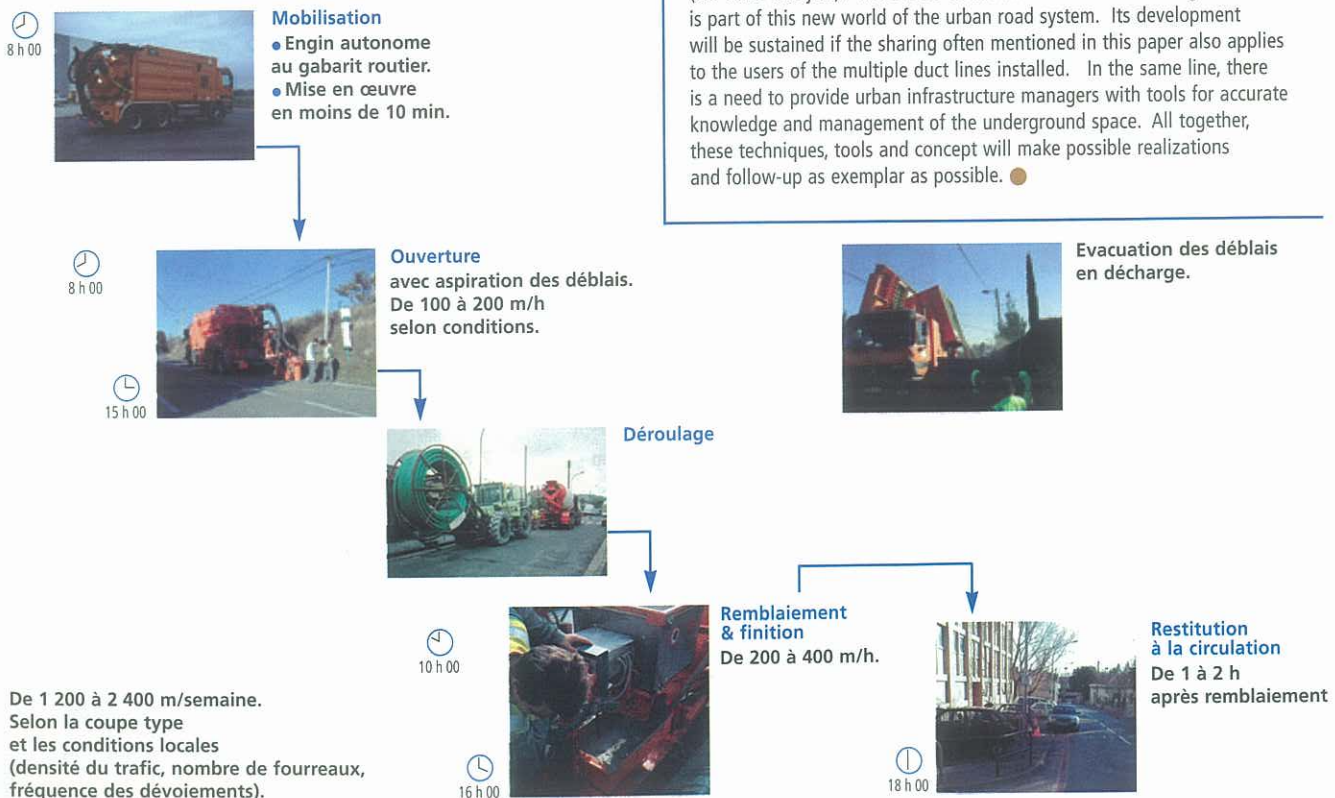
► Conclusion

This new concept of narrow & shallow trench, applied in a cohesive and stressed surrounding, filled with a self-compacting re-excavable material with fast return to service, opens the door to a new layer of the underground public domain asset for some communication networks: phone, traffic light, exploitation, etc. In a time of growing pressure to increase both quantity and quality of networks, it is clear that a better organization and valorization becomes mandatory for the rare resource offered by the occupation of the public domain in all its dimensions. It is especially interesting to valorize the space available in the road subgrade.

The multifunction road is a new concept compared to the traditional approach of road management. Today, we know how to accumulate and filter water in "reservoir" pavements when needed, we know how to build noise-reducing pavements absorbing and dissipating the sound generated by circulating vehicles, we know how to manage roads more and more equipped with sensor devices to improve the exploitation of road systems. Tomorrow, the intelligent road concept will lead us to install increasing quantities of wires and sensors in pavements.

The urban road system often questioned our traditional approaches and forces a global reinvention of the roles to include new priorities (c.f. value analysis). There is no doubt that the micro-trenching method is part of this new world of the urban road system. Its development will be sustained if the sharing often mentioned in this paper also applies to the users of the multiple duct lines installed. In the same line, there is a need to provide urban infrastructure managers with tools for accurate knowledge and management of the underground space. All together, these techniques, tools and concept will make possible realizations and follow-up as exemplar as possible. ●

CleanFast™ - LA JOURNÉE TYPE

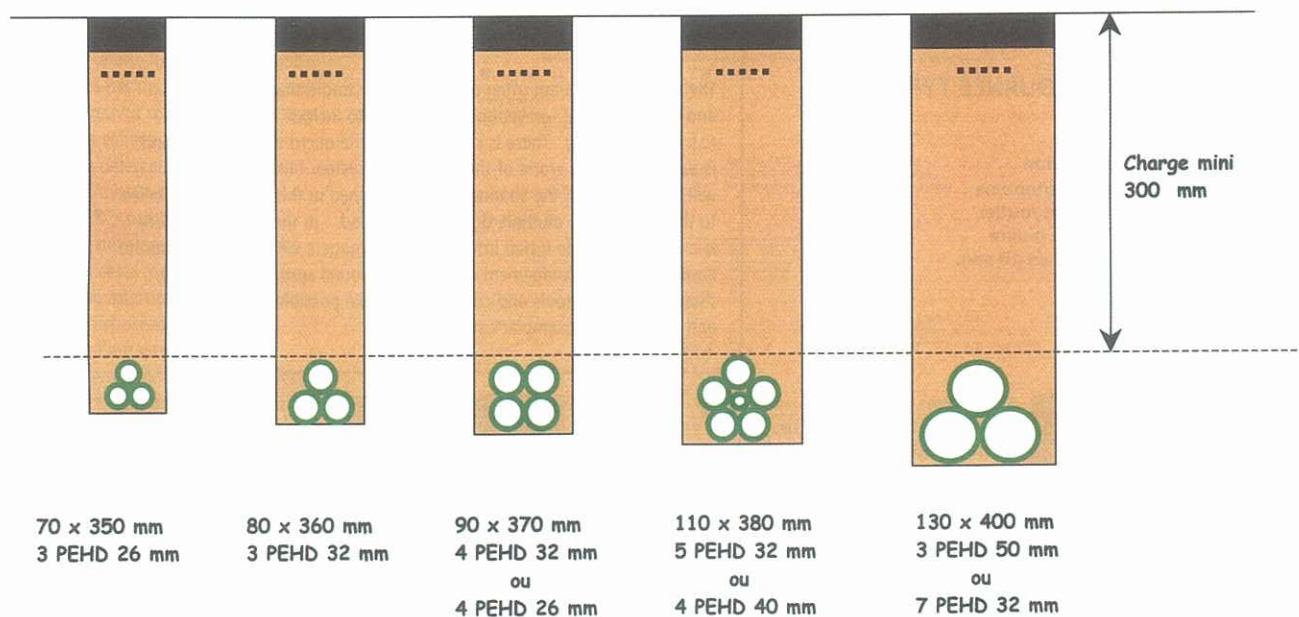




Applications :

- Réseaux urbains, routiers et autoroutiers
- Réseaux Télécoms
- Réseaux feux de signalisation
- Réseaux surveillances vidéos
- Eclairage public
- Réseaux mutualisés (BT, Télécoms, éclairage public, ...)

LES COUPES TYPES CleanFast™



Appendix 7 - Study of the Global Concept of Micro Trenches

Draft Proposal for Comments





Direction
Régionale
de l'Équipement
Bordeaux-Métropole



Laboratoire
Régional
de l'Ouest
Parisien

Projet de recherche DRAST/RGCU

Étude du concept global de micro-tranchées

Research Project DRAST/RGCU

Study of the global concept of micro trenches

STUDY OF THE IMPACTS AND PROVISIONS OF THE METHOD
OF URBAN MECHANICAL MICRO TRENCHES
FOR RESIDENTS, ROAD PAVEMENT USERS AND MANAGERS

Mechanical module

*Study on loading crane / instrumentation and measurements on
work site*

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As part of the experiment in the pit on a loading crane at the CER of
nce, a series of examination measurements have been performed with
to characterize mechanically the performed works.

The experiment in the pit on the loading crane has allowed to stress

in an accelerated way 3 types of road pavement structures subject to micro trenching, namely:

- flexible road pavement with non treated materials
- asphalt pavement made of asphalt gravel
- semi-rigid pavement made of cement gravel

One of the key interests of this work in pit lies in the clear and accurate knowledge of the different elements: materials implemented, stresses applied.

On the same structure we have points which have been stressed and points not subject to the stresses, which allows therefore to assess the impact of the traffic on the road pavement cut with a micro trench.

SUMMARY

1/ - Points to be remembered about the context / working method

2/ - Results of the deflection measurements

3/ - Results of the samplings performed in the body of the micro trench

4/ - Results of the samplings performed in the road foundation

5/ - Results of the coating samples on the road foundation and on the micro trench

6/ - Checking of the depressions (holes)

7/ - Measurements of ovalization

8/ - Conclusions and further steps to be taken



1/ Points to be remembered about the context / working method

At the end of the experiment at the CER, the LROP carried out a series of tests on the road pavement structures on March 7 and 8, 2005, namely:

- measurements of deflection on each of the 3 experiment plates : flexible, thick asphalt and semi-rigid ;
- performance of samples in diameter 100 in the body of the micro trench ;
- performance of samples /bore holes in the road foundation in order to record the pavement sections and to be in a position to perform measurements of ovalization (structures made of treated materials) ;
- performance of ovalization measurements to determine the deformations in the road pavement layers.

This first series of tests was completed by further investigations on April 8, 2005:

- checking of holes more particularly on a flexible area of the pavement subject to stronger stresses ;
- additional ovalization measurements on areas not subject to stresses ;
- coating samples on the micro trench.

2/- Results of the deflection measurements

Deflections are measured by using the Lacroix deflectograph, i.e. a 19-ton heavy goods vehicle loaded with 13 tons on the rear axle which is the datum axle used for the sizing of new road pavements in France.

The deflection measurements are aimed both at:

- assessing the residual structure condition of a road pavement ;
- adjusting the model and in particular determining by inverse calculation the bearing capacity of the pavement bearing platform.

The results obtained are reported in the following table:

Type of structure	Deflection level (11100 min)
flexible	40
thick asphalt coated	25
semi-rigid	10

On the basis of the above results, the following remarks can be given:

- no weak points appear at the level of the areas under stress ;
- great homogeneity of the measurements ;
- very low deflection values that do show however the difference in the behaviour of the 3 tested structures, i.e. flexible, thick asphalt and semi-rigid.

Furthermore, the deflection measurements have allowed to adjust the model by determining by inverse calculation the bearing capacity of the pavement bearing platform.

This consists by using the mechanical ALIZE software in determining the bearing value of the platform which makes it possible to reach the level of measured deflections.

The ALIZE calculation sheets are attached to appendix 1.

The results obtained are reported in the following table:

Type of structure	Bearing level MPa)
flexible	120
thick asphalt coated	180
semi-rigid	200

The bearing level obtained is by far higher than the initially predicted level. The results obtained correspond to a platform with a bearing PF3/PF3+ although the foreseen bearing level was PF2 (bearing ranging from 50 to 120 MPa).

3/- Results of the samplings in the body of the micro trench

The aim of these samplings is to check the characteristics of the filling material of the micro trench and to compare them with the formerly performed tests in particular on basis of the specimens made at the Unit UNIBETON in Chalonnes s/Loire.

The tests of compressive strength have been carried out on 3 samples and the results are given in the following table:

Samples	Compressive strength Re {MPa)
C 1	5.57
C2	4.31
C3	3.24

The average value on the 3 samples was $R_c = 4.37$ MPa.

This average value is about the same as the value of compressive strength obtained on the samples made in Chalonnes s/Loire.

4/- Results of the samplings performed in the road foundation

A series of samplings/bore holes have been made in the road foundation of each of the plates in the areas under stress and in areas not subject to stresses.



The detailed samplings/bore holes carried out are given in the following table :

N° de samples/borings	Context
Boring n° 35	Flexible structure, area under stress
Sample n° 33	Thick asphalt structure, area under stress
Sample n° 37	Thick asphalt structure, area not under stress
Sample n° 31	Semi-rigid structure, area under stress
Sample n° 36	Semi-rigid structure, area not under stress

A plate attached to Appendix 2 shows the exact location of each sampling/boring.

The following remarks can be given:

- bad setting of the cement gravel, disintegrated samples,
- no alteration of the glued interfaces and of the thickness of layers.

5/- Results of the coating samples on the road foundation and on the micro trench

A series of coating samples have been performed in order to check the implemented thickness and to carry out the density tests with the gamma densimetrical bench.

The thickness and density results are detailed in the table below:

N° of samples	Context	Thickness of BBSG (cm)	Density
34	Flexible structure on micro trench, area under stress	4	< 2
34 bis	Flexible structure on micro trench, area not under stress	4	
32	Asphalt structure on micro trench, area under stress	4	
37 bis	Asphalt structure on micro trench, area not under stress	4	
30	Semi-rigid structure on micro trench, area under stress	3.5	
31	Semi-rigid structure on micro trench, area under stress	6	< 2.2
36 bis	Semi-rigid structure on micro trench, area not under stress	3.5	
36	Semi-rigid structure on micro trench, area not under stress	6	

On the areas outside the micro trench, the foreseen thickness of 6 cm is complied with correctly but on the micro trench thicknesses are about 3.5 to 4 cm and thus show values lower than 6 cm as it was foreseen. The micro trench has been backfilled at a height over the foreseen one.

With regard to the density the following remarks can be given:

- heterogeneous compaction for the samples n° 37 bis and 36 bis ;
- regular compaction for the samples n° 30 and 32,
- the sample n° 34 shows a defective implementation with the appearance of three very different layers ;
- for the sample n° 31, regular compaction though two layers are visible ;
- for the sample n° 36, dispersion of the gradient due in particular to a multi-layer aspect of the asphalt concrete.

On the experimental work site, compaction defects globally appear in particular in the repair areas at the level of the micro trenches. Such a problem is quite specific to the defects related to the concept: difficulties of the compaction of a small 40 cm wide strip, which can lead to the appearance of holes or starting points of materials.

The results of the measurements with the gamma densimetric bench are given in Appendix 3.

6/- Checking of holes

On the flexible structure, an area has been subject to a heavier stress than the other areas.

A hole has appeared on the micro trench. Therefore this hole has been inspected.

This inspection has been performed in accordance with the NFP 98-218-1 standard.

The longitudinal inspection is carried out in the axis of each spreading strip and the transverse inspection is carried out in the whole cross profile.

The hole is measured according to the standard by using the 3 m ruler and the maximum values are established by the NFP 98-150 standard: « Execution of the road foundations, binder courses and surface courses ».

Regarding the big work sites, for the surface course, the maximum hole is 0.3 cm according to the longitudinal profile and 0.5 cm according to the cross profile.

With regard to the other work sites, for the surface course, the maximum hole is 0.5 cm according to the longitudinal profile and 0.7 cm according to the cross profile.

The lowest depth of the measured hole is 0.3 cm. This value complies with the specifications of the NFP 98-150 standard.



71- Ovalization measurements

The ovalization measurement consists in:

- determining the maximum principal deformation at different levels in the structure layers ;
- characterizing the condition of the interfaces.

These elements are determined by recording via displacement sensors the deformations in the road pavement layers, caused by a 13-ton axle running over the sampling hole which has been bored to place the sensors. The deformations are measured in the longitudinal, diagonal and transversal directions and at the base of the treated layer.

The exploitation of recordings: deformation depending on the 13-ton axle running over the sampling hole, enables to determine the maximum and minimum values of deformations.

Based on formulas defined in the newsletter of the Laboratoires des Ponts et Chaussées in 1983, it has been possible to determine the major deformations in the absence of cavity and also the angle of the main direction.

These data lead to the calculation of the deformations in the directions of measurement.

For each ovalization measurement, the following elements are presented in the Appendix:

- graphical representation at each measurement depth of the raw deformations recorded in the longitudinal, diagonal or transversal directions ;
- calculation sheet which leads at each depth of measurement to the calculation of the deformations in the main directions in the absence of cavity ;
- section of the structure ;
- diagram of the deformations depending on the depth. It should be pointed out that the agreement regarding the raw recordings is reverse. An increase in deformations corresponds to a compression and a decrease corresponds to a tension. The diagram of the deformations represents the mechanical operation of the road pavement: positive deformation for a tension and negative deformation for a compression.

Due to the poor quality of the cement gravel on the semi-rigid plate, the ovalization measurements do not give coherent results since the values are quite different from each other.

For the measurements made on the thick asphaltic plate, the following table shows the maximum values obtained by ovalization.





Location	Thickness of GB3 (cm)	Peak deformation GB3 (μdef)	Deformation base GB3 (μdef)	Peak deformation capping layer (μdef)
Area not under stress, sample n°37	16	-52.7	-16.0	22.7
Area under stress, sample n°33	16	-67.8	-21.6	Work in tension but measurement problem

The interpretation of the ovalization measurements is subject to a modelling of the structures examined by means of the ALIZE software for the pavement mechanics.

The modelling is made by performing a blocking at a 6 meter depth of the measurement.

The ALIZE calculation sheet is attached to Appendix 3.

The following table shows the deformation values obtained by modelling.

Location	Thickness of GB3 (cm)	Peak deformation GB3 (μdef)	Deformation base GB3 (μdef)	Peak deformation capping layer (μdef)
Model	16	-7.5	66.2	84.3

On the basis of the above elements and of the deformation diagrams attached to appendix, the following remarks can be given:

- the structure issued from the ALIZE modelling works much more in compression than the real structure characterized by ovalization measurement; the neutral fiber is higher in the asphaltic gravel ;
- on the structure under stress, the deformation values recorded are higher than on the structure not subject to stress, which is a logical result ;
- it is difficult to match the results of ovalization with the modelled structure ;
- the ovalization confirms a good adherence of the asphaltic gravel layer / capping layer.

8/- Conclusions and further steps to be taken

The different measures carried out on the experimental plates of the CER of ROUEN are the starting point of the adjustment of a theoretical micro trench model with real data. The proper principle of the completion of the plates in pit and the poor quality of the cement gravel have not made it possible to fully benefit from the measurement results, in particular with regard to ovalization.



What has been learnt from the above is the following:

- no structural weakness on the areas under stress in the vicinity of the micro trench ;
- the characteristics of the filling material of the micro trench, in particular the compressive strength, are comparable to the ones obtained on the samples made in the plant UNIBETON in Chalonnes s/Loire ;
- the hole noticed has a maximum depth in line with the specifications of the NF P 98-150 standard ;
- complementary ovalization measurements should be carried out in a real work site.

As a rule, this first instrumentation of a test micro trench work site must be completed with further investigations on real sites, it being understood that the sites are to be determined.



APPENDIX 1

ALIZE calculation sheets for the adjustment of the platform in accordance with the deflection measurements



Alizé-Lcpc – Sizing of the road pavement structures as per the rational method Lcpc-Sétra

Features of the calculation :

- Structure data : screen input, without name -
title of the study: none
- Loading data: - standard pairing of 65 kN
 - vertical pressure : 0.6620 MPa
 - contact radius : 0.1250 m
 - pairing ax. dist.: 0.3750 m
- units : m, MN and MPa ; deformations in μdef ; deflections in mm/100
- notations :
 - X=transverse axis Y=longitudinal axis Z= vertical axis
 - R=wheel vertical axis J= vertical axis between pairing

Table 1+2 (synthesis) :

Main major tensions in the horizontal plane XoY and main major compressions according to vertical line ZZ ; maximum deflection

Calculation level		EpsilonT horizontal	SigmaT horizontal	EpsilonZ vertical	SigmaZ vertical
		<i>surface</i>			
h= 0.060 m	0.000m	44.3 X-J	0.473 X-J	-4.8 Z-R	0.657 Z-R
E= 5400.0 MPa					
nu= 0.350	0.060m	19.5 X-R	0.341 Y-J	40.6 Z-R	0.588 Z-R
		<i>glued (z=0,</i>			
h= 0.160 m	0.060m	19.5 X-R	0.572 Y-J	12.1 Z-R	0.588 Z-R
E= 9300.0 MPa					
nu= 0.350	0.220m	-85.3 Y-J	-1.057 Y-R	78.4 Z-R	0.053 Z-R
		<i>glued (z=0, 220m)</i>			
h infinite	0.220m	-85.3 Y-J	0.007 Y-R	257.9 Z-R	0.053 Z-R
E= 180.0 MPa					
nu= 0.350					

Maximum deflection = 24.9 mm/100 (between pairing)

Radius of curvature = 856.9 m (between pairing)



Alizé-Lcpc – Sizing of the road pavement structures as per the rational method Lcpc-Sétra

Features of the calculation :

- Structure data : screen input, without name -
title of the study: none
- Loading data: - standard pairing of 65 kN
 - vertical pressure : 0.6620 MPa
 - contact radius : 0.1250 m
 - pairing ax. dist.: 0.3750 m
- units : m, MN and MPa ; deformations in μdef ; deflections in mm/100
- notations :
 - X=transverse axis Y=longitudinal axis Z= vertical axis
 - R=wheel vertical axis J= vertical axis between pairing

Table 1+2 (synthesis) :

Main major tensions in the horizontal plane XoY and main major compressions according to vertical line ZZ ; maximum deflection

	calculation level	EpsilonT horizontal	SigmaT horizontal	EpsilonZ vertical	SigmaZ vertical
			<i>surface (z=0.000)</i>		
h= 0.060 m	0.000m	15.5 X-R	0.161 X-J	56.3 Z-R	0657 Z-R
E= 5400.0 MPa					
nu= 0.350	0.060m	10.8 X-R	0.151 Y-J	58.8 Z-R	0.624 Z-R
			<i>glued (z=0, 060m)</i>		
h= 0.320 m	0.060m	10.8 X-R	0.487 Y-J	14.4 Z-R	0.624 Z-R
E= 23000.0 MPa					
nu= 0.250	0.380m	-20.5 Y-J	-0.593 Y-J	12.5 Z-J	0.014 Z-J
			<i>glued (z=0.380m)</i>		
h infinite	0.380m	-20.5 Y-J	0.002 Y-R	68.4 Z-J	0.014 Z-J
E= 180.0 MPa					
nu= 0.350					

Maximum deflection = 12.3 mm/100 (between pairing)

Radius of curvature = 4123.6 m (between pairing)



Alizé-Lcpc – Sizing of the road pavement structures as per the rational method Lcpc-Sétra

Features of the calculation :

- Structure data : screen input, without name -
title of the study: none
- Loading data: - standard pairing of 65 kN
 - vertical pressure : 0.6620 MPa
 - contact radius : 0.1250 m
 - pairing ax. dist.: 0.3750 m
- units : m, MN and MPa ; deformations in μdef ; deflections in mm/100
- notations :
 - X=transverse axis Y=longitudinal axis Z= vertical axis
 - R=wheel vertical axis J= vertical axis between pairing

Table 1+2 (synthesis) :

Main major tensions in the horizontal plane XoY and main major compressions according to vertical line ZZ ; maximum deflection

calculation level	EpsilonT horizontal	SigmaT horizontal	EpsilonZ vertical	SigmaZ vertical
<i>surface (z=0.000)</i>				
h= 0.080 m 0.000m nu= 0.350 0.080m	-38.4 X-J -156.0 Y-R	0.151 X-J -1.024 Y-R	-74.4 Z-J 187.6 Z-R	0.658 Z-R E= 0.351 Z-R
<i>glued (z=0, 080m)</i>				
h= 0.250 m 0.080m E= 600.0 MPa nu= 0.350 0.330m	-156.0 Y-R -158.1 Y-J	0.030 Y-J -0.085 Y-J	511.3 Z-R 220.2 Z-J	0.351 Z-R 0.083 Z-J
<i>glued (z=0, 330m)</i>				
h= 0.250 m 0.330m E= 300.0 MPa nu= 0.350 0.580m	-158.1 Y-J -129.8 Y-J	-0.020 Y-J	306.2 Z-J 198.0 Z-J	0.083 Z-J 0.034 Z-J
h infinite 0.580m E= 120.0 MPa nu= 0.350	-	-0.039 Y-J	-	-
<i>glued (z=0, 580m) -</i>				
Z-J	- 129.8 Y-J	-0.004 Y-J	-0.004 Y-J	0.034

Maximum deflection = 38.5 mm/100 (between pairing)

Radius of curvature = 228.4 m (between pairing)



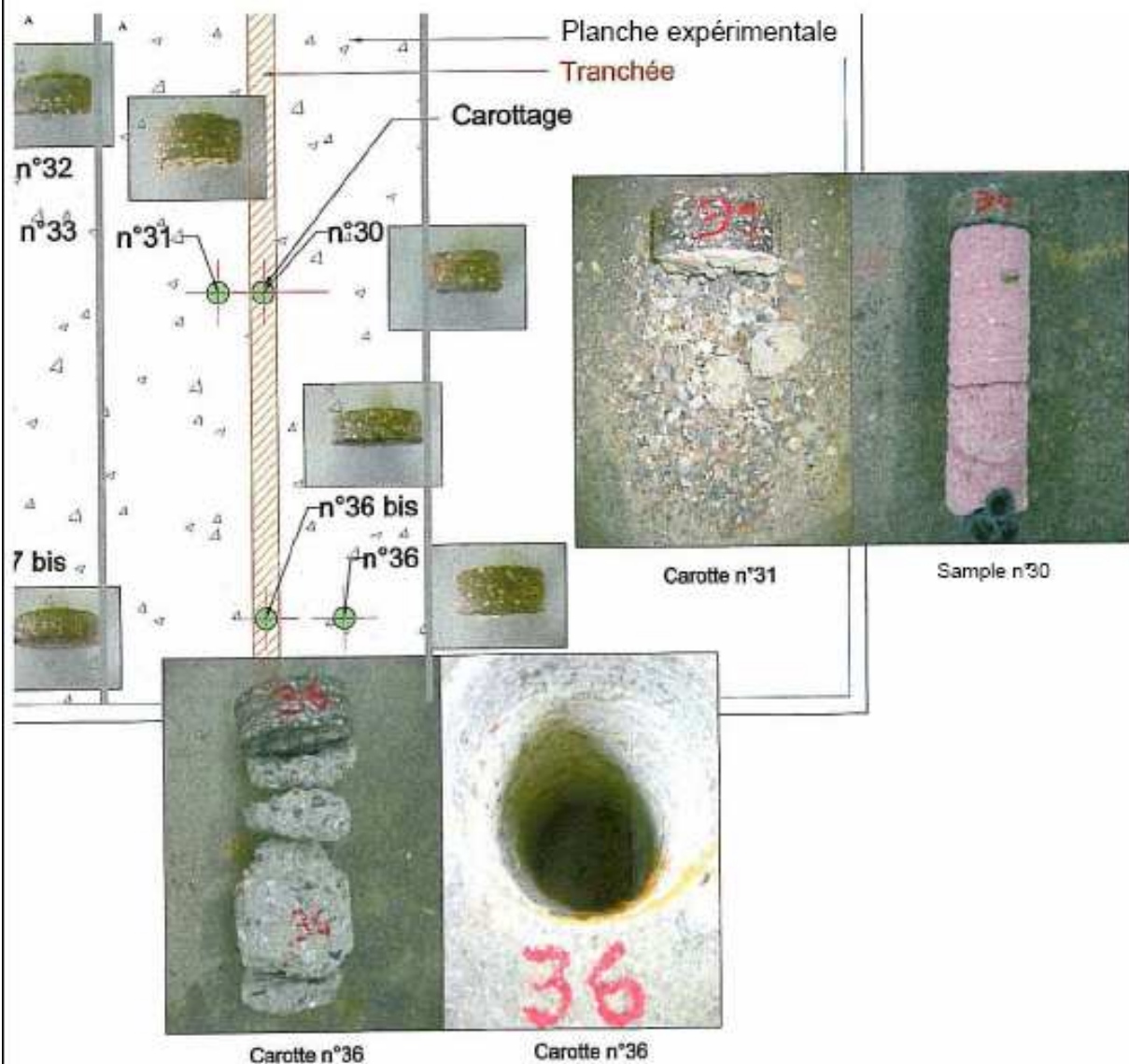
A P P E N D I X 2
Illustration plate of the experiment



a CER of Rouen (on March 7, 8 and April 8, 2005)



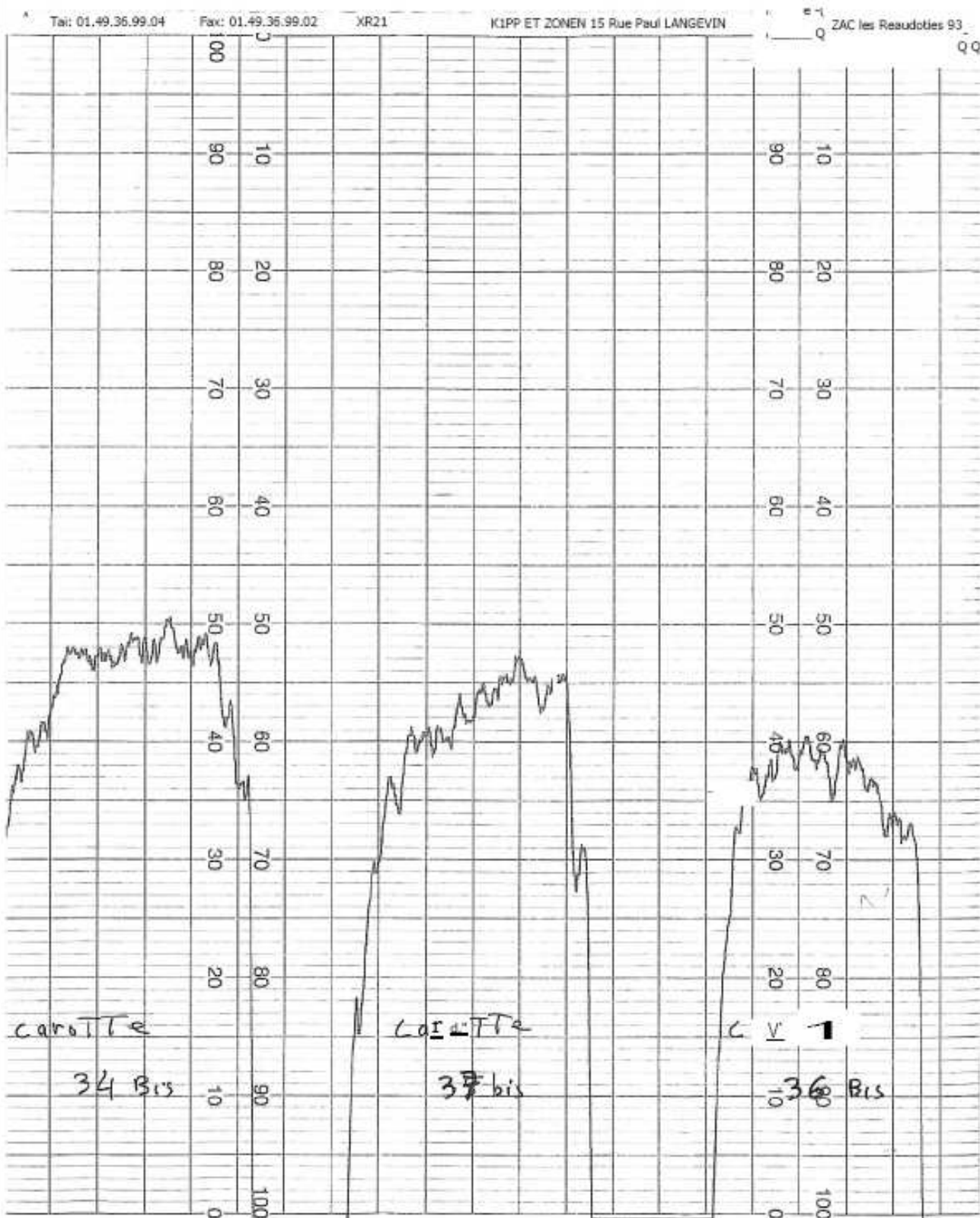
Semi-rigid – planche expér. Exper. Plate – carottage sampling carotte sample

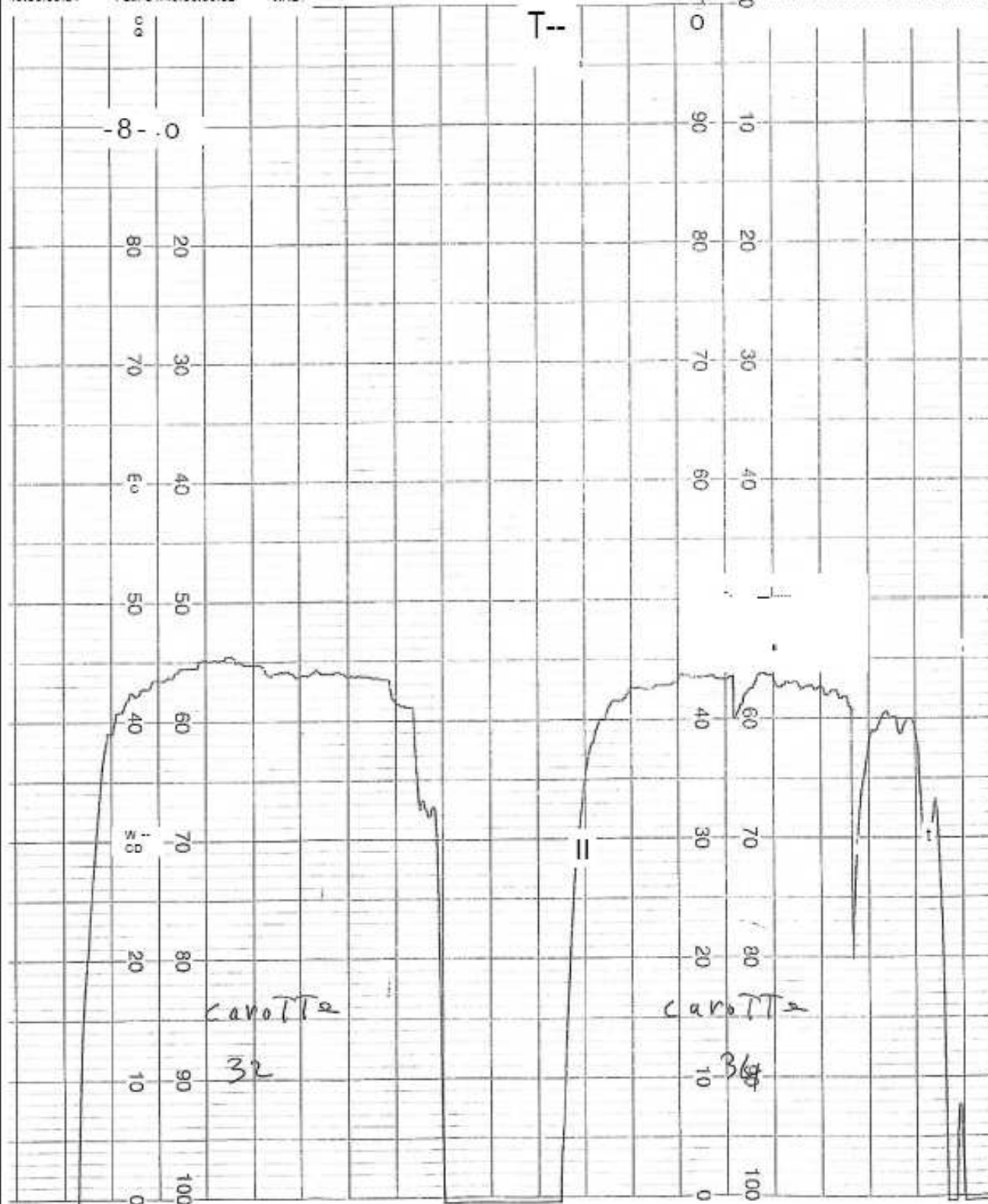


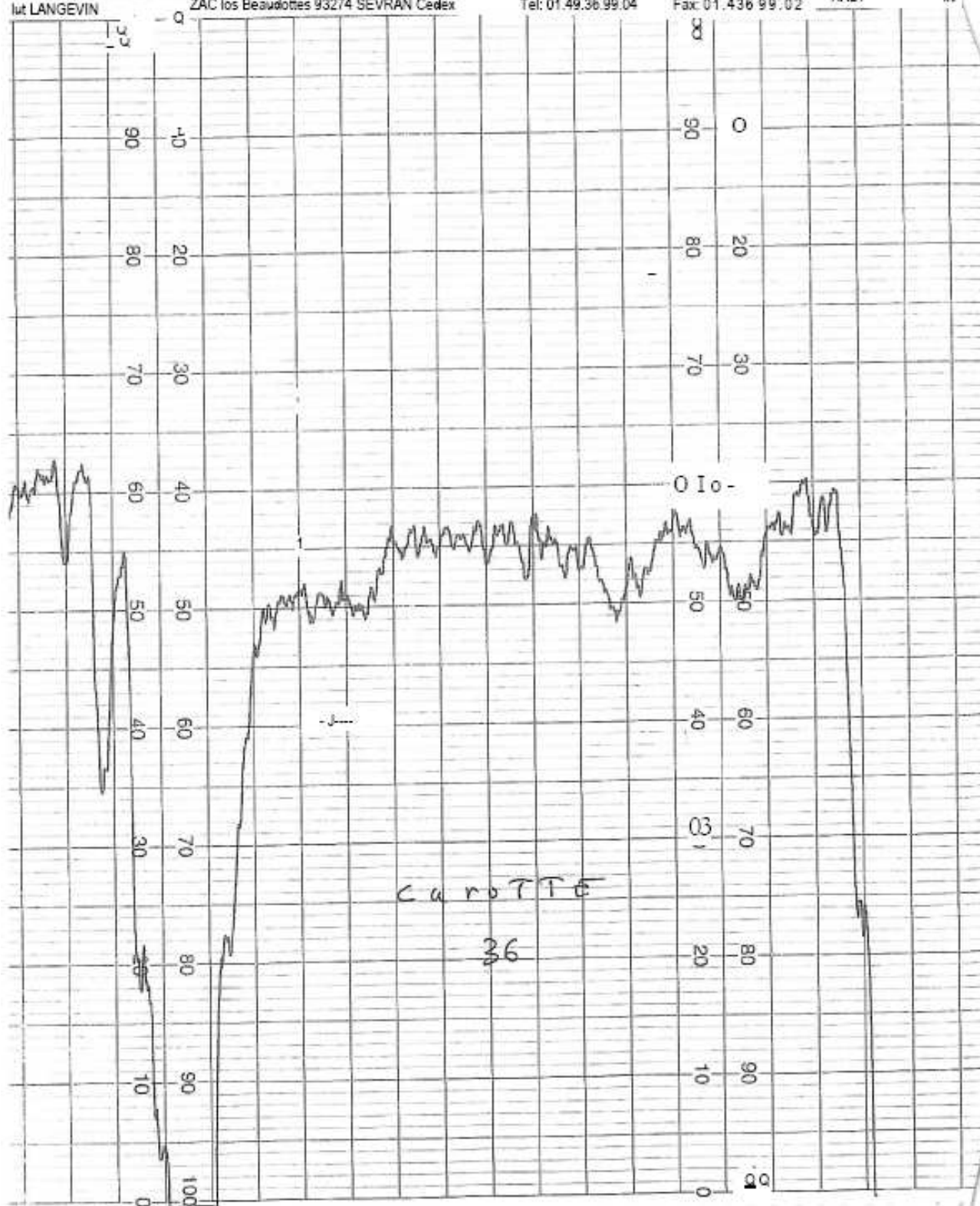
A P P E N D I X 3

Results of measurements with the gammadensimetric bench









A P P E N D I X 4
Results of the ovalization measurements



Alizé-Lcpc – Sizing of the road pavement structures as per the rational method Lcpc-Sétra

Features of the calculation :

- Structure data : screen input,
without name - title of
the study: none
- Loading data: - standard
pairing of 65 kN
 - vertical pressure : 0.6620 MPa
 - contact radius : 0.1250 m
 - pairing ax. dist.: 0.3750 m
- units : m, MN and MPa ; deformations in μdef ; deflections in mm/100
- notations :
 - X=transverse axis Y=longitudinal axis Z= vertical axis
 - R-wheel vertical axis J= vertical axis between pairing

Table 1+2 (synthesis) :

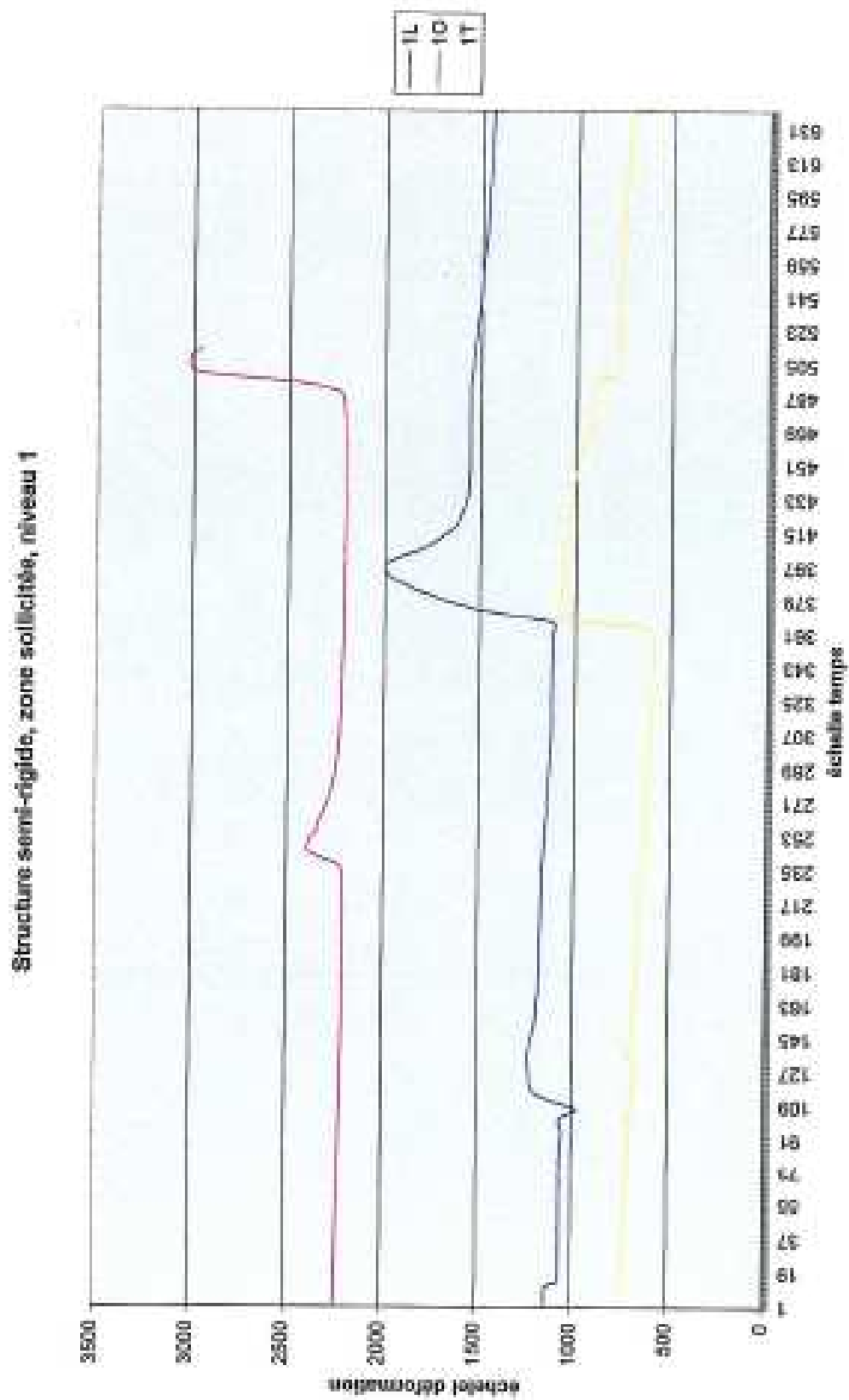
Main major tensions in the horizontal plane XoY and main major compressions according to vertical line ZZ ; maximum deflection

	calculation level	EpsilonT horizontal	SigmaT horizontal	EpsilonZ vertical	
<i>surface (z=0.000)</i>					
h= 0.060 m	0.000m	15.1 X-R	0.163 X-J	56.9 Z-R E=	0.624 Z-R
5400.0 MPa					
nu= 0.350	0.060m	10.4 X-R	0.148 Y-J	59.2 Z-R	
<i>glued (z=0, 080m)</i>					
h= 0.020 m	0.060m	10.4 X-R	0.476 Y-J	14.7 Z-R	0.624 Z-R
E= 23000.0 MPa					
nu= 0.250	0.080m	7.1 X-R	0.395 Y-J	15.6 Z-R	0.581 Z-R
<i>glued (z=0, 120m)</i>					
h= 0.120 m	0.080m	7.1 X-R	0.395 Y-J	15.6 Z-R	0.581 Z-R
E= 23000.0 MPa					
nu= 0.250	0.200m	-2.3 Y-R	0.010 Y-J	9.7 Z-R	0.232 Z-R
<i>glued (z=0.200m)</i>					
h= 0.180 m	0.200m	-2.3 Y-R	0.010 Y-J	9.7 Z-R	0.232 Z-R
					0.015 Z-J
E= 23000.0 MPa					
nu= 0.250	0.380m	-20.1 Y-J	-0.580 Y-J	12.2 Z-J	0.015 Z-J
h infinite	0.380m	-20.1 Y-J E=	0.002 Y-R	66.0 Z-J	
200.0 MPa					
nu= 0.350					

Maximum deflection = 11.4 mm/100 (between pairing)
Radius of curvature = 4260.4 m (between pairing)



Semi-rigid structure, area under stress, level 1 – time scale



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Ovalization calculations

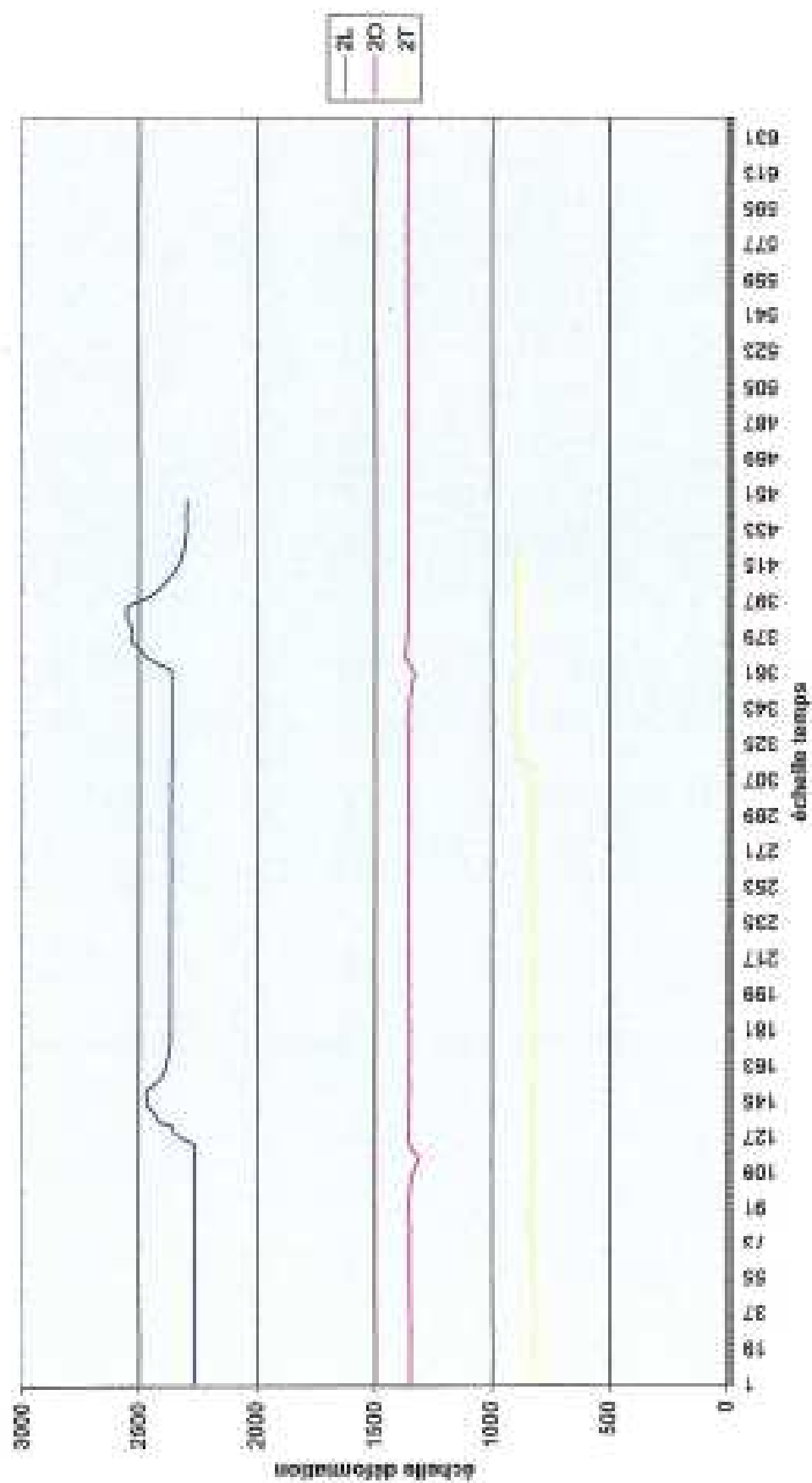
Case studied experiment CER of ROUEN, sample 31, semi-rigid structure under stress,
level 1
Inputs data
ANGLE (radian)
Variable A

Main deformations taking into account the presence of the cavity
Main deformations in the absence of the cavity
Deformations in the measurement direction

Calculs d'ovalisation			
Cas étudié	expérimentation CER de ROUEN, carotte 31, structure semi-rigide sollicitée, niveau 1		
	entrées	données	
	PHI_L	-103,2	
	PHI_O	-86,1	
	PHI_T	-57,4	
ANGLE (radian) variable A L=sigma1/sigma2		-0,3	ANGLE (°) -18,4
		1,46854106	
		-0,2	
signature sigma2/E		-59,9	
		19,6	
EPS11 EPS22		-104,6	Déformations principales en tenant compte de la présence de la cavité
		44,6	
EPS11 EPS12		-113,3	Déformations principales en l'absence de la cavité
		48,2	
EPS1L EPS1T		100,4	Déformations dans les directions de mesure
		142,2	



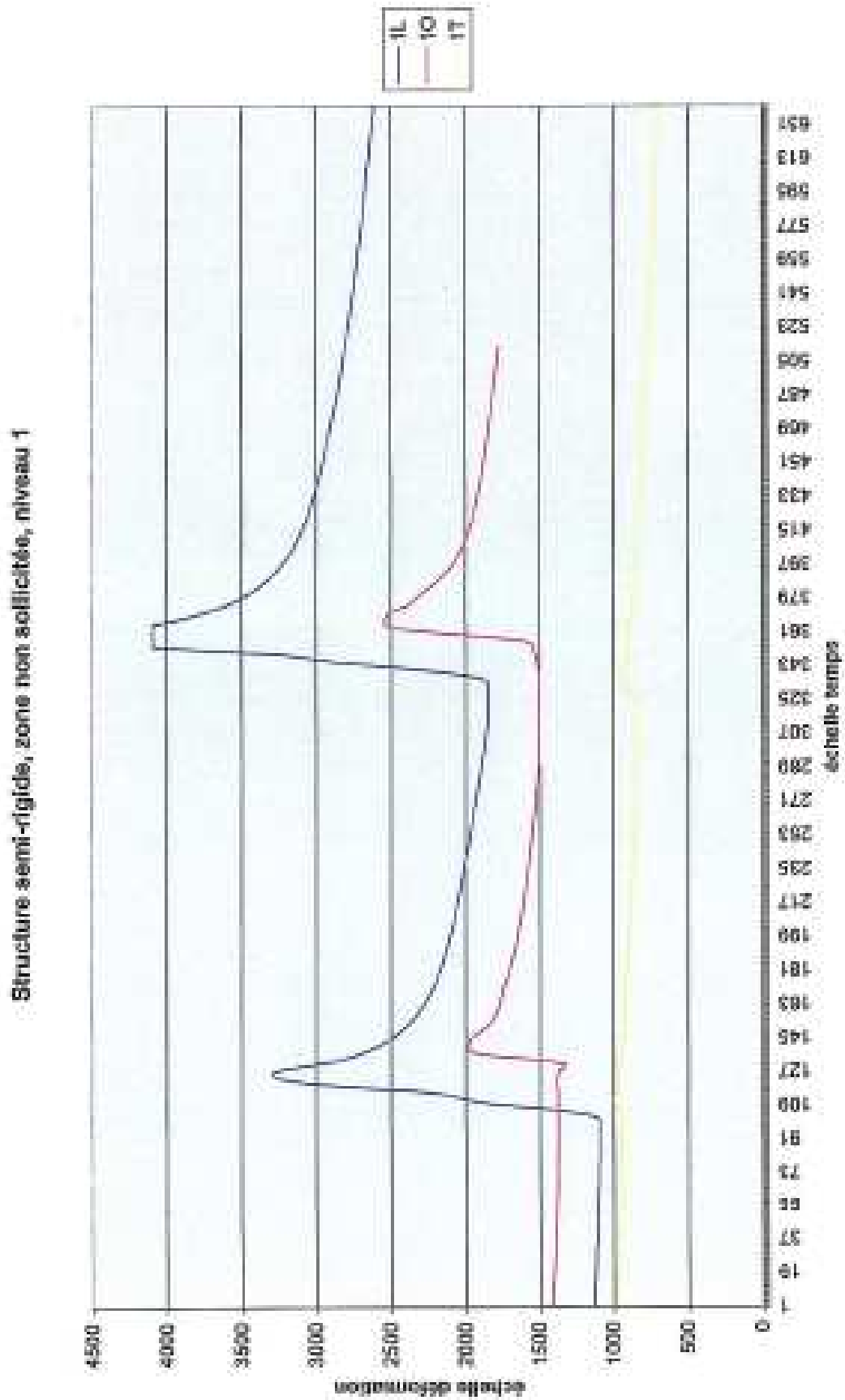
Structure semi-rigide, zone sollicitée, niveau 2 à -20 cm



Calculs d'ovalisation

Cas étudié	expérimentation CER de ROUEN, carotte 31, structure semi-rigide sollicitée, niveau 2
entrées PHI_L PHI_O PHI_T	données -22.3 2.3 -2.3
ANGLE (radian) variable A L=sigma1/sigma2	0.5 0.57558953 0.2
sigma1/E sigma2/E	-10.3 -2.0
EPSI1 EPSI2	-9.8 0.6
Déformations principales en tenant compte de la présence de la cavité	
EPSI1 EPSI2	-10.8 0.7
Déformations principales en l'absence de la cavité	
EPSI1 EPSI2	-10.8 0.7
EPSI1 EPSI2	0.2 3.8
Déformations dans les directions de mesure	

Semi-rigid structure, area not under stress, level 1 – time scale



Calculs d'ovalisation

Cas d'étude : expérimentation CBR de ROUEN, carte 36, structure semi-rigide non sollicitée, niveau 1

entrées
PHI_L
PHI_O
PHI_T

données
-284,3
-122,3
-15,0

ANGLE (radian)
variable A
 $L = \sigma_1 / \sigma_2$

0,1
-6,02753572
-1,4

ANGLE (°)

4,0

sigma1/E
sigma2/E

351,0
-490,7

Déformations principales en tenant
compte de la présence de la cavité

EP8I1
EP8I2

472,7
-578,5

Déformations principales en l'absence de
la cavité

EP8I1
EP8I2

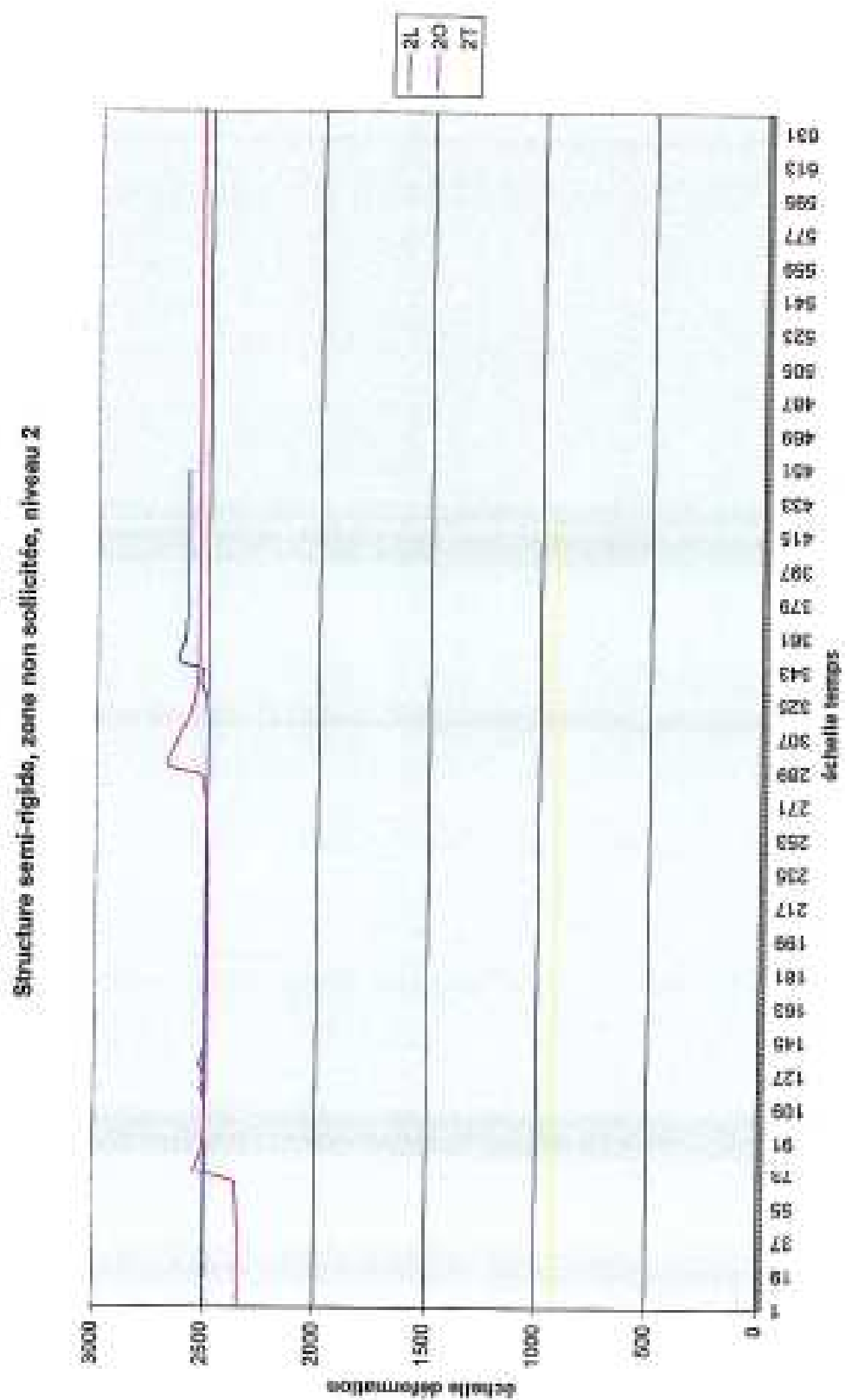
512,1
-625,4

Déformations dans les directions de
mesure

EP8I1
EP8I2

401,7
-502,5

Sample 36, semi-rigid structure, area not under stress, level



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Calculs d'ovalisation

Cas étudié expérimentation CER de ROUEN, carotte 36, structure semi-rigide non sollicitée, niveau 2

entrées	données
PHI_L	-16,3
PHI_O	-21,8
PHI_T	-3,4

ANGLE (radian)	-0,5	ANLGL (°)	-30,8
variable A	0,81706131		
$L=\sigma_1/\sigma_2$	0,1		

σ_1/E	-8,9
σ_2/E	-0,9

Déformations principales en tenant
compte de la présence de la cavité

EPSI1	-8,7
EPSI2	1,3

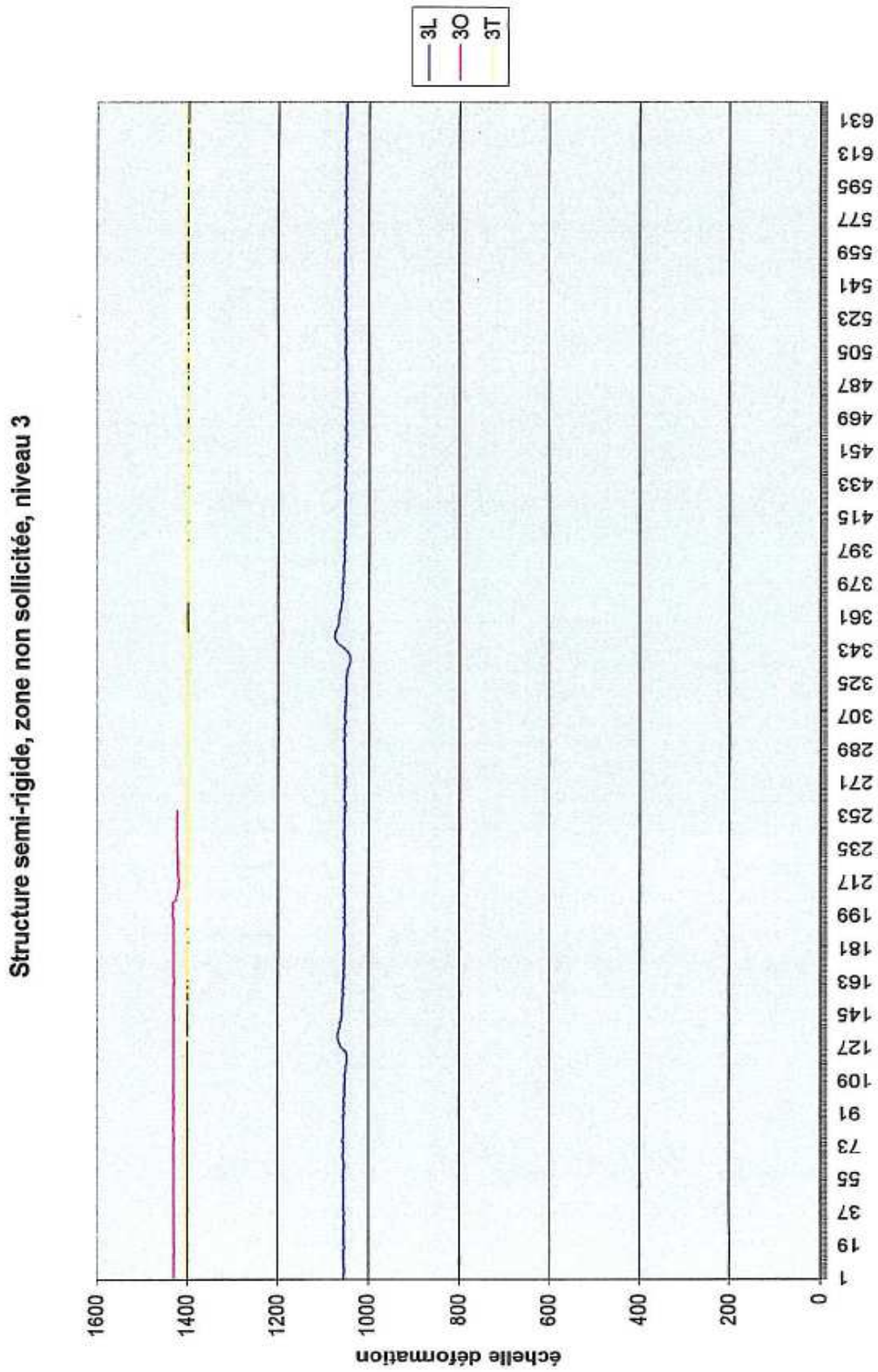
Déformations principales en l'absence de
la cavité

EPSI'1	-9,4
EPSI'2	1,4

Déformations dans les directions de
mesure

EPSI"L	-6,6
EPSI"T	-4,3

Semi-rigid structure, area not under stress, level 3



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Calculs d'ovalisation

Cas étudié	expérimentation CER de ROUEN, carotte 36, structure semi-rigide non sollicitée, niveau 3
entrées	données
PHI_L	-2,5
PHI_O	0,0
PHI_T	0,0
ANGLE (radian) variable A $L=\sigma_1/\sigma_2$	0,4 0,98860091 0,0
σ_1/E σ_2/E	-1,2 0,0
EPSI1 EPSI2	-1,2 0,3
Déformations principales en tenant compte de la présence de la cavité	
EPSI'1 EPSI'2	-1,3 0,3
Déformations principales en l'absence de la cavité	
EPSI''L EPSI''T	-1,1 -0,8
Déformations dans les directions de mesure	

Semi-rigid structure, area not under stress, level 3



Structure semi-rigide, zone non sollicitée, niveau 4



Calculs d'ovalisation

Cas étudié	expérimentation CER de ROUEN, carotte 36, structure semi-rigide non sollicitée, niveau 4	
entrées	données	
PHI_L	2,1	
PHI_O	2,3	
PHI_T	7,6	
ANGLE (radian) variable A $L=\sigma_1/\sigma_2$	-0,4 -0,65293822 4,8	ANLGE (°) -21,4
σ_1/E σ_2/E	0,8 4,0	
EPSI1 EPSI2	-0,2 3,8	Déformations principales en tenant compte de la présence de la cavité
EPSI'1 EPSI'2	-0,2 4,1	Déformations principales en l'absence de la cavité
EPSI'L EPSI'T	0,4 2,5	Déformations dans les directions de mesure

structure bihemineuse epaisse

Alizé-Lcpc - Dimensionnement des structures de chaussées
selon la méthode rationnelle Lcpc-Sétra

Signalement du calcul :

- données Structure : saisie écran, sans nom
 - titre de l'étude : sans titre
- données Chargement :
 - jumelage standard de 65 kN
 - pression verticale : 0,6620 MPa
 - rayon de contact : 0,1250 m
 - entraxe jumelage : 0,3750 m
- unités : m, MN et MPa ; déformations en $\mu\text{d}\epsilon\text{f}$; déflexions en mm/100
- notations :

X=axe transversal	Y=axe longitudinal	Z=axe verticale
R=axe vertical roue	J=axe vertical entre-jumelage	

Tableau 1+2 (synthèse) :
tractions principales majeures dans le plan horizontal XoY et
compressions principales majeures selon la verticale ZZ ; déflexion maximale

	niveau calcul	EpsilonT horizontale	SigmaT horizontale	EpsilonZ verticale	SigmaZ verticale
<i>surface (z=0.000)</i>					
h= 0,060 m	0,000m	42,8 X-J	0,455 X-J	-4,4 Z-R	0,659 Z-R
E= 5400,0 MPa					
nu= 0,350	0,060m	19,3 X-R	0,339 Y-J	40,8 Z-R	0,588 Z-R
<i>collé (z=0,060m)</i>					
h= 0,020 m	0,060m	19,3 X-R	0,569 Y-J	12,4 Z-R	0,588 Z-R
E= 9300,0 MPa					
nu= 0,350	0,080m	7,7 X-R	0,374 Y-J	22,9 Z-R	0,519 Z-R
<i>collé (z=0,080m)</i>					
h= 0,120 m	0,080m	7,7 X-R	0,374 Y-J	22,9 Z-R	0,519 Z-R
E= 9300,0 MPa					
nu= 0,350	0,200m	-86,2 Y-J	-0,799 Y-R	62,6 Z-R	0,072 Z-R
<i>collé (z=0,200m)</i>					
h= 0,020 m	0,200m	-86,2 Y-J	-0,799 Y-R	62,6 Z-R	0,072 Z-R
E= 9300,0 MPa					
nu= 0,350	0,220m	-85,5 Y-J	-1,059 Y-R	78,6 Z-R	0,053 Z-R
<i>collé (z=0,220m)</i>					
h= 0,010 m	0,220m	-85,5 Y-J	0,007 Y-R	258,1 Z-R	0,053 Z-R
E= 180,0 MPa					
nu= 0,350	0,230m	-84,3 Y-J	0,007 Y-R	251,9 Z-R	0,052 Z-J
<i>collé (z=0,230m)</i>					
h= 5,770 m	0,230m	-84,3 Y-J	0,007 Y-R	251,9 Z-R	0,052 Z-J
E= 180,0 MPa					
nu= 0,350	6,000m	0,0 Y-J	0,001 Y-R	4,0 Z-J	0,001 Z-J
<i>collé (z=6,000m)</i>					
h infini	6,000m	0,0 Y-J	0,000 Y-R	0,1 Z-J	0,001 Z-J
E= 10000,0 MPa					

nu 0.350

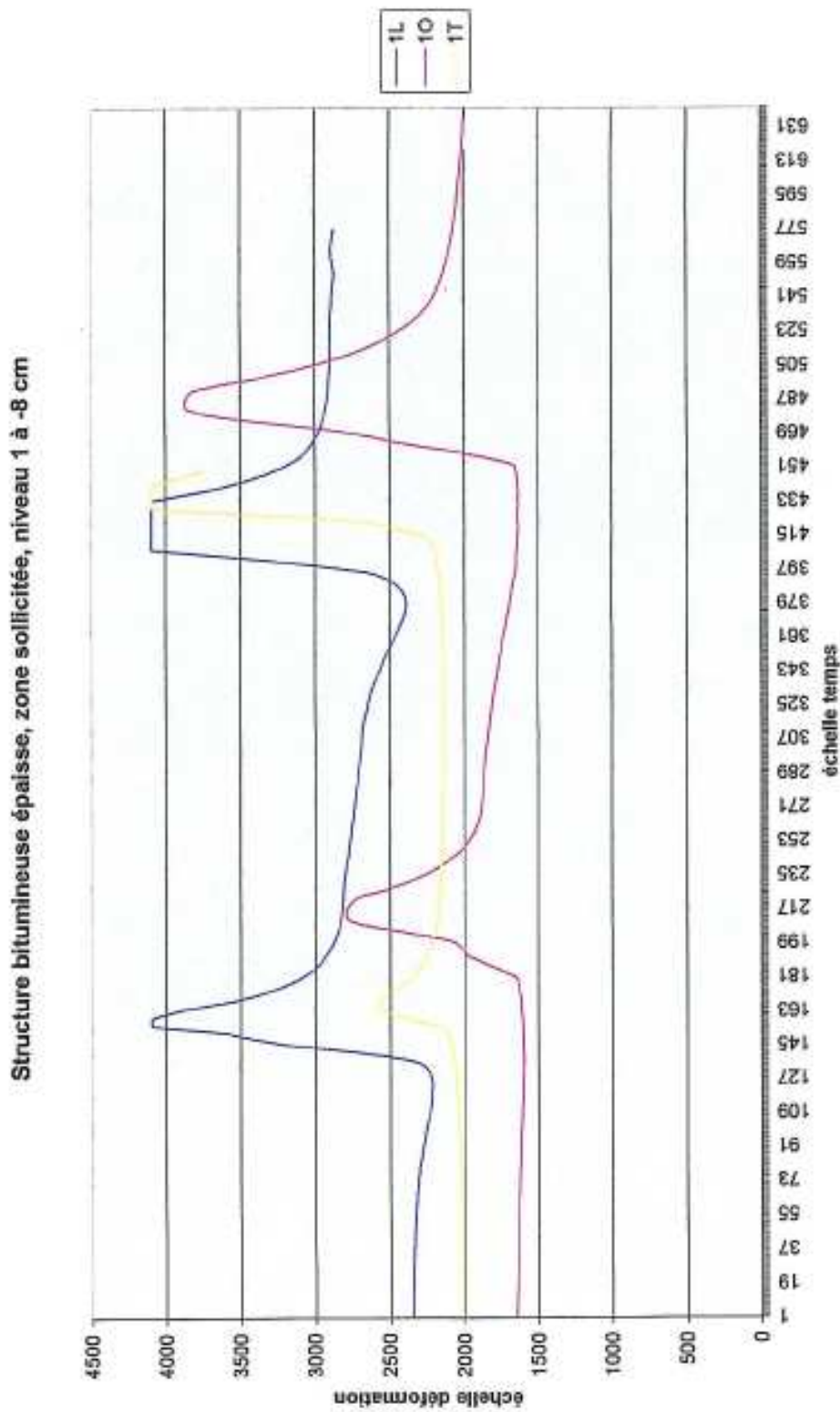
Maximum deflection = 22.7 mm/100 (between pairing) Radius of curvature = 883.1 m (between pairing)

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Thick asphalt structure, area under stress, level 1 to -8 cm

Deformation scale

Time scale

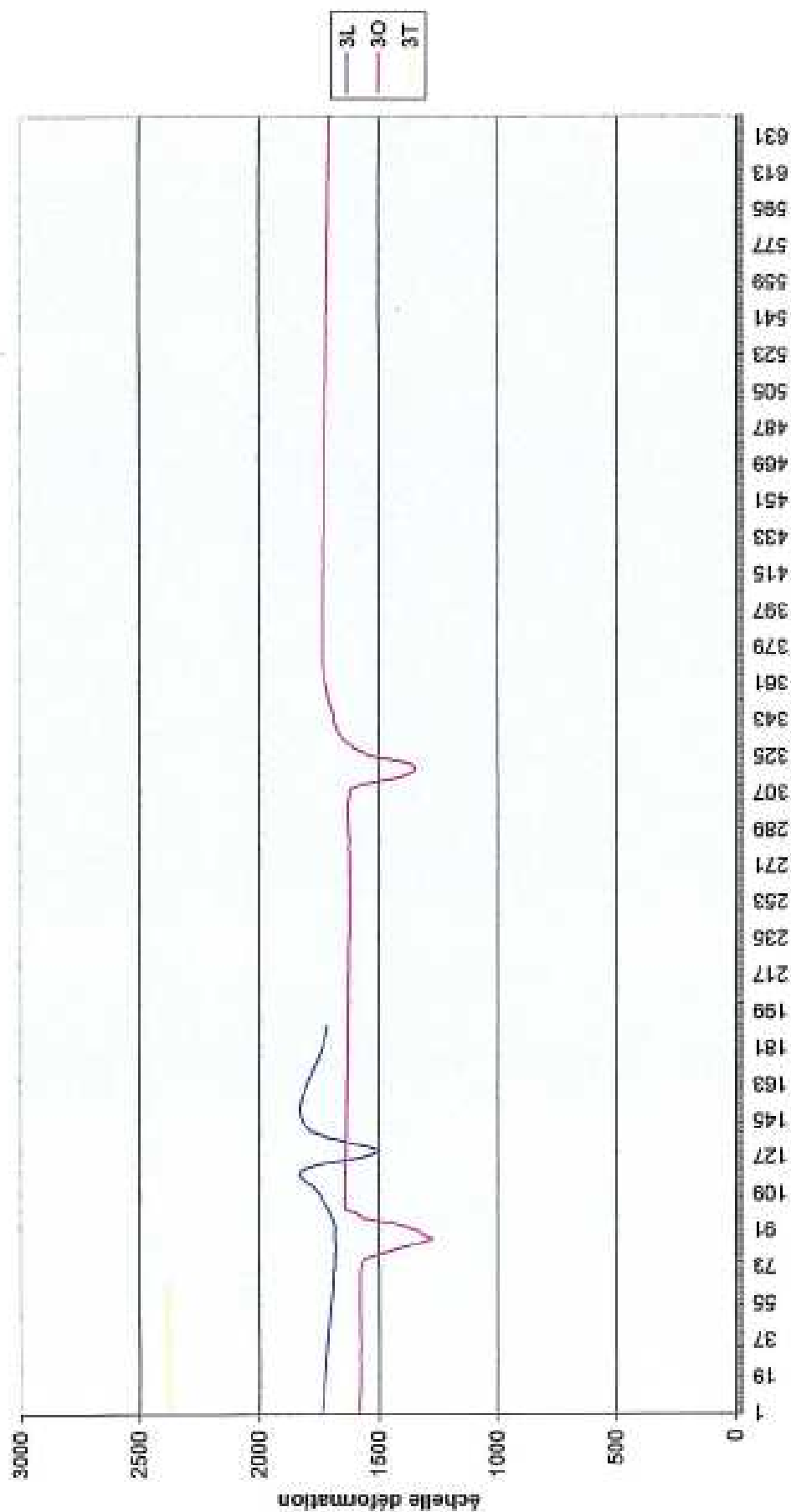


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Structure bitumineuse épaisse, zone sollicitée, niveau 2 à -20 cm



Structure bitumeneuse épaisse, zone sollicitée, niveau 3 à -23 cm



Calculs d'ovalisation

Cas étudié	expérimentation CER de ROUEN, carotte 33, structure bitumineuse sollicitée, niveau 1
entrées	données
PHI_L	-178,8
PHI_O	-118,3
PHI_T	-59,3
ANGLE (radian) variable A $L=\sigma_1/\sigma_2$	0,0 -0,29016282 1,8
σ_1/E σ_2/E	-42,2 -76,8
EPSI1 EPSI2	-23,0 -66,2
Déformations principales en tenant compte de la présence de la cavité	
Déformations principales en l'absence de la cavité	
EPSI'1 EPSI'2	-24,9 -71,6
EPSI''L EPSI''T	-24,9 -67,6
Déformations dans les directions de mesure	

Calculs d'ovalisation

Cas étudié	expérimentation CER de ROUEN, carotte 33, structure bitumineuse sollicitée, niveau 2
entrées PHI_L PHI_O PHI_T	données -72,8 -82,3 -59,9
ANGLE (radian) variable A $L=\sigma_1/\sigma_2$	-0,6 0,12295301 0,8
σ_1/E σ_2/E	-37,3 -29,1
EPSI1 EPSI2	-30,0 -19,8
Déformations principales en tenant compte de la présence de la cavité	
EPSI1 EPSI2	-32,4 -21,4
Déformations principales en l'absence de la cavité	
EPSI'L EPSI'T	-29,0 -21,6
Déformations dans les directions de mesure	

Structure bitumineuse épaisse, zone non sollicitée, niveau 1 à -8 cm



Structure bitumineuse épaisse, zone non sollicitée, niveau 2 à -20 cm



Structure bitumineuse épaisse, zone non sollicitée, niveau 3 à -23 cm



Calculs d'ovalisation

Cas étudié	expérimentation CER de ROUEN, carote 37, structure bitumineuse non sollicitée, niveau 1
entrées	données
PHI_L	-127,2
PHI_O	-176,9
PHI_T	-130,3
ANGLE (radian) variable A $L=\sigma_1/\sigma_2$	0,9 -0,00619154 1,0
σ_1/E σ_2/E	-64,0 -64,8
EPSI1 EPSI2	-47,8 -48,8
Déformations principales en tenant compte de la présence de la cavité	
EPSI'1 EPSI'2	-51,7 -52,7
Déformations principales en l'absence de la cavité	
EPSI''L EPSI''T	-52,2 -52,7
Déformations dans les directions de mesure	

Calculs d'ovalisation

Cas étudié	entrées	expérimentation CER de ROUEN	carotte 37, structure bitumineuse non sollicitée, niveau 2	
	PHI_L	données		
	PHI_O	-90.2		
	PHI_T	-60.8		
		-57.7		
ANGLE (radian) variable A L=sigma1/sigma2		0.3	ANGLE (°)	19.5
		0.41298239		
		0.4		
	sigma1/E	-52.2		
	sigma2/E	-21.7		
			Déformations principales en tenant compte de la présence de la cavité	
EPSI1		-46.8		
EPSI2		-8.6		
			Déformations principales en l'absence de la cavité	
EPSI1		-50.6		
EPSI2		-9.3		
			Déformations dans les directions de mesure	
EPSI'L		-46.0		
EPSI'T		-18.0		

Calculs d'ovalisation

Cas étudié expérimentation CER de ROUEN, carotte 37, structure bitumineuse non sollicitée, niveau 3

entrées
PHI_L 8,1
PHI_O 24,2
PHI_T 68,2

ANGLE (radian)
variable A -0,2 ANGLE (°) -12,5
L=sigma1/sigma2 -0,40340027
2,4

sigma1/E 11,4
sigma2/E 26,8

Déformations principales en tenant
compte de la présence de la cavité

EPSI1 4,7
EPSI2 23,9

Déformations principales en l'absence de
la cavité

EPSI'1 5,1
EPSI'2 25,9

Déformations dans les directions de
mesure

EPSI''L 5,0
EPSI''T 22,7

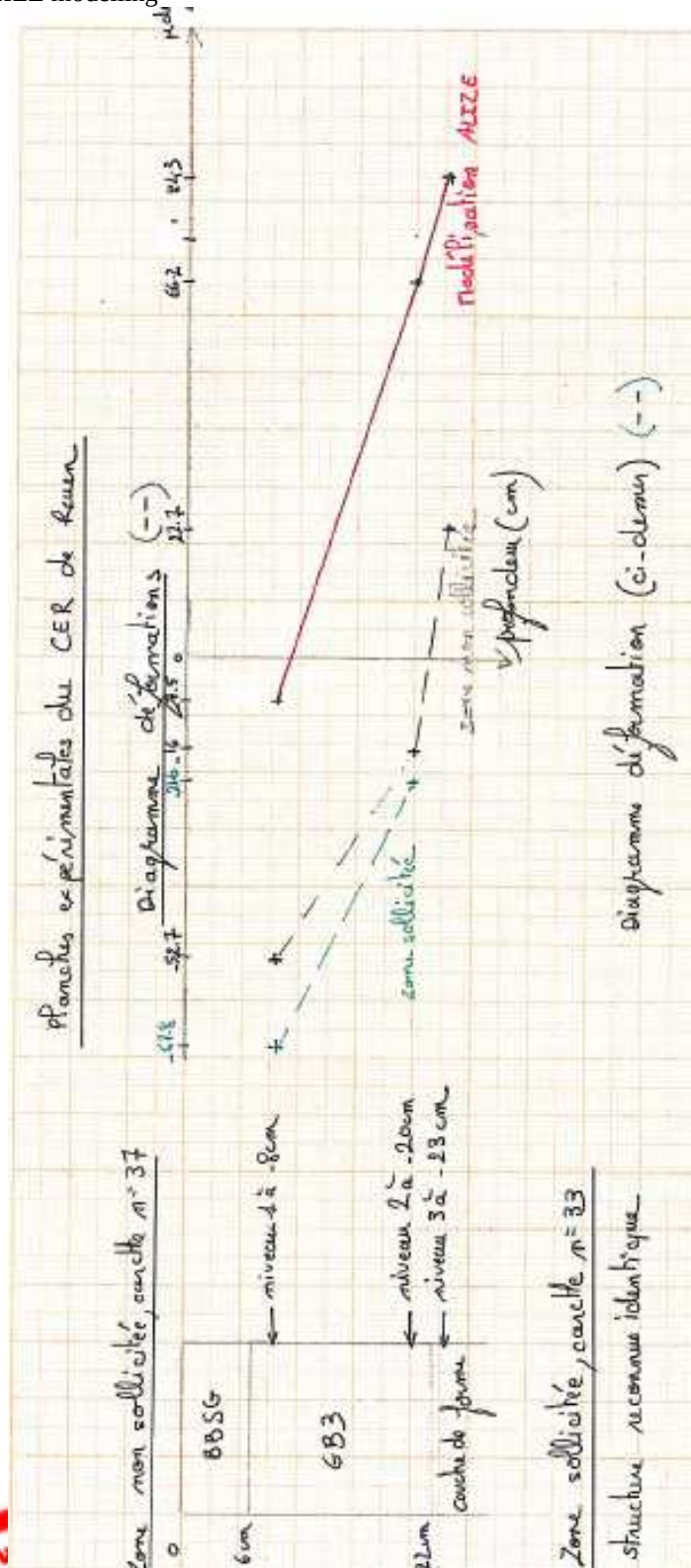
Experimental plates of the CER of ROUEN

Area not under stress, sample n° 37

Deformation diagram

ALIZE modelling

Level 1 at -8cm – couche de forme = capping layer / zone sollicitée = area under stress / prof. = depth / zone sollicitée, carotte n° 33 = area under stress, sample n° 33 – structure reconnue identique = Structure recognized as being identical – ALIZE modelling



Appendix 8 - Follow up of Micro Trenches

Draft Proposal for Comments





L R O P

**STUDY OF THE COMPREHENSIVE CONCEPT OF MICRO
TRENCHES**

Follow-up of the micro trenches

COSNE-COURS-SUR-LOIRE



Janvier 2005

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SUMMARY

1. Site plan
2. General specifications manual, examination and follow-up of the works :
implementation of a structured approach
3. Application of the method to the site of Cosne-Cours-sur-Loire
4. Synthesis map of the examination of the micro trenches of the site of Cosne-Cours-sur-Loire
5. Route diagrams
6. Portfolio and cross-section profilographs



Site plan



General specifications manual, examination and follow-up of the works: implementation of a structured approach



As part of the development of the “cleanfast” process, a general micro trench process, a general examination and follow-up approach for micro trench work sites has been implemented to assess the behaviour of the so modified structure.

Description of the examination and follow-up of the work sites: presentation of a structured approach

The point at issue is thanks to the different measurements which are going to be detailed, to follow the evolution along the time of the road pavement that has a “cleanfast” micro trench and to check it for the surface condition and for the structure condition. In this way, by making identical measurements on the road pavement before cutting the micro trench and then at regular time intervals after the completion of the works, it will be possible to assess the impact of this type of performance on a road pavement.

This examination work will possibly provide technical data for the approval of the “cleanfast” micro trench process.

The examination of the works is based on the following measurements and records:

- **Measurement of deflections by the deflectograph Lacroix:** This consists in determining the structural fatigue condition of the road pavement. The measurement consists in assessing the vertical deformation of the road pavement under a heavy goods vehicle axle of 13 t. This is the datum axle used in France for such a measurement. The measurement is given in one hundreds of millimetre. The higher the deflection value is, the shorter the residual time of life of the road pavement. This measurement is conducted on the axis and on the bank of the road.
- **Measurement of the longitudinal evenness:** This measurement conducted by means of an apparatus of the profile meter type makes it possible to determine the amplitudes of the vertical level differences of the longitudinal profile of the roadway layer to be examined. This reading allows to reproduce a picture of the longitudinal profile of the roadway. We take into account only the low waves for the examination of the micro trenches. The measurement is carried out at a speed of 21.6 km/h trying to pass over the micro trench.
- **Cross profile (transverse evenness) reading:** The principle consists in being placed in different points transversally to the roadway and to record the real profile of the roadway. The cross profile is obtained by using a ruler located horizontally with the roadway and a “feeler” pencil along the road pavement.
- **Optical recording:** These recordings are performed according to the modified LCPC method. It consists in recording the different indicators of the surface condition namely : rut depth, sinking, smooth wear, bleeding, removal, transverse crack – transverse joint, longitudinal crack – longitudinal joint, different cracks, crazing, description of the micro trench (crazing, cracking, sinking, spalling away, break-off) and condition of the micro trench (good, medium, bad).



- **Photographic recording** : it is carried out at each examination of the photographs on the same marked points.

Then these different recordings are published in the form of route diagrams per examined section or street.

The assessment of the global micro trench concept lies on the one hand on the assessment of the influence of the micro trenching on the road pavement and on the other hand on the assessment of the global condition of the micro trench.

1. Influence of the micro trenching on the road pavement

In order to study this influence, the following points used as a basis for the comparison of the different route diagrams (before works, after works, one year later, two years later, three years later) are then calculated :

- Deflections: medium, minimum, maximum values on each route diagram ;
- Longitudinal evenness: medium, minimum, maximum notes on each route diagram ;
- Cross profiles: overlay of the different recordings at each marked point ;
- Deteriorations: calculation of the percentage or of the appearance occurrence of each deterioration recorded along the route ;
- Photographs: photographs will be taken at the same marked points for each examination.

Such a method is based on the repeatability of the measurements. The tests are conducted by the same skilled staff certified for deterioration recordings.

2. Global condition of the micro trenches

This assessment is based on a visual recording of the condition of the micro trench and of the deteriorations which appeared along the width of the micro trench.

The recorders qualify globally the condition of the micro trench as good, medium or bad.

The different deteriorations which appeared along the width of the micro trench, namely crazing, cracking, sinking, spalling away, break-off, are recorded.

These values of deteriorations are recorded firstly on the route diagram used to assess the impact of the micro trenching on the road pavement and secondly on a map which makes it possible to locate the recorded condition.



Application of the method to the site of Cosne-Cours-sur-Loire



Cosne-Cours-sur-Loire

Follow-up before and after the works

This follow-up applies the general method as selected for the time follow-up of the sites concerned by micro trenches.

The follow-up of the sites concerns the streets of Général Binot, Naberis, Henri Dunant, Colonel Rabier, des Rivières, St Agnan, des 3 Ponts, du 8 Mai, Pont de Dahomey, Victor Hugo, Jean Jaurès, Sadi Carnot, Maréchal leclerc, Colette, Fontaine St Laurent, de la République, de l'Est, Croix Janvier and the RD 243. The total linear distance is 9,636 meters.

I. INFLUENCE OF THE MICRO TRENCHING ON THE ROAD PAVEMENT

1. Rue du Général Binot 1 (450 m)

Deteriorations	Road pavement before works (03/09)	Road pavement after works (04/01)	Road pavement after 1 year (04/09)
Transverse crackings	23	28	29
Break-off spall			
Longitudinal cracks	39.80 %	19.70 %	14 %
Deformations			
Surface deteriorations, crazing	4.30 %	11.50 %	
Repair works	43.40 %	31 %	7.50 %

The deflections are practically identical before works (68/100 mm) and after works (67/100 mm).

The average evenness note values are about the same before works (2.80) and after works (2.50).

2. Rue du Général Binot 1 (710 m)

Deteriorations	Road pavement before works (03/09)	Road pavement after works (04/01)	Road pavement after 1 year (04/09)
Transverse crackings	11	6	9
Break-off spall			
Longitudinal cracks	1.10 %		
Deformations		1.50 %	
Surface deteriorations, crazing			
Repair works	13.80 %	10.20 %	3.60 %

The deflections are practically identical before works (62/100 mm) and after works (68/100 mm).

The average evenness note values are about the same before works (3.90) and after works (3.30).



3. Rue du Général Binot 1 (459 m)

Deteriorations	Road pavement before works (03/09)	Road pavement after works (04/01)	Road pavement after 1 year (04/09)
Transverse crackings	2	1	3
Break-off spall			
Longitudinal cracks			
Deformations			
Surface deteriorations, crazing		1.80 %	
Repair works			

The deflections are practically identical before works (31/100 mm) and after works (30/100 mm).

The average evenness note values are about the same before works (6.20) and after works (5.10).

4. Rue du Général Binot 1 (647 m)

Deteriorations	Road pavement before works (03/09)	Road pavement after works (04/01)	Road pavement after 1 year (04/09)
Transverse crackings	5	3	1
Break-off spall	0.90 %		
Longitudinal cracks	2 %	4 %	5 %
Deformations	4 %		
Surface deteriorations, crazing	1.25 %	3.90 %	
Repair works	1.50 %		

The deflections are practically identical before works (3/100 mm) and after works (4/100 mm).

The average evenness note values are about the same before works (7.00) and after works (5.30).

5. Rue de Nabéris 1 (580 m)

Deteriorations	Road pavement before works (03/09)	Road pavement after works (04/01)	Road pavement after 1 year (04/09)
Transverse crackings	7	6	1
Break-off spall			
Longitudinal cracks	6 %	1 %	2 %
Deformations	3.75 %	1 %	
Surface deteriorations, crazing		1 %	
Repair works		1 %	

The deflections are practically identical before works (20/100 mm) and after works (17/100 mm).

The average evenness note values are about the same before works (6.20) and after works (4.60).



6. RD 243 (1) (440 m)

Deteriorations	Road pavement before works (03/09)	Road pavement after works (04/01)	Road pavement after 1 year (04/09)
Transverse crackings	5	2	2
Break-off spall			
Longitudinal cracks	5.30 %	2 %	4 %
Deformations	27 %	7.90 %	0.90 %
Surface deteriorations, crazing	0.50 %	83.30 %	
Repair works	66.80 %	60.70 %	25.70 %

The deflections are practically identical before works (61/100 mm) and after works (70/100 mm).

The average evenness note values are about the same before works (4.60) and after works (4.50).

7. RD 243 (1) (1,045 m)

Deteriorations	Road pavement before works (03/09)	Road pavement after works (04/01)	Road pavement after 1 year (04/09)
Transverse crackings	2		1
Break-off spall	1 %	0.65 %	19.40 %
Longitudinal cracks	3 %		2 %
Deformations		1 %	
Surface deteriorations, crazing			
Repair works	0.20 %		1 %

The deflections are practically identical before works (49/100 mm) and after works (54/100 mm).

The average evenness note values are about the same before works (8.40) and after works (5.60).

8. RD 243 (1) (315 m)

Deteriorations	Road pavement before works (03/09)	Road pavement after works (04/01)	Road pavement after 1 year (04/09)
Transverse crackings			
Break-off spall			
Longitudinal cracks	0.60 %		1 %
Deformations	28.90 %	14.50 %	
Surface deteriorations, crazing	0.90 %	2.20 %	
Repair works	45.10 %	24.40 %	24.50 %

The deflections are practically identical before works (53/100 mm) and after works (63/100 mm).

The average evenness note values are about the same before works (5.40) and after works (3.60).



9. Rue Henri Dunant (420 m)

Deteriorations	Road pavement before works (03/09)	Road pavement after works (04/01)	Road pavement after 1 year (04/09)
Transverse crackings	16	13	5
Break-off spall	19 %	9.60 %	5.30 %
Longitudinal cracks	22.10 %	4 %	9 %
Deformations		2.60 %	
Surface deteriorations, crazing	17.60 %	32.10 %	6 %
Repair works	10.30 %	10.70 %	5.30 %

The deflections are practically identical before works (38/100 mm) and after works (45/100 mm).

The average evenness note values are about the same before works (4.70) and after works (2.90).

10. Rue du Colonel Rabier (980 m)

Deteriorations	Road pavement before works (03/09)	Road pavement after works (04/01)	Road pavement after 1 year (04/09)
Transverse crackings	89	128	84
Break-off spall	56.90 %	46.50 %	33.20 %
Longitudinal cracks	98.30 %	69.20 %	45 %
Deformations	2.50 %	9.50 %	1.80 %
Surface deteriorations, crazing	41.20 %	68.20 %	10.20 %
Repair works	99.20 %	84.80 %	82.40 %

The deflections are practically identical before works (72/100 mm) and after works (82/100 mm).

The average evenness note values are about the same before works (1.60) and after works (1.60).

11. Rue Rivière St Agnan (280 m)

Deteriorations	Road pavement before works (03/09)	Road pavement after works (04/01)	Road pavement after 1 year (04/09)
Transverse crackings	16	14	13
Break-off spall	2.40 %		
Longitudinal cracks	25.10 %	6 %	5 %
Deformations	22.10 %	5.20 %	
Surface deteriorations, crazing			
Repair works	33.10 %	17.70 %	9.70 %

The deflections are practically identical before works (102/100 mm) and after works (112/100 mm).

The average evenness note values are about the same before works (1.70) and after works (1.80).



12. Rue des trois Ponts (540 m)

Deteriorations	Road pavement before works (03/09)	Road pavement after works (04/01)	Road pavement after 1 year (04/09)
Transverse crackings		3	5
Break-off spall	28.30 %	16.20 %	10.70 %
Longitudinal cracks	19.50 %	1.30 %	11 %
Deformations		43.40 %	5 %
Surface deteriorations, crazing	57 %	65.60 %	48.20 %
Repair works	86.50 %	98.20 %	60.40 %

The deflections are practically identical before works (72/100 mm) and after works (79/100 mm).

The average evenness note values are about the same before works (0.80) and after works (1.00).

13. Rue du 8 mai (230 m)

Deteriorations	Road pavement before works (03/09)	Road pavement after works (04/01)	Road pavement after 1 year (04/09)
Transverse crackings	11	13	4
Break-off spall	43 %	22.40 %	15.70 %
Longitudinal cracks	48.80 %	23.60 %	13 %
Deformations	9.80 %	7.80 %	
Surface deteriorations, crazing	3.80 %	7.80 %	
Repair works	35 %	31.40 %	4 %

The deflections are significantly higher before works (100/100 mm) than after works (72/100 mm).

The average evenness note values are about the same before works (2.60) and after works (1.20).

14. Rue Victor Hugo (170 m)

Deteriorations	Road pavement before works (03/09)	Road pavement after works (04/01)	Road pavement after 1 year (04/09)
Transverse crackings	4	1	5
Break-off spall	0.5 %		
Longitudinal cracks	36 %	8 %	13 %
Deformations		0.60 %	
Surface deteriorations, crazing			
Repair works	16.70 %	2.70 %	2.30 %

The deflections are practically identical before works (15/100 mm) and after works (26/100 mm).

The average evenness note values are about the same before works (3.50) and after works (3.90).



15. Rue Jean Jaurès (120 m)

Deteriorations	Road pavement before works (03/09)	Road pavement after works (04/01)	Road pavement after 1 year (04/09)
Transverse crackings	3	3	2
Break-off spall	2.30 %	1.60 %	
Longitudinal cracks	3 %		
Deformations			
Surface deteriorations, crazing			
Repair works	1 %	0.80 %	

The deflections are practically identical before works (28/100 mm) and after works (39/100 mm).

The average evenness note values are about the same before works (3.20) and after works (4.60).

16. Rue Sadi Carnot (220 m)

Deteriorations	Road pavement before works (03/09)	Road pavement after works (04/01)	Road pavement after 1 year (04/09)
Transverse crackings	8	6	6
Break-off spall	2.50 %	9.20 %	
Longitudinal cracks	2.90 %	2 %	5 %
Deformations	12.90 %	16.80 %	17.60 %
Surface deteriorations, crazing	80.60 %	89.10 %	89.60 %
Repair works	17.70 %	19.10 %	13.60 %

The deflections are significantly lower before works (22/100 mm) than after works (65/100 mm).

The average evenness note values are about the same before works (0.1) and after works (1.10).

17. Rue du Maréchal Leclerc (95 m)

Deteriorations	Road pavement before works (03/09)	Road pavement after works (04/01)	Road pavement after 1 year (04/09)
Transverse crackings			1
Break-off spall			
Longitudinal cracks			
Deformations			
Surface deteriorations, crazing			
Repair works			

The deflections are practically identical before works (11/100 mm) and after works (22/100 mm).

The average evenness note values are about the same before works (3.80) and after works (3.20).



18. Rue Colette (85 m)

Deteriorations	Road pavement before works (03/09)	Road pavement after works (04/01)	Road pavement after 1 year (04/09)
Transverse crackings	1		1
Break-off spall			
Longitudinal cracks	9 %	35 %	9 %
Deformations	60.10 %	19.60 %	
Surface deteriorations, crazing	91.90 %	99 %	67.40 %
Repair works			19.80

The deflections are significantly higher after works (122/100 mm) than before works (82/100 mm).

The average evenness note values are about the same before works (1.30) and after works (1.00).

19. Rue Fontaine St Laurent (720 m)

Deteriorations	Road pavement before works (03/09)	Road pavement after works (04/01)	Road pavement after 1 year (04/09)
Transverse crackings	6	6	7
Break-off spall			
Longitudinal cracks	5.20 %	6 %	
Deformations	9.50 %	38.50 %	
Surface deteriorations, crazing	0.50 %	3.30 %	
Repair works	18.50 %	27.40 %	9.60 %

The deflections are practically identical before works (50/100 mm) and after works (61/100 mm).

The average evenness note values are about the same before works (1.90) and after works (2.40).

20. Rue de la République (610 m)

Deteriorations	Road pavement before works (03/09)	Road pavement after works (04/01)	Road pavement after 1 year (04/09)
Transverse crackings	50	39	19
Break-off spall	15.70 %	10.30 %	8 %
Longitudinal cracks	32.30 %	23 %	6 %
Deformations	10.10 %	10.80 %	
Surface deteriorations, crazing	0.80 %	11.80 %	2 %
Repair works	41.70 %	33.10 %	9 %

The deflections are significantly lower after works (48/100 mm) than before works (67/100 mm).

The average evenness note values are about the same before works (2.90) and after works (3.00).



21. Rue de l'Est (165 m)

Deteriorations	Road pavement before works (03/09)	Road pavement after works (04/01)	Road pavement after 1 year (04/09)
Transverse crackings	18	9	2
Break-off spall			
Longitudinal cracks	19.60 %	2.60 %	
Deformations	0.50 %		
Surface deteriorations, crazing	69.40 %	100 %	63 %
Repair works	36.10 %	29.90 %	3 %

The deflections are practically identical before works (60/100 mm) and after works (64/100 mm).

The average evenness note values are about the same before works (3.00) and after works (3.70).

22. Rue Croix Janvier (240 m)

Deteriorations	Road pavement before works (03/09)	Road pavement after works (04/01)	Road pavement after 1 year (04/09)
Transverse crackings	57	60	69
Break-off spall	6 %	5.10 %	17.10 %
Longitudinal cracks	99.60 %	90.80 %	1 %
Deformations		1.80 %	
Surface deteriorations, crazing	30.70 %	99.50 %	1.40 %
Repair works	96.40 %	99 %	16 %

The deflections are practically identical before works (68/100 mm) and after works (62/100 mm).

The average evenness note values are about the same before works (3.50) and after works (3.90).

23. Synthesis (9,636 m)

Deteriorations	Road pavement before works (03/09)	Road pavement after works (04/01)	Road pavement after 1 year (04/09)
Transverse crackings	334	341	269
Break-off spall	10.70 %	7.70 %	7.62 %
Longitudinal cracks	23 %	14.10 %	8.41 %
Deformations	6 %	9.10 %	0.90 %
Surface deteriorations, crazing	13.30 %	28.90 %	7.88 %
Repair works	29.50 %	29.20 %	17.33 %



II. GLOBAL CONDITIONS OF THE MICRO TRENCHES

1. Rue du Général Binot 1 (450 m)

A few spalled areas and some sinking parts have been recorded although the condition of the micro trench is globally good.

2. Rue du Général Binot 2 (710 m)

A few spalled areas have been recorded with a globally medium condition of the micro trench.

3. Rue du Général Binot 3 (459 m)

A few spalled areas and some sinking parts have been recorded although the condition of the micro trench is globally good.

4. Rue du Général Binot 4 (647 m)

A few spalled areas have been recorded although the condition of the micro trench is globally good.

5. Rue de Nabéris (580 m)

A few spalled and crazed areas have been recorded with a globally medium condition of the micro trench.

6. RD 243 (1) (440 m)

A few spalled areas have been recorded although the condition of the micro trench is globally good.

7. RD 243 (2) (1,0450 m)

A few spalled areas have been recorded with a globally medium condition of the micro trench.

8. RD 243 (3) (315 m)

A medium condition of the micro trench is recorded all over the route and there is no recorded deterioration.

9. Rue Henri Dunant (420 m)

A good condition of the micro trench is recorded all over the route and there is no recorded deterioration.

10. Rue du Colonel Rabier (980 m)

A few spalled areas have been recorded with a globally medium condition of the micro trench.

11. Rue Rivière St Agnan (280 m)



A few sinking areas have been recorded with a globally medium condition of the micro trench.

12. Rue des trois Ponts (540 m)

A few sinking areas have been recorded with a globally medium condition of the micro trench.

13. Rue du 8 mai / Pont de Dahomey (230 m)

A few sinking areas have been recorded with a globally medium condition of the micro trench.

14. Rue Victor Hugo 170 m)

A few spalled areas and some sinking parts have been recorded with a globally bad condition of the micro trench.

15. Rue Jean Jaurès (120 m)

A few spalled areas have been recorded although the condition of the micro trench is globally good.

16. Rue Sadi Carnot (220 m)

A few sinking areas have been recorded with a globally medium condition of the micro trench.

17. Rue du Maréchal Leclerc (95 m)

A good condition of the micro trench is recorded all over the route and there is no recorded deterioration.

18. Rue Colette (85 m)

A medium condition of the micro trench is recorded all over the route and there is no recorded deterioration.

19. Rue Fontaine St Laurent (720 m)

A few sinking areas have been recorded with a globally medium condition of the micro trench.

20. Rue de la République (610 m)

A few spalled areas have been recorded although the condition of the micro trench is globally good.

21. Rue de l'Est (165 m)

A good condition of the micro trench is recorded all over the route and there is no recorded deterioration.

22. Rue Croix Janvier (240 m)



A few spalled areas have been recorded although the condition of the micro trench is globally good.

III. CONCLUSIONS

The site of Cosne-Cours-sur-Loire has been monitored for a bit more than one year, i.e. examination before micro trenching, after 6 months and then one year after completion of the works.

The recording performed on the site of Cosne-Cours-sur-Loire meets closely the reality because both recordings have been performed on the same lane before and after the micro trenching. Accordingly the following remarks have been made:

- stability of the transverse cracks and repairs, which proves the good repeatability of the measurements ;
- reduction in the crazing part and longitudinal cracks which can be explained by the fact that the micro trench was made along the road bank, an area which can be subject to the occurrence of these two deteriorations ;
- increase in the deformations and surface deteriorations / break-off, possibly due to the micro trenching.

It has been possible to perform the recording of the condition of the micro trenches along 9,042 m. The results achieved are as follows:

- 57.46 % good
- 37.80 % medium +
- 4.27 % medium –
- 0.47 % deteriorated

Remark! The recording performed after 1 year provides discrepancies and therefore it has been taken into account for these conclusions.



Synthesis map of the examination of micro trenches
of the site of Cosne-Cours-sur-Loire



Vocabulary

Overview of the Micro Trenches Site of Cosne-Cours-sur-Loire

**Direction Régionale de l'Équipement
Ile-de-France**

Evolution of the longitudinal evenness

Min. bank evenness
Max. bank evenness
Average bank evenness
September, 2003 without MTR
November, 2003 with MTR

DETERIORATION

Evolution of the deflections

Min. bank deflection
Max. bank deflection
Average bank deflection
September, 2003 without MTR
November, 2003 with MTR

Synthesis of the deteriorations

Faïençage	= crazing
Fissures longitudinales	= longitudinal cracks
Deformations	= deformations
Degrade. Super. Arrachements	= surface deteriorations / break-off
Réparations	= repairs
Ant travaux septembre 2003	= before works September, 2003
Après travaux, janvier 2004	= after works January, 2004

Percentage of road pavement per deterioration level

Medium +
Medium –
Deteriorated
Good

Surface condition

Total linear distance: 9,042 m
Good (5,195 m)
Deteriorated (43 m)
Medium + (3,418 m)
Medium – (386 m)

Echelle de la carte = Scale of the map : 1 cm / 650 m





Direction
Régionale de
l'Équipement
Île-de-France

PANORAMA GLOBAL DES MICROTRANCHEES - - SITE DE COSNE-COURS-SUR-LOIRE -

LROP
Atelier de
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Routes



Rue du Général Bugey



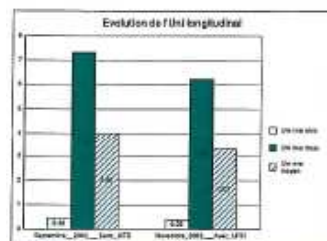
Rue Sadi Carnot



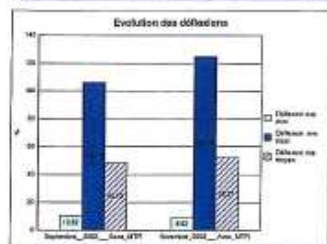
Rue des 3 Ponts



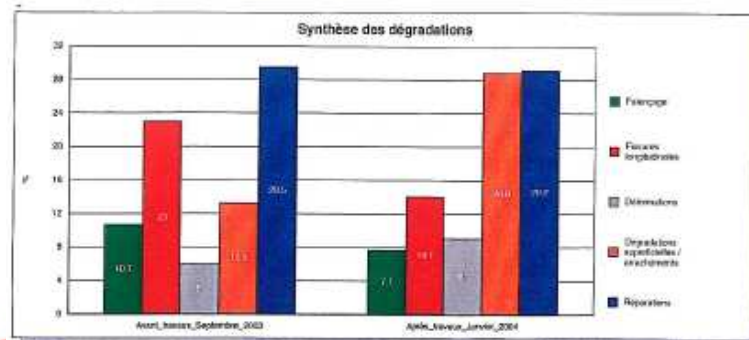
Rue de la Pivrière d'Agnan



DEGRADATION

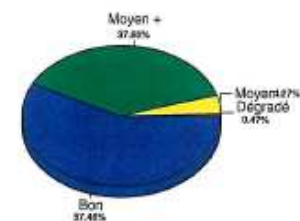


STABILITE



COSNE-COURS-SUR-LOIRE

Pourcentage de chaussée par niveau de dégradation



Echelle de la carte : 1 cm pour 550 m

This document is a work of the Direction Régionale de l'Équipement Île-de-France, Janvier 2005

POOD

Route diagrams



Vocabulary

FOLLOW-UP OF MICRO TRENCHES

File : 39387

SITE : COSNE-SUR-LOIRE

Street/road: Rue du Gal BINOT (1) (0 to 450 m) Scale: 1 cm / 70 m

Repérage	Marking
Nb fissures	number of cracks
Répar / signif / graves	Repair / Signif / very bad
Fissures transversales	transverse cracks
% long faïencée	crazed length %
Faïençages	crazings
Signif. Very bad / specif.	
% Long. Fissurée	Cracked length %
Fissures longitudinales	Longitudinal cracks
Repair / Signif / very bad / specif.	
% Long. Affaist	Sinking length %
Deformations	
Signif. / very bad /	
% Long. Arrach	break-off length %
Dégrad. Superfic.	Surface deterior.
Arrachements	break-offs
Little / very bad	
% long. Réparée	Repaired length %
Réparations	repairs
½ voie	< ½ lane > ½ lane
Déflexions	Deflections (in mm/100)
Min/max/Moy	Min/Max/Medium
Uni NBO	evenness – Waves Band Notation [WBN]
Notes Petites Ondes	Notes Small Waves
Relevé sans MTR	Recording without MTR (September, 2003)
Dégradations chaussée	Pavement deteriorations
Repérage	Marking
Nb fissures	number of cracks
Répar / signif / graves	Repair / Signif / very bad
Fissures transversales	transverse cracks
% long faïencée	crazed length %
Faïençages	crazings
Signif. Very bad / specif.	
% Long. Fissurée	Cracked length %
Fissures longitudinales	Longitudinal cracks
Repair / Signif / very bad / specif.	
% Long. Affaist	Sinking length %
Deformations	
Signif. / very bad /	
% Long. Arrach	break-off length %
Dégrad. Superfic.	Surface deterior.
Arrachements	break-offs
Little / very bad	
% long. Réparée	Repaired length %
Réparations	repairs
Etat % Long	Condition Length %
Nb dégrad.	Numb. deterior.
Dégradations	Deteriorations

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Déflexions
Min/max/Moy
Uni NBO
Notes Petites Ondes
Relevé avec MTR
Épaufr.

Relevé à un an
Relevé à deux ans

Deflections (in mm/100)
Min/Max/Medium
evenness – Waves Band Notation [WBN]
Notes Small Waves
Recording with MTR (January, 2004)
Spall

recording after one year
recording after two years





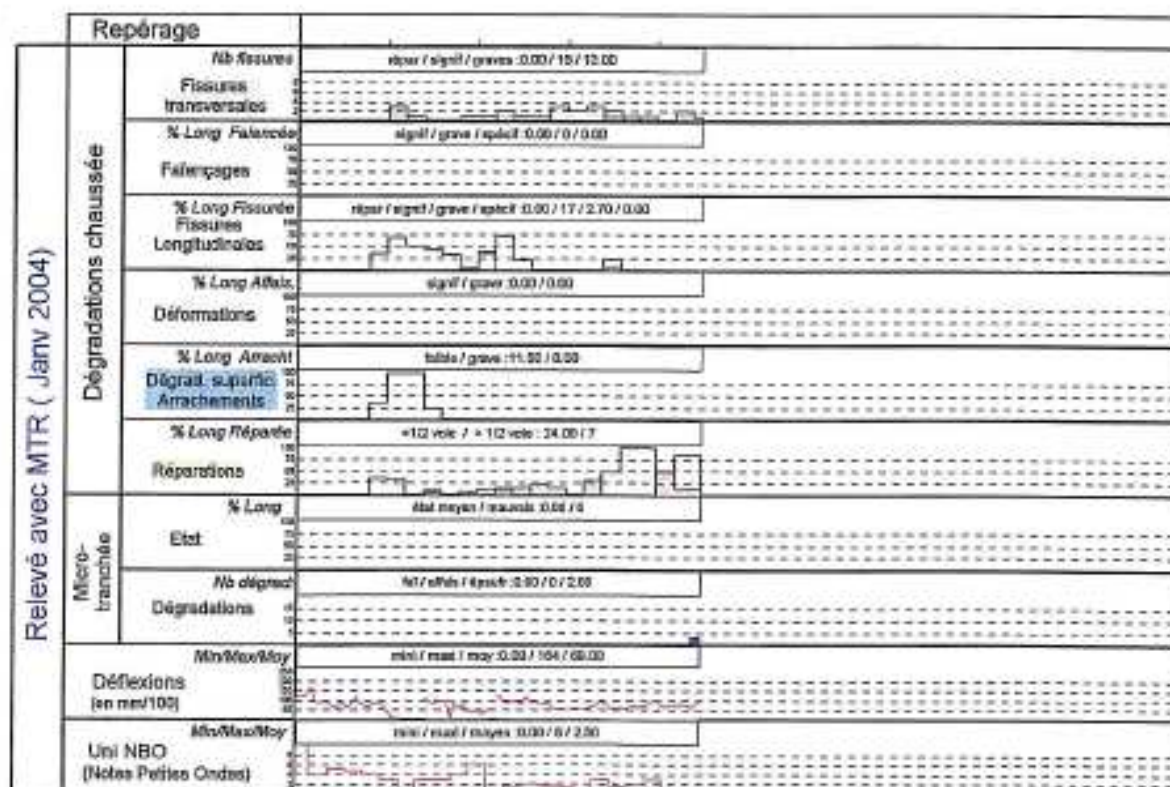
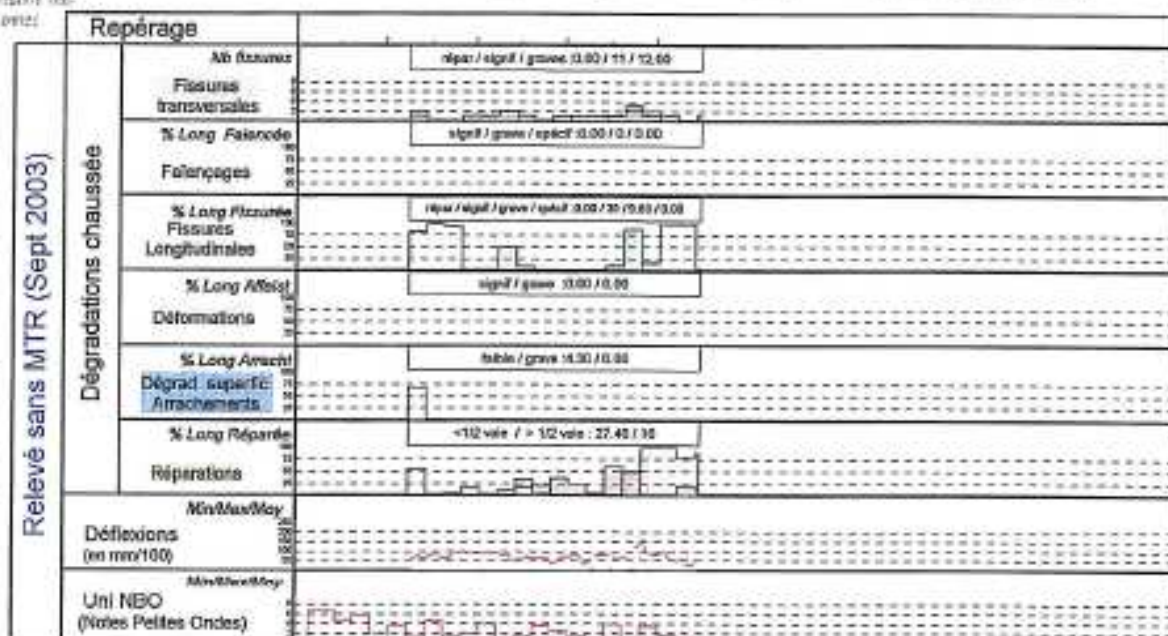
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de l'Ouest
France
Métropole
Normandie
Région de
Normandie

SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE DU Gal BINOT (1) (0 à 450m) Echelle : 1 cm pour 70 m



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Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE DU Gal BINOT (1) (0 à 450 m) Echelle : 1 cm pour 70 m

Relevé à un an (Sept 2004)		Repérage	
Dégradations chaussée	Nb fissures		type / largeur / profondeur 0.00 / 20 / 1.00
	Fissures transversales		
	% Long Falencade		type / largeur / profondeur 0.00 / 0 / 0.00
	Falencades		
	% Long Fissures Longitudinales		type / largeur / profondeur 0.00 / 14 / 0.00 / 0.00
	Fissures Longitudinales		
	% Long Affaiblissements		type / largeur 0.00 / 0.00
	Déformations		
	% Long Anfractuosités		type / largeur 0.00 / 0.00
	Dégradations Anfractuosités		
Micro-tranchée	% Long Réparations		+1/2 voie / = 1/2 voie 1.00 / 0
	Réparations		
	% Long Etat		état moyen / mauvais 0.00 / 0
	Etat		
Dégradations			type / largeur / profondeur 0.00 / 4 / 0.00
Déformations (en mm/100)			
Min/Max/Moy			
Unif NBO (Notes Petites Ondes)			

Relevé à deux ans ()		Repérage	
Dégradations chaussée	Nb fissures		
	Fissures transversales		
	% Long Falencade		
	Falencades		
	% Long Fissures Longitudinales		
	Fissures Longitudinales		
	% Long Affaiblissements		
	Déformations		
	% Long Anfractuosités		
	Dégradations Anfractuosités		
Micro-tranchée	% Long Réparations		
	Réparations		
	% Long Etat		
	Etat		
Dégradations			
Déformations (en mm/100)			
Min/Max/Moy			
Unif NBO (Notes Petites Ondes)			

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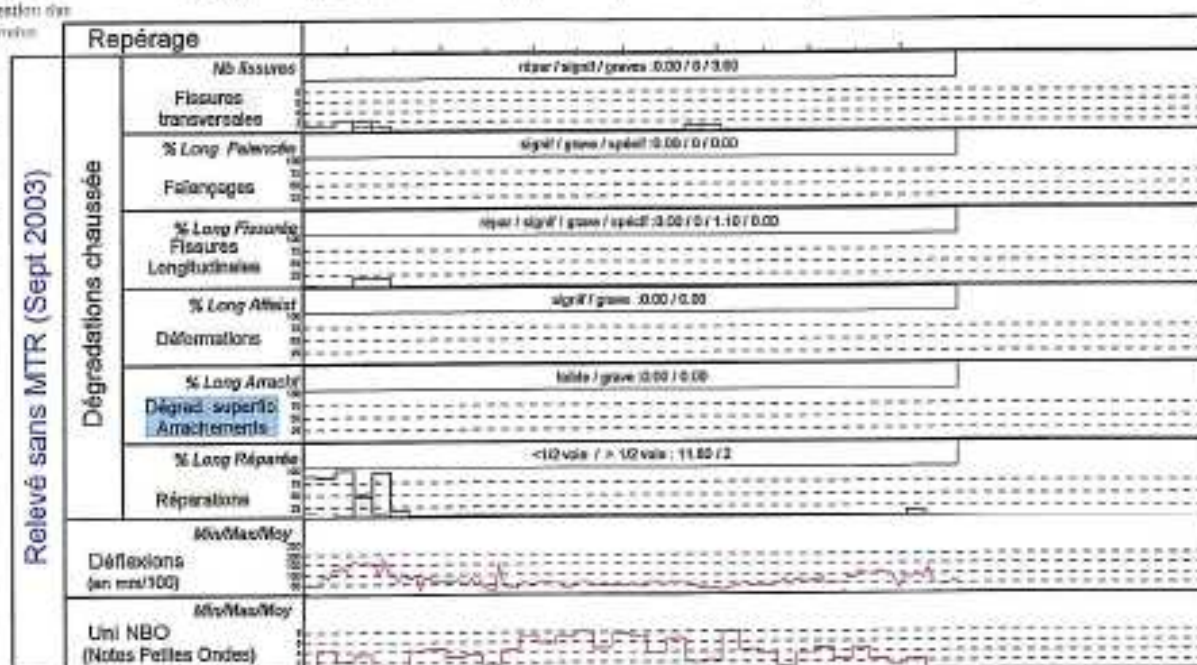
SUIVI DES MICRO-TRANCHEES

Dossier : 39387

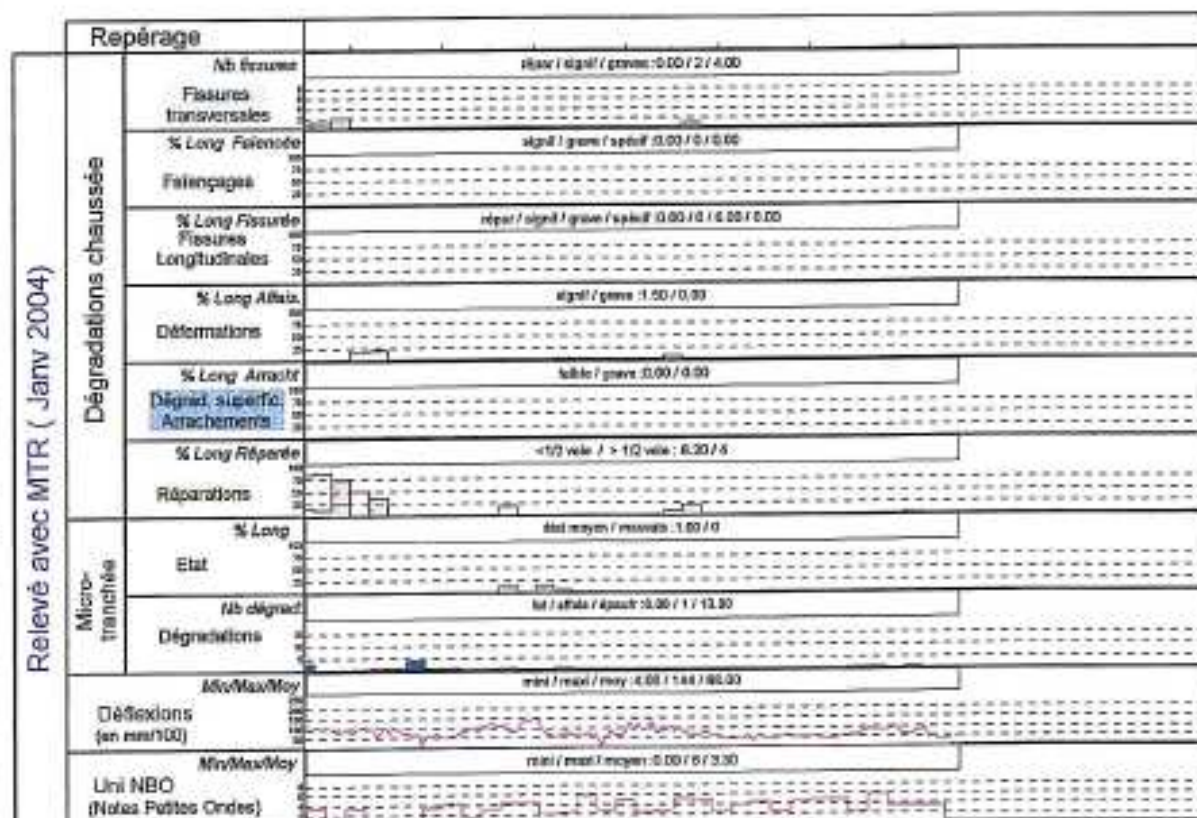
SITE : COSNE-SUR-LOIRE

Voie : RUE DU Gai BINOT (2) (450 à 1160m) Echelle : 1 cm pour 70 m

Relevé sans MTR (Sept 2003)



Relevé avec MTR (Janv 2004)



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SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE DU Gal BINOT (2) (450 à 1160 m) Echelle : 1 cm pour 70 m

Relevé à un an (Sept 2004)

Repérage		
Dégradations chaussée	Nb fissures	signif / signif / graves 0.00 / 0 / 0.00
	Fissures transversales	
	% Long Falencée	signif / grave / spétif 0.00 / 0 / 0.00
	Falencages	
	% Long Fissure	signif / signif / grave / spétif 0.00 / 0 / 0.00 / 0.00
	Fissures Longitudinales	
	% Long Affais	signif / grave 0.00 / 0.00
	Déformations	
	% Long Arraché	faible / grave 0.00 / 0.00
Micro-tranchée	Dégâts superficiels Arrachements	
	% Long Réparée	< 1/2 voie : 0 / 1/2 voie : 0.00 / 1
	Réparations	
Micro-tranchée	% Long Etat	Etat moyen / mauvaise 0.00 / 1
	Nb dégradations	fa / affais / spétif 0.00 / 0 / 0.00
Déflexions (en mm/100)		Min/Max/Moy 150 100 50
Uni NBO (Notes Petites Ondes)		Min/Max/Moy 1 1 1

Relevé à deux ans ()

Repérage		
Dégradations chaussée	Nb fissures	
	Fissures transversales	
	% Long Falencée	
	Falencages	
	% Long Fissure	
	Fissures Longitudinales	
	% Long Affais	
	Déformations	
	% Long Arraché	
Micro-tranchée	Dégâts superficiels Arrachements	
	% Long Réparée	
	Réparations	
Micro-tranchée	% Long Etat	
	Nb dégradations	
Déflexions (en mm/100)		Min/Max/Moy 150 100 50
Uni NBO (Notes Petites Ondes)		Min/Max/Moy 1 1 1

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SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE DU Gal BINOT (3) (1160 à 1619m) Echelle : 1 cm pour 70 m

Reperage		
Relevé sans MTR (Sept 2003)	Nb fissures	répar / signal / graves : 0.00 / 2 / 0.00
	Fissures transversales	
	% Long Falencée	signal / grave / réparé : 0.00 / 0 / 0.00
	Falencages	
	% Long Fissure	répar / signal / grave / réparé : 0.00 / 0 / 0.00 / 0.00
	Fissures Longitudinales	
	% Long Affais	signal / grave : 0.00 / 0.00
	Déformations	
	% Long Amoch	forte / grave : 0.00 / 0.00
	Dégrad. superfic. Arrachements	
	% Long Réparée	< 1/2 voie : 0.00 / 0
	Réparations	
Déflexions (en mm/100)		Min/Max/Moy
Uni NBO (Notes Petites Ondes)		Min/Max/Moy

Reperage		
Relevé avec MTR (Janv 2004)	Nb fissures	répar / signal / graves : 0.00 / 0 / 1.00
	Fissures transversales	
	% Long Falencée	signal / grave / réparé : 0.00 / 0 / 0.00
	Falencages	
	% Long Fissure	répar / signal / grave / réparé : 0.00 / 0 / 0.00 / 0.00
	Fissures Longitudinales	
	% Long Affais	signal / grave : 0.00 / 0.00
	Déformations	
	% Long Amoch	forte / grave : 1.00 / 0.00
	Dégrad. superfic. Arrachements	
	% Long Réparée	< 1/2 voie : 0.00 / 0
	Réparations	
Micro-tranchée	% Long	état moyen / mauvais : 0.00 / 0
	Etat	
	Nb dégrad. Dégradations	fort / affais / réparé : 0.00 / 0 / 7.00
Déflexions (en mm/100)		Min/Max/Moy
Uni NBO (Notes Petites Ondes)		Min/Max/Moy

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SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Vole : RUE DU Gal BINOT (3) (1190 à 1619 m) Echelle : 1 cm pour 70 m

Repérage																												
Dégradations chaussée	No fissures	répar / régré / grave : 0.00 / 0 / 0.00																										
	Fissures transversales	75 80 85 90																										
	% Long Falencée	sigil / grave / épilcé : 0.00 / 0 / 0.00																										
	Falencages	75 80 85 90																										
	% Long Fissurée	répar / régré / grave / épilcé : 0.00 / 0 / 0.00 / 0.00																										
	Fissures Longitudinales	75 80 85 90																										
	% Long Affaib	sigil / grave : 0.00 / 0.00																										
	Déformations	75 80 85 90																										
	% Long Amoch	table / grave : 0.00 / 0.00																										
	Regrat superfic macrohomom																											
Micro-tranchée	% Long Réparée	+1/2 mls / + 1/2 mls : 0.00 / 0																										
	Réparations																											
	% Long Etat	Mat moyen / mauvais : 0.00 / 0																										
	No dégrad	fil / affaib / épilcé : 0.00 / 0 / 0.00																										
Dégradations																												
Déflexions (en mm/100)		Min/Max/Moy																										
Uni NBO (Notes Petites Ondes)		Min/Max/Moy																										

Repérage			
Relevé à deux ans ()	Dégradations chaussée	No fissures	
		Fissures transversales	
		% Long Falencée	
		Falencages	
		% Long Fissure	
		Fissures Longitudinales	
		% Long Affaib	
		Déformations	
	% Long Amoch		
	Dégradations		
	% Long Réparée		
	Réparations		
	Micro-tranchée	% Long	
		Etat	
No dégrad			
Dégradations			
Min/Max/Moy			
Déflexions (en mm/100)			
Min/Max/Moy			
Uni NBO (Notes Petites Ondes)			

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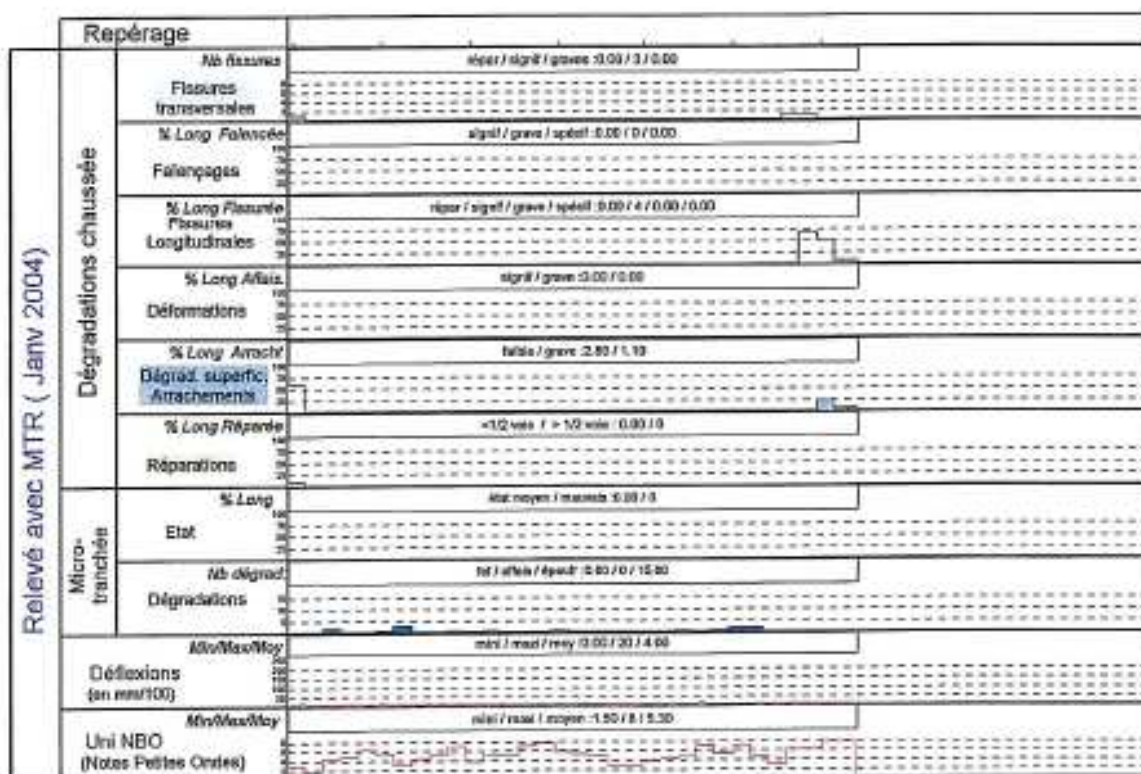
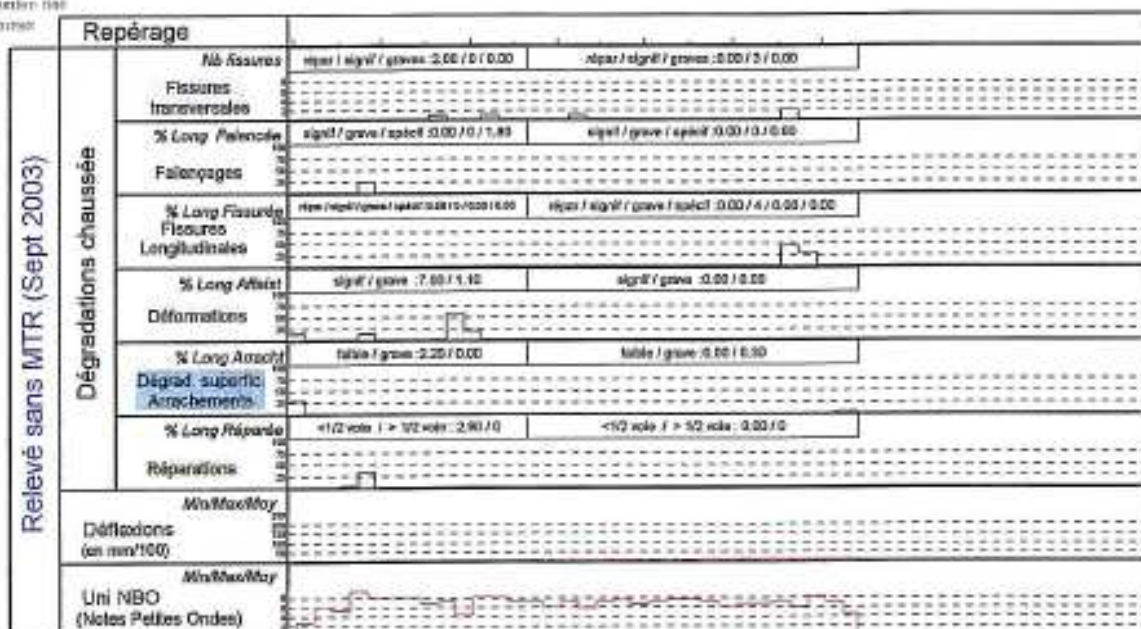
Voie : 10
Garde : 10
Garde : 10

SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE DU Gal BINOT (4) (1694 à 2341m) Echelle : 1 cm pour 70 m



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SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE DU Gal BINOT (4) (1694 à 2341 m) Echelle : 1 cm pour 70 m

relevé à un an (sept 2004)

Repérage		
Dégradations chaussée	Nb fissures	signif / grave / 0.00 / 1 / 0.00
	Fissures transversales	
	% Long Falencée	signif / grave / split / 0.00 / 0 / 0.00
	Falencages	
	% Long Fissurée	signif / signif / grave / split / 0.00 / 0 / 0.00 / 0.00
	Fissures Longitudinales	
	% Long Affaib.	signif / grave / 0.00 / 0.00
	Déformations	
	% Long Amoché	balise / grave / 0.00 / 0.00
	Dégrad. superficielles / Amochements	
Micro-tranchée	% Long Réparée	<1/2 voie / >1/2 voie / 0.00 / 0
	Réparations	
	% Long Etat	état moyen / mauvais / 0.00 / 0
Micro-tranchée	Nb dégrad. Dégradations	0 / 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10
	Min/Max/Moy	
	Déflexions (en mm/100)	
Micro-tranchée	Min/Max/Moy	
	Uni NBO (Notes Petites Ondes)	

relevé à deux ans ()

Repérage		
Dégradations chaussée	Nb fissures	
	Fissures transversales	
	% Long Falencée	
	Falencages	
	% Long Fissurée	
	Fissures Longitudinales	
	% Long Affaib.	
	Déformations	
	% Long Amoché	
	Dégrad. superficielles / Amochements	
Micro-tranchée	% Long Réparée	
	Réparations	
	% Long Etat	
Micro-tranchée	Nb dégrad. Dégradations	
	Min/Max/Moy	
	Déflexions (en mm/100)	
Micro-tranchée	Min/Max/Moy	
	Uni NBO (Notes Petites Ondes)	

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Dossier : 39387

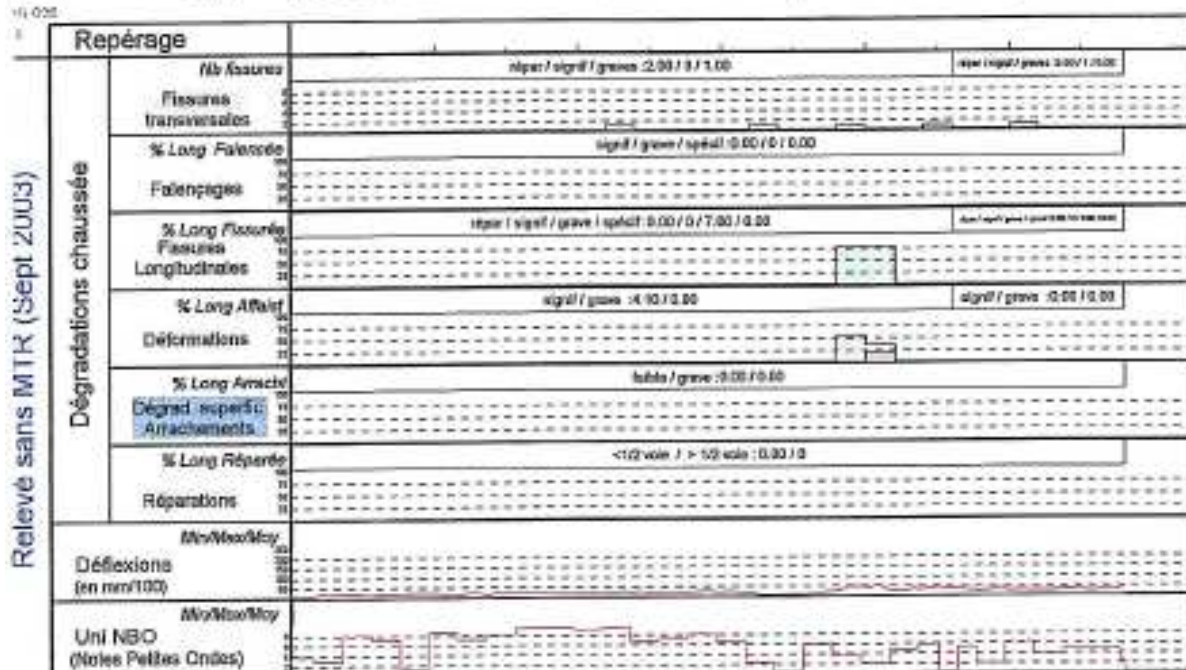
SITE : COSNE-SUR-LOIRE

Voie : RUE DE NABERIS

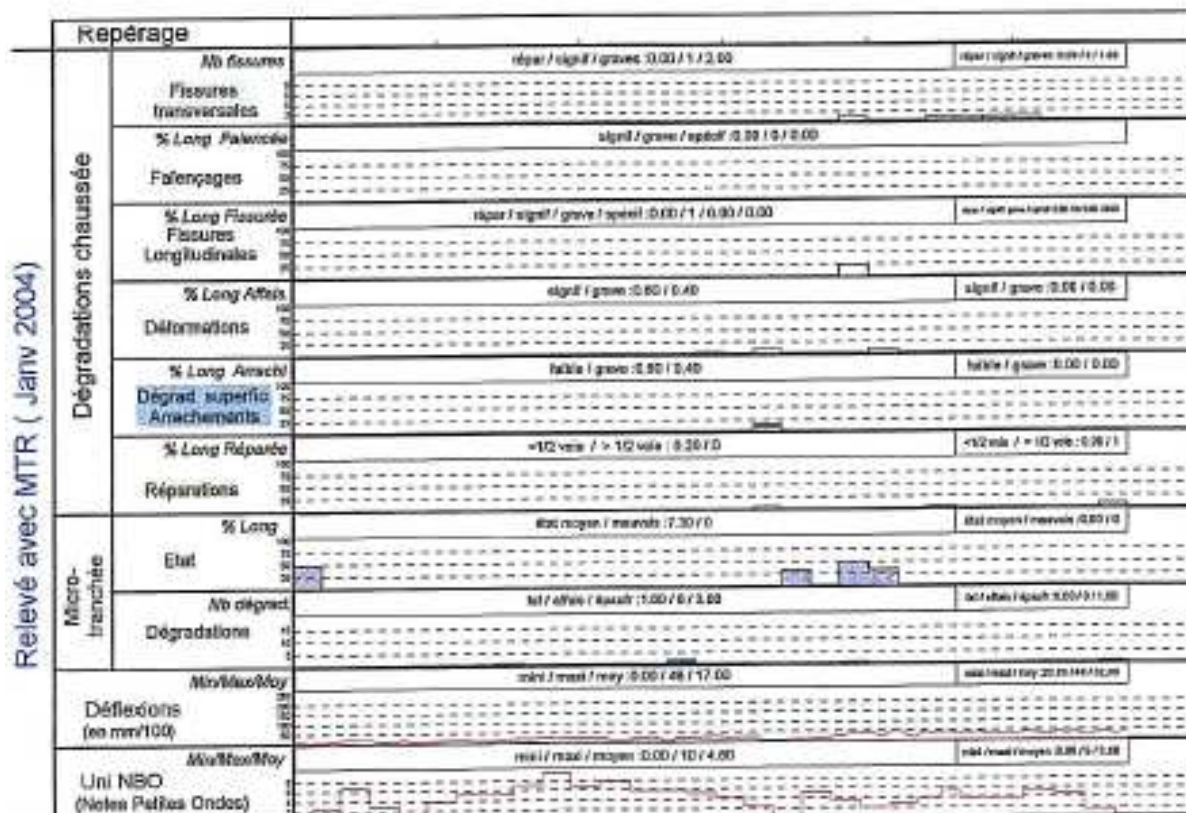
(0 à 580m)

Echelle : 1 cm pour 45 m

Relevé sans MTR (Sept 2003)



Relevé avec MTR (Janv 2004)



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SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE DE NABERIS

(0 à 580 m)

Echelle : 1 cm pour 70 m

Relevé à un an (Sept 2004)		Repérage	
Dégradations chaussée	Nb fissures		signif / signif / grave : 0.00 / 1 / 0.00
	Fissures transversales		
	% Long Falencée		signif / grave / signif : 0.00 / 0 / 0.00
	Fallencées		
	% Long Fissures Longitudinales		signif / signif / grave / signif : 0.00 / 2 / 0.00 / 0.00
	Fissures Longitudinales		
	% Long Affais		signif / grave : 0.00 / 0.00
	Déformations		
	% Long Amoch		forte / grave : 0.00 / 0.00
	Dégrad. superficielles transversales		
Micro-tranchée	% Long Réparée		< 1/2 voie / > 1/2 voie : 0.00 / 0
	Réparations		
	% Long Etat		état moyen / mauvais : 0.00 / 0
Déflections (en mm/100)			
Uni NBO (Notes Petites Ondes)			

Relevé à deux ans ()		Repérage	
Dégradations chaussée	Nb fissures		
	Fissures transversales		
	% Long Falencée		
	Fallencées		
	% Long Fissures Longitudinales		
	Fissures Longitudinales		
	% Long Affais		
	Déformations		
	% Long Amoch		
	Dégrad. superficielles transversales		
Micro-tranchée	% Long Réparée		
	Réparations		
	% Long Etat		
Déflections (en mm/100)			
Uni NBO (Notes Petites Ondes)			

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SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RD 243 (1)

(0 à 440 m)

Echelle : 1 cm pour 70 m

Relevé à un an (Sept 2004)	Repérage		
	Dégradations chaussée	Nb fissures	strie / signal / grave : 0.00 / 2 / 0.00
		Fissures transversales	
		% Long Falcotée	signal / grave / signal : 0.00 / 0 / 0.00
		Falencages	
		% Long Fissure Fissures Longitudinales	strie / signal / grave / signal : 0.00 / 4 / 0.00 / 0.00
		% Long Affais	signal / grave : 0.00 / 0.00
		Déformations	
		% Long Arraché	signal / grave : 0.00 / 0.00
	Micro-tranchée	Dégradations	
		% Long Réparation	< 1/2 voie / > 1/2 voie : 25.70 / 0
		Reparations	
		% Long	strie / signal / grave : 0.00 / 0
	Etat	Nb dégrad.	strie / signal / grave : 0.00 / 0 / 47.00
		Dégradations	
	Min/Max/Moy		
	Déflexions (en mm/100)		
	Min/Max/Moy		
	Uni NBO (Notes Petites Ondes)		

Relevé à deux ans ()	Repérage		
	Dégradations chaussée	Nb fissures	
		Fissures transversales	
		% Long Falcotée	
		Falencages	
		% Long Fissure Fissures Longitudinales	
		% Long Affais	
		Déformations	
		% Long Arraché	
	Micro-tranchée	Dégradations	
		% Long Réparation	
		Reparations	
		% Long	
	Etat	Nb dégrad.	
		Dégradations	
	Min/Max/Moy		
	Déflexions (en mm/100)		
	Min/Max/Moy		
	Uni NBO (Notes Petites Ondes)		

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Unité : m
Section : 100
Date :

SUIVI DES MICRO-TRANCHEES

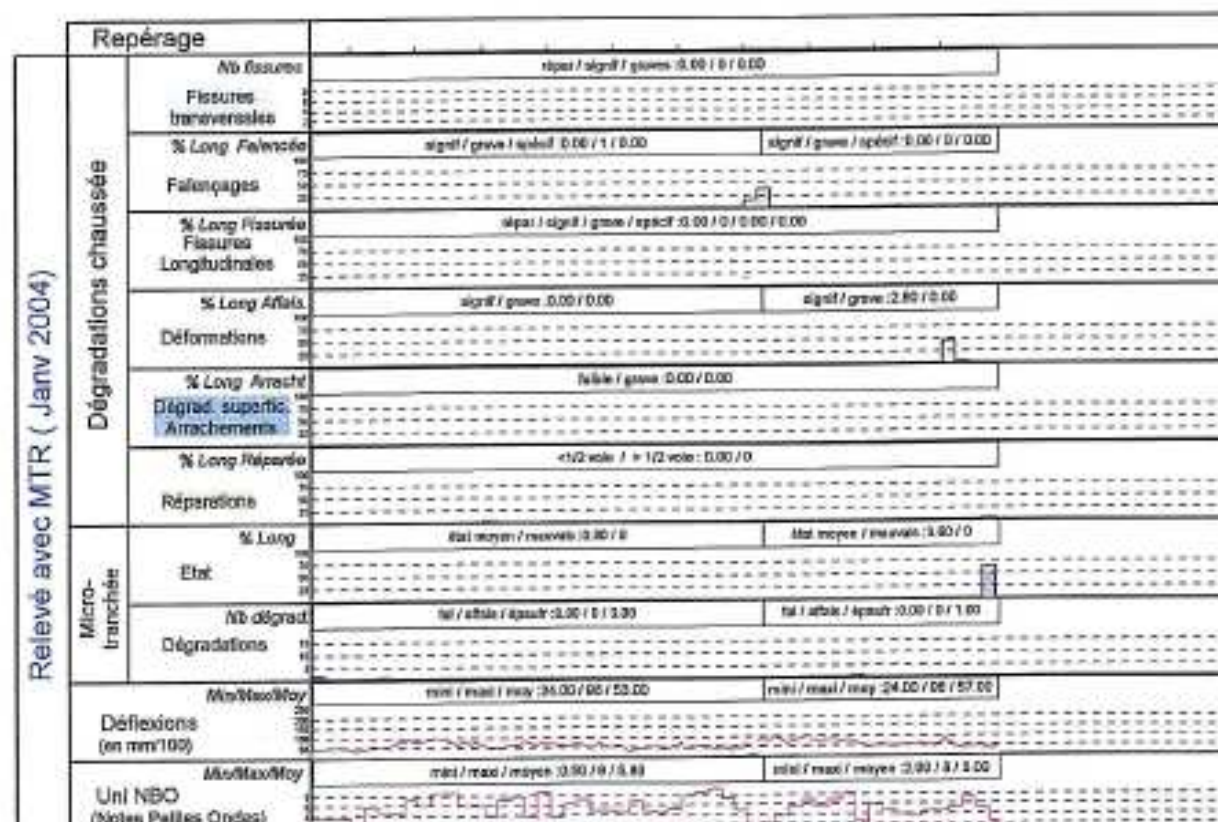
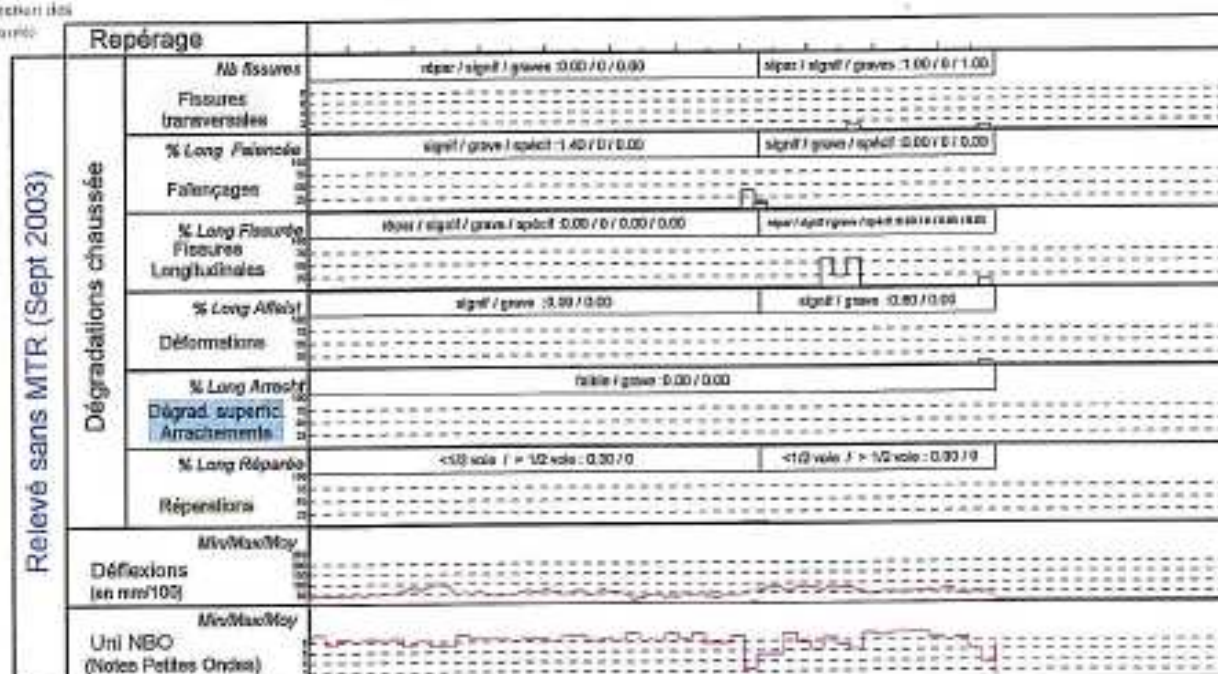
Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RD 243 (2)

(440 à 1485m)

Echelle : 1 cm pour 100 m



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SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RD 243 (2)

(440 à 1485 m)

Echelle : 1 cm pour 100 m

Relevé à un an (Sept 2004)

Repérage		
Dégradations chaussée	Nb fissures	réparé / signalé / grave : 0.00 / 1 / 0.00
	Fissures transversales	
	% Long Faisnése	signalé / grave / signalé : 0.00 / 0 / 12.00
	Falénages	
	% Long Fissure Fissures Longitudinales	réparé / signalé / grave / signalé : 0.00 / 2 / 0.00 / 0.00
	% Long Affais	signalé / grave : 0.00 / 0.00
	Déformations	
	% Long Arraché	réparé / grave : 0.00 / 0.00
	Dégradations	
	% Long Réparé	réparé / grave : 0.00 / 0.00
Micro-tranchée	% Long	état moyen / mauvais : 0.00 / 0
	Etat	
	Nb dégrad	réparé / signalé / grave : 0.00 / 0 / 0.00
Dégradations		
Déflexions (en mm/100)		
Min/Max/Moy		
Unit NBO (Notes Pelles Ondes)		

Relevé à deux ans ()

Repérage		
Dégradations chaussée	Nb fissures	
	Fissures transversales	
	% Long Faisnése	
	Falénages	
	% Long Fissure Fissures Longitudinales	
	% Long Affais	
	Déformations	
	% Long Arraché	
	Dégradations	
	% Long Réparé	
Micro-tranchée	% Long	
	Etat	
	Nb dégrad	
Dégradations		
Déflexions (en mm/100)		
Min/Max/Moy		
Unit NBO (Notes Pelles Ondes)		

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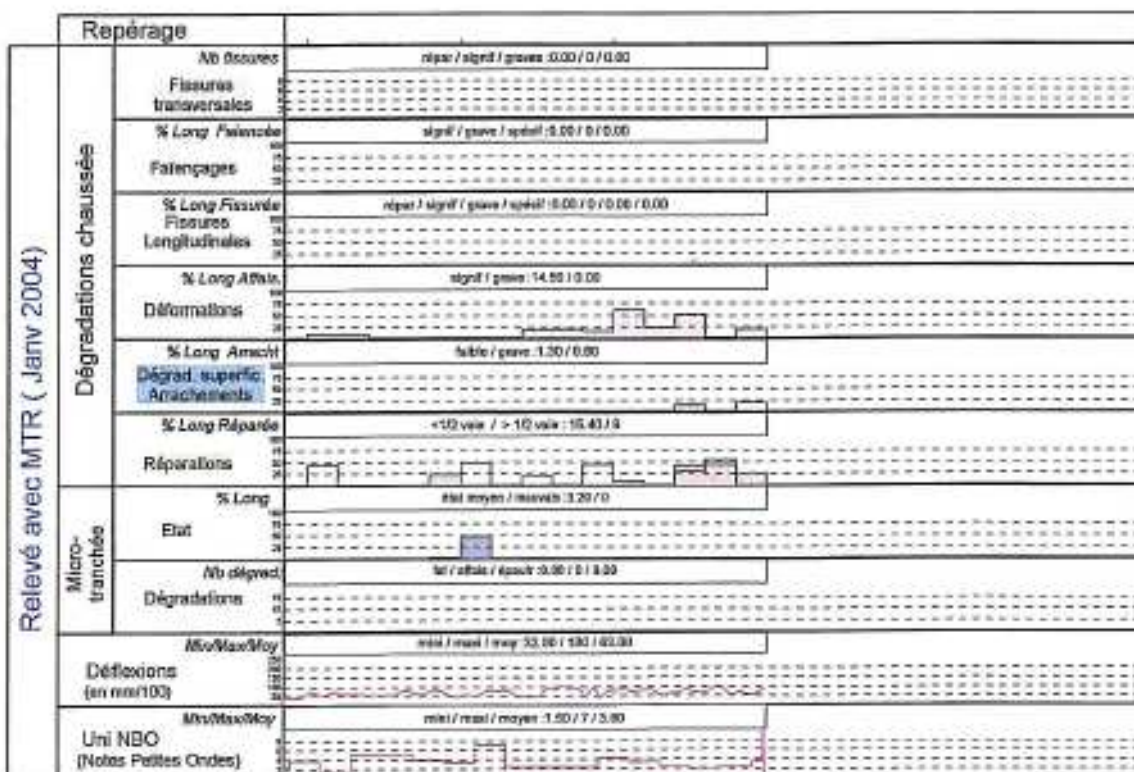
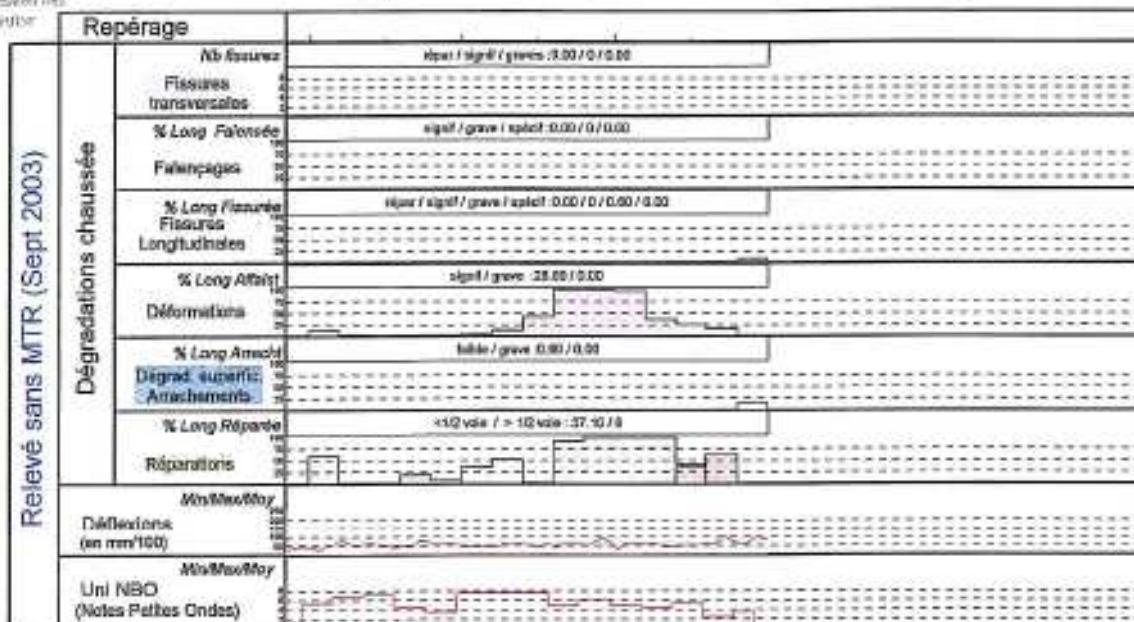
Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RD 243 (3)

(1485 à 1800m)

Echelle : 1 cm pour 40 m



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SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RD 243 (3)

(1485 à 1800 m)

Echelle : 1 cm pour 40 m

Relevé à un an (Sept 2004)		Repérage	
Dégradations chaussée	Nb fissures	répar / signal / grave	0.00 / 0 / 0.00
	Fissures transversales		
	% Long Falencée	signal / grave / signal	0.00 / 0 / 0.00
	Falencées		
	% Long Fissurée	répar / signal / grave / signal	0.00 / 1 / 0.00 / 0.00
	Fissures Longitudinales		
	% Long Affaie	signal / grave	0.00 / 0.00
	Déformations		
	% Long Arraché	signal / grave	0.00 / 0.00
	Dégrad. superficielles / Arrachements		
Micro-tranchée	% Long Réparée	~1/2 voie / ~ 1/2 voie	18.50 / 8
	Réparations		
	% Long Etat	état moyen / mauvais	8.00 / 0
	Etat		
	Nb dégrad. Dégradations	tel / autres / signal	0.00 / 0 / 0.00
	Dégradations		
	Min/Max/Moy		
	Déflexions (en mm/100)		
	Min/Max/Moy		
	Uni NBO (Notes Petites Ondes)		

Relevé à deux ans ()		Repérage	
Dégradations chaussée	Nb fissures		
	Fissures transversales		
	% Long Falencée		
	Falencées		
	% Long Fissurée		
	Fissures Longitudinales		
	% Long Affaie		
	Déformations		
	% Long Arraché		
	Dégrad. superficielles / Arrachements		
Micro-tranchée	% Long Réparée		
	Réparations		
	% Long Etat		
	Etat		
	Nb dégrad. Dégradations		
	Dégradations		
	Min/Max/Moy		
	Déflexions (en mm/100)		
	Min/Max/Moy		
	Uni NBO (Notes Petites Ondes)		

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SUIVI DES MICRO-TRANCHEES

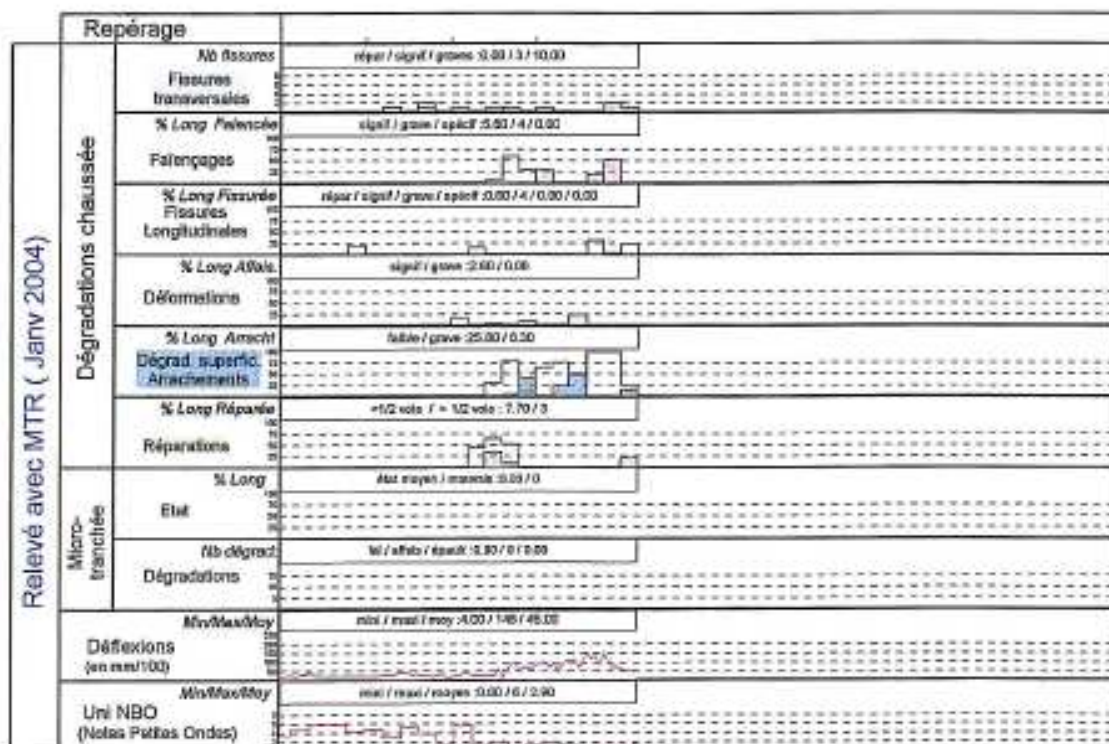
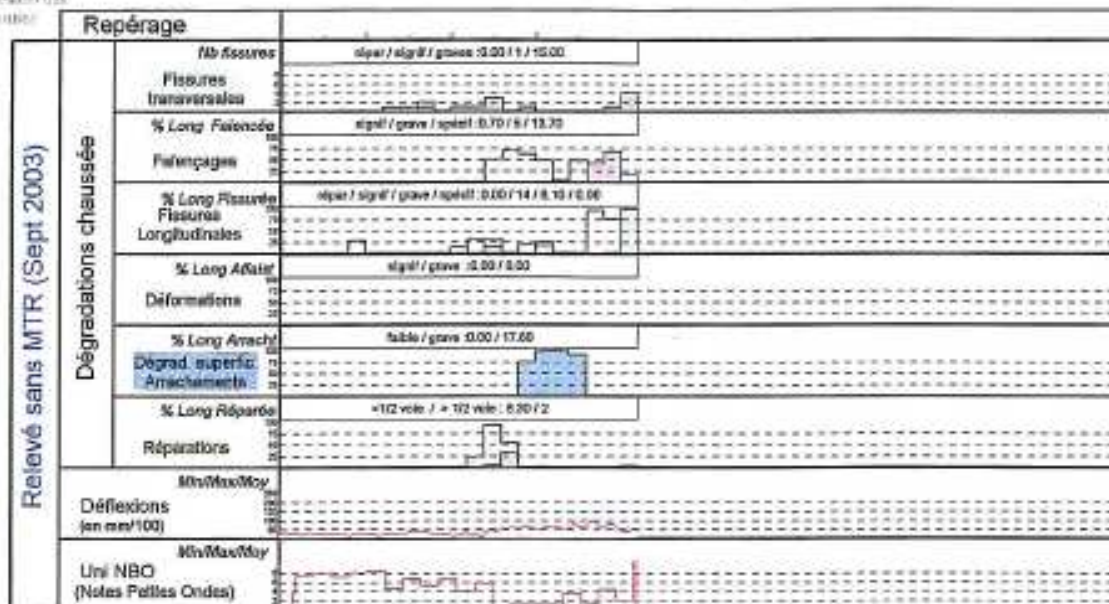
Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE HENRI DUNANT

(0 à 420m)

Echelle : 1 cm pour 70 m



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Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE HENRI DUNANT (0 à 420 m) Echelle : 1 cm pour 70 m

Relevé à un an (Sept 2004)		Repérage	
Dégradations chaussée	Nb fissures	nbpar / signif / grave 0.00 / 0 / 0.00	
	Fissures transversales		
	% Long Falencée	signif / grave / split 5.30 / 0 / 0.00	
	Falencages		
	% Long Fissure	nbpar / signif / grave / split 0.00 / 0 / 0.00 / 0.00	
	Fissures Longitudinales		
	% Long Affais.	signif / grave 0.00 / 0.00	
	Déformations		
	% Long Arraché	tulle / grave 0.00 / 0.00	
	Arrachements		
Micro-tranchée	% Long Réparée	< 10 vide / > 10 vide : 5.30 / 0	
	Réparations		
	% Long Etat	état moyen / mauvais 0.00 / 0	
Dégradations	Nb dégrad.	sur / arraché / déformé 0.00 / 0 / 0.00	
	Dégradations		
	Min/Max/Moy		
Déflexions	(en mm/100)		
	Min/Max/Moy		
	Uni NBO (Notes Petites Ondes)		

Relevé à deux ans ()		Repérage	
Dégradations chaussée	Nb fissures		
	Fissures transversales		
	% Long Falencée		
	Falencages		
	% Long Fissure		
	Fissures Longitudinales		
	% Long Affais.		
	Déformations		
	% Long Arraché		
	Arrachements		
Micro-tranchée	% Long Réparée		
	Réparations		
	% Long Etat		
Dégradations	Nb dégrad.		
	Dégradations		
	Min/Max/Moy		
Déflexions	(en mm/100)		
	Min/Max/Moy		
	Uni NBO (Notes Petites Ondes)		

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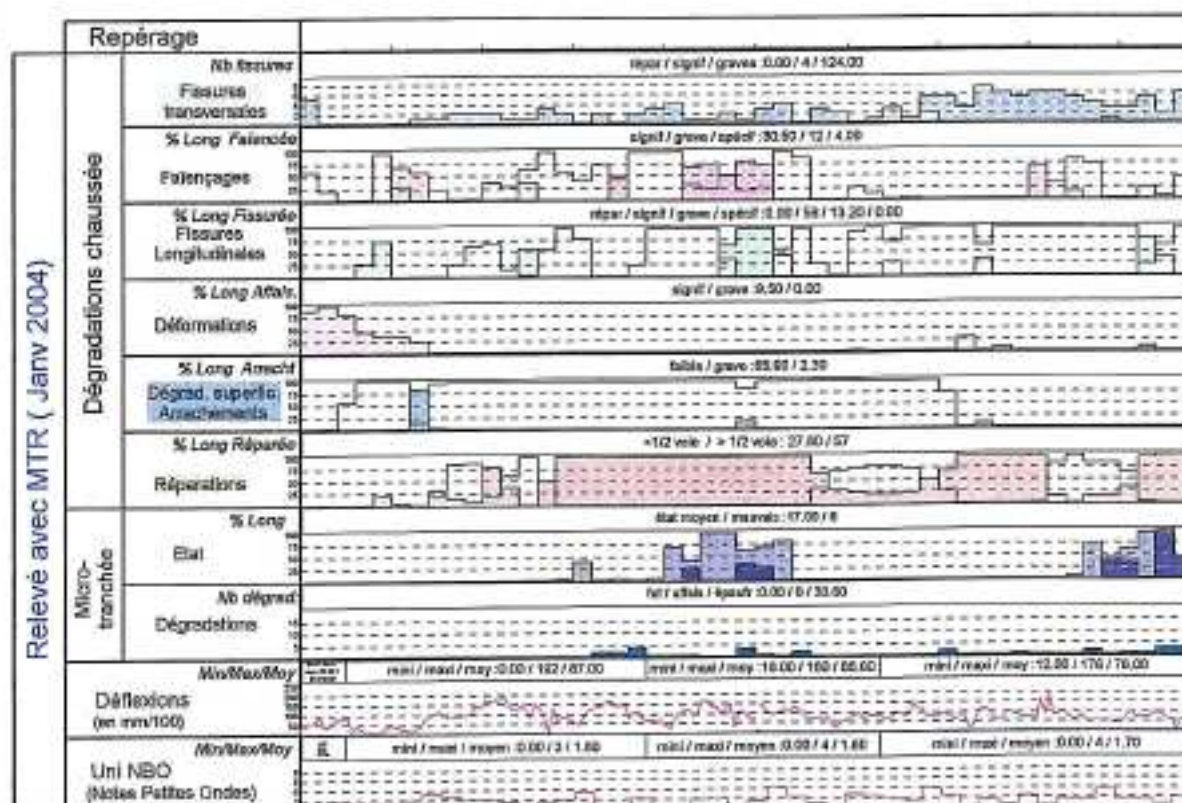
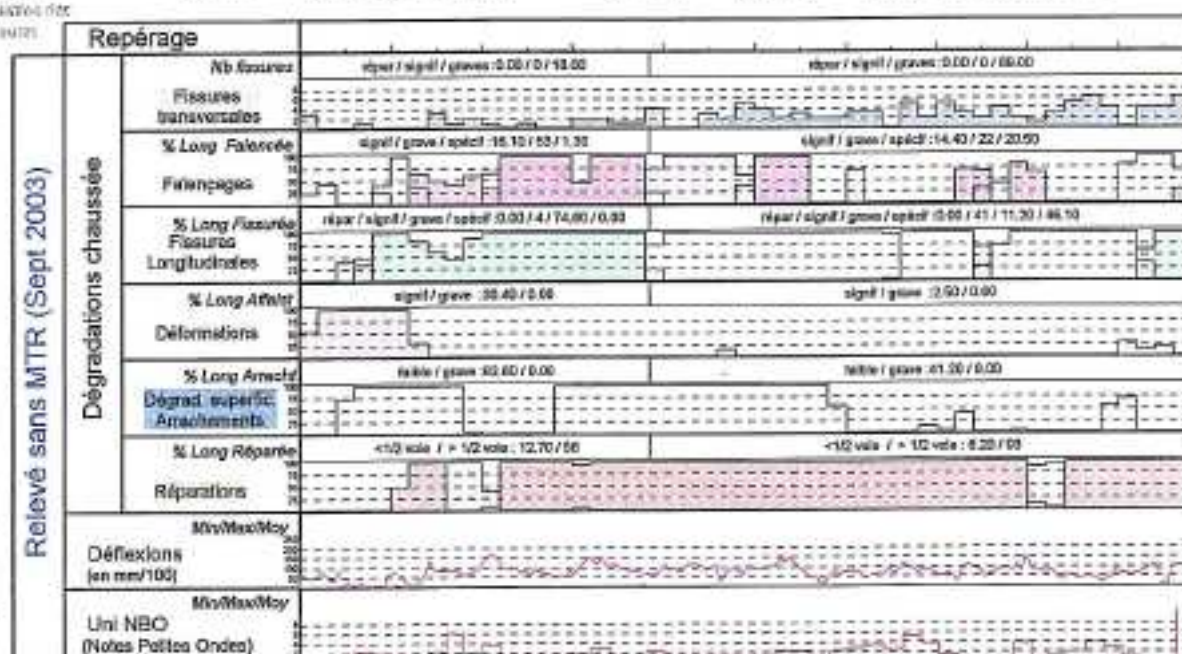
10/07/03

SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE DU Col. RABIER (0 4 980m) Echelle : 1 cm pour 70 m



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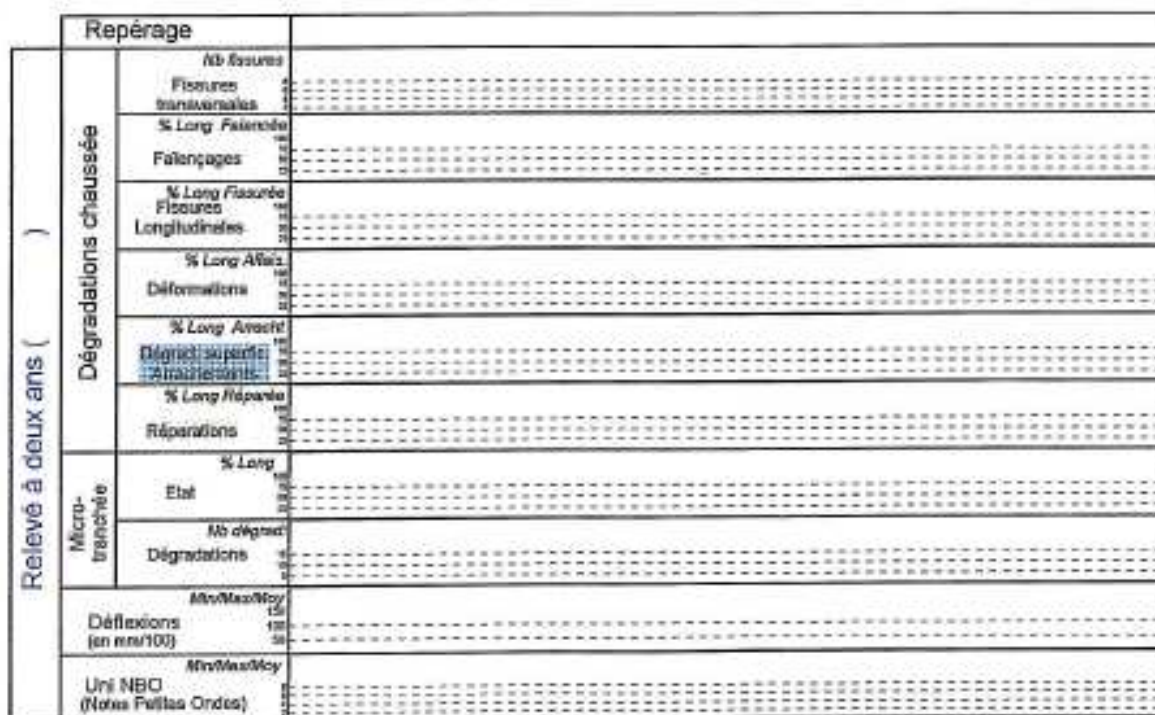
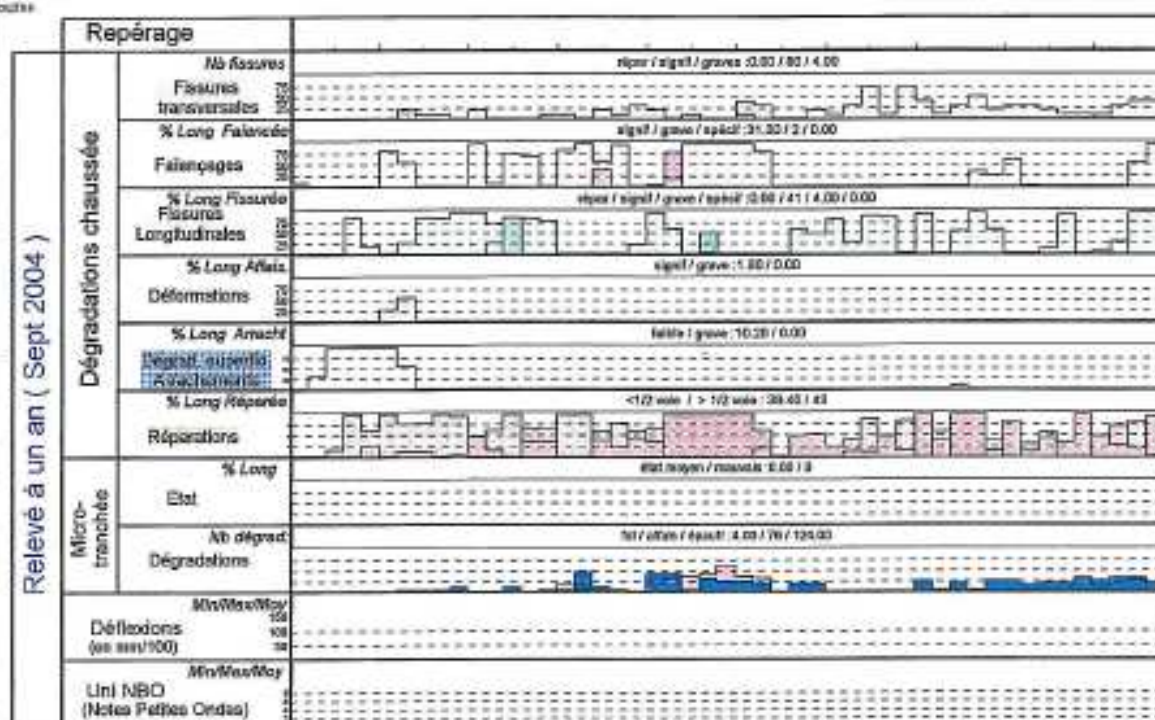
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et l'Ouest
architecture
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Gestion des
Coutiers

SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE DU Col. RABIER (0 à 980 m) Echelle : 1 cm pour 70 m



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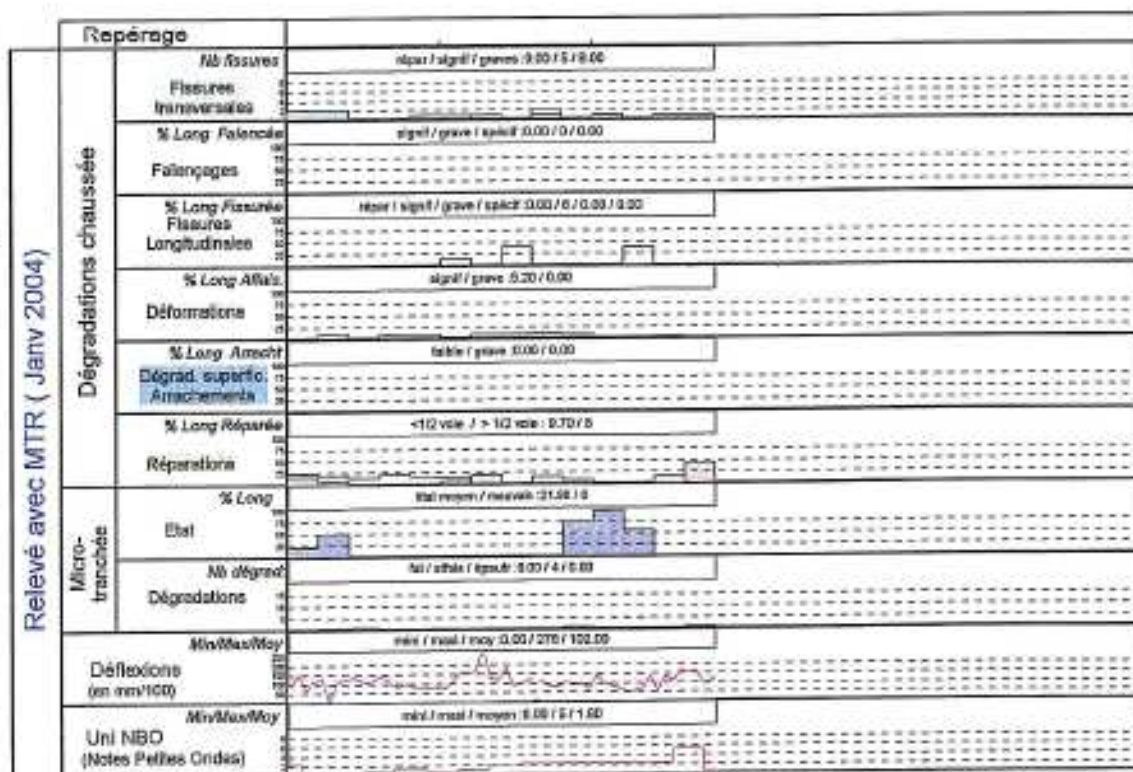
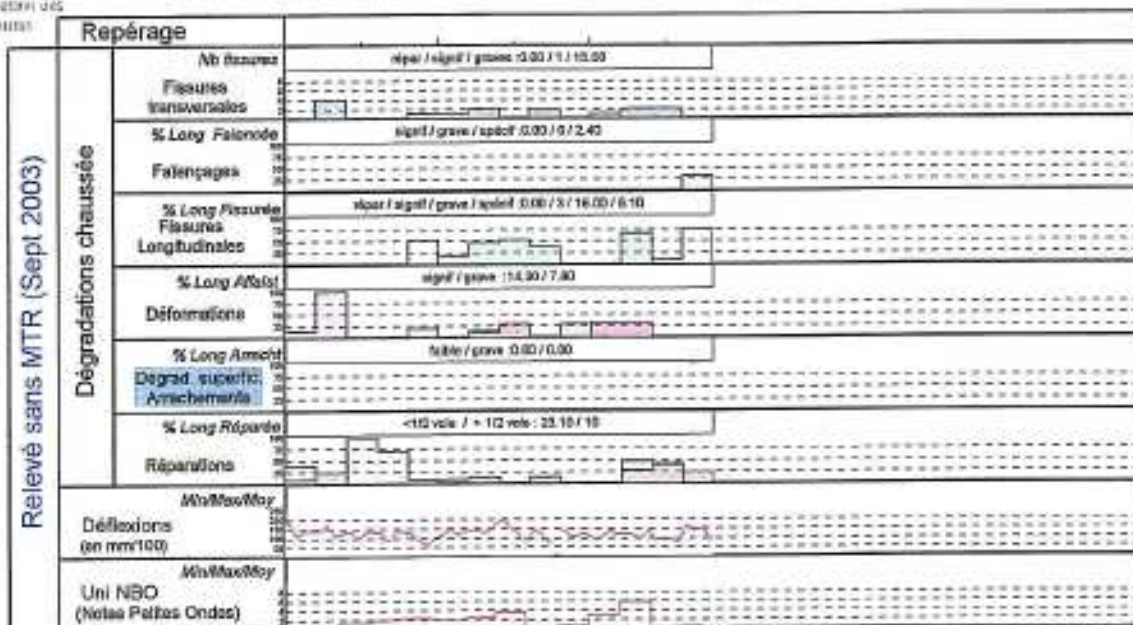
SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE RIVIERE ST-AGNAN (0 à 280m)

Echelle : 1 cm pour 40 m



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Travaux

SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE RIVIERE ST-AGNAN (0 à 280 m) Echelle : 1 cm pour 40 m

Repérage		
Relevé à un an (Sept 2004)	Dégradations chaussée	Nb fissures
		répar / signal / grave : 0.00 / 13 / 0.00
		Fissures transversales
		% Long Falencade
		Falencades
		% Long Fissures Longitudinales
		Fissures
		% Long Affais
		Déformations
		% Long Arraché
Relevé à deux ans ()	Dégradations chaussée	Dégradations supérieures
		Arrachements
		% Long Réparés
		Réparations
		% Long
		Etat
		Nb dégrat
		Dégradations
		Min/Max/Moy
		Déflexions (en mm/100)
Relevé à deux ans ()	Micro-tranchée	Min/Max/Moy
		Uni NBO (Notes Petites Ondes)

Repérage		
Relevé à deux ans ()	Dégradations chaussée	Nb fissures
		Fissures transversales
		% Long Falencade
		Falencades
		% Long Fissures Longitudinales
		Fissures
		% Long Affais
		Déformations
		% Long Arraché
		Dégradations supérieures
Relevé à deux ans ()	Dégradations chaussée	Arrachements
		% Long Réparés
		Réparations
		% Long
		Etat
		Nb dégrat
		Dégradations
		Min/Max/Moy
		Déflexions (en mm/100)
Relevé à deux ans ()	Micro-tranchée	Min/Max/Moy
		Uni NBO (Notes Petites Ondes)

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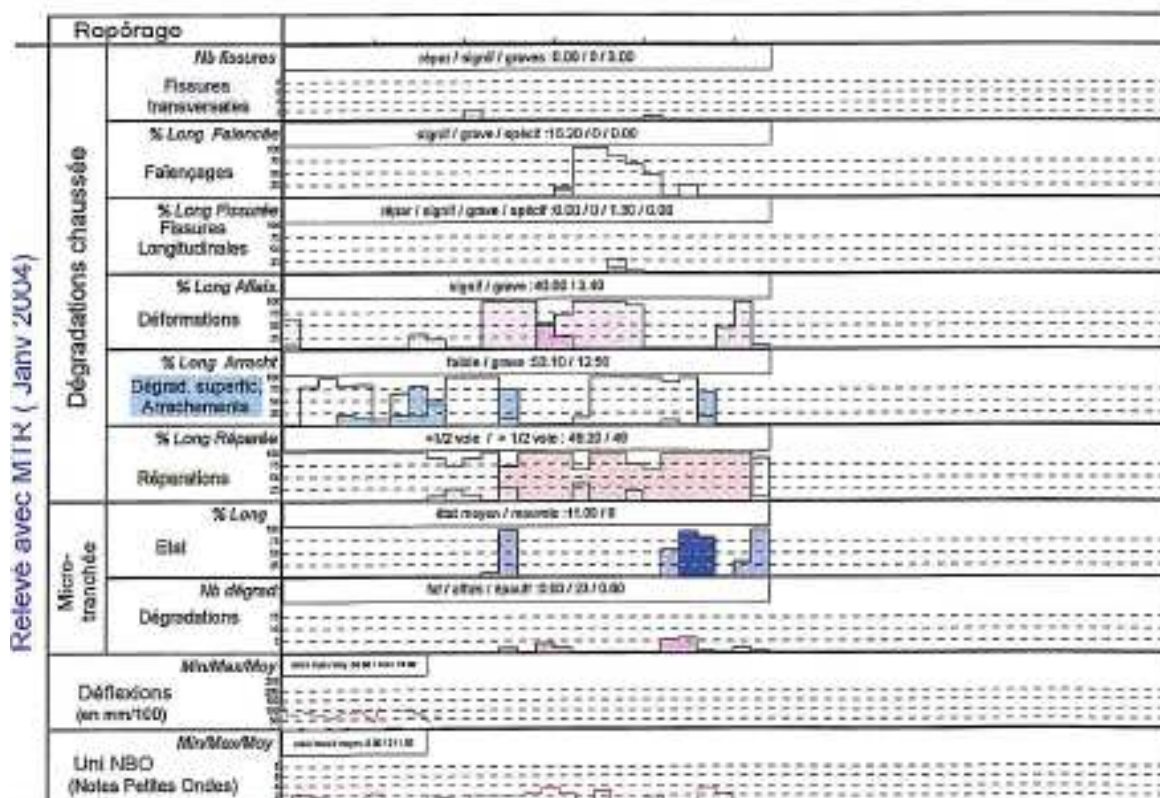
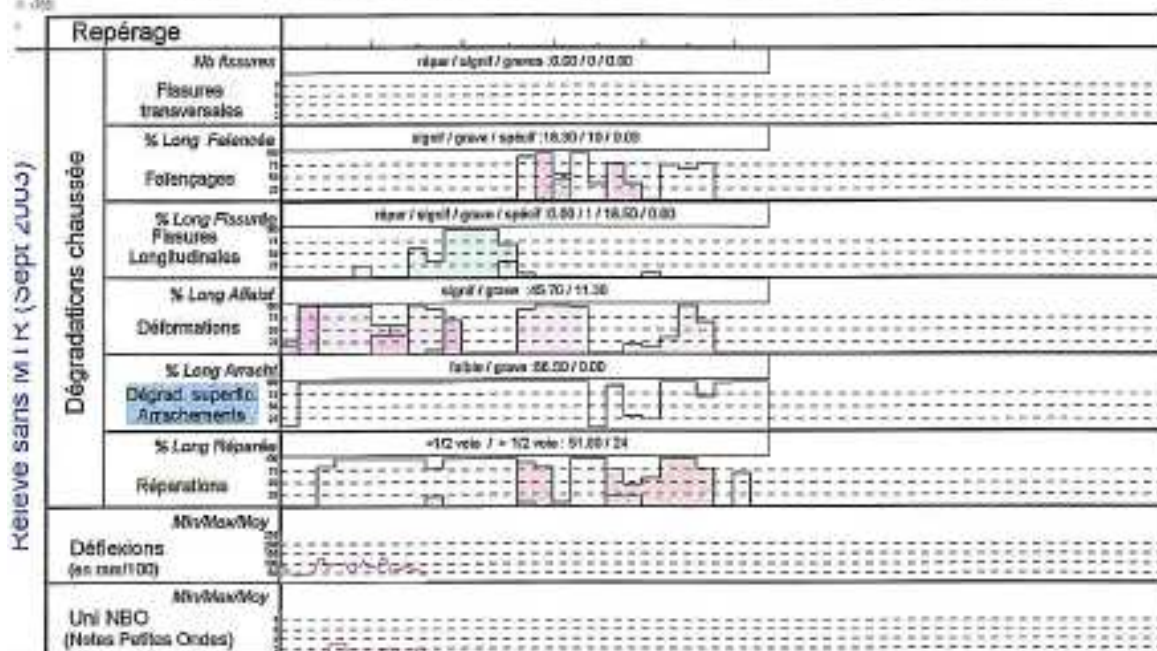
Relevé sans MTR (Sept 2003)

SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Vole : RUE DES TROIS PONTS (0 à 540m) Echelle : 1 cm pour 70 m



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SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE DES TROIS PONTS (0 à 540 m) Echelle : 1 cm pour 70 m

Relevé à un an (Sept 2004)		Reperage	
Dégradations chaussée	Nb fissures	align / align / grave 0.00 / 0.00	
	Fissures transversales		
	% Long Falencade	align / grave 0.00 / 0.00	
	Falencades		
	% Long Fissure	align / align / grave 0.00 / 0.00	
	Fissures Longitudinales		
	% Long Affais	align / grave 1.70 / 0.00	
	Déformations		
	% Long Arraché	align / grave 0.00 / 0.00	
	Arrachés		
Micro-tranchée	% Long	align / grave 0.00 / 0.00	
	Etat		
Dégradations	Nb dégrad	align / grave 0.00 / 0.00	
	Dégradations		
Min/Max/Moy			
Déflexions (en mm/100)			
Min/Max/Moy			
Uni NBO (Notes Pelles Ondes)			

Relevé à deux ans ()		Reperage	
Dégradations chaussée	Nb fissures		
	Fissures transversales		
	% Long Falencade		
	Falencades		
	% Long Fissure		
	Fissures Longitudinales		
	% Long Affais		
	Déformations		
	% Long Arraché		
	Arrachés		
Micro-tranchée	% Long		
	Etat		
Dégradations	Nb dégrad		
	Dégradations		
Min/Max/Moy			
Déflexions (en mm/100)			
Min/Max/Moy			
Uni NBO (Notes Pelles Ondes)			

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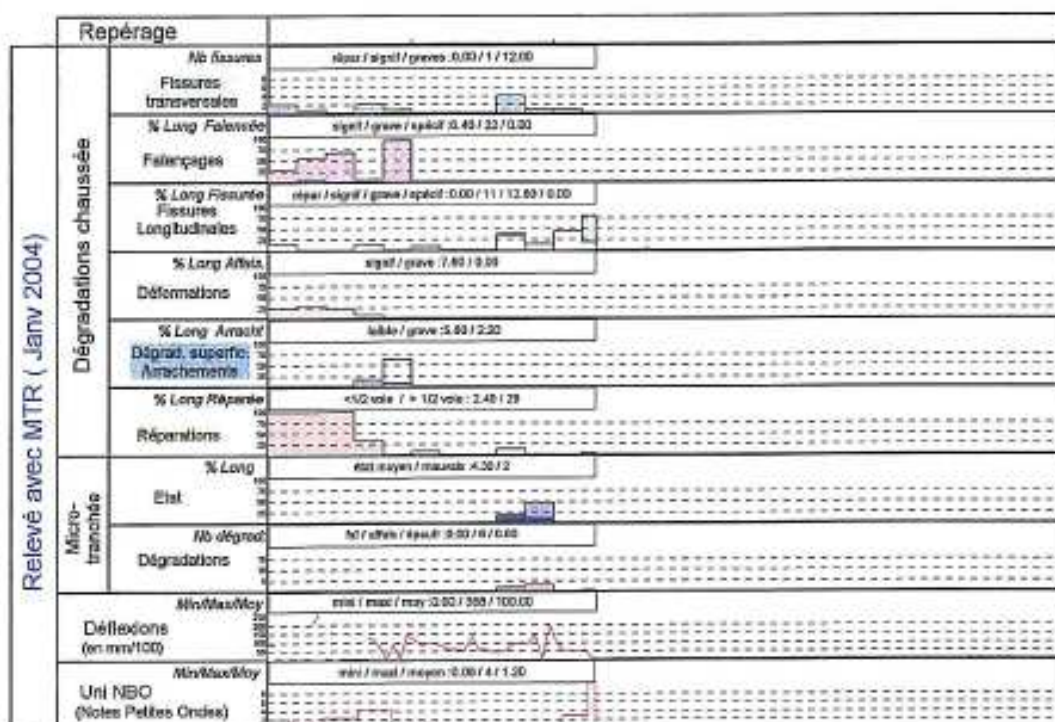
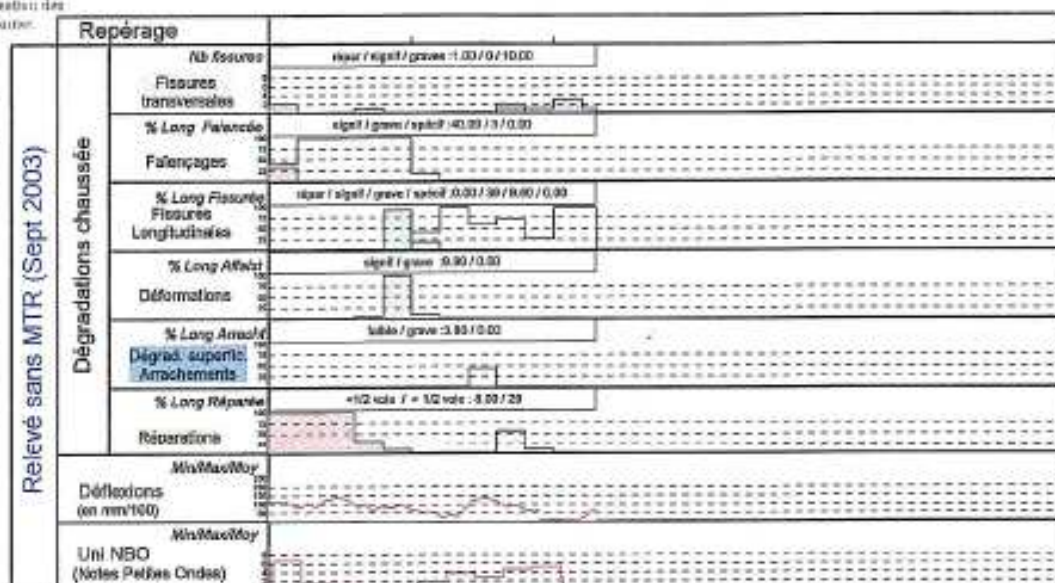
Site : la
Station des
Sables

SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE 8 MAI / DAHOMEY (0 à 230m) Echelle : 1 cm pour 40 m



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SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE 8 MAI / DAHOMEY (0 à 230 m) Echelle : 1 cm pour 40 m

Reperage		
Relevé à un an (Sept 2004)	Dégradations chaussée	Nb fissures
		répar / répar / grave 0.00 / 0 / 2.00
		Fissures transversales
		% Long Falcotée
		Falcotées
		% Long Fissurée
		Fissures Longitudinales
		% Long Affaib
		Déformations
		% Long Amoch
Micro-tranche	Micro-tranche	Etat
		Nb dégrad
		Dégradations
		Min/Max/Moy
		Déflexions (en mm/100)
		Min/Max/Moy
		Uni NBO (Notes Petites Ondes)

Reperage		
Relevé à deux ans ()	Dégradations chaussée	Nb fissures
		Fissures transversales
		% Long Falcotée
		Falcotées
		% Long Fissurée
		Fissures Longitudinales
		% Long Affaib
		Déformations
		% Long Amoch
		Dégradations
Micro-tranche	Micro-tranche	Etat
		Nb dégrad
		Dégradations
		Min/Max/Moy
		Déflexions (en mm/100)
		Min/Max/Moy
		Uni NBO (Notes Petites Ondes)

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SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE VICTOR HUGO (0 à 170m) Echelle : 1 cm pour 40 m

Relevé sans MTR (Sept 2003)

Repérage	
Dégénération chaussée	Nb fissures
	Fissures transversales
	% Long Falencée
	Falencages
	% Long Fissure
	Fissures Longitudinales
	% Long Affaibl
	Déformations
	% Long Arrach
	Dégrad. superfic. Arrachements
Micro-tranchée	% Long Réparée
	Réparations
	Min/Max/Moy
Déflexions (en mm/100)	
Min/Max/Moy	
Uni NBO (Notes Petites Ondes)	

Relevé avec MTR (Janv 2004)

Repérage	
Dégénération chaussée	Nb fissures
	Fissures transversales
	% Long Falencée
	Falencages
	% Long Fissure
	Fissures Longitudinales
	% Long Affaibl
	Déformations
	% Long Arrach
	Dégrad. superfic. Arrachements
Micro-tranchée	% Long Réparée
	Réparations
	Min/Max/Moy
Déflexions (en mm/100)	
Min/Max/Moy	
Uni NBO (Notes Petites Ondes)	

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SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Vole : RUE VICTOR HUGO

(0 à 170 m)

Echelle : 1 cm pour 40 m

Relevé à un an (Sept 2004)

Repérage		
Dégradations chaussée	Nb fissures	signif / signif / graves 0.00 / 5 / 0.00
	Fissures transversales	
	% Long Falencée	signif / grave / signif 0.00 / 0 / 0.00
	Falencages	
	% Long Fissure	signif / signif / grave / signif 0.00 / 0 / 0.00 / 0.00
	Fissures Longitudinales	
	% Long Affaie	signif / grave 0.00 / 0.00
	Déformations	
	% Long Amochi	signif / grave 0.00 / 0.00
	Dégradations	
Micro-tranchée	% Long	Etat moyen / mauvais 0.00 / 0
	Nb dégrad	signif / grave / signif 0.00 / 0 / 0.00
Dégradations		
Déflexions (en mm/100)		
Uni NBO (Notes Petites Ondes)		

Relevé à deux ans ()

Repérage		
Dégradations chaussée	Nb fissures	
	Fissures transversales	
	% Long Falencée	
	Falencages	
	% Long Fissure	
	Fissures Longitudinales	
	% Long Affaie	
	Déformations	
	% Long Amochi	
	Dégradations	
Micro-tranchée	% Long	
	Nb dégrad	
Dégradations		
Déflexions (en mm/100)		
Uni NBO (Notes Petites Ondes)		

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Pavés

SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE JEAN JAURES

(0 à 120m)

Echelle : 1 cm pour 20 m

Relevé sans MTR (Sept 2003)

Repérage		
Dégradations chaussée	Nb fissures	rtpr / signt / grave 0.00 / 0 / 3.00
	Fissures transversales	
	% Long Falencée	signt / grave / splat 2.00 / 0 / 0.00
	Falencages	
	% Long Fissurée	rtpr / signt / grave / splat 0.00 / 0 / 0.00 / 0.00
	Fissures Longitudinales	
	% Long Affaib	signt / grave 0.00 / 0.00
	Déformations	
	% Long Arrach	table / grave 0.00 / 0.00
	Dégrad. superfici. Arrachements	
Micro-tranchée	% Long Réparée	<1/2 voie / > 1/2 voie 0.00 / 1
	Réparations	
	Min/Max/Moy	
Déflexions	(en mm/100)	
	Min/Max/Moy	
Uni NBO (Notes Petites Ondes)		

Relevé avec MTR (Janv 2004)

Repérage		
Dégradations chaussée	Nb fissures	rtpr / signt / grave 0.00 / 0 / 3.00
	Fissures transversales	
	% Long Falencée	signt / grave / splat 1.00 / 0 / 0.00
	Falencages	
	% Long Fissurée	rtpr / signt / grave / splat 0.00 / 0 / 0.00 / 0.00
	Fissures Longitudinales	
	% Long Affaib	signt / grave 0.00 / 0.00
	Déformations	
	% Long Arrach	table / grave 0.00 / 0.00
	Dégrad. superfici. Arrachements	
Micro-tranchée	% Long Réparée	<1/2 voie / > 1/2 voie 0.00 / 0
	Réparations	
	Min/Max/Moy	
Déflexions	(en mm/100)	
	Min/Max/Moy	
Uni NBO (Notes Petites Ondes)		

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SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE JEAN JAURES (0 à 120 m) Echelle : 1 cm pour 20 m

Repérage		
Relevé à un an (Sept 2004)	Dégradations chaussée	Nb fissures
		réparé / réparé / grave 0.00 / 2 / 0.00
		Fissures transversales
		% Long Falencée
		réparé / grave / réparé 0.00 / 0 / 0.00
		Falencages
		% Long Fissurée
		réparé / réparé / grave 0.00 / 0 / 0.00
		Fissures Longitudinales
		% Long Affais.
Micro-tranchée	Dégradations	Déformations
		% Long Arraché
		réparé / grave 0.00 / 0.00
		Dégradations
		% Long Réparée
		+1/2 voie / + 1/2 voie 0.00 / 0
		Réparations
		% Long
		Etat
		Nb dégrad.
Relevé à deux ans ()	Dégradations chaussée	Dégradations
		Min/Max/Moy
		Déflexions (en mm/100)
		Min/Max/Moy
		Uni NBO
		(Notes Petites Ondes)

Repérage		
Relevé à un an (Sept 2004)	Dégradations chaussée	Nb fissures
		Fissures transversales
		% Long Falencée
		Falencages
		% Long Fissurée
		Fissures Longitudinales
		% Long Affais.
		Déformations
		% Long Arraché
		Dégradations
Micro-tranchée	Dégradations	% Long Réparée
		Réparations
		% Long
		Etat
		Nb dégrad.
		Dégradations
		Min/Max/Moy
		Déflexions (en mm/100)
		Min/Max/Moy
		Uni NBO
Relevé à deux ans ()	Dégradations chaussée	Dégradations
		Min/Max/Moy
		Déflexions (en mm/100)
		Min/Max/Moy
		Uni NBO
		(Notes Petites Ondes)

58 C0010
Edité le : 22/10/2004

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SUIVI DES MICRO-TRANCHEES

Dossier : 39387

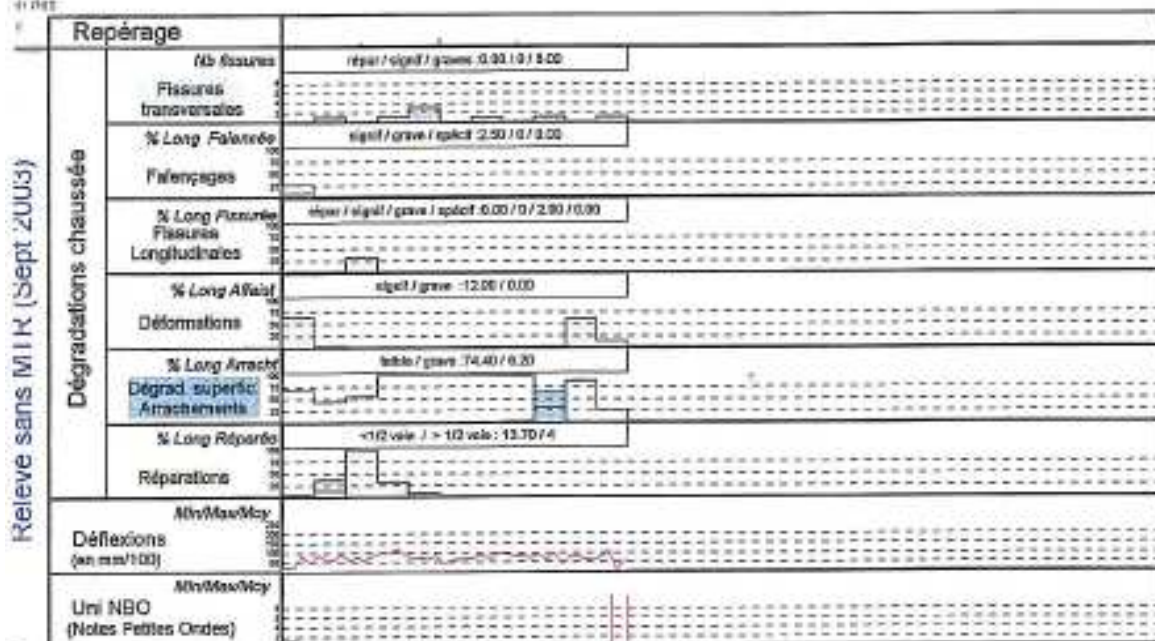
SITE : COSNE-SUR-LOIRE

Voie : RUE SADI CARNOT

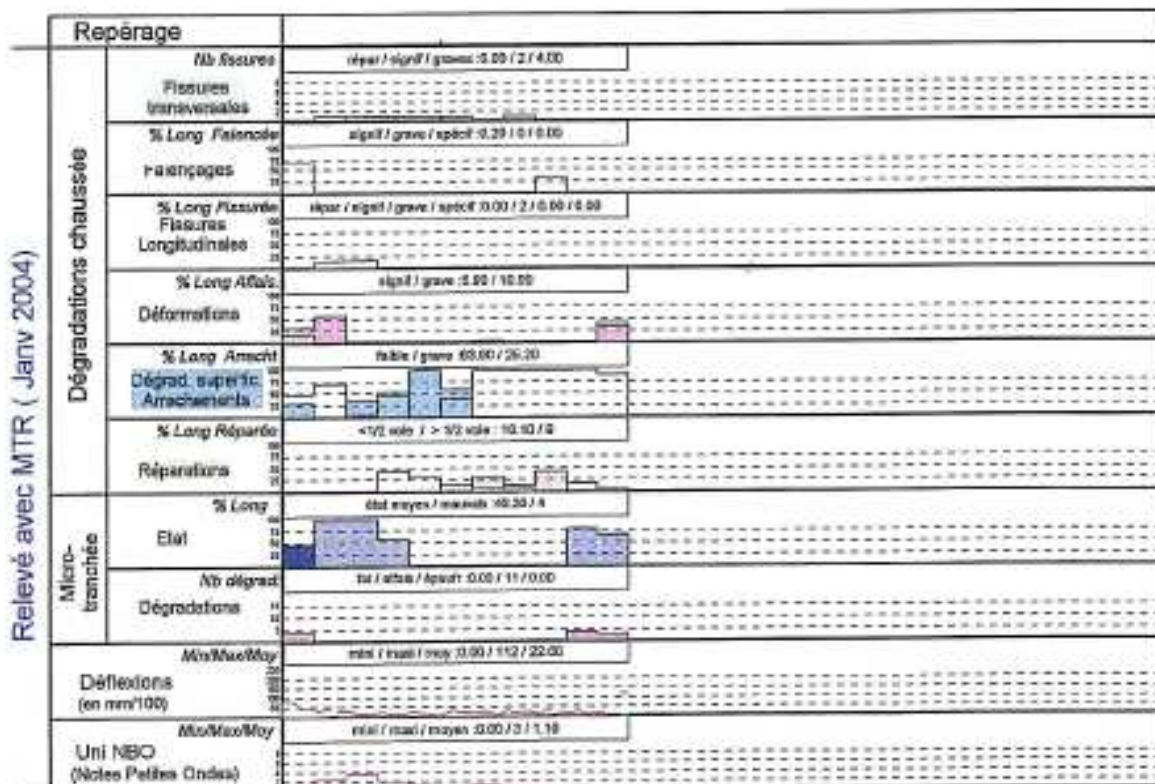
(0 à 220m)

Echelle : 1 cm pour 40 m

Relevé sans MTR (Sept 2003)



Relevé avec MTR (Janv 2004)



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SUIVI DES MICRO-TRANCHEES

Dossier : 39387

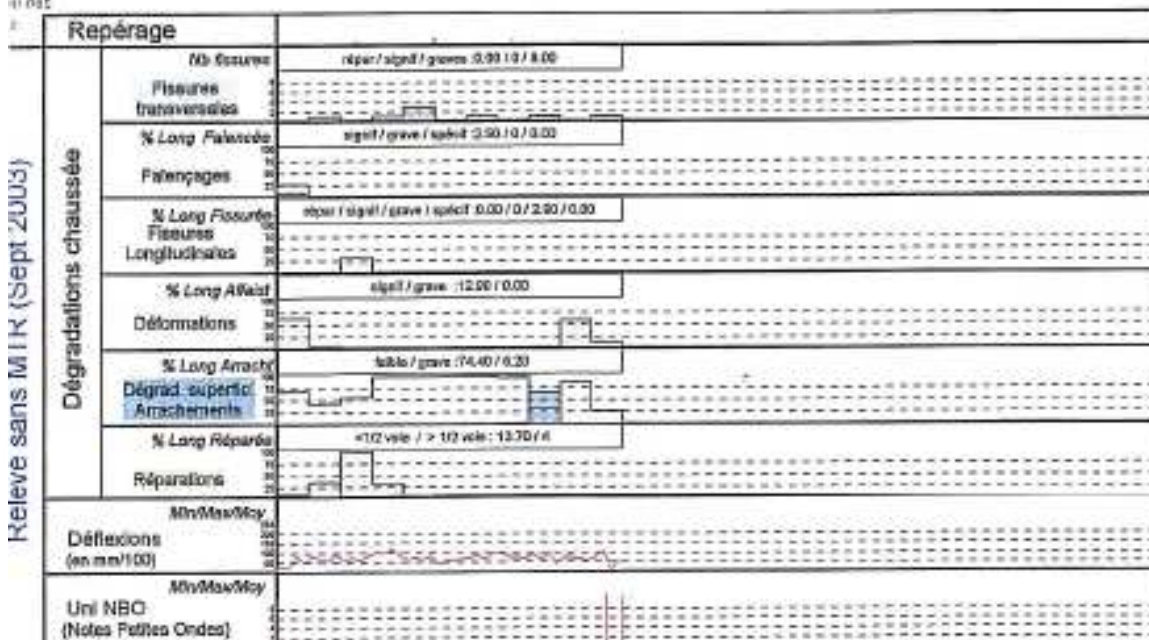
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Voie : RUE SADI CARNOT

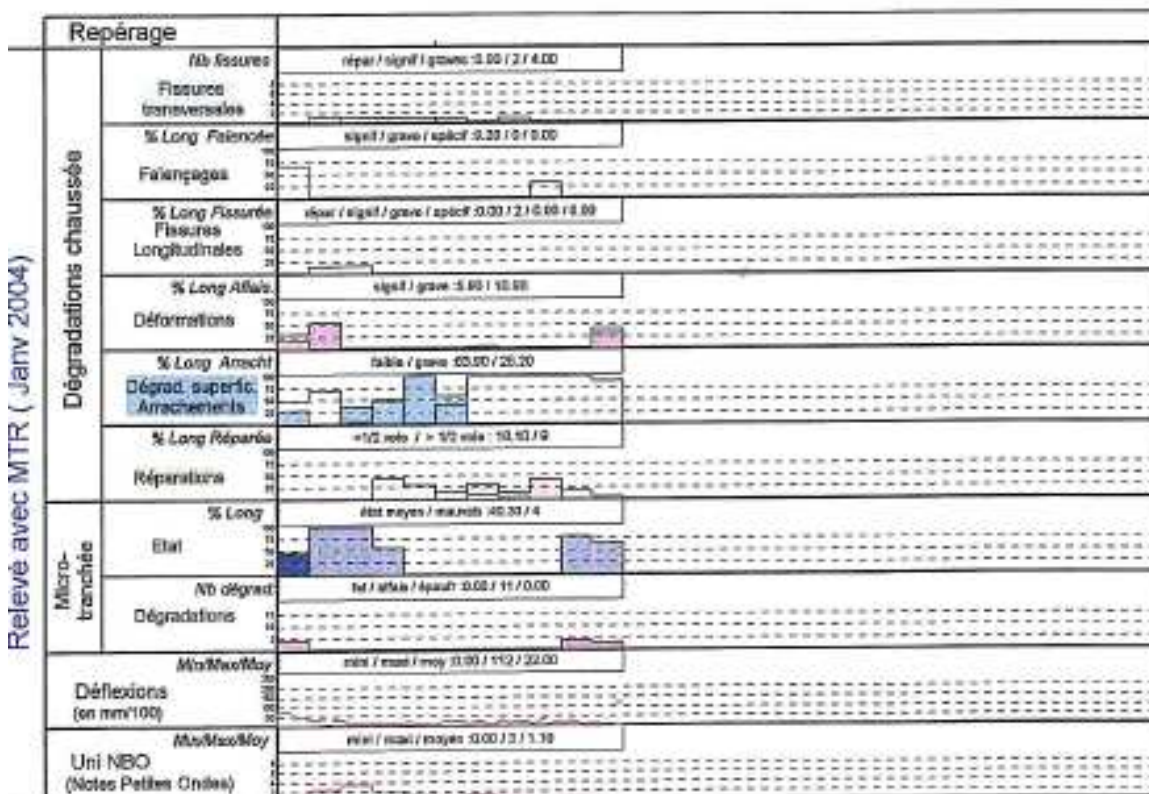
(0 à 220m)

Echelle : 1 cm pour 40 m

Relevé sans MTR (Sept 2003)



Relevé avec MTR (Janv 2004)



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Ministère
de l'Énergie
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Transport

SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE SADI CARNOT

(0 à 220 m)

Echelle : 1 cm pour 40 m

Releve a un an (Sept 2004)

Repérage		
Dégradations chaussée	Nb fissures	répar / élarg / grave : 0.00 / 0.00 / 0.00
	Fissures transversales	
	% Long Falcroche	signif / grave / épais : 0.00 / 0.00 / 0.00
	Falcroches	
	% Long Fissure Fissures Longitudinales	répar / signif / grave / épais : 0.00 / 0.00 / 0.00 / 0.00
	% Long Affaiblissements	signif / grave : 17.60 / 0.00
	Déformations	
	% Long Amasch	forte / grave : 20.70 / 10.90
	% Long Réparations	< 1/2 voie : > 1/2 voie : 4.90 / 0
	Réparations	
Micro-tranchée	% Long Etat	Etat moyen / mauvaise : 0.00 / 0
	Nb dégrad. Dégradations	tot / affaib / épais : 0.00 / 0 / 0.00
Déflexions (en mm/100)		Min/Max/Moy : 100 / 100 / 100
Unit NBO (Notes Petites Ondes)		Min/Max/Moy : 100 / 100 / 100

Releve a deux ans ()

Repérage		
Dégradations chaussée	Nb fissures	
	Fissures transversales	
	% Long Falcroche	
	Falcroches	
	% Long Fissure Fissures Longitudinales	
	% Long Affaiblissements	
	Déformations	
	% Long Amasch	
	% Long Réparations	
	Réparations	
Micro-tranchée	% Long Etat	
	Nb dégrad. Dégradations	
Déflexions (en mm/100)		Min/Max/Moy : 100 / 100 / 100
Unit NBO (Notes Petites Ondes)		Min/Max/Moy : 100 / 100 / 100

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SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Vole : RUE COLETTE

(0 à 86m)

Echelle : 1 cm pour 20 m

Relevé sans MTR (Sept 2003)		Dégénération chaussée		Déflections		Uni NBO	
Repérage		Nb fissures		Min/Max/Moy		Min/Max/Moy	
Fissures transversales		vigrat / vigrat / grave 0.00 / 0 / 1.00		(en mm/1.00)		(Notes Petites Ondes)	
% Long Fatigués		vigrat / grave / cp&st 0.00 / 0 / 0.00					
Fatigués		cp&st / vigrat / grave / cp&st 0.00 / 0 / 0.00					
% Long Fissures Longitudinales		vigrat / vigrat / grave / vigrat 0.00 / 0 / 0.00					
Déformations		vigrat / grave 0.00 / 0.00					
% Long Arrachés		grave / grave 0.00 / 0.00					
Dégrad. superficielles Arrachements		grave / grave 0.00 / 0.00					
% Long Réparés		< 12 mm / > 12 mm 0.00 / 0					
Réparations							

Relevé avec MTR (Janv 2004)		Relevé	
Dégénération chaussée	Mb Assume	répét / signifi / grave : 0.00 / 0 / 0.00	
	Fissures transversales		
	% Long Falencée	signifi / grave / spécif : 0.00 / 0 / 0.00	
	Falencages		
	% Long Fissures Longitudinales	stop / signifi / grave / spécif : 0.00 / 0 / 0.00 / 0.00	
	% Long Affais	signifi / grave : 19.00 / 0.00	
	Déformations		
	% Long Arraché	faible / grave : 05.70 / 0.00	
Micro-tranchée	Dégradé, stop / Ic. Arrachements		
	% Long Répété	<1/2 voie / > 1/2 voie : 0.00 / 0	
	Réparations		
Etat	% Long	état moyen / mauvaise : 14.18 / 0	
	Nb dégrad Dégénération	nul / affaib / grave : 0.00 / 0 / 0.00	
Déflexions (en mm/100)	Min/Max/Moy	mini / maxi / moy : 80.00 / 356 / 122.00	
Uni NBO (Notes Petites Ondes)	Min/Max/Moy	mini / maxi / moy : 0.00 / 2 / 1.00	



Ministère de l'Énergie
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Renouvelables

SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE COLETTE

(0 à 85 m)

Echelle : 1 cm pour 20 m

relevé à un an (sept 2004)

Repérage		
Dégradations chaussée	Nb fissures	répar / signal / graves 0.00 / 1 / 0.00
	Fissures transversales	
	% Long Falencée	signal / grave / signal 0.00 / 0 / 0.00
	Falencages	
	% Long Fissurée	répar / signal / grave / signal 0.00 / 0 / 0.00 / 0.00
	Fissures Longitudinales	
	% Long Affaib	signal / grave 0.00 / 0.00
	Déformations	
	% Long Amoché	répar / grave 0.00 / 0.00
	Dégrad. superficielles / Amochement	
Micro-tranchée	% Long Réparée	<1/2 voir / > 1/2 voir : 10.00 / 0
	Réparations	
	% Long	Nb / moyen / max/min 0.00 / 0
	Etat	
Dégradations	Nb dégrad.	Nb / moyen / réparé : 0.00 / 0 / 0.00
	Dégradations	
	Min/Max/Moy	
	Déflexions (en mm/100)	
Uni NBO (Notes Petites Ondes)	Min/Max/Moy	

relevé à deux ans (sept 2004)

Repérage		
Dégradations chaussée	Nb fissures	
	Fissures transversales	
	% Long Falencée	
	Falencages	
	% Long Fissurée	
	Fissures Longitudinales	
	% Long Affaib	
	Déformations	
	% Long Amoché	
	Dégrad. superficielles / Amochement	
Micro-tranchée	% Long Réparée	
	Réparations	
	% Long	
	Etat	
Dégradations	Nb dégrad.	
	Dégradations	
	Min/Max/Moy	
	Déflexions (en mm/100)	
Uni NBO (Notes Petites Ondes)	Min/Max/Moy	

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SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE COLETTE

(0 à 85 m)

Echelle : 1 cm pour 20 m

Repérage		
Dégradations chaussée	Nb fissures	rtpe / rtgnt / grave 0.00 / 1 / 0.00
	Fissures transversales	
	% Long Falencée	rtgnt / grave / rtgnt 0.00 / 0 / 0.00
	Falencages	
	% Long Fissure	rtpe / rtgnt / grave / rtgnt 0.00 / 0 / 0.00 / 0.00
	Fissures Longitudinales	
	% Long Affaib.	rtgnt / grave 0.00 / 0.00
	Déformations	
	% Long Amoché	rtgnt / grave 0.00 / 0.00
	Dégrad. sup. / Amochement	
Micro-tranchée	% Long Réparée	<10 voir / > 10 voir : 0.00 / 0
	Réparations	
	% Long	Nb moyen / max 0.00 / 0
	Etat	
Dégradations	Nb dégrad.	Nb / rtgnt / rtgnt : 0.00 / 0 / 0.00
	Dégradations	
Min/Max/Moy		
Déflexions (en mm/100)		
Min/Max/Moy		
Uni NBO (Notes Petites Ondes)		

Repérage		
Dégradations chaussée	Nb fissures	
	Fissures transversales	
	% Long Falencée	
	Falencages	
	% Long Fissure	
	Fissures Longitudinales	
	% Long Affaib.	
	Déformations	
	% Long Amoché	
	Dégrad. sup. / Amochement	
Micro-tranchée	% Long Réparée	
	Réparations	
	% Long	
	Etat	
Dégradations	Nb dégrad.	
	Dégradations	
Min/Max/Moy		
Déflexions (en mm/100)		
Min/Max/Moy		
Uni NBO (Notes Petites Ondes)		

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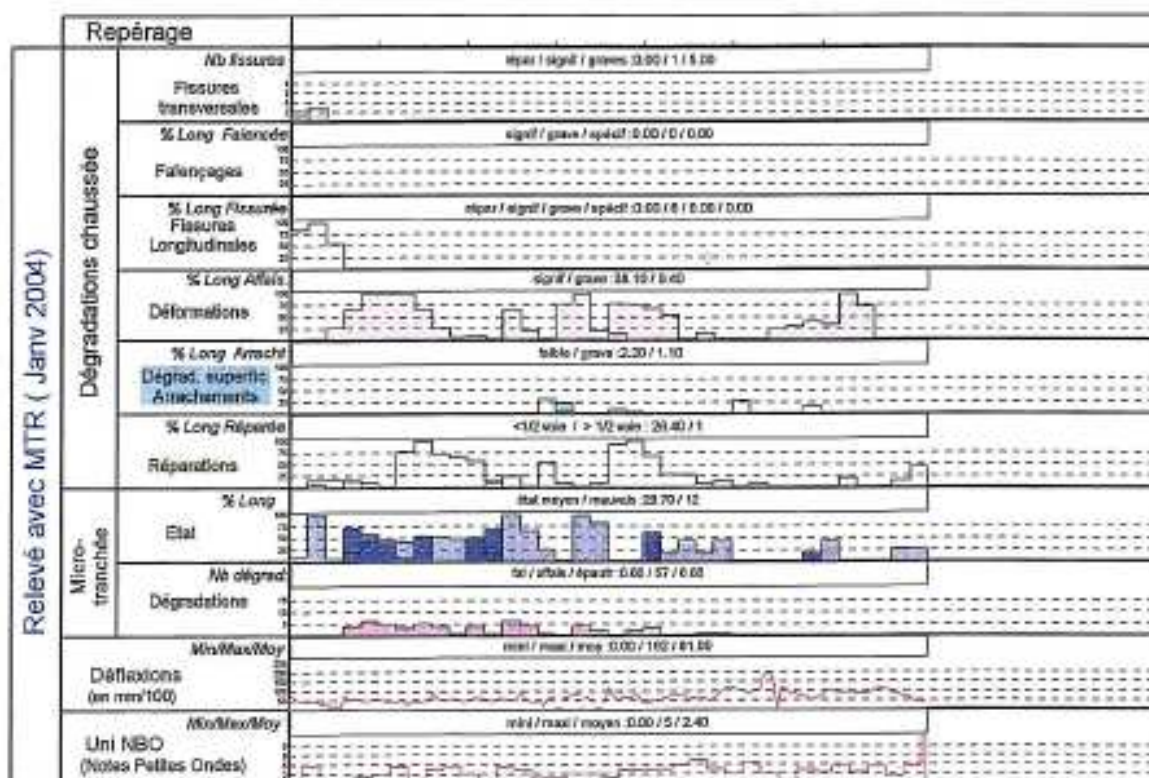
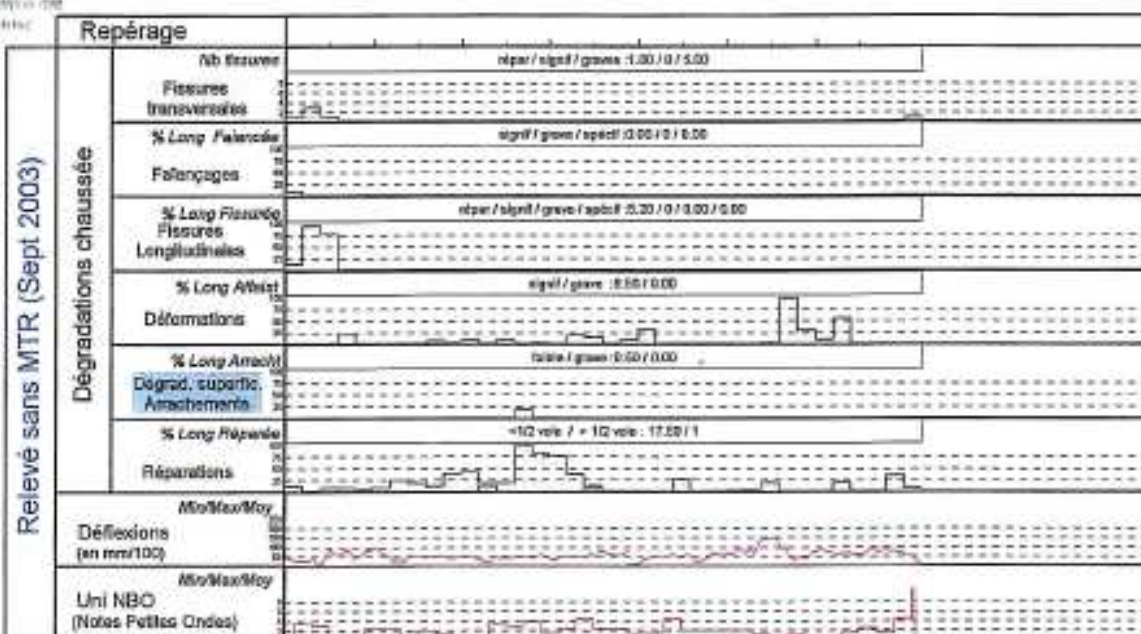
N° de l'ouvrage :
Date de l'état :
Technique :

SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE FONT. ST-LAURENT (0 à 720m) Echelle : 1 cm pour 70 m



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Logo relative
National
le 70 ans
terrien
Nide à la
Section des
Arvates

SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE FONT. ST-LAURENT (0 à 720 m) Echelle : 1 cm pour 70 m

Relevé à un an (Sept 2004)		Repérage	
Dégradations chaussée	Nb fissures	répar / répar / graves 0.00 / 4 / 3.00	
	Fissures transversales		
	% Long Falencade	signif / grave / épais 0.00 / 0 / 0.00	
	Falencades		
	% Long Fissure	répar / répar / grave / épais 0.00 / 0 / 0.00 / 0.00	
	Fissures Longitudinales		
	% Long Affais.	signif / grave 0.00 / 0.00	
	Déformations		
	% Long Anchoir	forte / grave 0.00 / 0.00	
	Dégrad. anchoir / Anchoir		
Micro-tranchée	% Long Réparée	*122 vide / * 122 vide 7.80 / 2	
	Réparations		
	% Long	Etat moyen / mauvais 0.00 / 0	
	Etat		
Dégradations	Nb dégrad.	M / affais / Anchoir 0.00 / 0 / 17.00	
	Dégradations		
	Min/Max/Moy		
Déflections	(en mm/100)		
	Min/Max/Moy		
Uni NBO (Notes Petites Ondes)			

Relevé à deux ans ()		Repérage	
Dégradations chaussée	Nb fissures		
	Fissures transversales		
	% Long Falencade		
	Falencades		
	% Long Fissure		
	Fissures Longitudinales		
	% Long Affais.		
	Déformations		
	% Long Anchoir		
	Dégrad. anchoir / Anchoir		
Micro-tranchée	% Long Réparée		
	Réparations		
	% Long		
	Etat		
Dégradations	Nb dégrad.		
	Dégradations		
	Min/Max/Moy		
Déflections	(en mm/100)		
	Min/Max/Moy		
Uni NBO (Notes Petites Ondes)			

63 CCO 14
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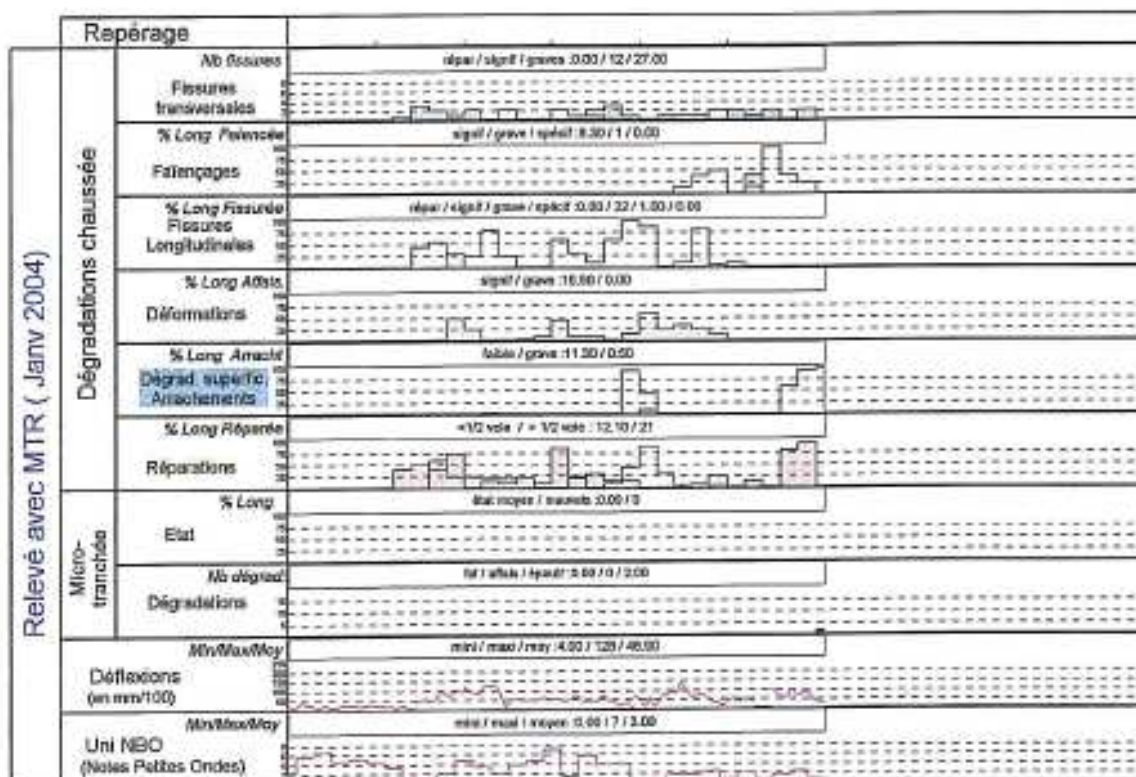
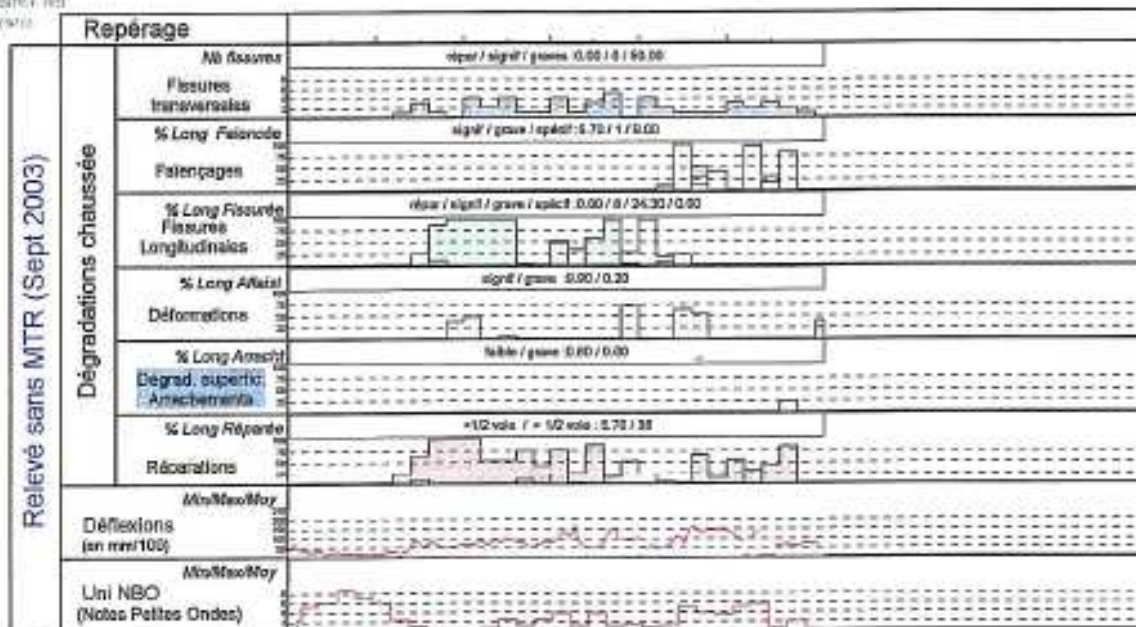
Laboratoire
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le Pôuest
Parisien
Métro
Système des
Voies

SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE DE LA REPUBLIQUE (0 à 610m) Echelle : 1 cm pour 70 m



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gestion des
infrastructures

SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE DE LA REPUBLIQUE (0 à 610 m) Echelle : 1 cm pour 70 m

Relevé à un an (Sept 2004)		Repérage	
Dégradations chaussée	Nb fissures		ripes / signifi / graves : 0.00 / 10 / 0.00
	Fissures transversales		
	% Long Falcroche		signifi / graves / spécul : 0.00 / 0 / 0.00
	Falcroches		
	% Long Fissures Fissures Longitudinales		ripes / signifi / graves / spécul : 0.00 / 0 / 0.00 / 0.00
	% Long Affais		signifi / graves : 0.00 / 0.00
	Déformations		
	% Long Arraché		lattes / graves : 2 / 0.00
	Dégrad. superficielles Arrachements		
	% Long Réparés		<10 voir / > 10 voir : 1.00 / 0
	Réparations		
Micro-tranchée	% Long		Etat moyen / mauvais : 0.00 / 0
	Etat		
	Nb dégrad. Dégradations		Nb / état / graves : 0.00 / 0 / 12
Déflexions (en mm/100)			
Uni NBO (Notes Petites Ondes)			

Relevé à deux ans ()		Repérage	
Dégradations chaussée	Nb fissures		
	Fissures transversales		
	% Long Falcroche		
	Falcroches		
	% Long Fissures Fissures Longitudinales		
	% Long Affais		
	Déformations		
	% Long Arraché		
	Dégrad. superficielles Arrachements		
	% Long Réparés		
	Réparations		
Micro-tranchée	% Long		
	Etat		
	Nb dégrad. Dégradations		
Déflexions (en mm/100)			
Uni NBO (Notes Petites Ondes)			

59-00015
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SUIVI DES MICRO-TRANCHEES

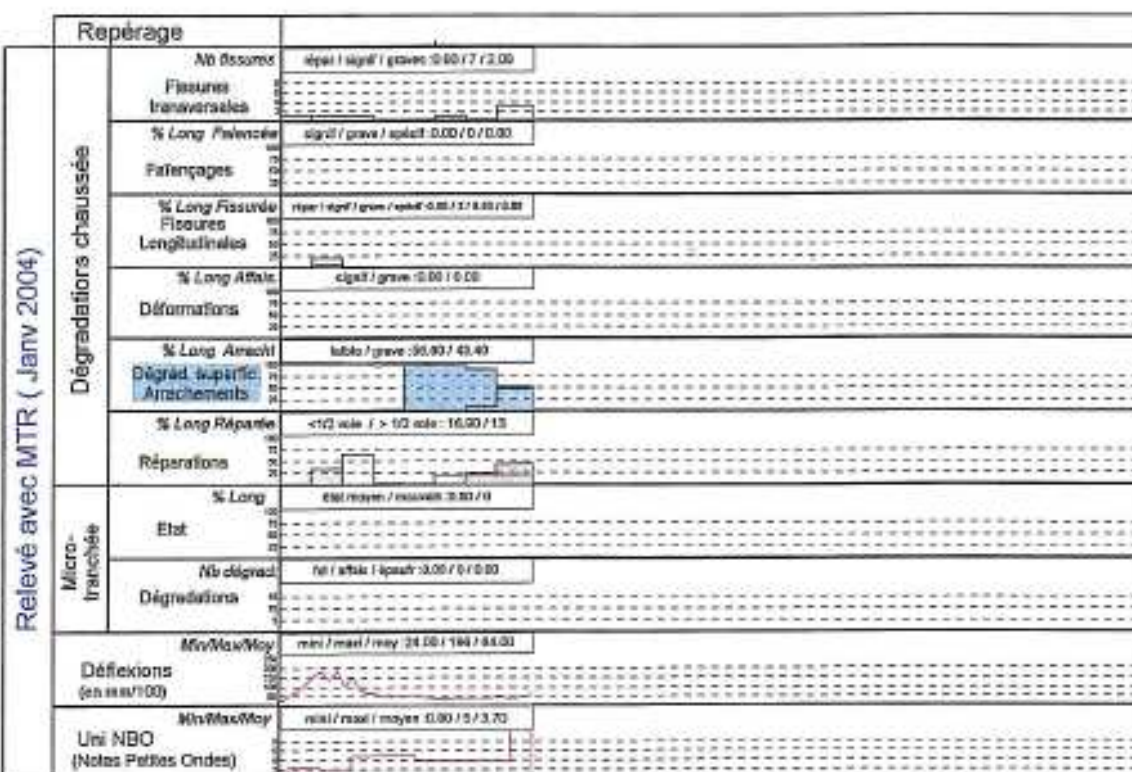
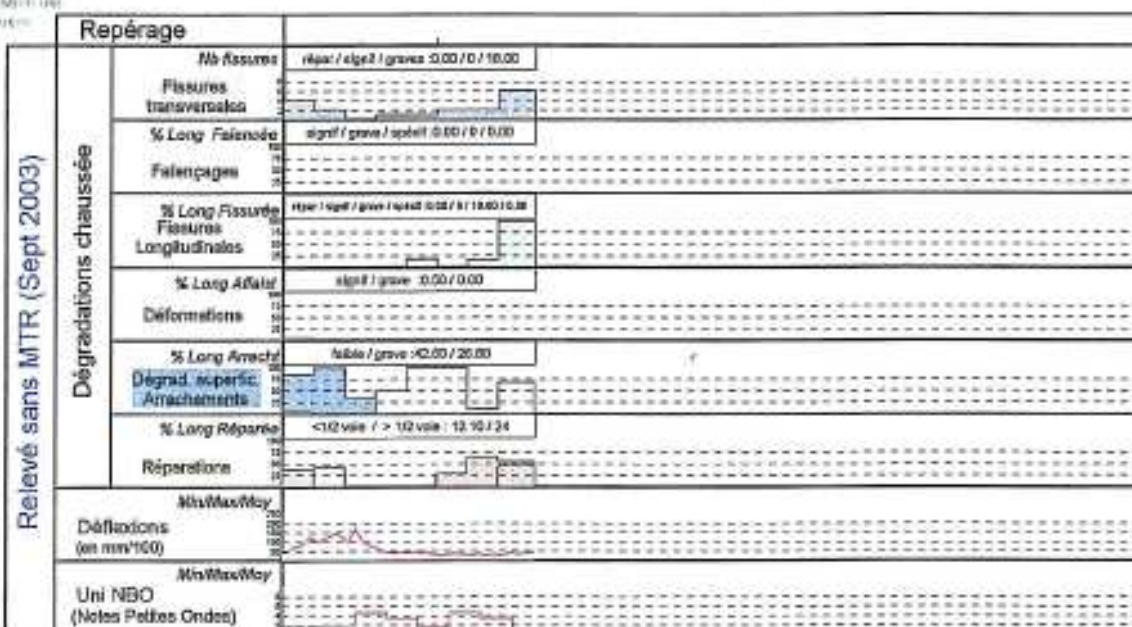
Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE DE L'EST

(0 à 165m)

Echelle : 1 cm pour 40 m



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durable

SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE DE L'EST

(0 à 165 m)

Echelle : 1 cm pour 40 m

Relevé à un an (Sept 2004)

Repérage		
Dégénération chaussée	Nb fissures	répar / régal / graves 0.00 / 2 / 0.00
	Fissures transversales	
	% Long Falencée	régal / grave / régal 0.00 / 0 / 0.00
	Falencées	
	% Long Fissures Longitudinales	régal / régal / grave / régal 0.00 / 0 / 0.00 / 0.00
	Fissures	
	% Long Affaiblissements	régal / grave 0.00 / 0.00
	Déformations	
	% Long Arrachements	régal / grave 0.00 / 0.00
	Arrachements	
Micro-tranchée	% Long Réparations	< 10 vds / > 10 vds : 0.00 / 0
	Réparations	
	% Long Etat	état moyen / mauvais : 0.00 / 0
Micro-tranchée	Nb dégradations	ré / affa / épous : 0.00 / 0 / 0.00
	Dégradations	
	Min/Max/Moy	
Déflexions (en mm/100)		
Min/Max/Moy		
Uni NBO (Notes Petites Ondes)		

Relevé à deux ans ()

Repérage		
Dégénération chaussée	Nb fissures	
	Fissures transversales	
	% Long Falencée	
	Falencées	
	% Long Fissures Longitudinales	
	Fissures	
	% Long Affaiblissements	
	Déformations	
	% Long Arrachements	
	Arrachements	
Micro-tranchée	% Long Réparations	
	Réparations	
	% Long Etat	
Micro-tranchée	Nb dégradations	
	Dégradations	
	Min/Max/Moy	
Déflexions (en mm/100)		
Min/Max/Moy		
Uni NBO (Notes Petites Ondes)		

50 C0016
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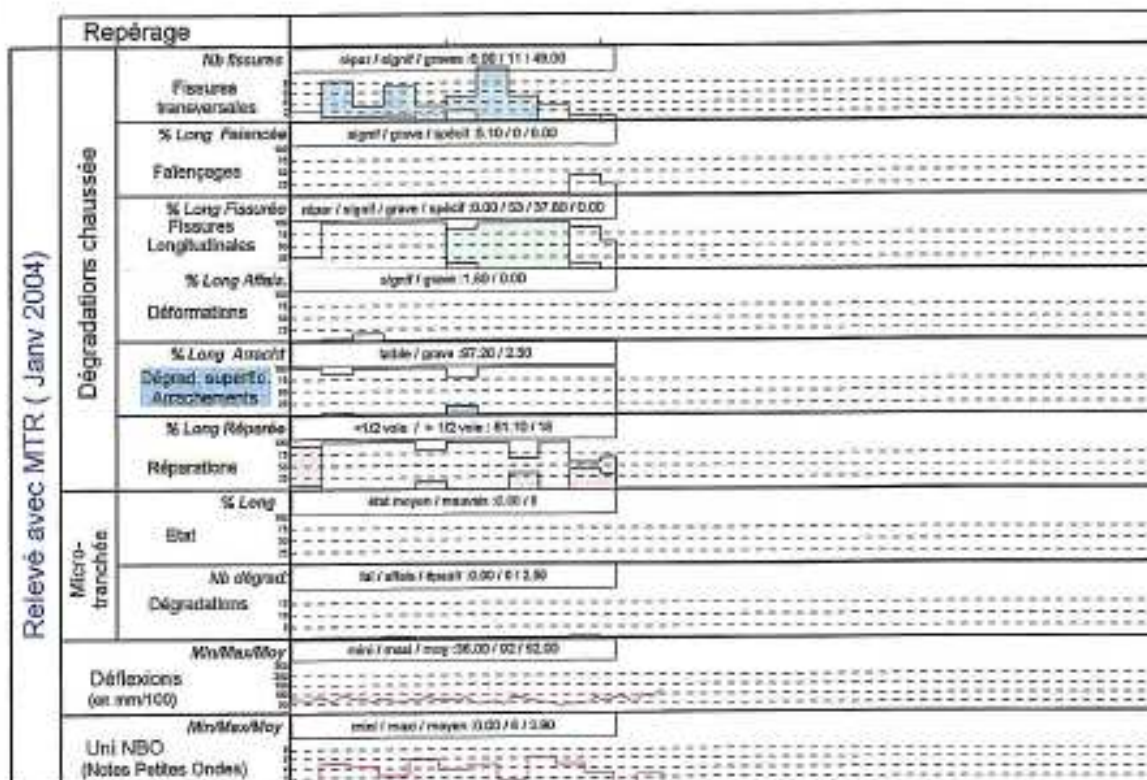
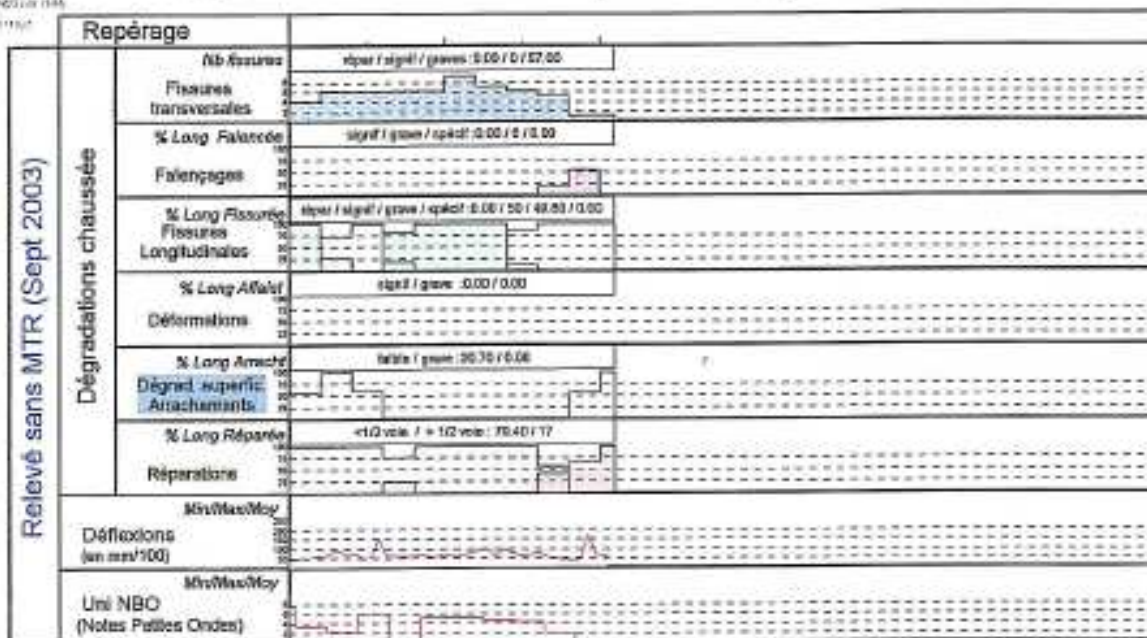
Site : D
projet 144

SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE LA CROIX-JANVIER (0 à 240m) Echelle : 1 cm pour 40 m



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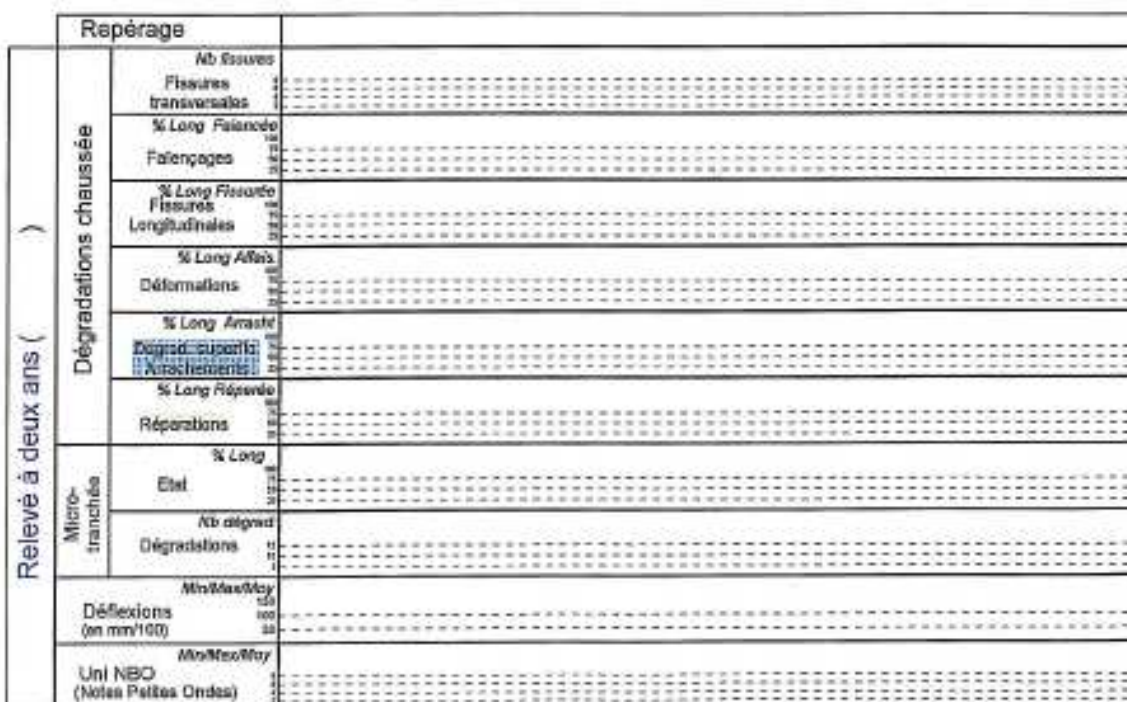
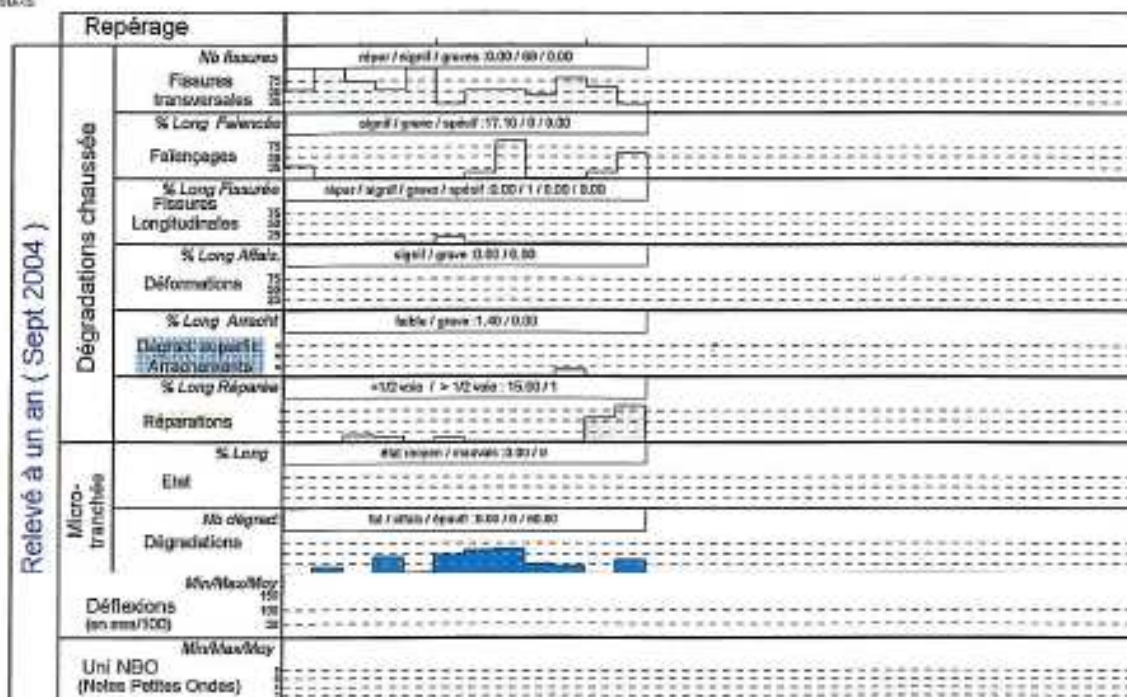
Laboratoire
régional
de l'ouest
français
Voie : la
Boulevard des
Nations

SUIVI DES MICRO-TRANCHEES

Dossier : 39387

SITE : COSNE-SUR-LOIRE

Voie : RUE LA CROIX-JANVIER [0 à 240 m] Echelle : 1 cm pour 40 m



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Portfolio and cross-section profilographs



Cosne-Cours-sur-Loire

Rue du Général Binot – Urbanized area outlet

Follow-up before works

Inspection performed in September, 2003

Follow-up after works

Inspection performed in November, 2003

Follow-up after 1 year

Inspection performed on September 8, 2004

Cosne-Cours-sur-Loire

Rue du Général Binot – sortie d'agglomération

Suivi avant travaux

Visite effectuée en septembre 2003



Suivi à 1 an

Visite effectuée le 8 septembre 2004



Suivi après travaux

Visite effectuée en novembre 2003



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CROSS-SECTION PROFILOGRAM

Département : COSNE SUR LOIRE (58)

Road : Général Binot

Date of the zero point : 09/09/2003

Location : in front of the urbanized area outlet sign, 1,854 m away from the beginning

Axe = Axis

Tranchée = Trench

Echelle = Scale

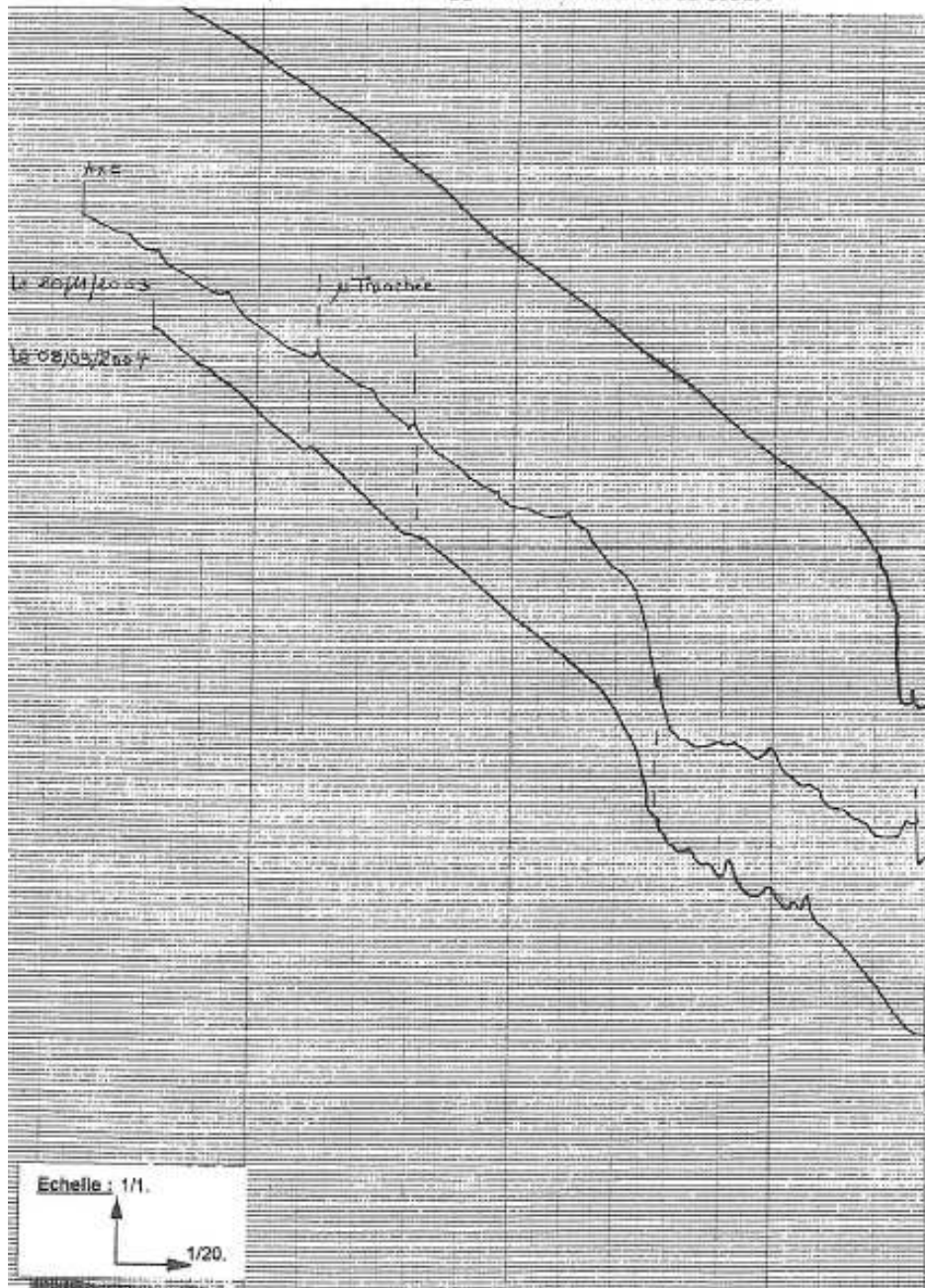
TRANSVERSOPROFILOGRAMME.

Département : COSNE SUR LOIRE (58).

Route : Général BINOT

Date du point zéro : le 09/09/2003

Localisation : face au panneau sortie d'agglomération à 1854 m du début .



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LOSNE-COURT-SUR-LOIRE

Rue du Général Binot – à 808 m du début de rue

Suivi avant travaux

Visite effectuée en septembre 2003



Suivi après travaux

Visite effectuée en novembre 2003



Suivi à 1 an

Visite effectuée le 8 septembre 2004

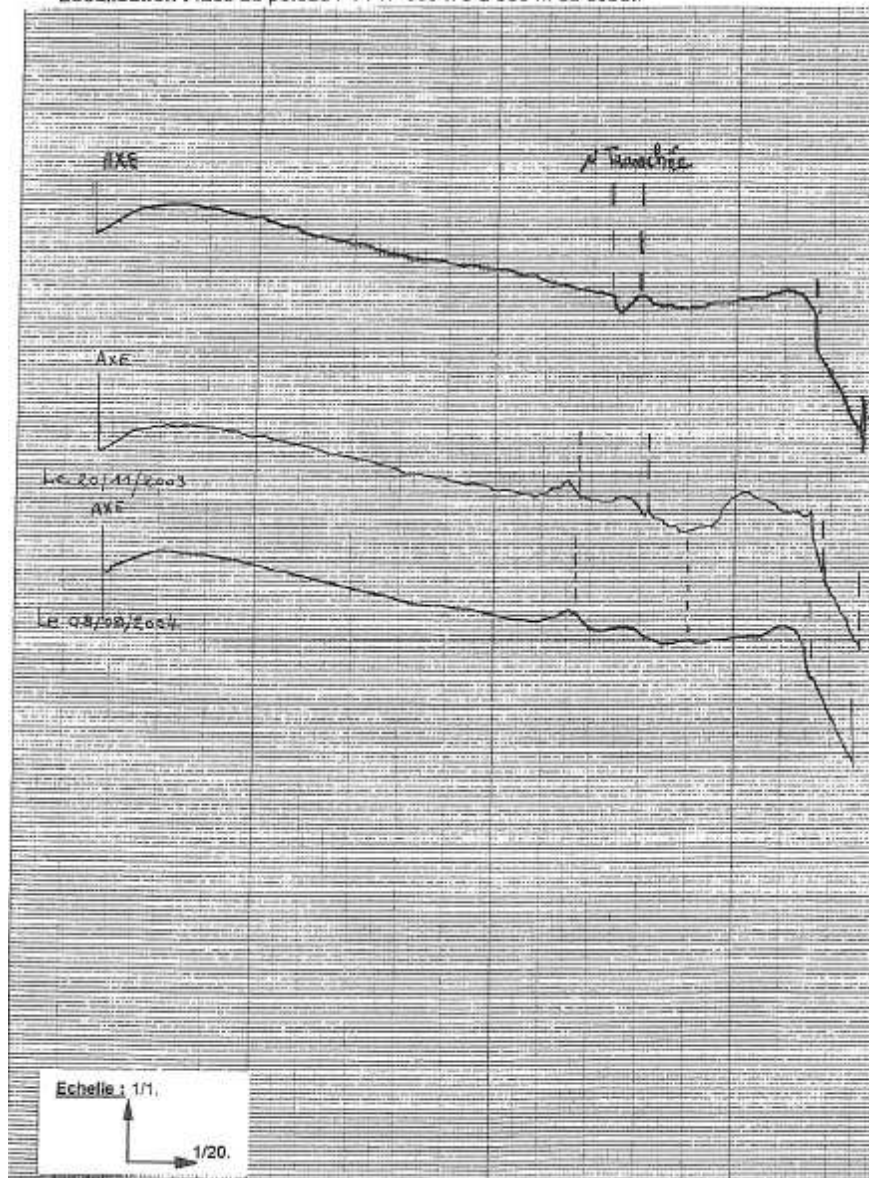


CROSS-SECTION PROFILOGRAM

Département : COSNE SUR LOIRE (58) Road : Général Binot
Date of the zero point : 09/09/2003
Location : in front of the PTT pole n°809475, 808 m away from the beginning
Axe = Axis
Tranchée = Trench
Echelle = Scale

TRANSVERSOPROFILOGRAMME.

Département : COSNE SUR LOIRE (58) Route : Général BINOT
Date du point zéro : le 09/09/2003
Localisation : face au poteau PTT n° 809475 à 808 m du début.



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Cosne-Cours-sur-Loire

Rue du Général Binot – poteau PTT n°809466

Suivi avant travaux

Visite effectuée en septembre 2003



Suivi après travaux

Visite effectuée en novembre 2003



Suivi à 1 an

Visite effectuée le 8 septembre 2004

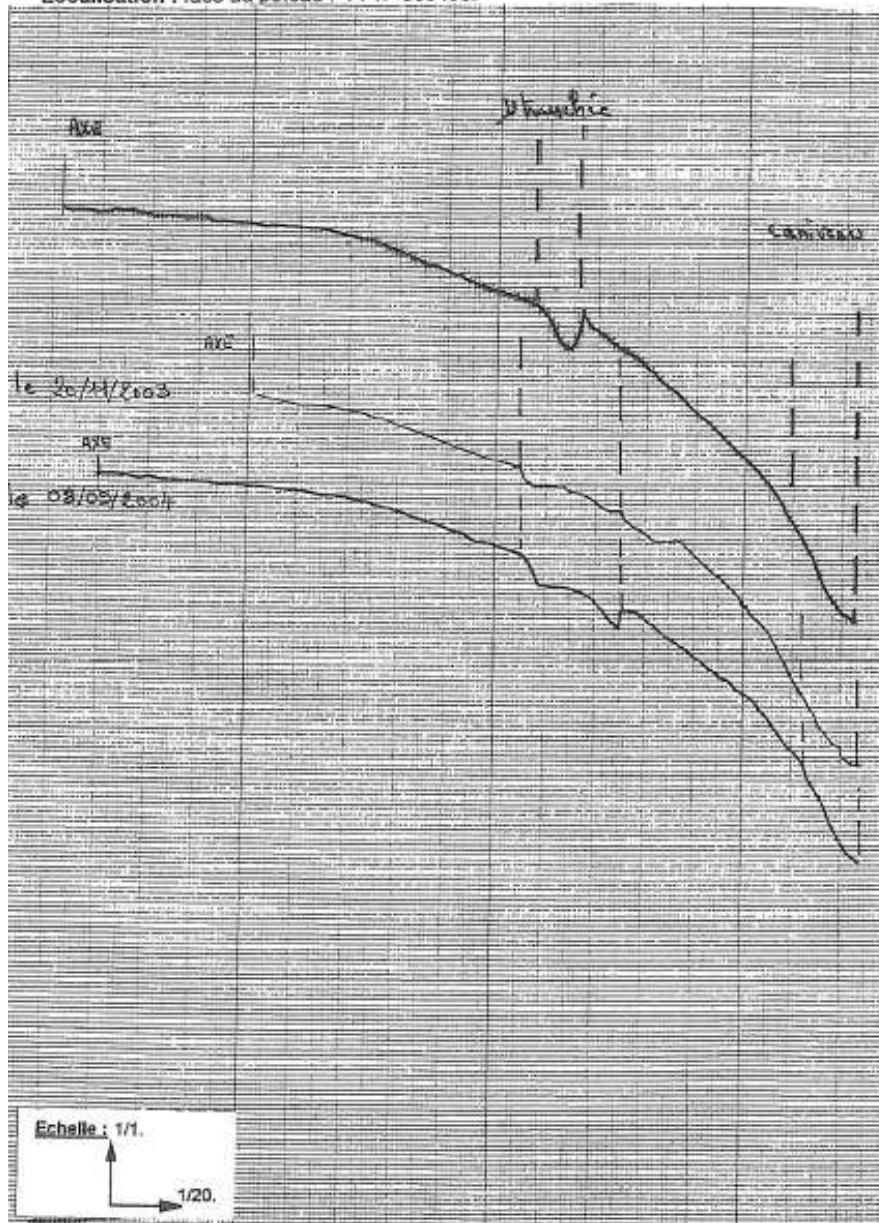


CROSS-SECTION PROFILOGRAM

Département : COSNE SUR LOIRE (58) Road : Général Binot
Date of the zero point : 09/09/2003
Location : in front of the PTT pole n°809466
Axe = Axis
Tranchée = Trench
Echelle = Scale

TRANSVERSOPROFILOGRAMME.

Département : COSNE SUR LOIRE (58). Route : Général BINOT
Date du point zéro : le 09/09/2003
Localisation : face au poteau PTT n° 809466.



Rue de Nabéris – SNCF sign

Cosne-Cours-sur-Loire

Rue de Nabéris – panneau SNCF

Suivi avant travaux



Visite effectuée en septembre 2003

Suivi après travaux



Visite effectuée en novembre 2003

Suivi à 1 an



Visite effectuée le 8 septembre 2004

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CROSS-SECTION PROFILOGRAM

Département : COSNE SUR LOIRE (58)

Road : rue de Nabéris

Date of the zero point : 11/20/2003

Location : in front of the green lamp standard and the SNCF sign, 482 m from the beginning

Axe = Axis

Tranchée = Trench

Echelle = Scale

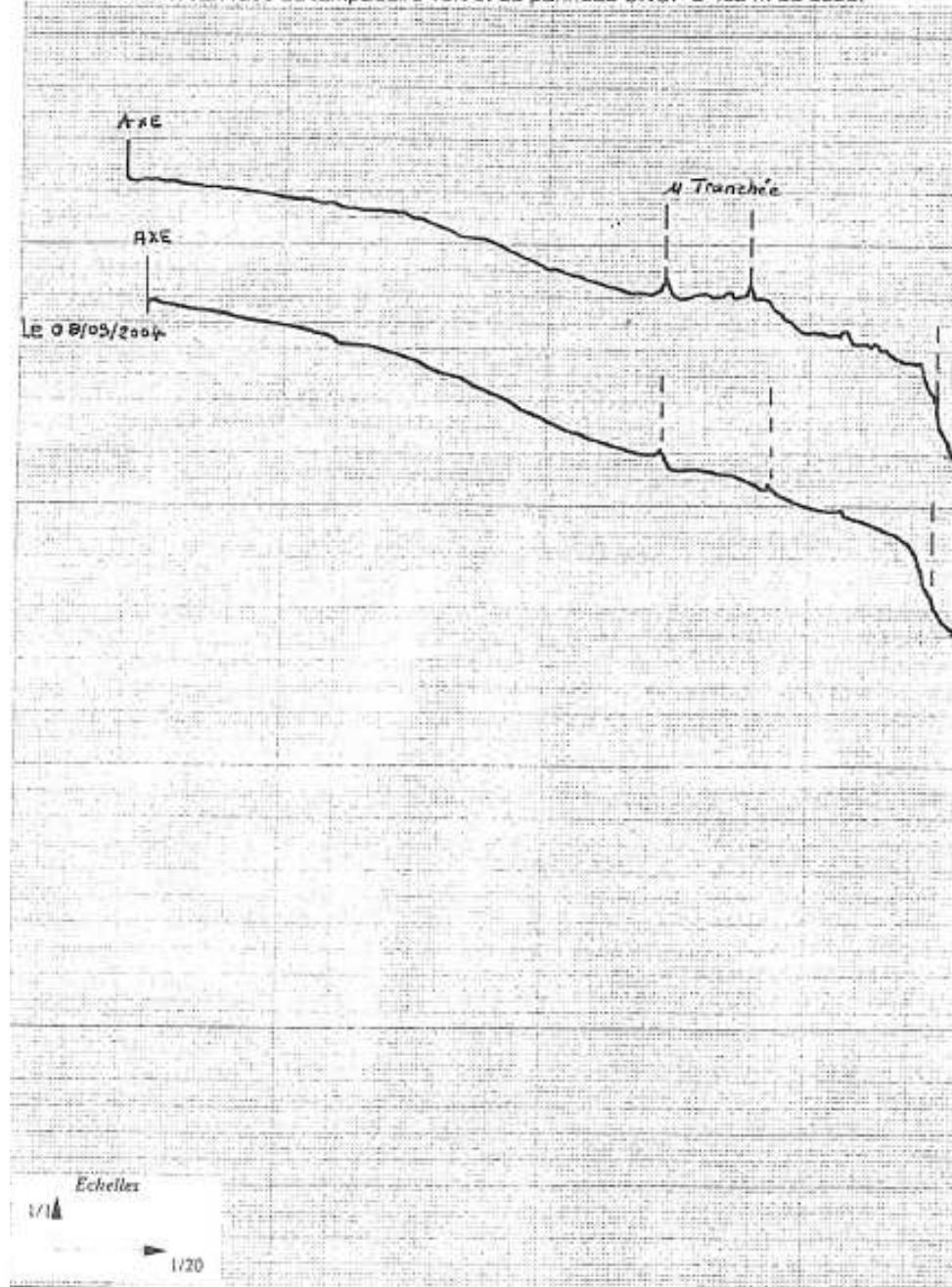
TRANSVERSOPROFILOGRAMME

Département : COSNE SUR LOIRE (58)

Route : rue de Nabéris

Date du point zéro : le 20/11/2003

Localisation : En face du lampadaire vert et du panneau SNCF à 482 m du début



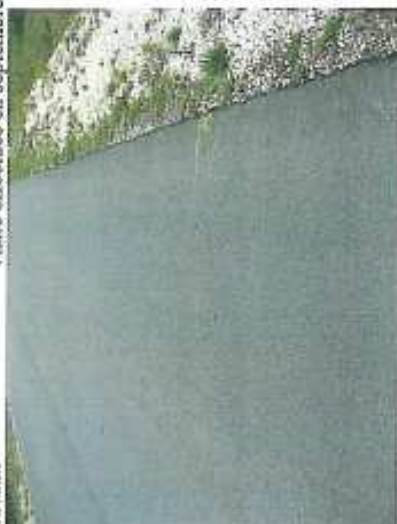
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Cosne-Cours-sur-Loire

Rue de Nabéris – VC n°3

Suivi avant travaux

Visite effectuée en septembre 2003



Suivi après travaux

Visite effectuée en novembre 2003



Suivi à 1 an

Visite effectuée le 8 septembre 2004

This document is now
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CROSS-SECTION PROFILOGRAM

Département : COSNE SUR LOIRE (58)

Road : rue de Nabéris

Date of the zero point : 09/09/2003

Location : in front of the green lamp standard and vc n°3, 130 m from the beginning of the street

Axe = Axis

Tranchée = Trench

Echelle = Scale

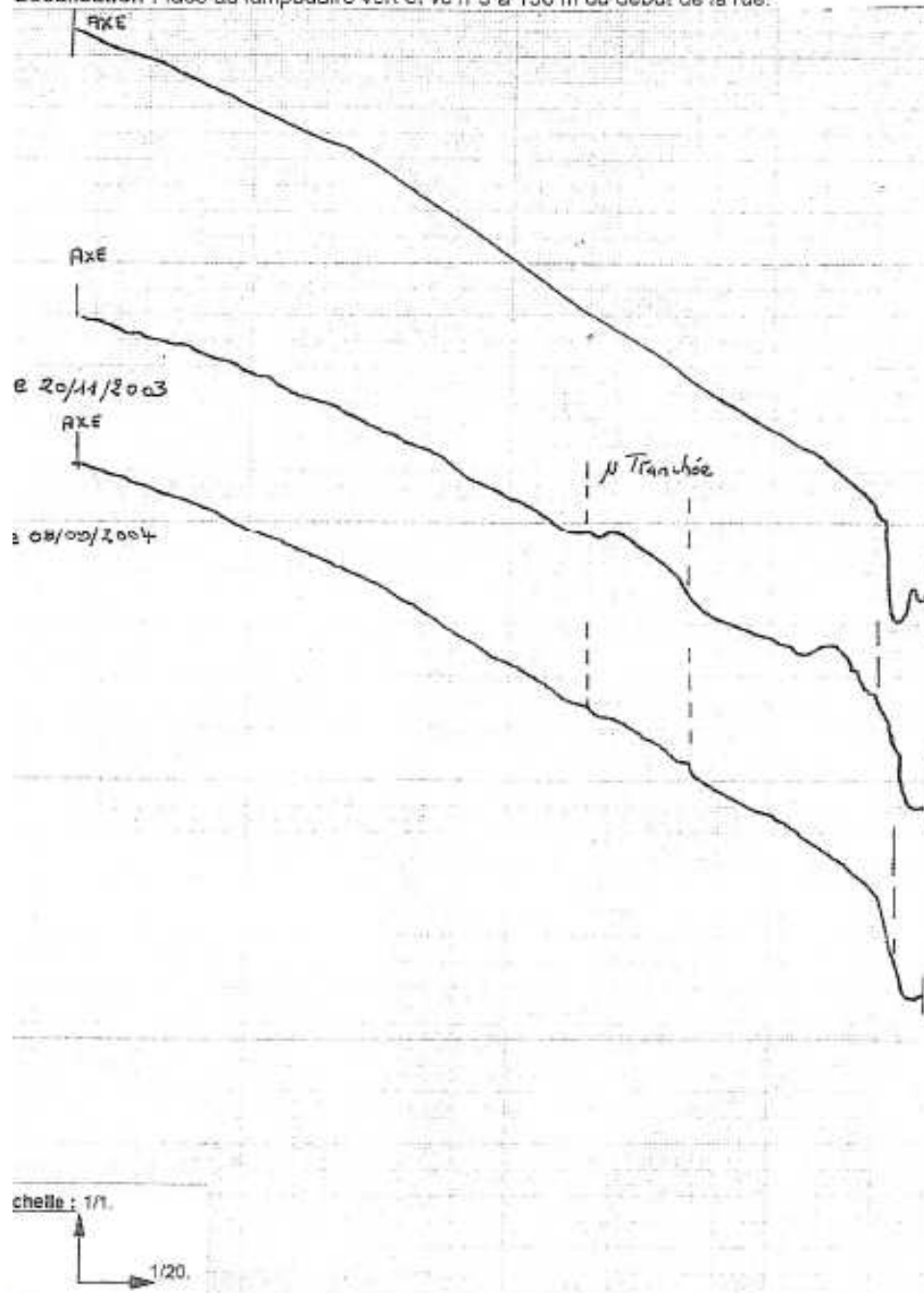
TRANSVERSOPROFILOGRAMME.

Département : COSNE SUR LOIRE (58)

Route : rue de Nabéris

Date du point zéro : le 09/09/2003

Localisation : face au lampadaire vert et vc n°3 à 130 m du début de la rue.



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CROSS-SECTION PROFILOGRAM

Département : COSNE SUR LOIRE (58)

Road : RD 243

Date of the zero point : 09/09/2003

Location : in front of the cross-road sign, 370 m from the beginning of the street

Axe = Axis

Tranchée = Trench

Echelle = Scale



RD 243 – in front of the EDF sign



CROSS-SECTION PROFILOGRAM

Département : COSNE SUR LOIRE (58)

Road : RD 243

Date of the zero point : 09/09/2003

Location : in front of the EDF sign at PR 30, 1,200 m from the beginning of the street

Axe = Axis

Tranchée = Trench

Echelle = Scale



RD 243 – in front of the cross-road sign



Cosme-Cours-car-Laive

Rue Henri Dunant

Suivi avant travaux



Suivi après travaux



Visite effectuée en novembre 2003

Suivi à 1 an



Visite effectuée le 8 septembre 2004

Rue du Colonel Rabier – in front of the secondary school

RD 243 – fin de travaux d'intersection

Suivi avant travaux



Visite effectuée en septembre 2003

Suivi après travaux



Visite effectuée en novembre 2003

Suivi à 1 an

Visite effectuée le 8 septembre 2004



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CROSS-SECTION PROFILOGRAM

Département : COSNE SUR LOIRE (58)

Road : Colonel RABIER

Date of the zero point : 09/09/2003

Location : in front of the lamp standard and the school, 210 m from the beginning of the street

Axe = Axis

Tranchée = Trench

Echelle = Scale

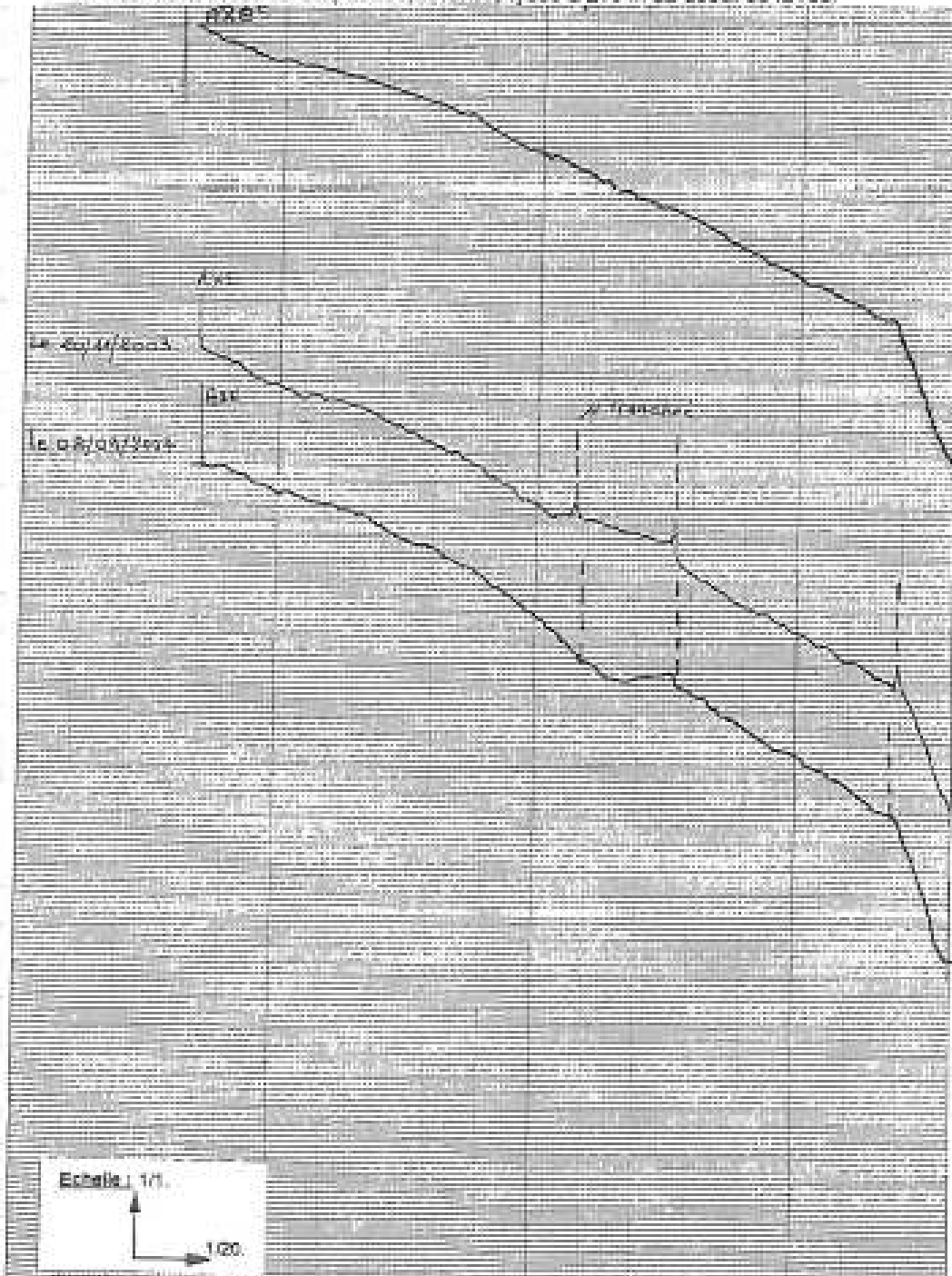
TRANSVERSOPROFILOGRAMME.

Département : COSNE SUR LOIRE (58)

Route : Colonel RABIER

Date du point zéro : le 09/09/2003

Localisation : face au lampadaire, devant le lycée à 210 m du début de la rue.



Echelle: 1/1.

1/20.

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Croix-Cours-sur-Loire

Rue du Colonel Rabier – à 850 m du début de rue

Suivi avant travaux



Visite effectuée en septembre 2003

Suivi après travaux



Visite effectuée en novembre 2003

Suivi à 1 an



Visite effectuée le 8 septembre 2004

CROSS-SECTION PROFILOGRAM

Département : COSNE SUR LOIRE (58)

Road : Colonel RABIER

Date of the zero point : 09/09/2003

Location : in front of the lamp standard n°47, 850 m from the beginning of the street

Axe = Axis

Tranchée = Trench

Echelle = Scale

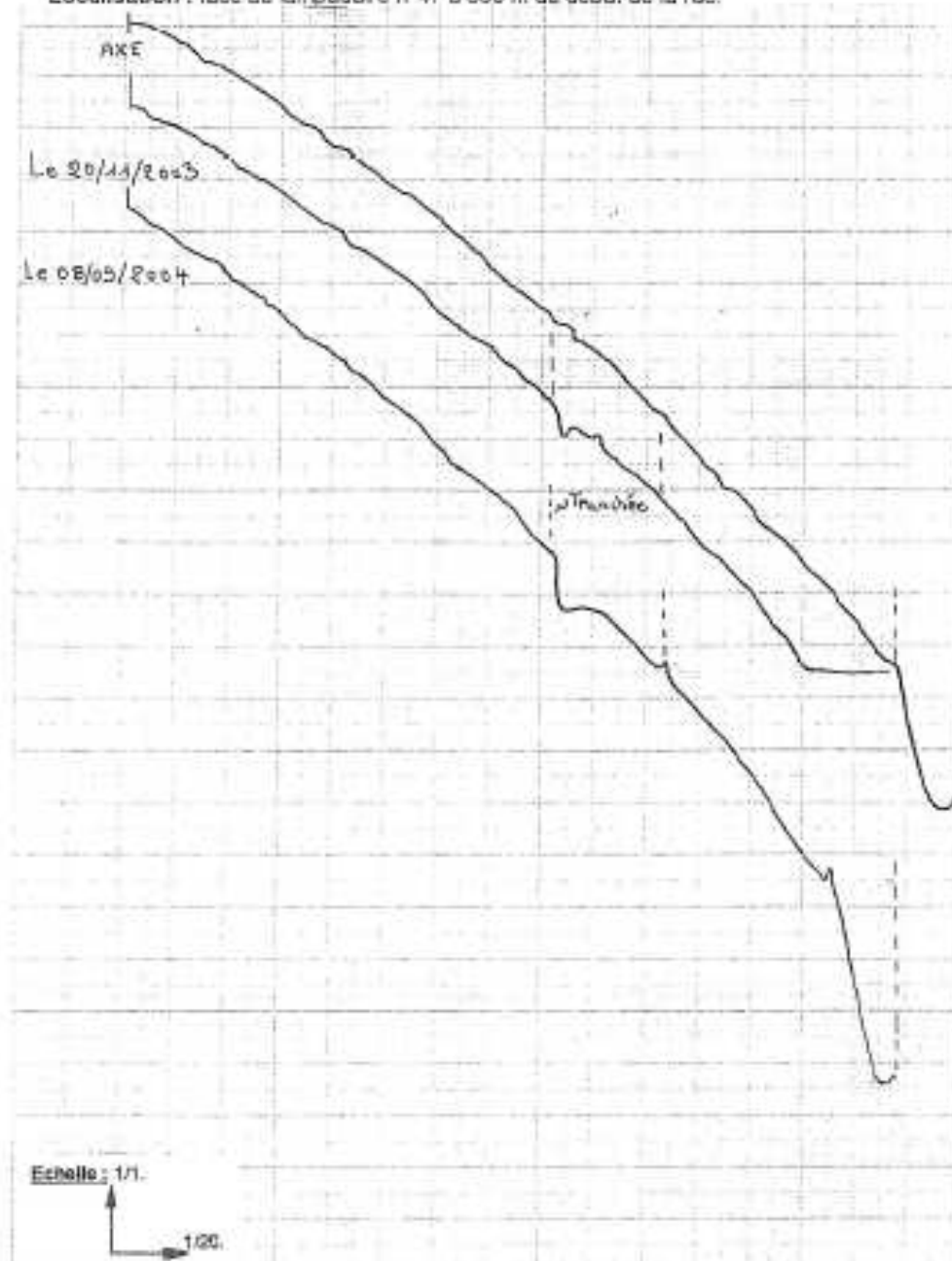
TRANSVERSOPROFILOGRAMME.

Département : COSNE SUR LOIRE (58)

Route : Colonel RABIER

Date du point zéro : le 09/09/2003

Localisation : face au lampadaire n°47 à 850 m du début de la rue.



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Rue des rivières de St Agnan

Document communiqué en vertu de l'art. 10 de la Loi sur l'accès à l'information

Rue des rivières St Agnan

Suivi avant travaux



Visite effectuée en septembre 2003

Visite effectuée en novembre 2003



Suivi après travaux

Suivi à 1 an

Visite effectuée le 8 septembre 2004



CROSS-SECTION PROFILOGRAM

Département : COSNE SUR LOIRE (58)

Road : St AGNAN

Date of the zero point : 09/09/2003

Location : in front of the EDF pole near the wash house, 150 m from the beginning of the street

Axe = Axis

Tranchée = Trench

Echelle = Scale

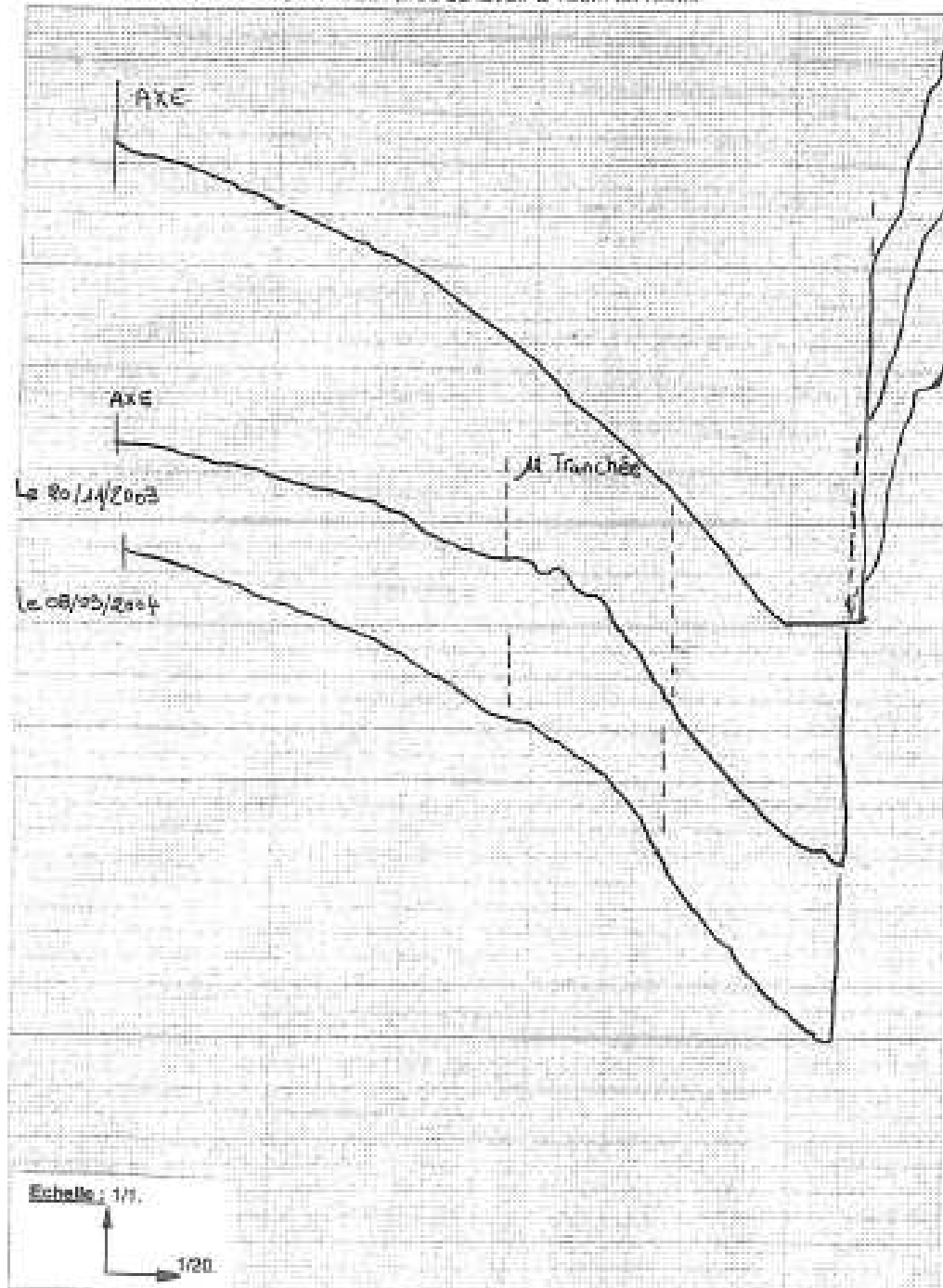
TRANSVERSOPROFILOGRAMME

Département : COSNE SUR LOIRE (58)

Route : St AGNAN

Date du point zéro : le 09/09/2003

Localisation : face au poteau EDF près du lavoir à 150m du début



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Rue 3 Ponts

Source: Service d'urbanisme de la Ville de Québec

Rue des 3 ponts

Suivi avant travaux

Visite effectuée en septembre 2003



Suivi après travaux

Visite effectuée en novembre 2003



Suivi à 1 an

Visite effectuée le 8 septembre 2004



CROSS-SECTION PROFILOGRAM

Département : COSNE SUR LOIRE (58)

Road : rue des Trois Ponts

Date of the zero point : 09/09/2003

Location : in front of the lamp standard between the first and the second bridges, 350 m from the beginning of the street

Axe = Axis

Tranchée = Trench

Echelle = Scale

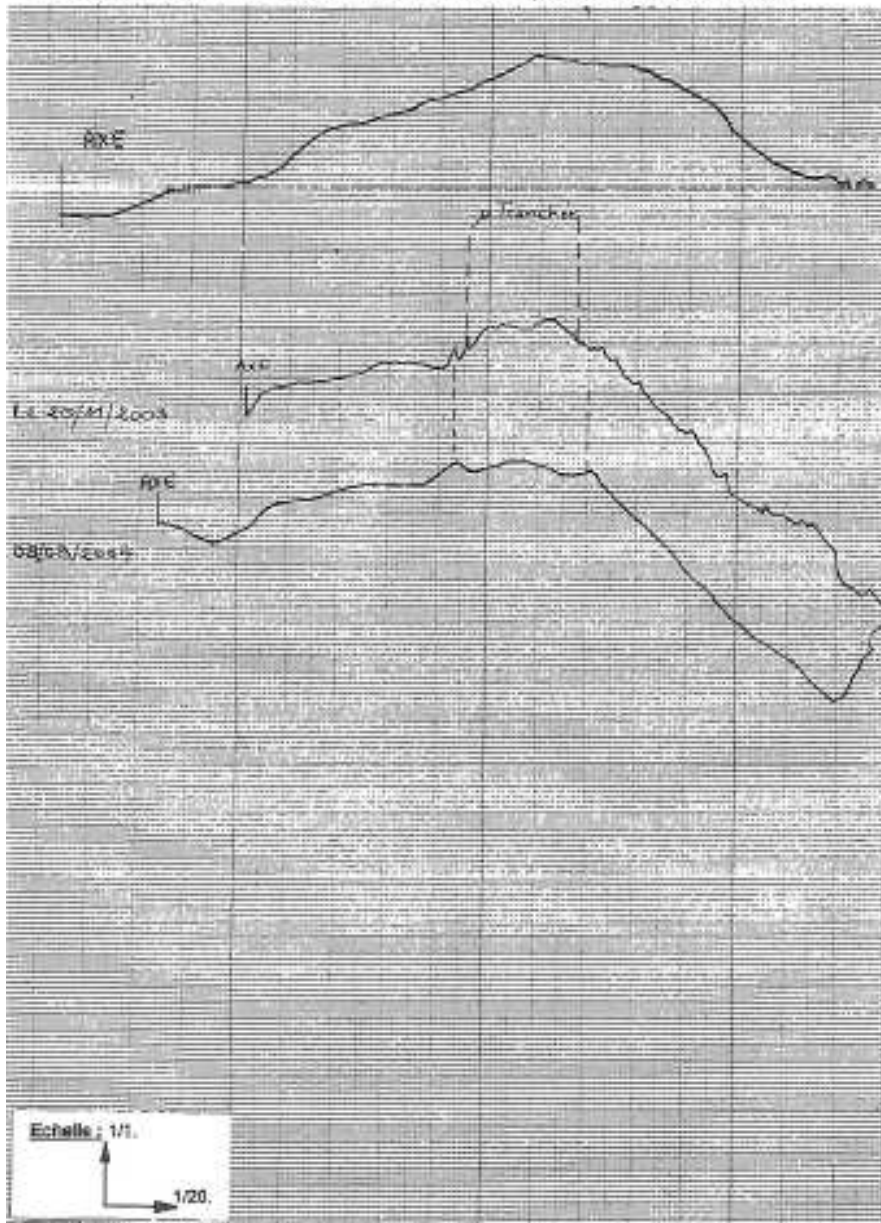
TRANSVERSOPROFILOGRAMME

Département : COSNE SUR LOIRE (58)

Route : Rue des TROIS PONTS

Date du point zéro : le 09/09/2003

Localisation : face au lampadaire entre le un et le second pont à 305m du début.



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Rue du 8 mai – Pont de Dahomey

Suivi avant travaux



Visite effectuée en septembre 2003

Suivi après travaux

Visite effectuée en novembre 2003

Suivi à 1 an



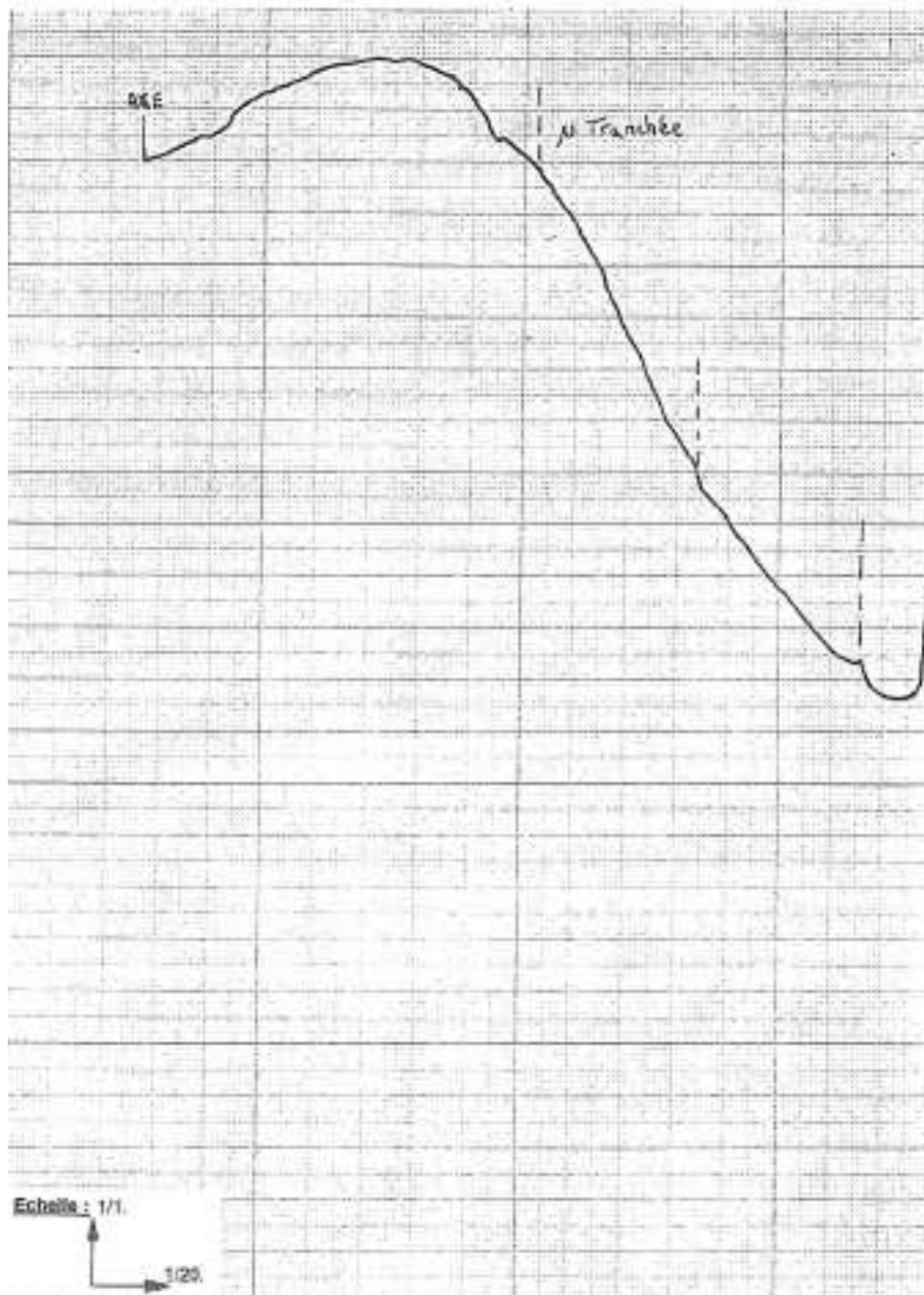
Visite effectuée le 8 septembre 2004

CROSS-SECTION PROFILOGRAM

Département : COSNE SUR LOIRE (58) Road : rue du 8 mai – Pont Dahomey
Date of the zero point : 09/08/2004
Location : in front of the EDF pole n°p417, 50 m from the beginning of the street
Axe = Axis
Tranchée = Trench
Echelle = Scale

TRANSVERSOPROFILOGRAMME

Département : COSNE SUR LOIRE (58) Route : rue 8 MAI-Pt DAHOMEY
Date du point zéro : le 08/09/2004
Localisation : en face du poteau EDF n° p417 à 50 m du début



Rue Victor Hugo

LAURE-LIMITE-1007-CAMPE

Rue Victor Hugo

Suivi avant travaux



Visite effectuée en septembre 2003

Suivi après travaux



Visite effectuée en novembre 2003

Suivi à 1 an



Visite effectuée le 8 septembre 2004

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CROSS-SECTION PROFILOGRAM

Département : COSNE SUR LOIRE (58)

Road : rue Victor Hugo

Date of the zero point : 11/20/2003

Location : in front of the third lamp standard, 120 m from the beginning of the street

Axe = Axis

Tranchée = Trench

Echelle = Scale

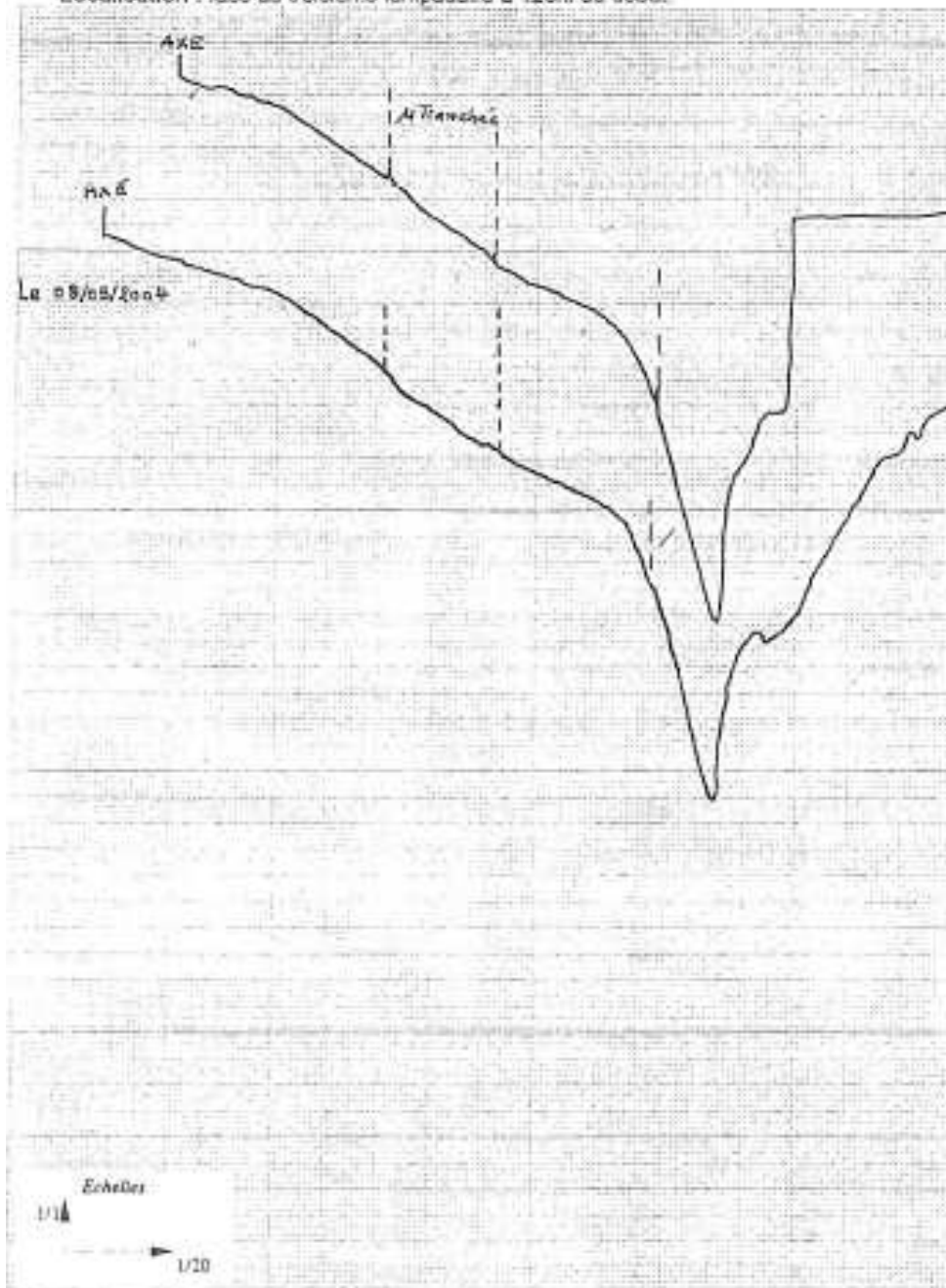
TRANSVERSOPROFILOGRAMME.

Département : COSNE SUR LOIRE (58)

Route : rue Victor HUGO

Date du point zéro : 11/20/2003

Localisation : face au troisième lampadaire à 120m du début



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Clamecourt-sur-Loire

Rue Jean Jaurès

Suivi avant travaux



Visite effectuée en septembre 2003

Suivi après travaux



Visite effectuée en novembre 2003

Suivi à 1 an



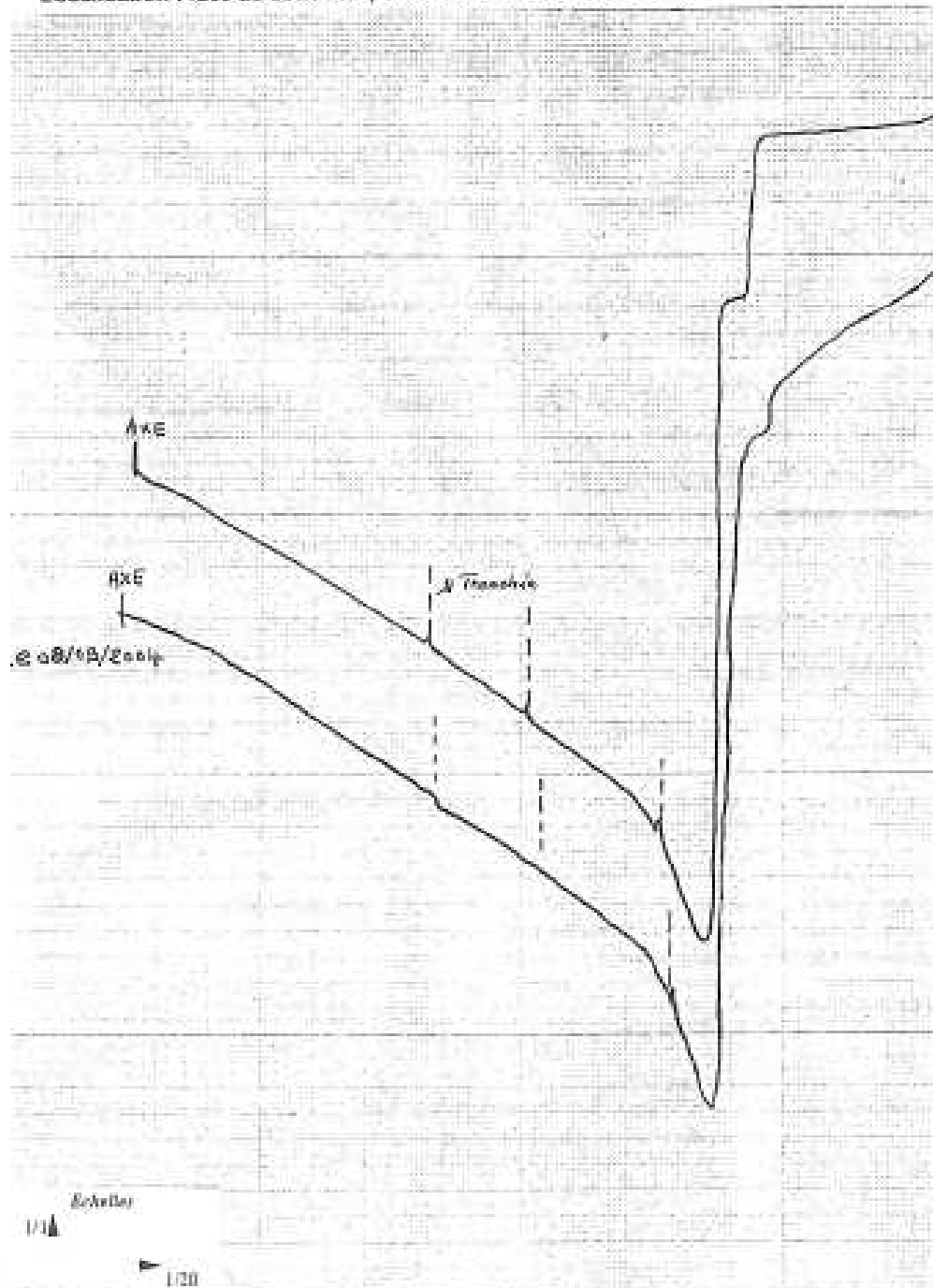
Visite effectuée le 8 septembre 2004

CROSS-SECTION PROFILOGRAM

Département : COSNE SUR LOIRE (58) Road : rue Jean Jaurès
Date of the zero point : 11/20/2003
Location : in front of the second pole, 65 m from the beginning of the street
Axe = Axis
Tranchée = Trench
Echelle = Scale

TRANSVERSOPROFILOGRAMME

Département : COSNE SUR LOIRE (58) Route : rue Jean JAURES
Date du point zéro : le 20/11/2003
Localisation : face au deuxième poteau à 65m du début de la rue



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Cosme-Cours-sur-Loire

Rue Sadi Carnot

Suivi avant travaux



Visite effectuée en septembre 2003

Suivi après travaux



Visite effectuée en novembre 2003

Suivi à 1 an

Visite effectuée le 8 septembre 2004



CROSS-SECTION PROFILOGRAM

Département : COSNE SUR LOIRE (58)

Road : rue Sadi Carnot

Date of the zero point : 11/20/2003

Location : in front of the PTT pole n°12, 100 m from the beginning of the street

Axe = Axis

Tranchée = Trench

Echelle = Scale

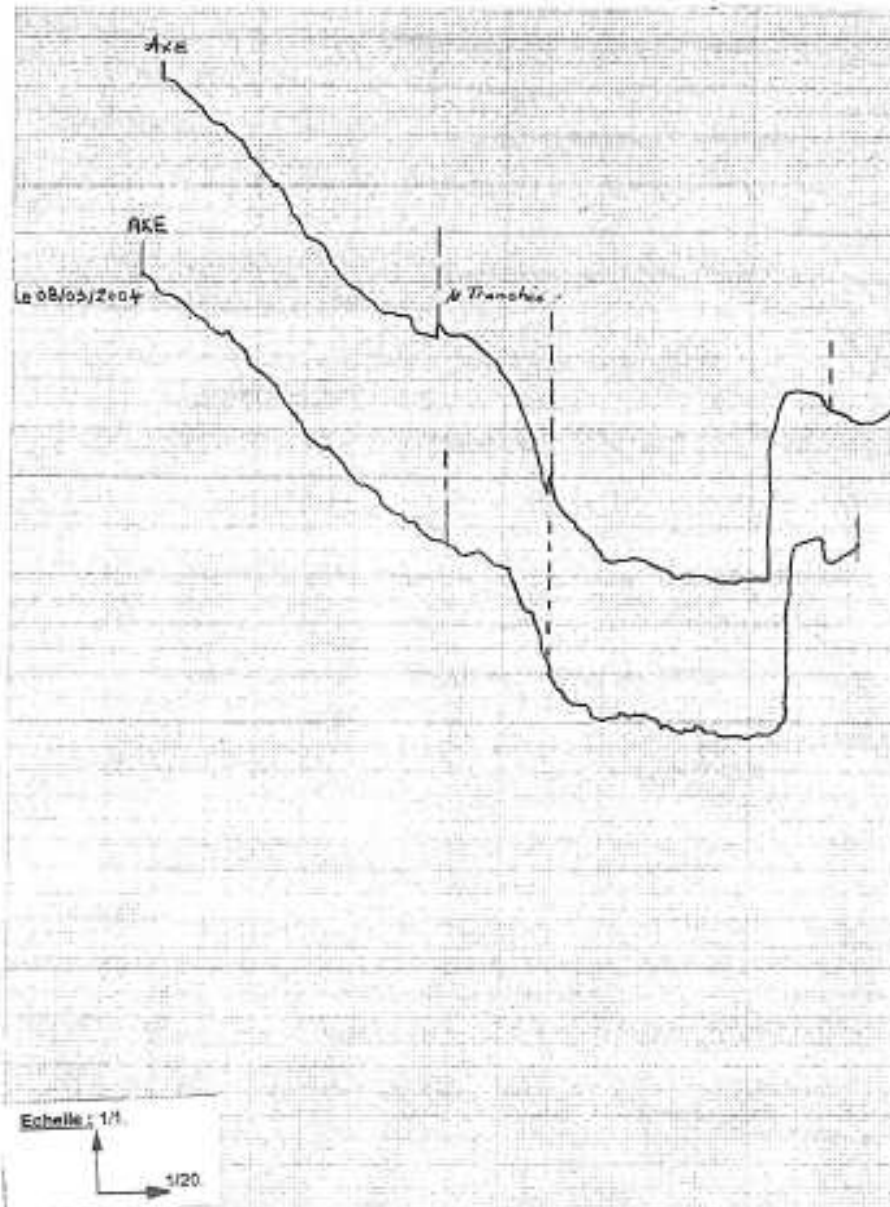
TRANSVERSOPROFILOGRAMME.

Département : COSNE SUR LOIRE (58).

Route : rue SADI CARNOT

Date du point zéro : le 20/11/2003

Localisation : face au poteau PTT N°12 à 100m du début de la rue.



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Casne-Cours-sur-Loire

Rue du Maréchal Leclerc

Suivi avant travaux



Visite effectuée en septembre 2003

Suivi après travaux



Visite effectuée en novembre 2003

Suivi à 1 an



Visite effectuée le 8 septembre 2004

CROSS-SECTION PROFILOGRAM

Département : COSNE SUR LOIRE (58)

Road : rue du Maréchal Leclerc

Date of the zero point : 11/20/2003

Location : in front of the Police Nationale sign

Axe = Axis

Tranchée = Trench

Echelle = Scale

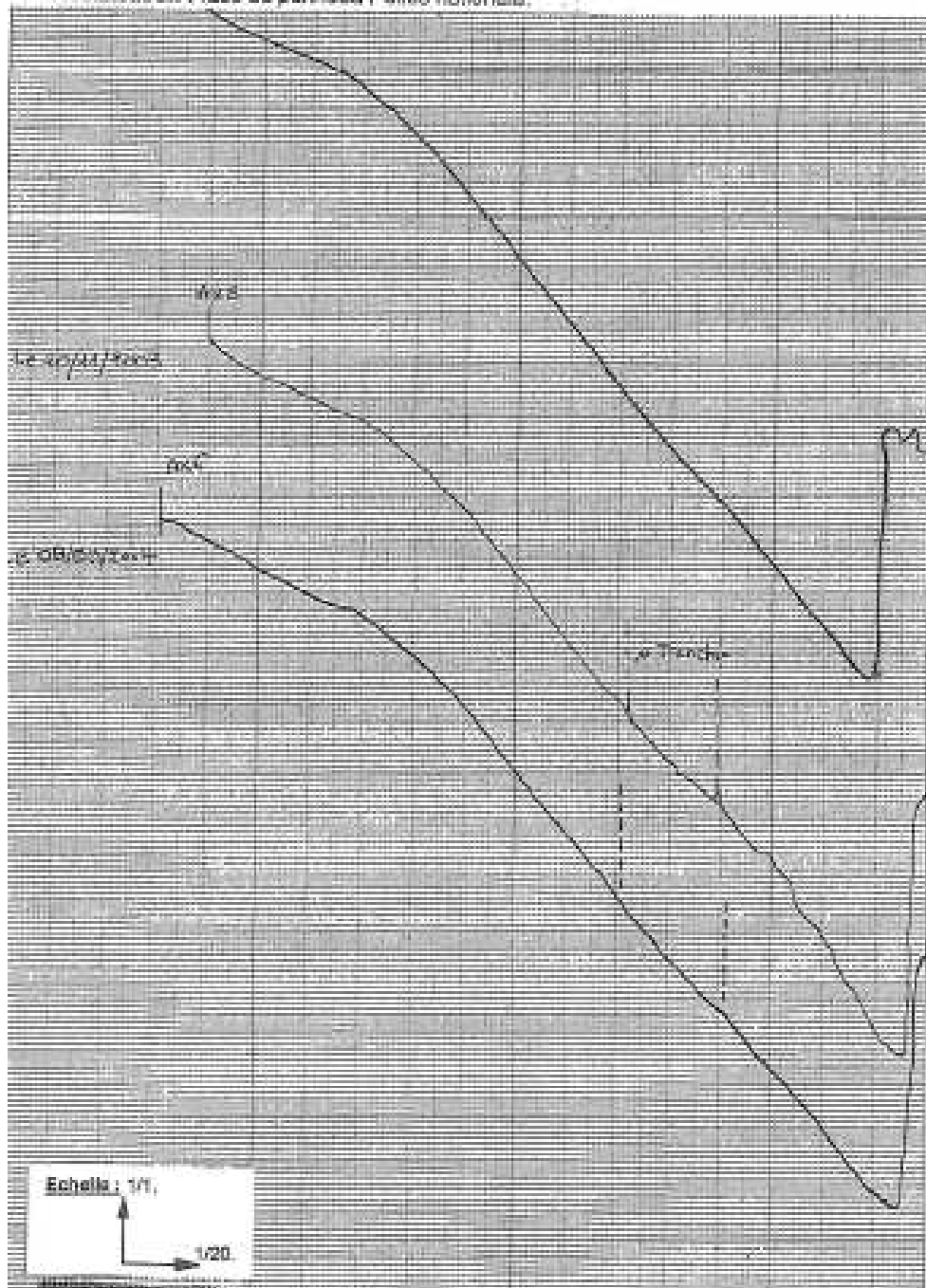
TRANSVERSOPROFILOGRAMME

Département : COSNE SUR LOIRE (58)

Route : du maréchal LECLERC

Date du point zéro : le 09/09/2003

Localisation : face au panneau Police nationale.



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Cours-Cours-sur-Loire

Rue Colette

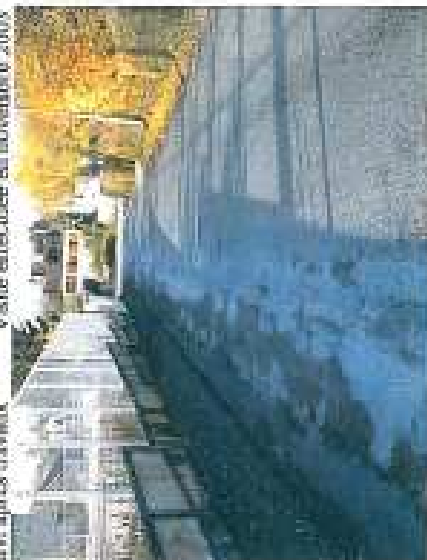
Suivi avant travaux

Visite effectuée en septembre 2003



Suivi après travaux

Visite effectuée en novembre 2003



Suivi à 1 an

Visite effectuée le 8 septembre 2004

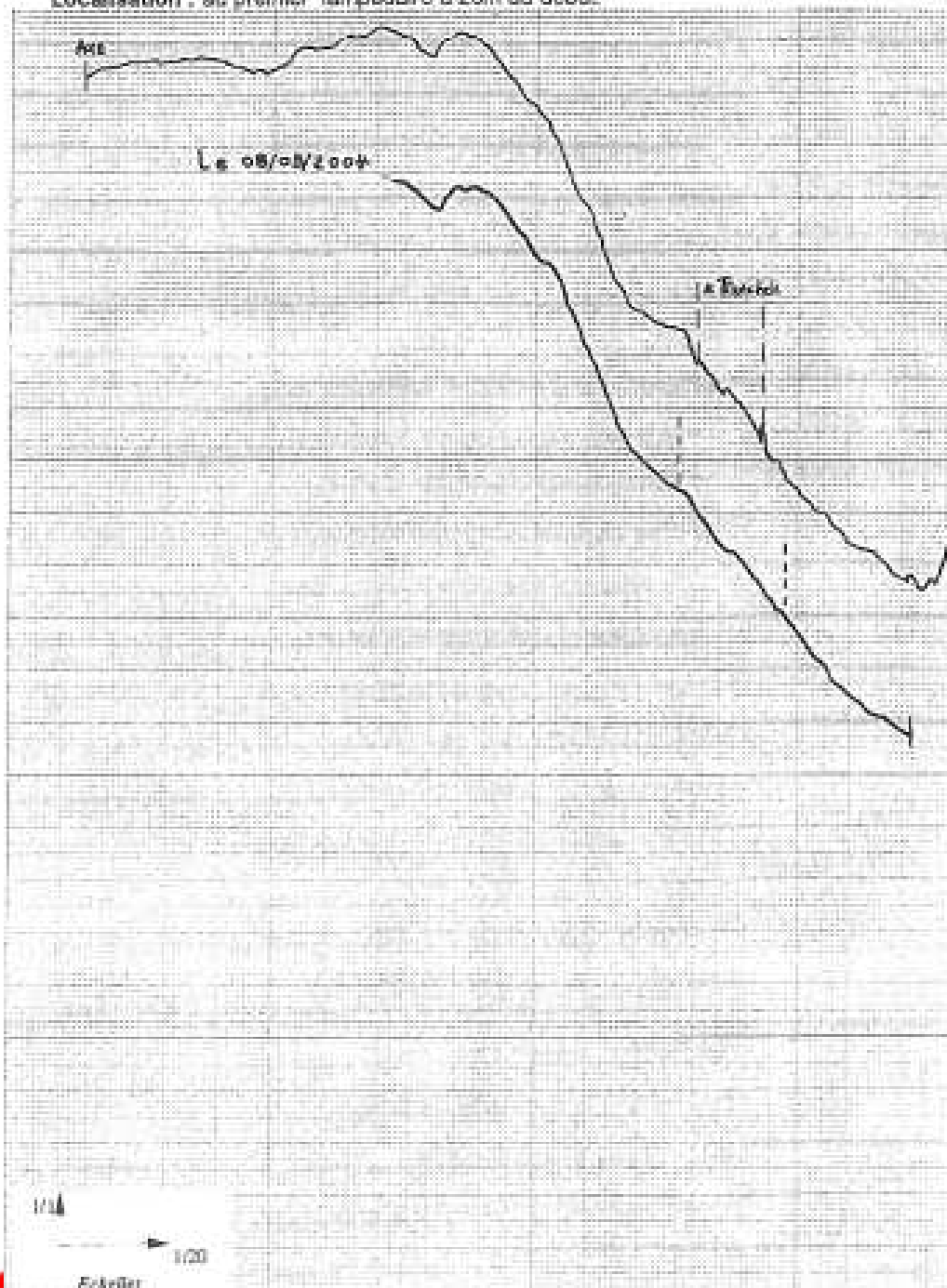


CROSS-SECTION PROFILOGRAM

Département : COSNE SUR LOIRE (58) Road : rue Colette
Date of the zero point : 11/20/2003
Location : at the first lamp standard, 25 m from the beginning of the street
Axe = Axis
Tranchée = Trench
Echelle = Scale

TRANSVERSOPROFILOGRAMME.

Département : COSNE SUR LOIRE (58). Route : COLETTE
Date du point zéro : le 20/11/2003
Localisation : au premier lampadaire à 25m du début.



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Rue de la Fontaine St Laurent, 100 m from the beginning of the street

Comme-Cours-sur-Loire

Rue de la Fontaine St Laurent – à 100 m du début de rue

Suivi avant travaux

Visite effectuée en septembre 2003



Suivi après travaux

Visite effectuée en novembre 2003



Suivi à l'ao

Visite effectuée le 8 septembre 2004

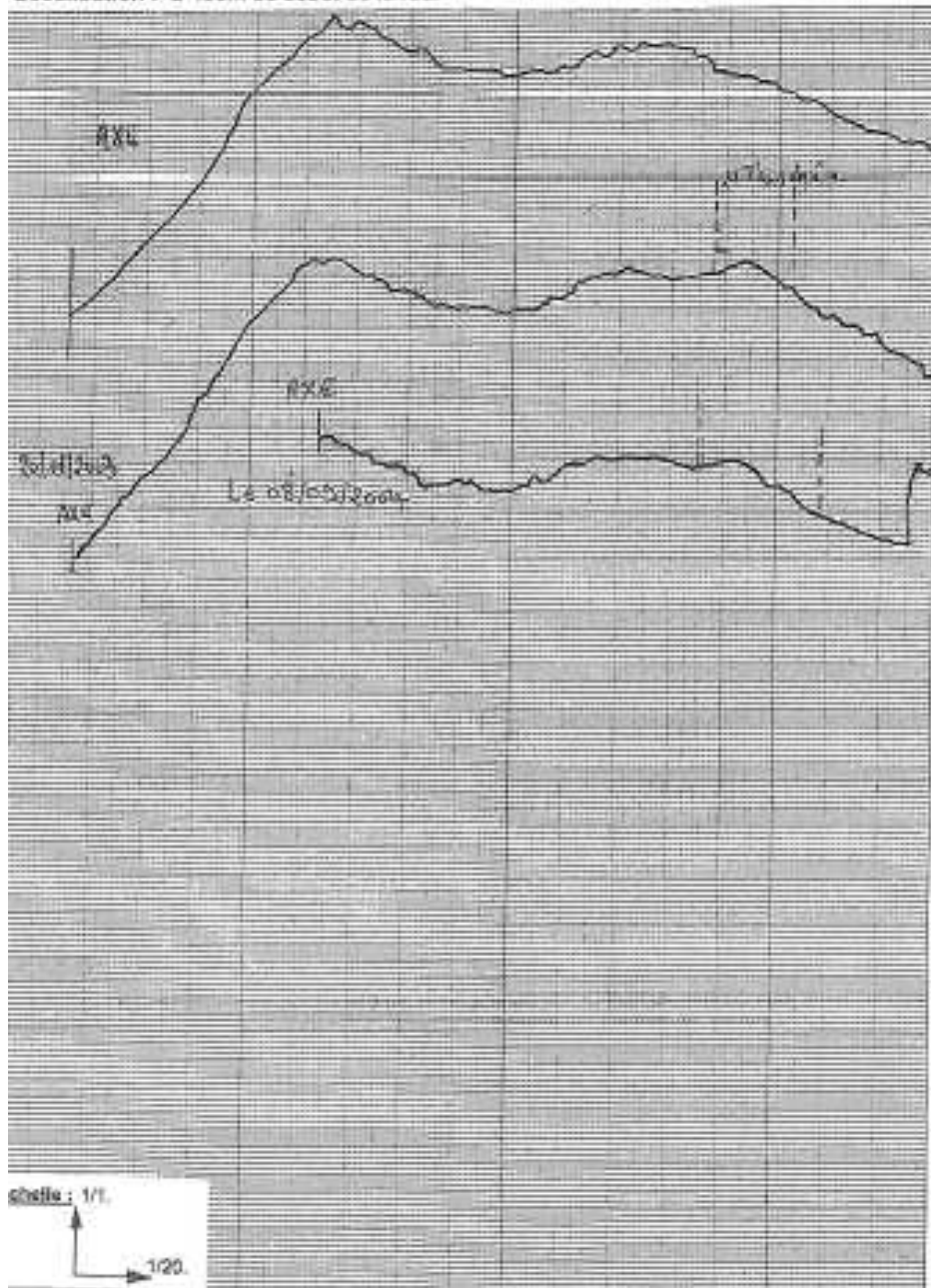


CROSS-SECTION PROFILOGRAM

Département : COSNE SUR LOIRE (58) Road : rue de la Fontaine St Laurent
Date of the zero point : 09/09/2003
Location : in front of the PTT pole n°12, 100 m from the beginning of the street
Axe = Axis
Tranchée = Trench
Echelle = Scale

TRANSVERSOPROFILOGRAMME

Département : COSNE SUR LOIRE (58) Route : rue de la fontaine ST LAURENT
Date du point zéro : le 09/09/2003
Localisation : à 400m du début de la rue.



Rue de la Fontaine St Laurent, 400 m from the beginning of the street

Cosme-Comme-sur-Laure

Boulevard de la République – en face de la Grandmairie

Suivi avant travaux



Visite effectuée en septembre 2003

Suivi après travaux



Visite effectuée en novembre 2003

Suivi 1 an

Visite effectuée le 8 septembre 2004

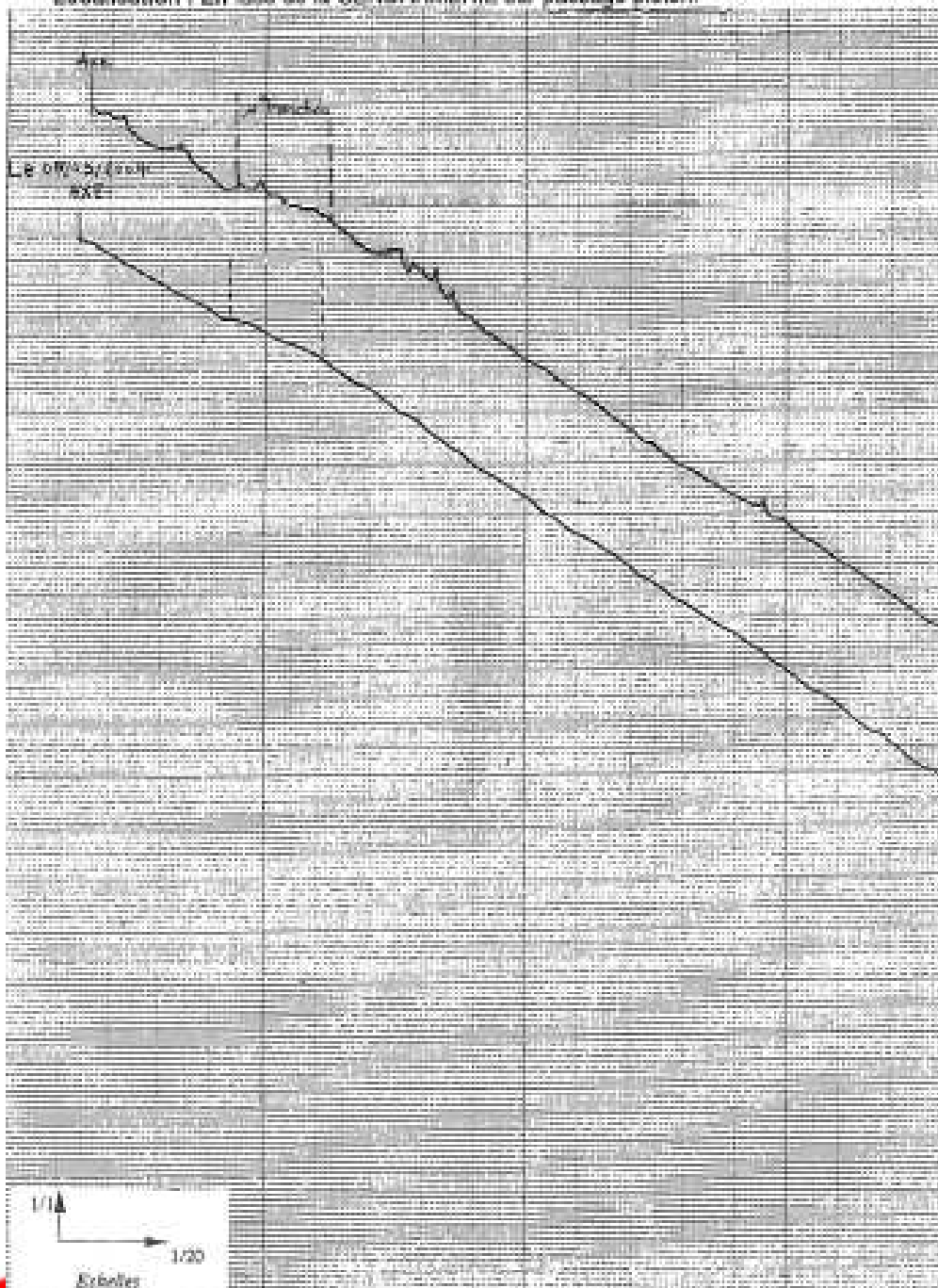


CROSS-SECTION PROFILOGRAM

Departement : COSNE SUR LOIRE (58) Road : rue de la Fontaine St Laurent
Date of the zero point : 09/09/2003
Location : 400 m from the beginning of the street
Axe = Axis
Tranchée = Trench
Echelle = Scale

TRANSVERSOPROFILOGRAMME.

Département : COSNE SUR LOIRE (58) Route : BD de la REPUBLIQUE
Date du point zéro : le 20/11/2003
Localisation : En face de la GENDARMERIE sur passage piéton.



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Coque-Cours-sur-Loire

Boulevard de la République – devant la mairie des associations

Suivi avant travaux

Visite effectuée en septembre 2003

Suivi après travaux

Visite effectuée en novembre 2003



Suivi à 1 an

Visite effectuée le 8 septembre 2004

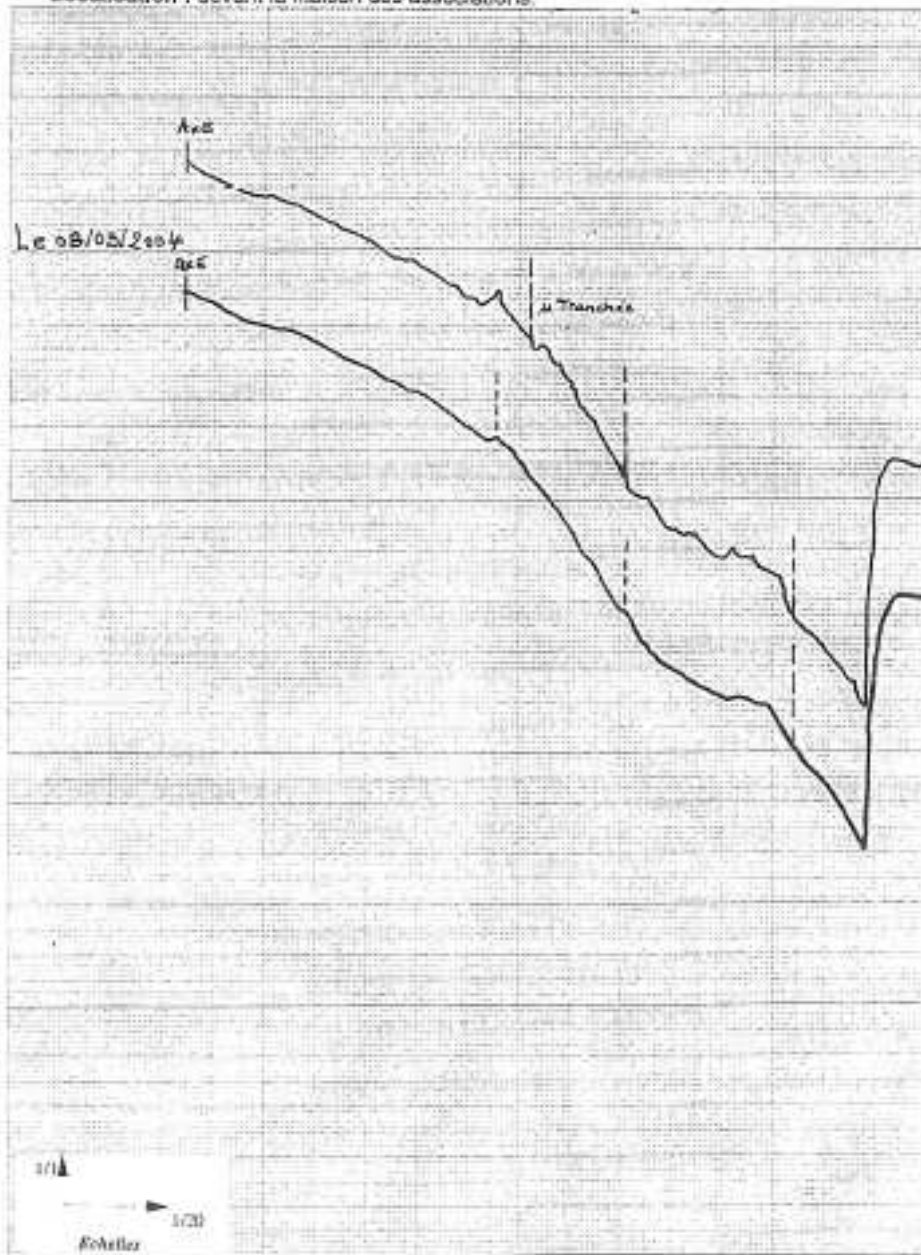


CROSS-SECTION PROFILOGRAM

Département : COSNE SUR LOIRE (58) Road : Bd de la République
Date of the zero point : 11/20/2003
Location : in front of the Gendarmerie at the cross walk
Axe = Axis
Tranchée = Trench
Echelle = Scale

TRANSVERSOPROFILOGRAMME

Département : COSNE SUR LOIRE (58). Route : BD de la REPUBLIQUE
Date du point zéro : 16/20/11/2003
Localisation : devant la maison des associations



Couze-Cours-sur-Loire

Rue de l'Est

Suivi avant travaux



Visite effectuée en septembre 2003.

Suivi après travaux



Visite effectuée en novembre 2003

Suivi à 1 an



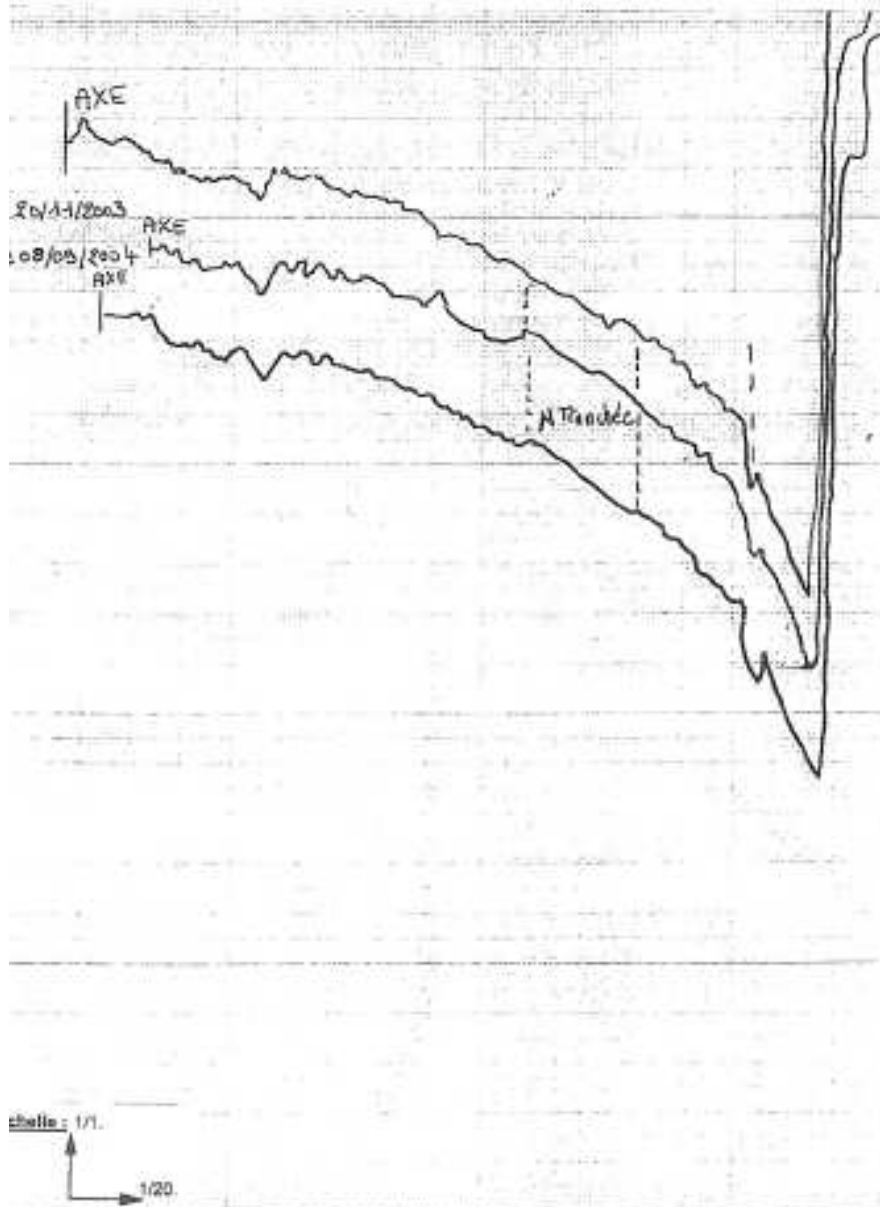
Visite effectuée le 8 septembre 2004

CROSS-SECTION PROFILOGRAM

Département : COSNE SUR LOIRE (58) Road : Bd de la République
Date of the zero point : 11/20/2003
Location : in front of the Maison des associations
Axe = Axis
Tranchée = Trench
Echelle = Scale

TRANSVERSOPROFILOGRAMME

Département : COSNE SUR LOIRE (58) Route : de L' EST
Date du point zéro : le 09/09/2003
Localisation : face au poteau 2512 à 108m du début.



Cosme-Cours-sur-Loire

Rue de l'Est

Suivi avant travaux

Visite effectuée en septembre 2003



Suivi après travaux

Visite effectuée en novembre 2003



Suivi à 1 an

Visite effectuée le 8 septembre 2004

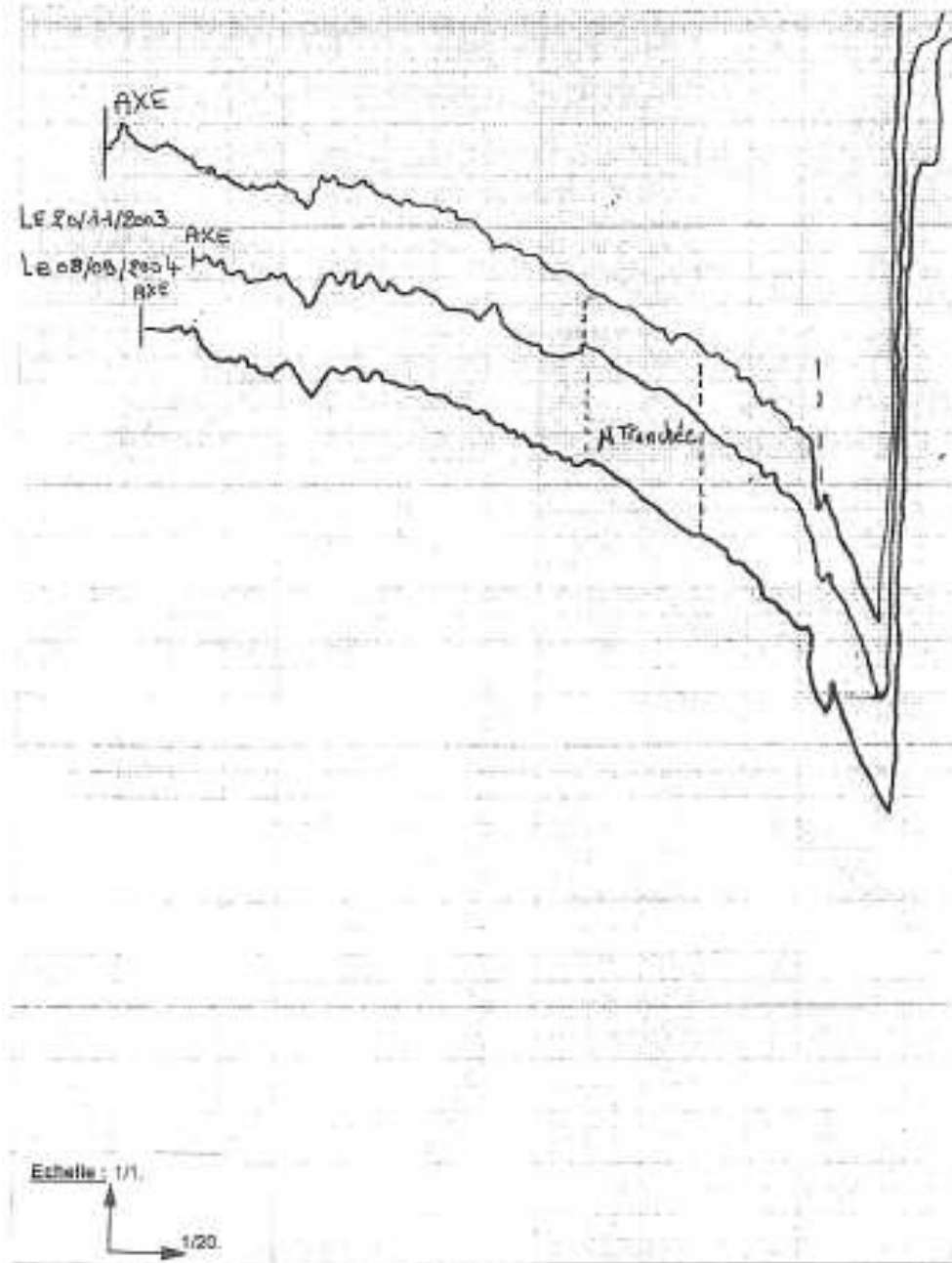


CROSS-SECTION PROFILOGRAM

Departement : COSNE SUR LOIRE (58) Road : rue de l'Est
Date of the zero point : 09/09/2003
Location : in front of the pole 2512, 108 m from the beginning of the street
Axe = Axis
Tranchée = Trench
Echelle = Scale

TRANSVERSOPROFILOGRAMME

Département : COSNE SUR LOIRE (58) Route : de L' EST
Date du point zéro : le 09/09/2003
Localisation : face au poteau 2512 à 108m du début



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Couze-Cours-sur-Loire

Rue Croix Janvier

Suivi avant travaux



Visite effectuée en septembre 2003

Suivi après travaux



Visite effectuée en novembre 2003

Suivi à 1 an



Visite effectuée le 8 septembre 2004

CROSS-SECTION PROFILOGRAM

Département : COSNE SUR LOIRE (58)

Road : rue de l'Est

Date of the zero point : 09/09/2003

Location : in front of the PTT pole n°808414, 195 m from the beginning of the street

Axe = Axis

Tranchée = Trench

Echelle = Scale

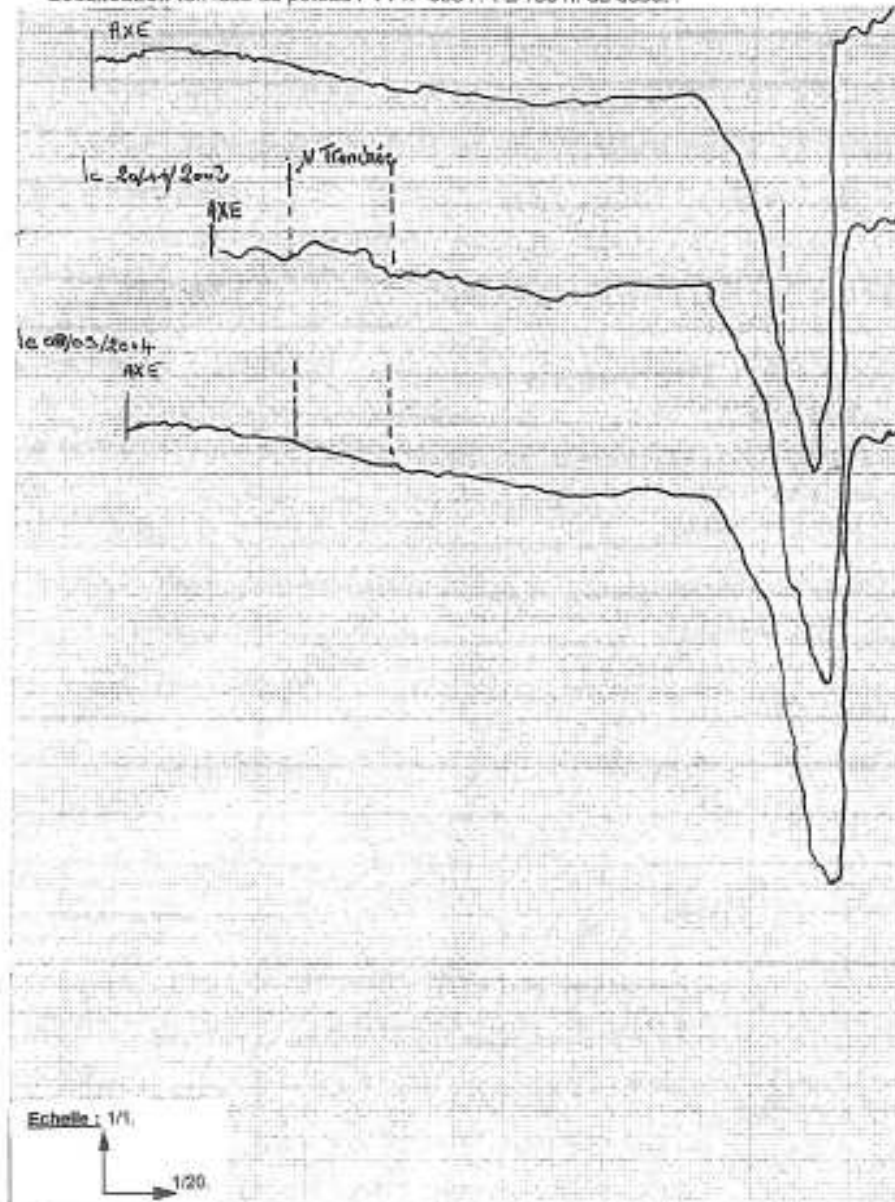
TRANSVERSOPROFILOGRAMME

Département : COSNE SUR LOIRE (58)

Route : croix JANVIER

Date du point zéro : le 09/09/2003

Localisation : en face du poteau PTT n° 808414 à 195 m du début.



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