

Landscape and road legibility

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SYNOPSIS

A working group led by Setra (French Ministry for Public Works, Transport, Land Planning, Tourism and Sea) is developing a comprehensive approach which associates landscape and road safety through road legibility. This approach emerges from several study cases, mainly road requalifications. However, it can also be applied to road conception, in order to detect dangerous configurations and find “soft” and sustainable solutions.

The hypothesis of this systemic approach is based on the relation between man, vehicle and environment. Making the road legible by working on the road environment improves the driver’s perception of the road layout, which contributes to road safety.

For the last four years, study engineers have transposed to interurban roads a methodology developed during the mid-80’s for cities which integrates the driver’s perception and behaviour in the analysis of the road and in its improvement project. Consequently, the current knowledge about the driver’s mental activities and road legibility and the presentation of three studies have been brought together in a study case compilation.

- ⇒ RN23 : 3 lane road managed through the notion of constraint and comfort for the driver, and through the connections between the road and its area ;
- ⇒ RN71 : roadside tree planting project associating landscape identification, road legibility and road safety ;
- ⇒ RD2000 : phased express road (projected 4 lane road but two lane in the first phase) where it is difficult to identify the road type (national road or motorway).

These three cases dealt differently with road legibility, road safety and landscape. Due to this compilation, the working group begun to think about a common way to introduce road legibility in route analysis.

The different steps of the “landscape and road legibility” methodology are :

- ⇒ inventory of all the components of the route and their interactions ;
- ⇒ dynamic identification of this route based on the landscape scales ;
- ⇒ diagnosis revealing the disfunctions of the road (in regard to a complete safety diagnosis) ;
- ⇒ proposals of modifications along and next to the infrastructure to enhance its legibility, and reduce the road unsafety.

The working group now has to complete the dynamic identification of road method through which the road is sequenced. The sequences are as closed as possible to the driving sequences linked to the driver’s perception.

This kind of analysis enriches the safety approach and helps to understand the difficulties, by taking into account the driver’s behaviour. It can be used to complete a safety diagnosis in road requalification by bringing a comprehensive approach. It can help to integrate road safety in land planning documents by a better understanding of the relations between the road and its area. Another objective of this method would be to integrate the driver’s perception and behaviour in road conception and to build more legible road.

Landscape and road legibility

INTRODUCTION

A working group led by Setra (French Ministry for Public Works, Transport, Land Planning, Tourism and Sea) since 2001 has been working on landscape and road legibility in route analysis linked to road safety. This methodology had been developed in the 80's-90's for urban areas in order to integrate in the analysis the driver's behaviour and perception but also the relation between the road and its area.

Due to a compilation of study cases, the working group begun to identify elements for a common way to introduce road legibility in route analysis, which are presented here. It leads to a comprehensive approach associating landscape and road legibility, which includes a better understanding of the driver's behaviour and of legibility.

As a complex reality, road safety is enriched by a landscape component through this approach. Landscape is often modified because of road safety requirements (withdrawal of plantations, demolition of buildings,...). But landscape can be created, composed or conserved for road safety requirements.

This approach do not replace road safety diagnosis. It is a relevant complement which helps to find potentially dangerous route sequences by integrating aspects linked to the driver and his behaviour.

PRINCIPLES AND CONCEPTS OF ROAD LEGIBILITY

Hypothesis of this approach

The work is based on a systemic approach analysing the relation between man, vehicle and environment, which is leading to a reflection on the legibility of the road and its surroundings.



Figure 1: safety approach triptyque

The environment of the road, including landscape, helps the driver in his driving act. That is to say that the surroundings of the road give signs to the driver so that he can regulate his behaviour (speed and rule acceptance) through a constant analysis of linear and transversal information he gets in every landscaped sequence. Improving the road legibility with a work on the road landscape contributes to the stability of the man-vehicle-environment system.

The aim of this is to adapt the driver's behaviour to the route he is driving on. As the driver's behaviour is directly linked to the perception of the route, it is essential to make the road more legible in order to induce a change of the driver's behaviour improving road safety.

The driver's perception

Here follows a scheme explaining the mechanisms of perception applied to driving.

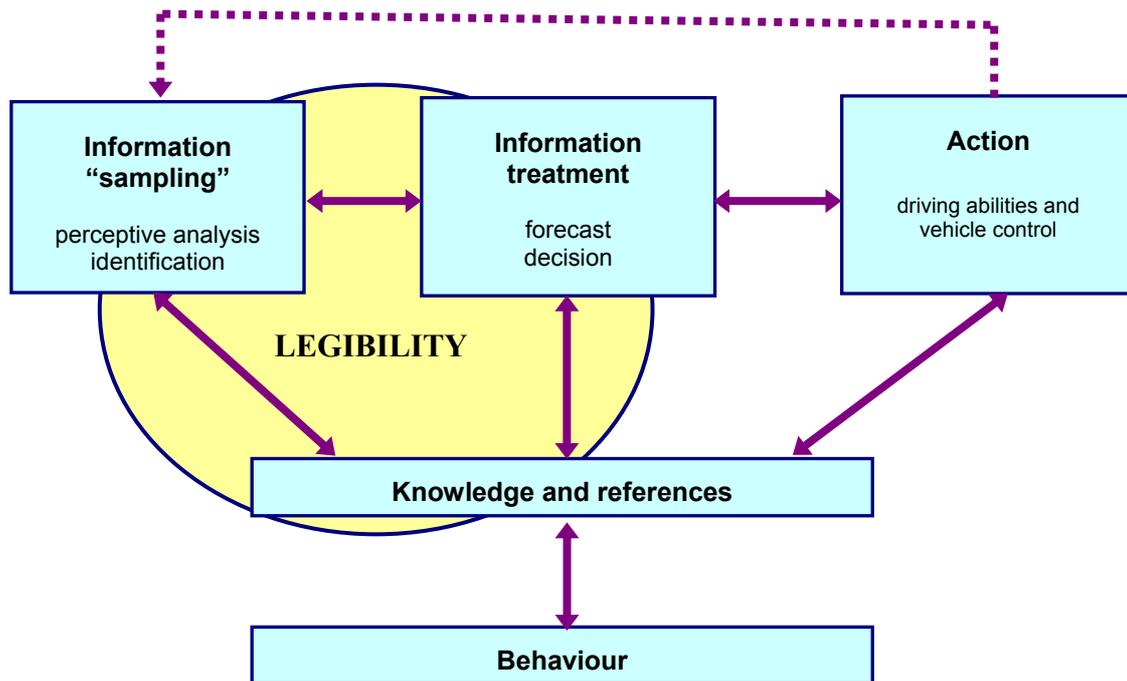


Figure 2 : Mental activities linked to driving (from Neboit and Blanchard, 1978)

We can see on that scheme that there are three levels of activities respectively based on :

- ⇒ automatisms or activities based on abilities or habits,
 - ⇒ procedures or activities based on rules,
 - ⇒ problem solving or activities based on knowledge,
- from the lowest to the highest level of vigilance/conscience.

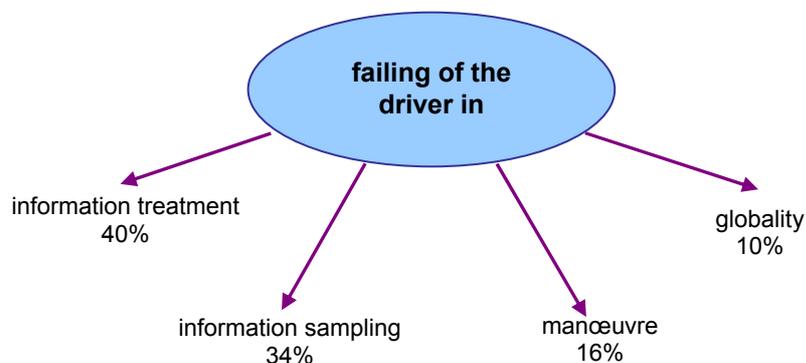


Figure 3 : human error in corporal accident breakdown (from INRETS report n°218, June 1997)

In figure 3, we can see that the driver's failing involves in 74% of the cases the information capture and the analysis of the situation, and consequently the driver's perception of the situation. That is why it seems essential to work on the road legibility to improve road safety.

To do so, the landscape approach contributes to :

- ⇒ better understand the information capture,
- ⇒ better analyse and characterize the road space,
- ⇒ improve the information capture for the driver.

Road perception indications

There are two kinds of road perception indications, the formal ones and the informal ones.

The formal indications can be :

- ⇒ horizontal and vertical signs,
- ⇒ others road equipments.

The informal indications can be :

- ⇒ the landscaped roadside (static indications),
- ⇒ the temporary land use, walkers, agricultural or forest activities (dynamic indications).



Picture 1 and 2 : formal indications



Picture 3 and 4 : informal indications

Some examples of legible or non legible situations



Picture 5 : phased 4 lane road

This picture shows a road where it is difficult for the driver to identify whether he drives on a motorway or on a bidirectional 2 lane road. The treatment of the roadside and the crossings is characteristic of motorways although you are driving on a bidirectional 2 lane road. That situation induces many frontal accidents.



Picture 6 : non legible bend

On that picture, you can see a configuration where the driver has no visibility nor legibility of the bend and of the crossing. What the driver sees (the double line of trees in the perspective of the road he's driving on) is in contradiction with the sign. The driver wonders "where is the road going ?" and "where are the bend and the crossing ?".



Picture 7 : legible bend

In this picture, there are a good visibility and a good legibility of the bend. Indeed, you can see the road and the bend. The slope, the trees on the slope and the presence of the house indicate the bend to the driver and they confirm the direction of the bend.

The road is legible when its configuration is in accordance with the use expected by the driver.

LANDSCAPE AND ROAD METHODOLOGY APPROACH

The diagnosis sequencing

Through this sequential route diagnosis, done for both ways of the road, the aim is to convey what the driver sees in order to conceive relevant developments to the road. The different components of the road are “superimposed”, which gives prominence to dysfunction points of the route. Dysfunction points are places where the surroundings of the road and the landscape cannot help to improve road safety, where they reduce road safety because they make the driver adopt a behaviour contrary to what is expected from the driver. These points are the places where the legibility will have to be improved.

After the road developments, the aim is to obtain a series of driving sequences without any ambiguity between the road configuration and the driver’s knowledge and references.

The building of this sequencing is based on 4 families of criteria,

- the technical configuration of the road :
 - ⇒ road geometry,
 - ⇒ development principles (status of the road, priorities, ups and downs of the road, crossing developments,...),
 - ⇒ road equipments ;
- the functional aspect :
 - ⇒ traffic nature,
 - ⇒ user types,
 - ⇒ uses and functions of the road ;
- territorial and landscape context :
 - ⇒ topography,
 - ⇒ visual axes and fronts,
 - ⇒ land use,
 - ⇒ landscape units,
 - ⇒ global and selective landscaped development choices,
 - ⇒ atmosphere (night, day) ;
- the driver’s perception :
 - ⇒ constraint and comfort notions,
 - ⇒ dynamic road reading.

This sequencing is compared to the road safety diagnosis which it completes. These two tools give a better understanding of the route, its dysfunctions and the accidentology.

The landscape scales

The diagnosis sequencing is associated to the different landscape units.

- The kilometric scale which gives the general geographical ambiances :
 - ⇒ the global landscape units which structure the travel axis and its distant surroundings (valley, hill, bocage, vineyard, mountains,...).
- The monumental elements which bring breaks in the monotony of the travel :
 - ⇒ visual landmarks (bell tower, grain silo, isolated tree,...).
- The hectometric scale which concerns the overall legibility :
 - ⇒ nearby landscapes.
- The driving scale which concerns the close visibility-legibility :
 - ⇒ the travelled roadway and immediate roadside.

The reading units

These units are used to do the dynamic sequencing.

The driver’s visual perception unit (UPVC) :

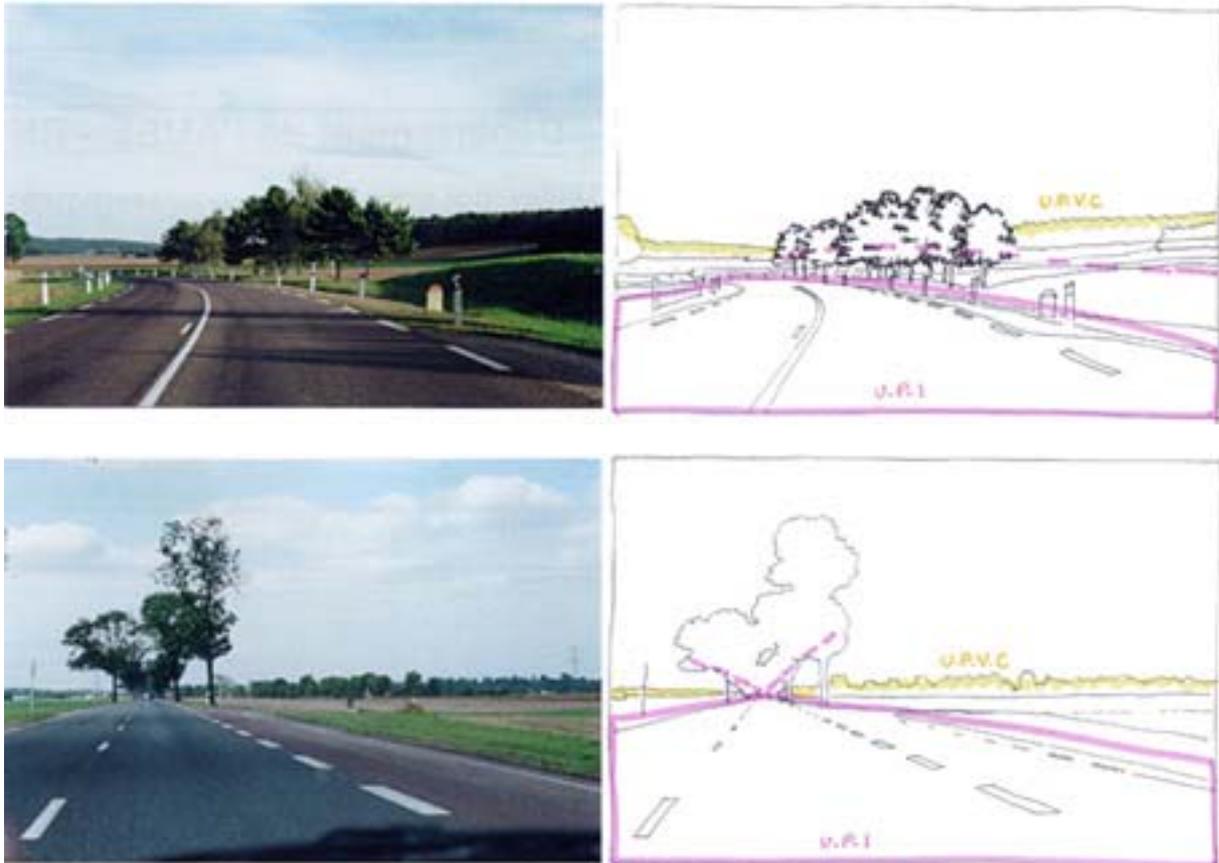
- ⇒ It is a homogeneous complex perceived by the travelling driver.
- ⇒ It comprised overall legibility and the monumental elements.
- ⇒ It punctuates the travelling pattern.

The infrastructure perception unit (UPI) :

- ⇒ It is the unit perceived by the travelling driver.
- ⇒ It corresponds to close visibility-legibility.
- ⇒ It makes short-term anticipation possible and reflects direct road –driver interaction.



Figure 4 : UPI and UPVC seen by the driver



Picture 8 and 9 : examples of UPI an UPVC

It is important to note that UPI are included in UPVC. The UPI is a space in which you move along the travel pattern. In this dynamic situation, we can use the concepts of overtaking and sliding, which characterize legibility disruptions.

These units express the transversal relations of the road.

The constraint and comfort notions

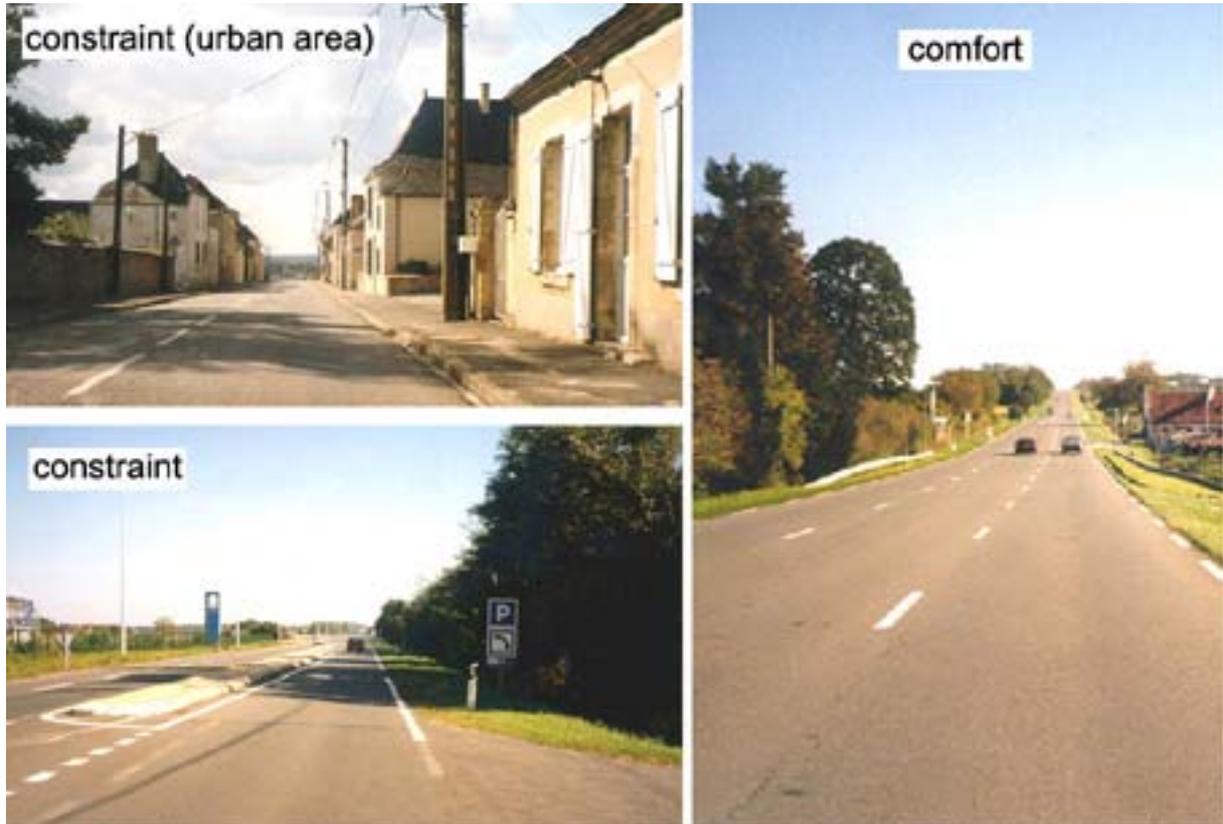
These notions express the linear rhythm of the travelling pattern. The aim of the constraint-comfort analysis is to regulate the vigilance level of the driver, in order to alternate constraint sequences with comfort sequences. The monotony disruption must help to build a rhythm in accordance with the expectations of the driver and what is expected from the driver's behaviour.

In a simplifying approach, these notions give prominence to the driver's behaviour in his driving strategy.

- ⇒ Constraint is the embarrassment real or felt due to the rules, to dense circulation conditions, to a difficult layout of the road, to specific road developments the driver cannot escape without taking risks.
- ⇒ Comfort is a feeling of well-being given by a large perception of the road context which allows to take speed initiative in the respect of the rules.

There are three kinds of zones :

- ⇒ the constraint zone in urban area,
- ⇒ the constraint zone in rural area,
- ⇒ the comfort zone.



Picture 10 : constraint and comfort zones

CONCLUSIONS

That kind of analysis helps to better understand the relations between the road, its areas and its users. It brings a global and transversal approach which makes road projects and developments more relevant and sustainable. It allows to consider development solutions for the different fields of space : the road way, the roadside and outside the road property.

At the beginning, this approach was mostly used to complete a road diagnosis in order to improve safety on that road. However, the study engineers working with this approach have begun to be appealed to work on planning projects. Indeed, it is a good way to include road safety in landplanning documents because it is a transversal approach.

For the moment this analysis has been applied to some study cases. However, the working group on road legibility led by Setra tries to elaborate a methodology which could be widely used.

ENDNOTES

none

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APPENDICES

Some terminology for a common language

Landscape : "Landscape" means an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors (definition given by the European landscape convention)

road landscape : (considered here only from the driver point of view, not from the roadside inhabitants) perceived from the road, it is composed by the road itself and its equipments (horizontal and vertical signs, crash barriers, vegetal or mineral roadside, etc.). It cannot be dissociated from its immediate environment, both are seen simultaneously at a more or less important keenness depending on the vigilance degree.

visibility : it is associated to "see" from a functional point of view : to see the road way, the crossings, the signs, the other drivers, not have the perception perturbed by masks,...

legibility : it is associated to "see" from an interpretation point of view : to understand what is seen or has just been seen to adapt his driving act to the current situation, according to collective and individual mental schemes.

An example of a sequencing map describing the infrastructure perception units (UPI) on a part of the RN31

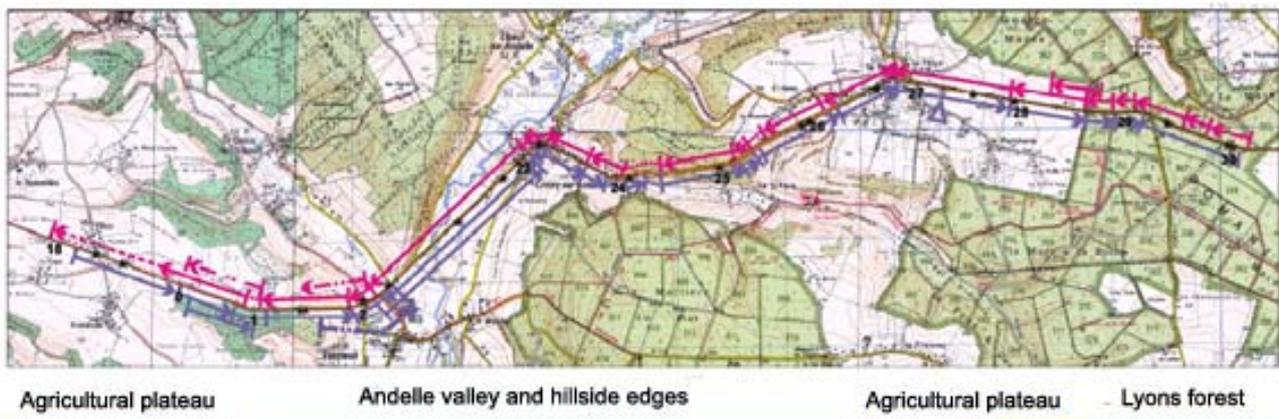


Figure 5 : infrastructure perception units on the RN31

Some examples of before and after proposals according to comprehensive analysis of the route including road legibility

The examples below cannot be considered as systematic solutions available for any place or any situation. There are here to show some development concepts stemmed from global approaches at the route scale based on landscape and road legibility.

Example 1 : call attention to the curve by an external alignment of trees or a hedge to better anticipate the bend



Figure 6 : bend, before



Figure 7 : bend, after with trees

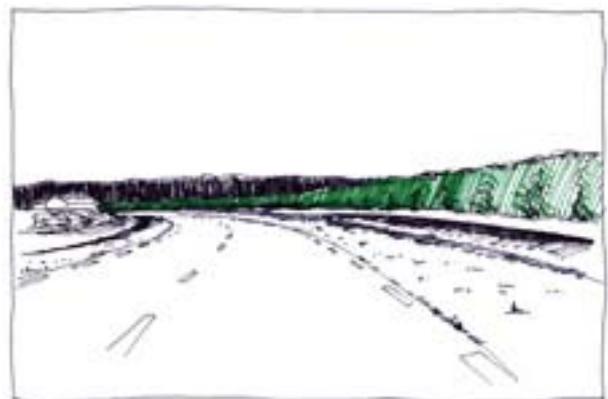


Figure 8 : bend, after with a hedge

Example 2 : enhance a village crossing where the streets are very wide by a space requalification



Picture 11 : village crossing, before



Figure 9 : village crossing, after

Example 3 : avoid the perception of a double infrastructure perception unit by withdrawing the trees along the first unit and planting a hedge that masks the second unit so that the road user will slow down on entering the bend

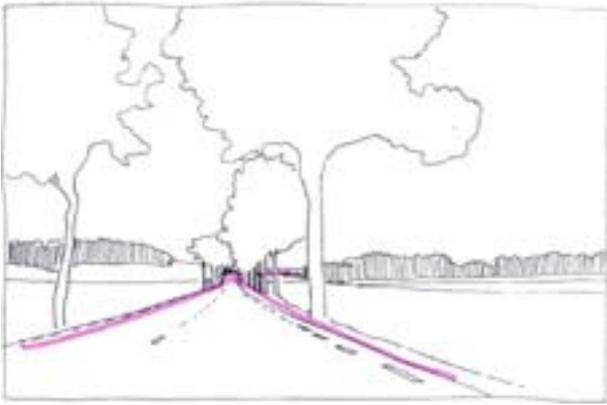


Figure 10 : double UPI, before

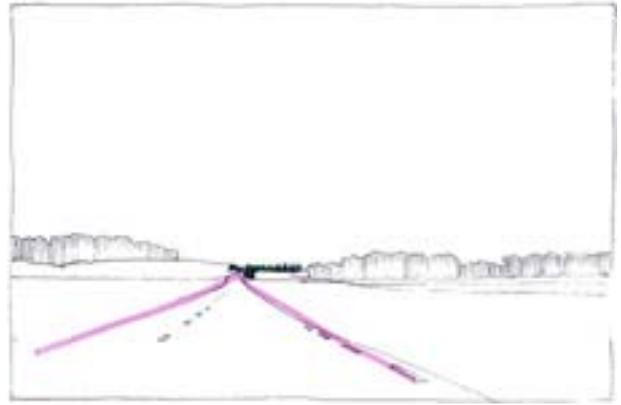


Figure 11 : double UPI, after

Example 4 : making a phased 4 lane road consistent with the definitive roadside during the 2 lane phase by reducing the field of view with planting on the future second road way



Picture 12 : phased road, before



Picture 13 : phased road, after

Example 5 : call attention to intersecting roads by an alignment that helps the driver to anticipate the presence of the crossing



Figure 12 : crossing roads, before

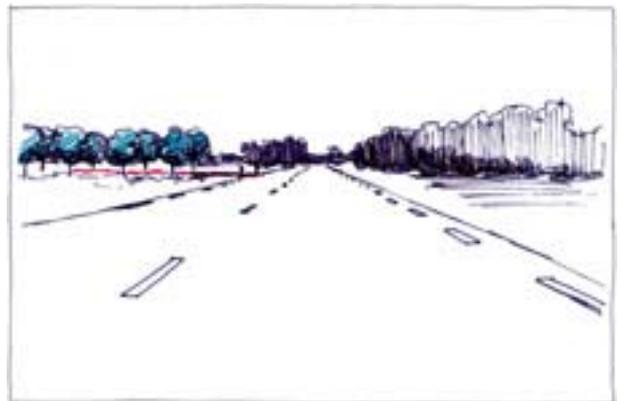


Figure 13 : crossing roads, after