

PERMANENT INTERNATIONAL ASSOCIATION  
OF ROAD CONGRESSES

43, Avenue du Président-Wilson, PARIS

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XIIth WORLD ROAD CONGRESS  
ROME 1964

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REPORT  
OF THE  
PROCEEDINGS OF THE CONGRESS



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**PERMANENT INTERNATIONAL ASSOCIATION  
OF ROAD CONGRESSES**

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*Secretary-General: 43, Avenue du Président-Wilson. Paris, 16*

**XIIth CONGRESS  
ROME 1964**

Section 2. Road traffic. Economic problems.  
Usage problems. Safety.

**QUESTION X**

**Road aesthetic problems**

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### 10.1. FITTING THE ROAD INTO THE LANDSCAPE

The aim of the methods of alignment and planning of motorways in the USSR is to provide means of transporting goods by motor vehicle over long distances at high speeds and offer a convenient mode of traveling for passengers. The roads must satisfy aesthetic conditions as they will be in the service of mankind for several decades.

The requirements laid down for the alignment of roads in relation to the surface relief in the USSR have become stricter, more especially in recent years since the adoption by the governments of the Soviet Federal Republic of Russia and other Republics of the Soviet Union of laws relating to the protection of natural beauty spots, in particular during the execution of constructional work.

The principles of the alignment of motorways in relation to the surface relief and aesthetics were published for the first time in the USSR in 1950 in the "General Rules for the Location of the Alignment"<sup>1</sup>, which still remain in force. In these rules it is emphasised that the alignment, while ensuring that the road possesses high transport characteristics, must in addition blend in an harmonious manner with the surface relief of the ground and with the landscape. The axis of the road must follow a uniform curve, in space. The plan and the longitudinal and cross sections, as well as the general appearance of the road must be closely linked together. The road must not be detrimental to the beauty of the landscape. A rational alignment which takes into account all the factors in the landscape will, on the contrary, enable travellers to discern more easily the special features of the surroundings.

The combination of the elements of plan and section obtained in a space curve is the result of an alignment achieved by juxtaposition of the principal curvatures of the surface relief. This provides the possibility of arranging the curves in section in complete harmony with the curves in plan.

The conditions arising from the alignment regarded as a function of the landscape induce us, when drawing up plans, to devote considerable attention to questions of architecture.<sup>2</sup> The latter must be developed not only in order to obtain, within the framework of the landscape, a general harmony of the road with its engineering structures, as seen by an observer placed outside the road, but mainly in order to achieve a general idea ensuring the completion of a journey at a definite time and without accidents when travelling at high speeds. The difficulty of utilising, in the architecture of the road, the principles of appropriate geometrical proportions (standard width of the road bed, "infinitely" great length and limited possibilities of variation in the dimensions) leads us to adopt, as a principle, the division of the alignment into several spaces visible without difficulty, cut naturally or voluntarily by plan or section elements.

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1. "General Rules for the Location of the Alignment", Dorizdet, 1950.  
2. Prof. V. F. Babkov "Modern Motorways" Avtotransizdat, 1961.

Such spaces having, as a general rule, a length of 3 to 4 km., corresponding to a travelling time of 2 minutes, are termed in the USSR "architectural basins"<sup>1</sup> or "landscape zones". From the point of view of the visual perception of the traveller the lay-out within each basin must be determined individually in relation to the site through which the road passes. It is also necessary to take into consideration the difference in visual perception for each direction of the traffic, the different part played by certain lines of sight, and the displacement of the limits of the architectural basins observed by travellers moving in opposite directions.

The essential principle of road architecture in the USSR consists of the combination of elements of plan and section that are pleasant to the eye, satisfy the conditions for road traffic and divide the road into architectural basins.

A second means of visual perception for the driver is the improvement of the roadway and its immediate surroundings which provides for the installation of road signs, groups of sculpture and decorative plantations in accordance with a deliberately designed architecture. These secondary means are effective for the improvement of zones that are unaesthetic from the architectural point of view (for example, curvature of the longitudinal profile) or for the psychological preparation of the passengers when there is a loss of speed at points necessitating a stop (automobile stations, recreation zones).

When drawing the red line within the limits of each architectural basin, allowance must be made for the need for architectural arrangement of the space in the basin by means which have the least possible effect on the site through which the road passes. In order to achieve this aim, it is advisable to plan the alignment in such a manner that, as a general rule, it represents a series of curves in the space without concave transition curves of long upgrades and downgrades with a small radius of curvature which were formerly in favour. The use of curves of large radius which fit easily into the surface relief is always rational from the point of view of the comfort and safety of the traffic as well as from the architectural point of view.

When passing from one architectural basin to another the requirements arising from the visual alignment must be satisfied. The driver must be able to visualise clearly the direction followed by the road. For this purpose it is rational to make the convex vertical curves coincide with the horizontal curves. The "General Rules" recommend that the alignment should be linked to the surface relief. Excessive meandering of the alignment in flat country, as well as unnecessarily long straight lengths of road in very hilly or mountainous districts are regarded as unacceptable.

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1. Prof. N. P. Ornatsky and A. N. Kiseleesky. "Architectural solutions in space of the alignment of roads" in the journal "Building Construction and Architecture" No. 11, 1961, Kiev.

In flat country where the observer has a clear view, long straight lengths of road must be avoided because, under the conditions of a uniform landscape they cause slackening of the driver's attention and consequently result in a large number of more serious accidents.

In country dotted with hills it is advisable that the alignment should show lines with a large radius of curvature which follows harmoniously the natural curves of the surface relief. The alignment must not be subjected to the secondary changes of a greatly intersected surface feature which might give frequently repeated curvatures to the longitudinal section and to the horizontal line of the road.

The experience of the research stations and planning offices of the Soviet Republic of Latvia (Latdortransproekt) shows that in order to ensure that the road has visual harmony it is necessary to employ transition curves of considerable length and this is prescribed in the specifications now in force for horizontal curves having a radius of less than 5000 m.

The harmony of the road in space necessitates a definite ratio between the number of horizontal and sectional elements. A longitudinal section undulating within the limits of a horizontal curve or a horizontal sinuosity with the limits of a convexity of the longitudinal section gives poor visual perception. In such cases it is advisable to replace some of the horizontal elements by a single element of larger size.

In mountainous or much intersected country it is rational to give the alignment the form of a sinuous and harmonious line without straight lines of transition between curves in the same direction or in different directions. Taking into account the conditions of safety and comfort, the value of adjacent horizontal radii of curvature should not differ to any extent.

In order to adapt the road better to the shapes of the surface relief where it is rational to do so and where the requirements of the architecture are to be satisfied at the same time, it is advisable to provide a separate alignment for each direction of the traffic. In country with a steep transverse slope, independent carriageways for each direction of the traffic can be arranged on different levels and even have divergences horizontally in order to accommodate them more easily to the surface relief and reduce the volume of earthworks in rocky ground and the number of retaining walls. In such cases it is natural that the problem of the alignment in relation to the surface relief should be solved independently for each direction of the traffic.

In cases where slight embankments alternate with shallow cuttings the road can be made to harmonise very satisfactorily with the surroundings by the construction of a rounded cross section with harmonious transition between the banks and the surface of the ground. In such cases it is advisable to give the banks a variable slope. The lower the embankment or the shallower the cutting, the less should be the slope of the banks.



In Fig. 1 an example is given of such a cross section on one of the motorways in the USSR.

The rounded shapes of the roadway and verges ensure lateral visibility for the drivers travelling on the outer lanes of the carriageway and enable a harmonious transition between the roadway and the surface of the ground to be effected. These shapes of the roadway and verges extending over a width of 24 m. are achieved as a result of a reduction of the slope towards the bottom of the banks and of a rounding of the verges and of the base of the roadway.

This type of cross section, quite apart from its advantages as regards traffic safety, increases the stability of the banks and of the whole of the road bed. In the event of vehicles accidentally leaving the carriageway and the shoulders, the risks of accidents are reduced if the banks have a gentle slope.

For a bank slope of 1:4 the rounded shape of the cross section of an embankment approximates in its upper part to a surface subjected to a snow storm. The winter maintenance of one of the motorways in the USSR has shown that snowing up practically never occurs with such types of cross section.

Since they regard visual harmony as a factor of quality of the road which permits a uniform or harmonious movement of the vehicle, the research establishments and planning offices undertake verifications and investigations of road sections that are spatially complex by means of perspective drawings. This method is applied to the determination of places exhibiting a lack of harmony and to the comparison of different alignments from the point of view of road architecture or in order to improve them.

In order to tone down solutions of projects the perspective drawings are corrected to obtain an harmonic image. A graphical measurement of the co-ordinates of the improved alignment makes it possible to determine its new position in plan and in section. Special graphical methods have been worked out for this purpose, in particular the method of double-image reciprocal perspectives.

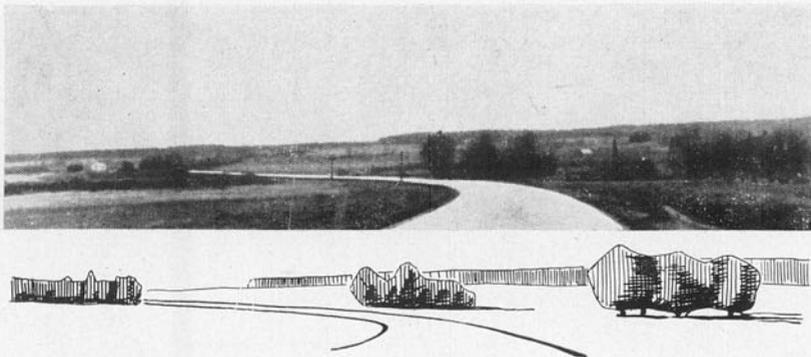


Fig. 2.

Fig. 2 shows a comparison between a diagrammatic view in perspective and a photograph of a section of the road as constructed.

The place where the observer is located ("viewpoint") for the visual analysis of the alignment of the road by means of graphical representation of the perspective is selected by taking into account the rate of travel of the vehicle. In very hilly country, the alignment constitutes a geometrical curve in space with straight transition sections of very short length and many points with limited visibility. In view of the importance, in this case, of the visibility of a vehicle moving towards a meeting with another vehicle on a convex vertical curve the minimum distance from the point of observation up to the estimated point must be equal to the visibility of the vehicles coming in the opposite direction established by the standards for roads of the category being planned.

The sections of roads passing across plains or through country which is not hilly are characterised by vehicles overtaking one another. Under these conditions, the distance between the viewpoint of the observer and the section being studied must be equal to, or greater than, the sight distance in the case of overtaking at a design speed.

#### **Methods of representation of the images of sections of motorways**

In order to verify the satisfactory architectural solutions of the alignments the conventional methods of descriptive geometry are employed in the USSR. Accurate methods have been worked out at the Kharkov Institute of Motor Vehicles and Roads under the direction of a candidate for a doctor's degree in science, G. K. Nikolaevsky: these methods enable better allowance to be made for the special features of the topographical surface and for the geometrical shapes of the road.<sup>1</sup>

E. S. Tomarevskaja has prepared nomograms making it possible to determine, from the natural co-ordinates of the axis of the road, the co-ordinates in perspective of the characteristic points of the roadway (general case of a plane inclined with respect to the image.) The nomograms are intended for drawing perspectives on vertical and inclined planes and on cylindrical and conical surfaces.

In the photographic method developed by O. D. Mikhno the principal projection in perspective on a plane image (Fig. 3a) is constructed from the secondary projection (Fig. 3b), obtained by photographing the plane at an angle by means of a camera with a special tripod.

In order to represent a section of road over a wide front, determined by any particular angle of vision, it is necessary to employ panoramas in perspective on cylindrical and conical surfaces.

In order to propagate the general solution from the point of view of the engineer and architect and the concordance in space of the road in relation to the surface relief, G. K. Nikolaevsky proposes to employ

1. Questions of descriptive geometry and of its applications. Collection of articles edited by G. K. Nikolaevsky, Vol. 1 and ff: Published by the Kharkov Institute of Motor Vehicles and Roads, 1958 and 1961.

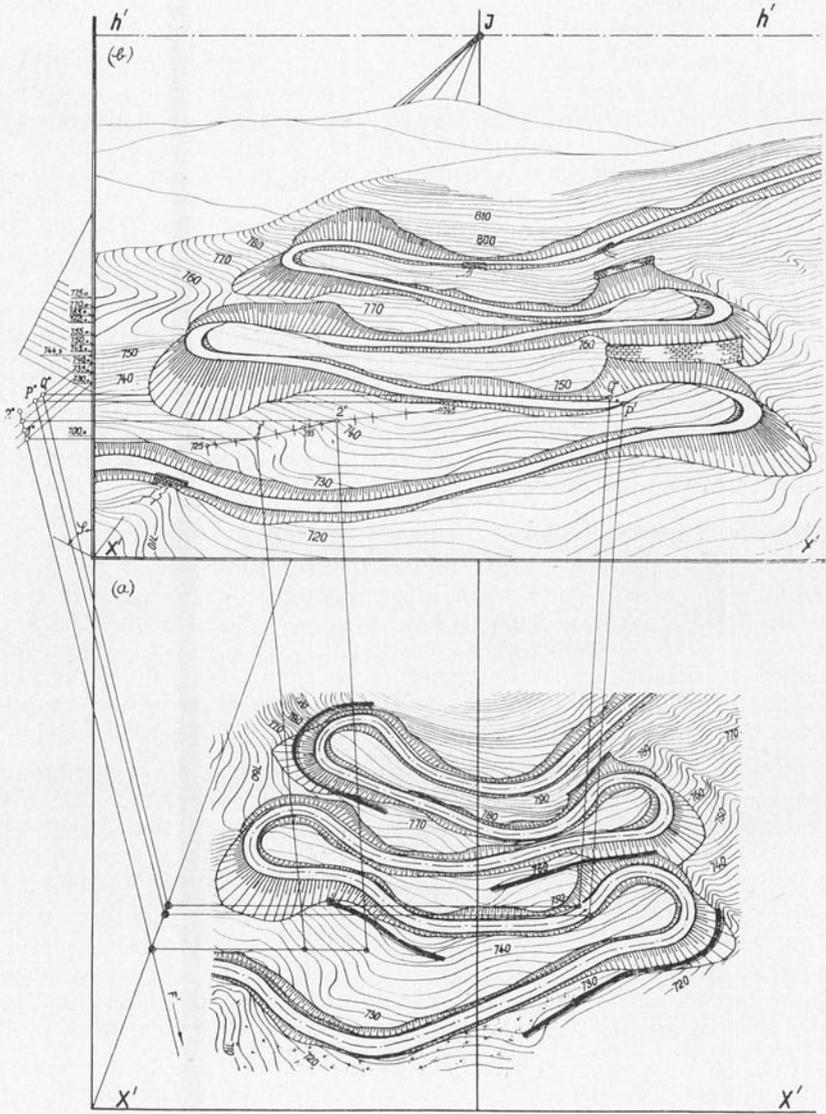


Fig. 3

representative images from a front view. The simplest frontal representation is a parallel axonometry (Fig. 4) on coinciding  $y$  and  $x$  axes with application without modification of the plan as secondary projection (Fig. 4b). The principal image (Fig. 4a) is constructed by simple vertical elevation of each point of the plan taking into account the deformations of the  $y$  axis.

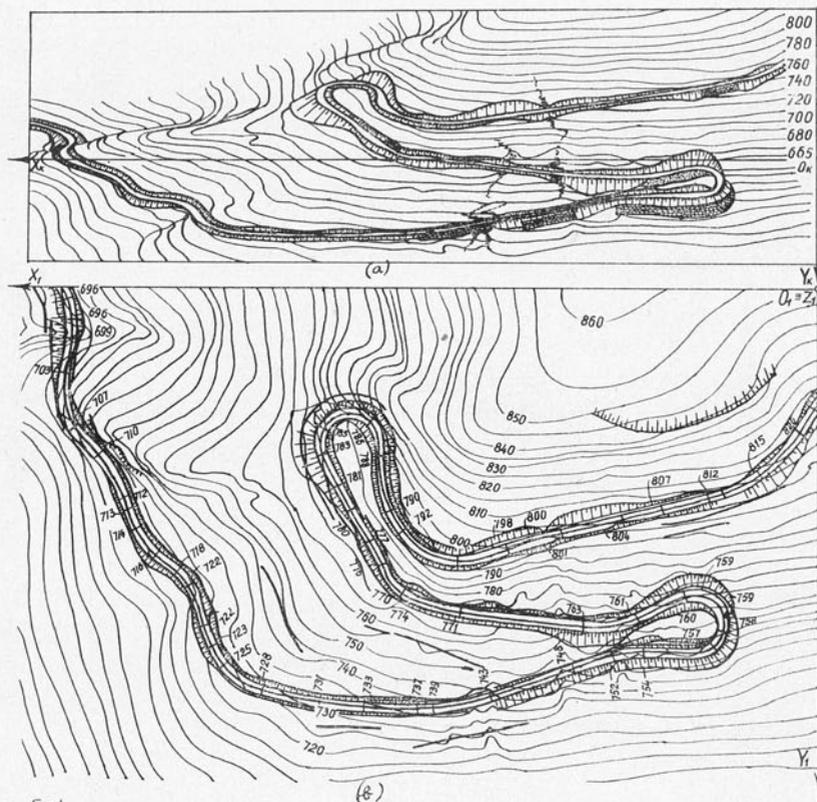


Fig. 4

In order to facilitate the drawing of the secondary projection of the panorama in perspective, use is made of the process of linking the coordinates of the plan with the scale of elevation recommended by P. V. Panoff.<sup>1</sup> In this case a sheet of transparent tracing paper covered with concentric circles divided by radii is placed over the plan (Fig. 5) in such a manner that the centre of the circles coincides with the point of view of the observer.

The panorama of the scale is obtained by projection on to the surface of a straight cylinder from a centre located on its axis. Fig. 6b shows a scale of the panorama with image of the plan, obtained by reproduction from the grids of the plan and the panorama.

In order to obtain points on the principal image (Fig. 6a) use is made of a perspective scale of elevation.

U. S. Sitnikoff has suggested a visual perspectograph (Fig. 7) for constructing an image in perspective of a natural site, which has certain advantages as compared with the analogous apparatus of Ranke. The advantages of Sitnikoff's perspectograph are as follows:

1. P. V. Panoff "Solution of problems of perspective analysis" in the journal "Roads" No. 4, 1962.

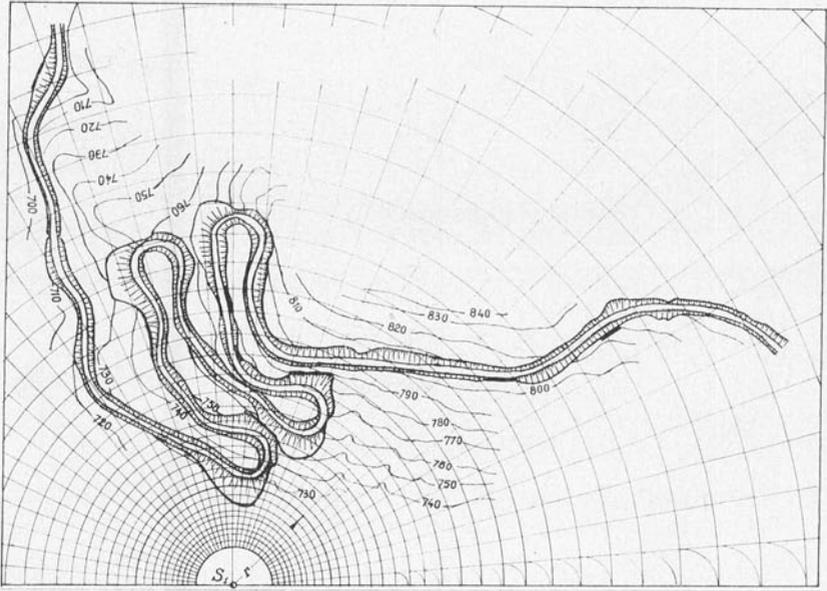


FIG 5.

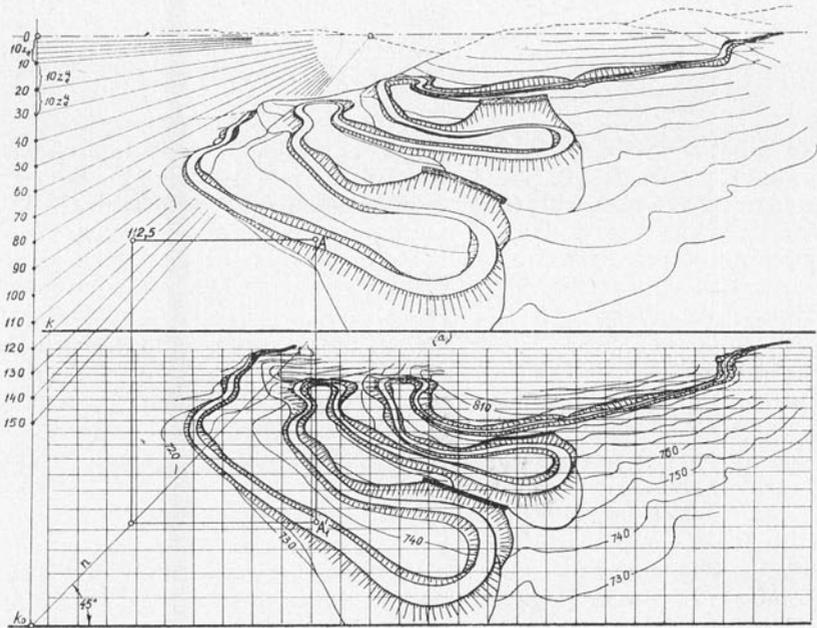


FIG 6

(6)

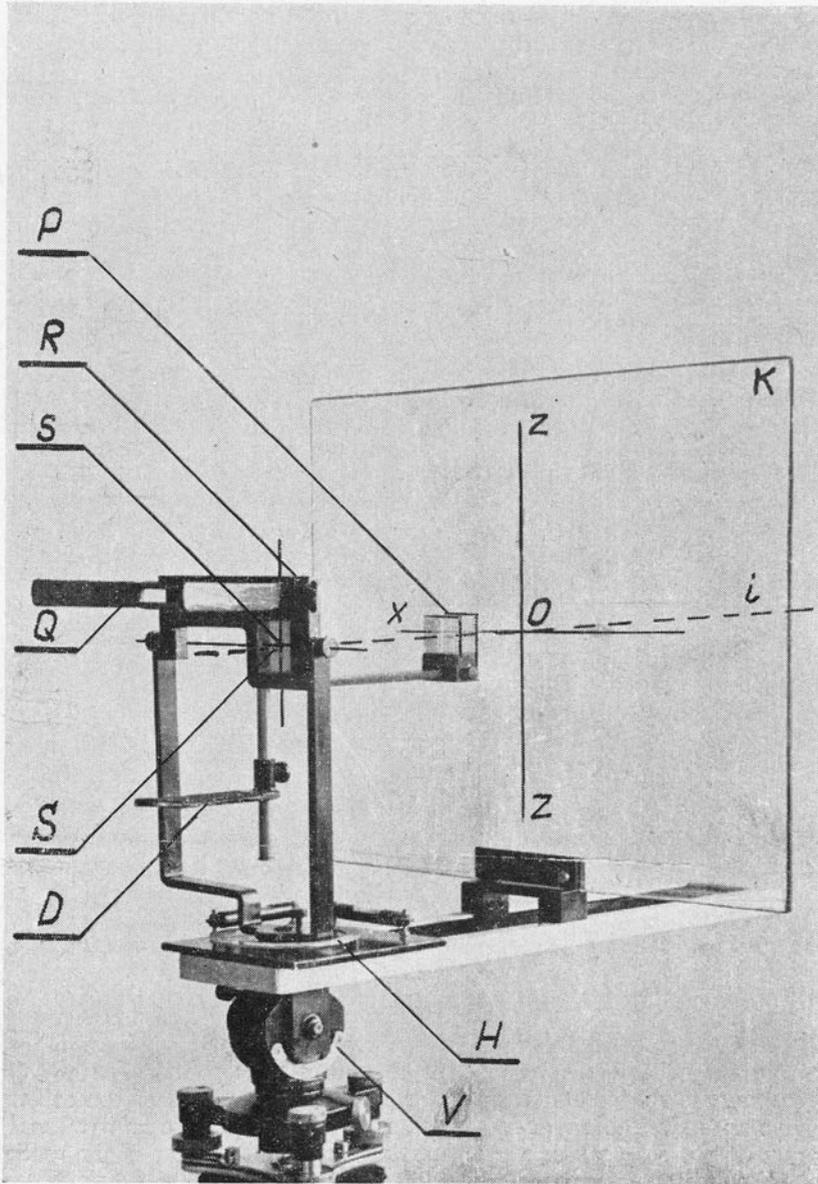


Fig. 7.

1. The centre of projection, the axis of vision  $i$  and the screen  $k$  are connected together in a definite manner like the components of a projection apparatus.

2. The presence of a horizontal quadrant H and of a vertical quadrant V make it possible to determine the angle of inclination of the image, the angles of projection and the direction in the plane of the principal visual radius. All this makes it possible to determine any point on the surface relief without having recourse to geodesic instruments.

3. The flat screen may be replaced by a cylindrical screen without changing the construction of the apparatus, thus enabling panoramic images to be received.

The image of the road projected by means of special nomograms may be inscribed in the visual perspective established by means of Sitnikoff's apparatus.

O. K. Koulminsky has worked out a method for determining the projected road by means of a cinematographic perspective reflecting the images seen by the driver travelling along the road with his vehicle.

The cinematographic perspective is filmed like an animated cartoon by means of frames each of which represents an image of the roadway, verges, etc., seen in perspective from a fixed point of observation on the trajectory of the movement and taken at regular intervals. The length of the interval corresponds to the distance travelled by the eye during one second.

After further development and studies the cinematographic perspective method may play an important part in the process of investigating the alignment and planning of roads by determining the conditions of visual perception of the future road experienced by a driver at high speeds of travel.

The cinema laboratory of the State University of Kiev has made a scientific sound-film for the students: — "The cinematographic perspective of a section of road being planned" showing the technique of production of the cinematographic perspective, together with its applications. The film has proved useful in institutions of higher education for courses of lectures dealing with questions relating to road aesthetics.

## 10.2. VISUAL AIDS TO DRIVING

The architecture of the road must likewise exclude combinations of plan and longitudinal profile with the surrounding landscape which might have a detrimental effect on the visual perceptions of the driver or give an undesirable reaction to the senses. In either case an irrational alignment not only causes a deterioration in the appearance of the road, but disconcerts the driver, inducing him to undertake unnecessary manoeuvres liable to jeopardise road safety.

The driver travelling over a road for the first time must be guided constantly by the actual alignment of the road, and by its surroundings, in regard to the direction to be followed beyond the limits of visibility.

The combination of the geometrical elements of plan and section while changing in the perspective must not give the driver an impression of difficulty in the road conditions and induce him to make an unnecessary reduction in the speed of the vehicle.

The experience of the alignment and planning of roads in the USSR shows that the application of the principles of visual alignment serves the following purposes:

- (a) elimination of sudden turns in plan and of humpbacks in section — the obtaining of a visual harmony in the alignment;
- (b) determination of the direction of the road beyond the limits of direct visibility by a rational lay-out of the curves both in plan and in profile;
- (c) prior warning to the driver in case of a change in direction of the road by retaining the existing trees and shrubs and by making new plantations on the prolongation of the original direction.

A highly erroneous impression of the road conditions is obtained in cases where the road crosses a deep valley at right angles. A driver descending one slope sees an upgrade on the other side of the valley which appears to have a gradient equal to the sum of the gradients of the two slopes meeting one another. This impression can be readily eliminated by the insertion of a horizontal curve at the bottom of the valley even with a very small angle of deviation.

The convex curves of the longitudinal section arranged on the alignments and concealing the direction of the road from the drivers are the most vulnerable places on the alignment from the architectural point of view and are, furthermore, dangerous on account of inadequate visibility. In order to reduce the architectural difficulties associated with the planning of convex curves it is advisable to make the curves that are convex in section coincide with the horizontal curves having a large radius of curvature.

The analysis of the visual perception of the curves in plan and in section on roads that are being planned or are already in existence makes it possible to suggest a number of quantitative recommendations in order to ensure that the alignment possesses a harmony and a distinct indication of the direction followed by the road.

On the basis of the analysis of a large number of representations of roads in perspective it has been established that the edges of the carriageway or of the roadway, verges etc., over a length of horizontal curve are seen as straight lines meeting at an acute angle  $\beta$  (Fig. 8). The edges of the carriageway on a length of concave curve (Fig. 9) give the impression of meeting at an obtuse angle  $\beta$ , which ranges from  $110^\circ$  to  $160^\circ$ . The apparent bend in the road on the image in perspective generally occupies nearly one-quarter of the length of the section represented.<sup>1</sup>

1. I. V. Begma and E. S. Tomarevskaja "Visual perception of the direction of the road experienced by the driver" in the journal "Roads" (Automobylniy dorogi) No. 1, 1960.

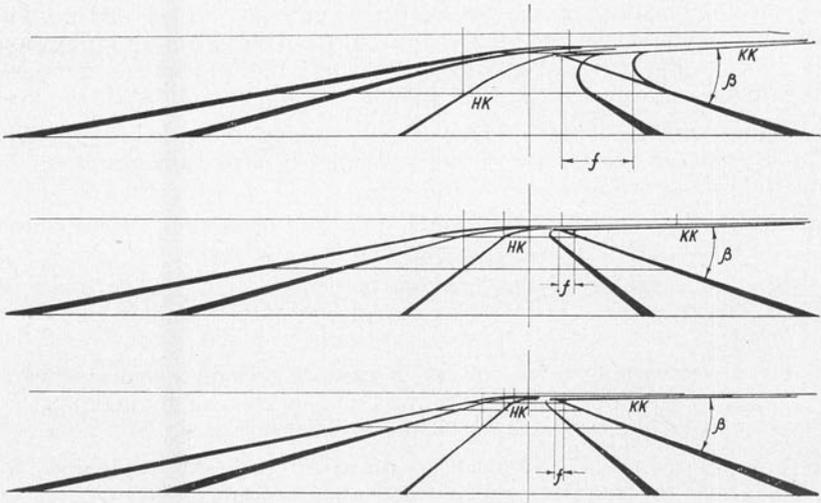


FIG 8

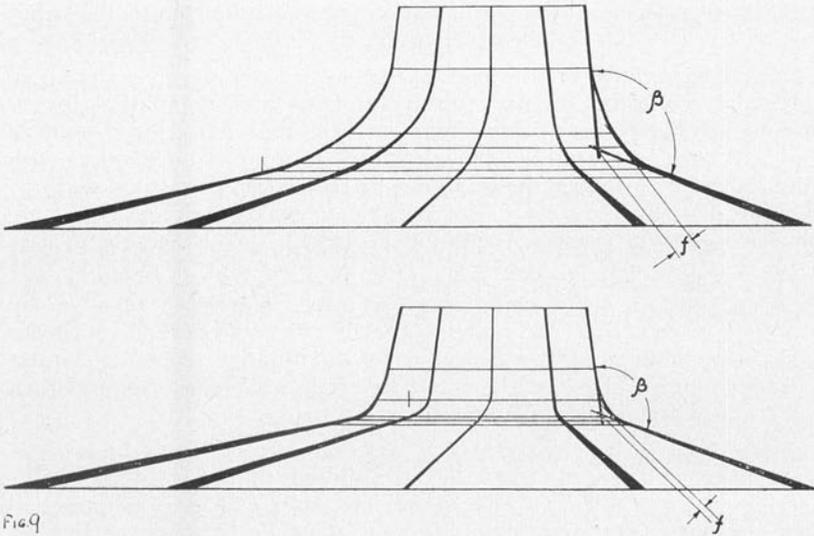


FIG 9

The harmony of the curves is determined on images in perspective constructed on a scale of 1:100 with a distance of the plan-image  $D = 100$ . For the horizontal curves according to the magnitude of the distance between the edges of the carriageway with respect to the apex of the curve (Fig. 8) it is estimated that a curve is harmonious ( $f > 1$  cm.), abrupt ( $1$  cm.  $> f > 0.4$  cm.) or acute ( $f > 0.4$  cm.).

The lengths of road on concave curves in section are regarded as harmonious in cases where the distances between the edges of the carriageway determined on the perspective image exceed 0.4 cm. with respect to the apex of the angle  $\beta$  (Fig. 9).

In the case of transition between gradients having the same direction the use of curves of short length connecting straight lengths of road is undesirable. This is to be explained by the fact that convex and concave curves alternating with straight lengths of road give the impression, when seen from a distance, of an undulating alignment.

The analysis of the visual perceptions of the driver on concave curves from a point remote from the bend, over a length of road equivalent to the overtaking sight distance, shows that in order to obtain visual harmony the radius of curvature must exceed the figures given in Table I.

**Table I**

Sum of the gradients %	Class of road and design speed					
	Class I		Class II		Class III	
	V = 200 km./h.		V = 100 km./h.		V = 80 km./h.	
	A-300m.	B-900m.	A-250m.	B-550m.	A-200m.	B-500m.
10	8000	20000	4000	16000	2500	12000
20	4000	10000	3000	8000	1000	6000
30	2500	7000	2500	6000	900	4000
40	2000	5000	2000	4000	800	3000
50	—	—	1500	3000	600	2500
60	—	—	—	—	500	2000

**NOTE**

A — sections of road on which overtaking manoeuvres are difficult or impossible on account of poor sighting distance in plan, steep gradient, etc.

B — sections of road on which the movement of the vehicle is not hindered.

The requirements of a visual alignment specify that the beginning of a horizontal curve should be located in front of the curvature of a curve in section. In that case a driver is able to perceive the direction followed by the road.<sup>1</sup>

It is found by experience that a driver notices the shift of the points if the angle of curvature exceeds 10-20 minutes. It is for that reason that a driver only notices a curve after he has gone beyond the com-

1. I. V. Begma and E. S. Tomarevskaja "Determination of the sight distance on roads by means of projections in perspective" in the journal "Roads" (Automobilny dorogi) No. 6, 1959.

mencement of the curve from a point whose distance depends on the sight distance. If the design sight distance  $S$  is equal to 150 m., its ordinate is equal to 0.6 m., if  $S = 100$ m. it is 0.4 m., and if  $S = 50$  m. it is 0.2 m.

In order that a driver should have the possibility of preparing himself in advance to approach a horizontal curve located on a curvature of the section, it is absolutely essential that the minimum distance from the commencement of the horizontal curve to the apex of curvature should exceed the figures given in Table II.

**Table II**

Class of road	Radius of curvature of the horizontal curve, m.					
	Sight distance	500	1000	1500	2000	2500
I	150	30	35	45	45	55
II	125	25	30	40	45	50
III	100	20	28	35	40	45

### 10.3 ROADSIDE PLANTING

Roadside plantations in the USSR are generally arranged in order to protect the carriageway, verges, etc. against being snowed up (plantations for protection against snow), for purposes of architecture and aesthetics (decorative plantations) and as a means of ensuring and enhancing road safety (accentuation of curves, visual alignment, creation of near and remote points of orientation, elimination of head lamp dazzle and of monotonous roads).

In addition, plantations are used for protecting the road against erosion (anti-erosion plantations) and the encroachment of sand (protection against sand). At the same time that their special utility is taken into account, endeavours are made, in relation to local conditions, to use them in a universal manner. Thus, for example, during the planting of trees for plantations designed to protect the road against being snowed up, their decorative role is also taken into account.

Protective plantations are, for the majority of the territories of the USSR, the most rational means for protecting the roads from becoming snow-bound. In comparison with artificial means (transportable barriers, etc.) plantations require only a limited amount of plant and labour and, if suitably arranged, afford reliable protection.

That is why plantations for protection against snow are widely employed and have been the most thoroughly studied.

Schemes for plantations as a protection against the snowing up of roads are given in Fig. 10.

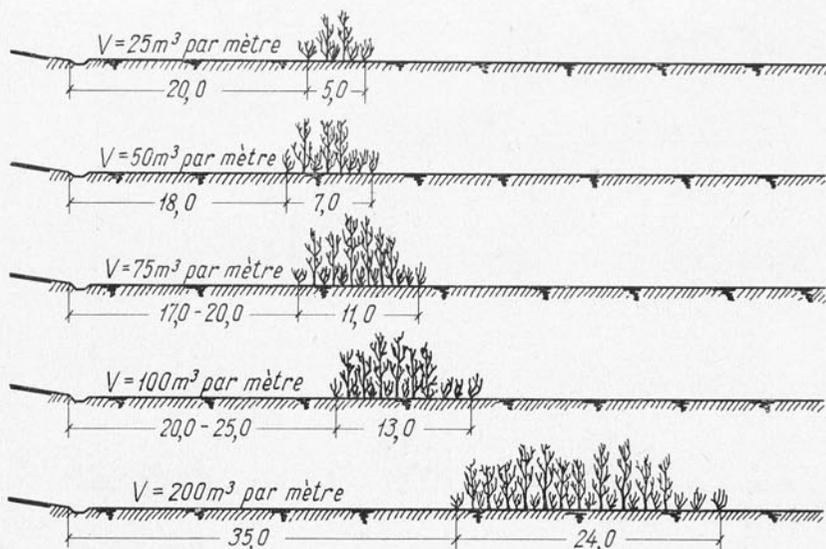


FIG. 10

These plantations provide a protection for the road against snow for volumes of driven snow not exceeding  $50 \text{ m}^3$  for each metre of road. In the case of larger volumes, the snow is deposited on the carriageway and buries it, on account of the proximity of the plantations with respect to the road. For large volumes of snow the standard types of plantation must be extended by additional plantations of bushes or by the installation of transportable protective barriers.

During recent years the Institute of Scientific Research on Roads of the Soviet Union (Soiuzdoznyi), on the basis of complicated research work, and taking into account the experience of the maintenance departments, has put forward a more rational scheme for plantations as a protection against the snowing up of roads (Fig. 11).

These recommendations offer a number of advantages over those now in force in accordance with the instructions and specifications for roadside plantations.

(a) The distance between the edge of the carriageway and verges and the plantation is increased from 13-25 m. to 20-50 m. in relation to the volume of snow.

In that case, the snow is not deposited on the road.

(b) Instead of plantations with 6-14 rows of trees, narrower plantations with 4 to 6 rows of trees are recommended.

(c) for a volume of snow of 100 to  $200 \text{ m}^3$  per metre of road instead of one strip of plantation a system of plantation in two strips is recommended.

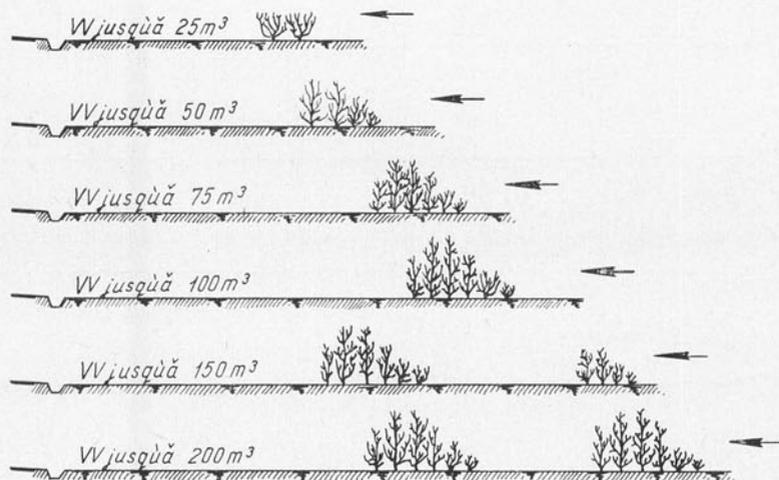


FIG. 11.

(d) instead of a distance between each row of 1.0 to 1.5 m. and a space between the saplings in each line of 1.0-0.7 m., these distances can be increased to 2.50 m. between the rows and 0.40 m. between the saplings, respectively, and this makes it possible to use tractors for the work of cultivation.

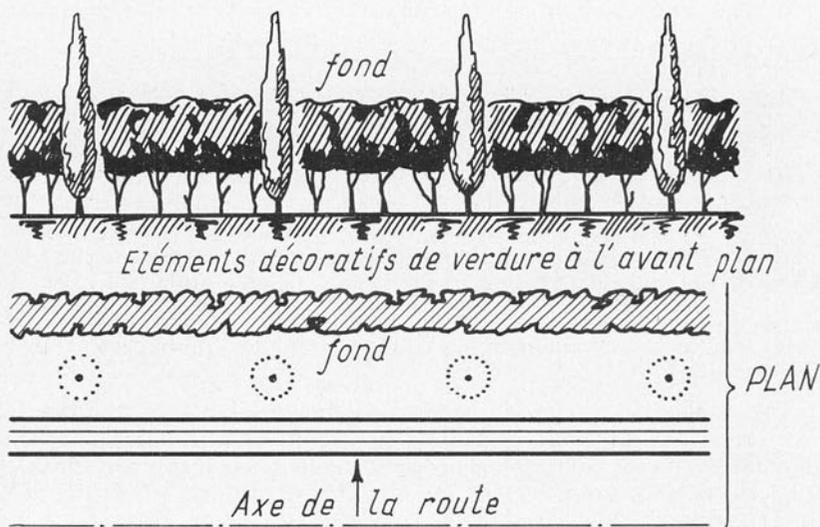
(e) The young trees are generally arranged with the same species in each row and care is taken to ensure penetration of the sun at the tops of the trees on the side against the road and the plantation of bushes only on the side remote from the road.

(f) The application of narrow strips with wide spaces between the rows ensuring an abundant supply of water during the melting of the snow makes it possible to utilise these spaces for growing fruit trees.

Decorative plantations alongside the roads are now widespread in the USSR. These plantations are located along the roads, at road junctions, at intersections on different levels, at cross-roads, near engineering structures, at bus stations, near recreation zones, on the central reserve between dual carriageways and on the ground occupied by the road maintenance services.

Decorative plantations must be a connecting element between the road and its surroundings and form a unified system, while at the same time beautifying the landscape. The basic principle of decorative plantations consists of emphasising the geometrical elements of the road, increasing the safety of the traffic, eliminating the monotonous appearance of the road as well as attenuating the inaeesthetic aspects of the alignment in relation to the surface relief. In this case the visual impression of the plantations received at a high speed of travel must be taken into account.

VUE GÉNÉRALE DES PLANTATIONS  
FAÇADE



FAÇADE  
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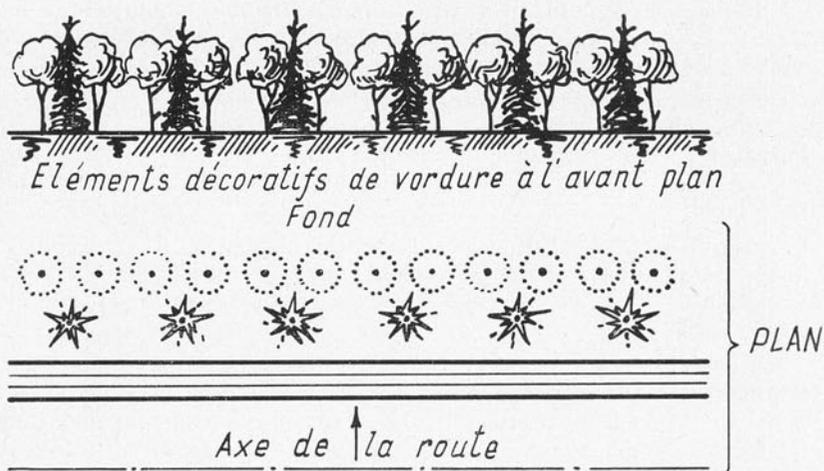


Fig 12

The important point in all these questions is road safety. The plantations must emphasise the direction, the curves and the gradients followed by the road and whatever induces the driver to feel more readily the effects of the surrounding space.

In relation to the existing types of plantation and the local conditions three forms of plantation are generally employed:

- (a) regular.
- (b) by groups in relation to the surface relief or free
- (c) combined.

At the present time the regular form of plantation occupies a predominant place on the roads and consists of respecting a strict order between the trees and the bushes (or between the groups of trees and bushes) according to the alignments or the curves with a uniform spacing over the entire length of the section of plantation (Fig. 12).

The method of regular plantation is suitable for sections of road with short lengths of alignment in flat country or at the approaches to towns and localities.

The method by groups in relation to the surface relief provides for free spacing of the trees or bushes, by groups or in isolated positions, of different shape and size. This method gives its maximum effect in hilly districts or country with an undulating surface relief (Fig. 13). Special importance is given to the retention of existing trees and shrubs and their use as a supporting element in the visual alignment of roads. The preservation of trees or of isolated groups along the road divides the highway into shorter lengths enabling drivers to appreciate them better.

The method of combined plantation is mainly employed in flat country. It consists of introducing groups of trees and bushes into the regular plantations or of forming a background with them (Fig. 14).

The application of the same method over a considerable length is not permissible because it gives an impression of monotony. A repeated alternation of the character of the plantations gives a variegated impression and does not enable the surrounding landscape to be fully appreciated.

Taking into account the speed of the vehicles, it is advisable to change the character of the plantations every 2-10 km. along the road, at road junctions, where the road crosses watercourses, at the approaches to towns, etc.

The plantations must provide good visibility of the road at the intersections by the use of turfed spaces, flowers and dwarf shrubs. The part played by roadside plantations is also taken into account in the visual alignment in order to give drivers guidance regarding the direction of the road, the curves and the road junctions. As guiding elements, apart from the customary plantations, use is made of isolated trees growing to considerable heights.

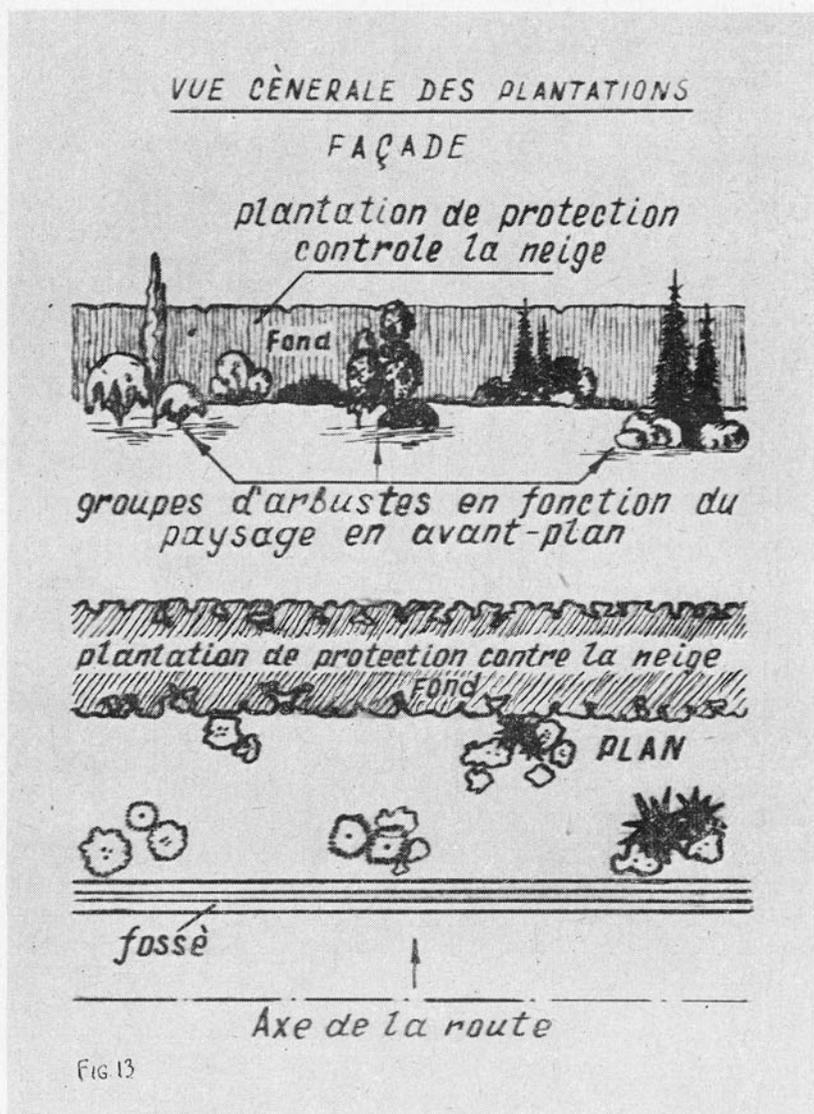


FIG 13

Fig. 15 shows a section of road in the Soviet Republic of Latvia where the preservation of a group of pine trees when the road was being constructed warns drivers of a change in the direction of the road.

Plantations on the central reserves dividing the carriageways serve the purpose not only of decoration, but also of preventing drivers from being dazzled by vehicles travelling in the opposite direction.

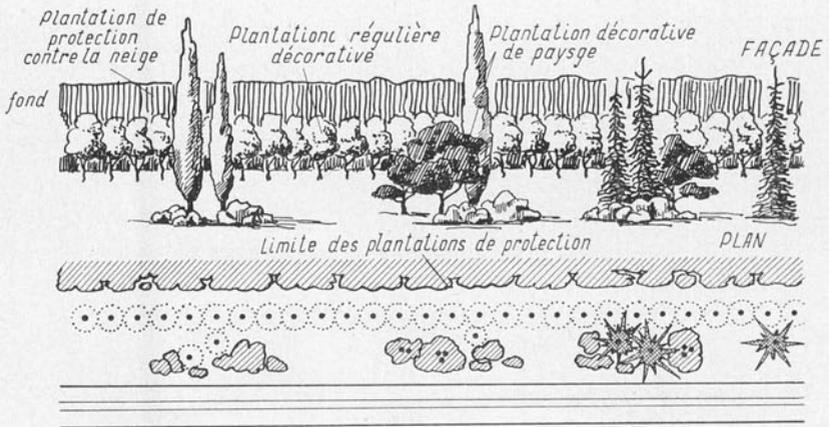


Fig. 14. Axe de la route

At places where drifting of snow on to the carriageway is unlikely, various methods of plantation on the central reserves are permissible, including continuous plantations.

Where there is a possibility of drifting, it is advisable to put turf or dwarf shrubs planted very close together forming screens with intervals of 20-30 m.

Along road service buildings close screens of shrubs and flowers are planted and the fences, walls and balconies are covered with climbing plants.

In recent years, areas in the Ukraine, and the districts of Voronezh, Kursk, Orel and Bielgorod in the Soviet Republic of Russia have undertaken extensive planting of fruit trees on a strip 100-150 m. wide on each side of the road (for example, on the Moscow-Simferopol road).

### Architecture of the Road

Having regard to the distinctive features of road transport, which consist, in particular, of the fact that the passengers watch the road during almost the whole of their journey and are able to stop where they wish, great importance is attached to the architecture of the road.

The specifications for the planning of roads provide for an architectural composition of the road in relation to the surface relief for Class I, Class II and Class III roads; for tourist, seaside-resort and pleasure roads of Classes IV and V and for roads at the approaches to towns.

The elements of architectural composition comprise: the architecture of the bridges, channels, retaining walls and ancillary road structures, the buildings of the road services and minor architectural constructions, works of art and sculptures at important places (monuments, side roads leading to famous beauty spots, etc.) The essential requirement from the aesthetic point of view of these structures is that they should harmonise with the surrounding landscape. The archi-

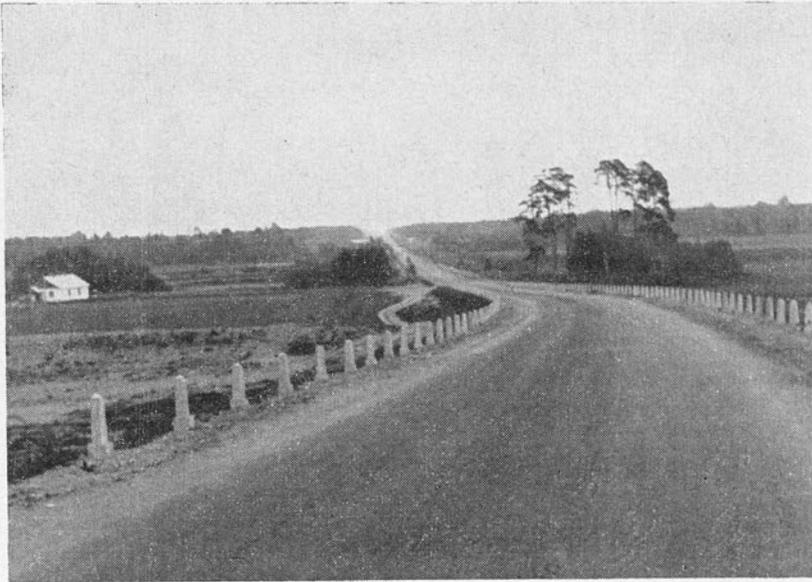


Fig. 15.

tectural composition therefore depends to a large extent on the surrounding conditions. Sculpture erected alongside roads must be visible from a considerable distance and arranged against a contrasting background; green plants, shrubs and trees are regarded as the preferred solution.

Pieces of sculpture must be connected with the spot where they are located by the ideas they suggest. Thus great emotion is felt when contemplating the sculptures and monuments of the great national war erected along the Moscow-Kharkov road, in the district of the Oral-Kursk battles, or when admiring the statues of great Russian writers, such as L. Tolstoi and J. Turgeniev erected on this road near their birth-places and the places where they lived — Jasnaia Poliana and Spassk-Loutovinovo.

The painting of the sculptures is an important question. Flat, pale colours give a better impression; a bright colour, on the contrary, for example, a pale silver colour, does not appear life-like and it is unpleasant to the eye. By means of paints, of contrasting colour, but not motley, the details and lines can be emphasised in the architecture of structures and buildings.

Great importance is attached to minor architectural forms. Road signs, placards, the names of towns and localities and rivers must present a clear and light form. Directions consisting of letters mounted on wire netting are particularly successful.

All forms of architectural composition relating to roads must be strictly commensurate with the special features of the surrounding landscape.