

TRACECA - Project

Trade and Transport Sectors

Implementation of Pavement
Management Systems

Tedjen - Mary Road

Improvement

Environmental Assessment

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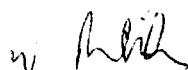
Dear Sir,

TRACECA Project:
Implementation of Pavement Management Systems, Project Number: TELREG 9305
Preparation of a Road Improvement Project: Turkmenistan, Tedjen - Mary Road
Environmental Assessment

We have prepared the environmental assessment for the Tedjen - Mary road section of the Ashgabat - Mary road and take pleasure in submitting this report to you in one original.

Yours faithfully,

KOCKS CONSULT GMBH
Consulting Engineers



Werner P. Weiler

Copies to: EBRD London, Mr. Christopher Ousey, 3 copies

COVER PAGE
ENVIRONMENTAL ASSESSMENT(TM - TM)

REPORT COVER PAGE

Project Title	:	Traceca Project - Implementation of Pavement Management Systems
		Addendum No. 1, Component 2: Preparation of a Road Improvement Project Ashgabat to Mary Road (Section Tedjen - Mary)
Project Number	:	TELREG 9305
Country	:	Republic of Turkmenistan

	Local Operator	EC Consultant
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1 **Introduction**

1.1 **Project background and terms of reference**

The planning for the 143 km of existing paved road between Tedjen and Mary (M 37) aims at the improvement of the road surface itself, whereas the layout (alignment, width and gradient) shall mainly remain unchanged. Exceptions to this could be in the two cases where the structural stability of the existing bridges is questionable. Replacements will probably be necessary in the immediate future and they could be constructed either on or off line¹. Given the project frame and the actual state of the road environment (see point 1.2) it can be presumed that within the construction corridor itself there will be *no significant* disturbance of the natural environment such as large scale soil erosion, changes to streams, underground water or interference with animal or plant life. However, according to the national legal and regulatory requirements and also according to EBRD-standards, this in fact does not exclude the need to plan for a number of measures, that would help to avoid construction-related impacts or to keep them to a minimum.

Additionally, adverse environmental impacts may result from the extraction of construction material so that these factors will also have to be included in the environmental considerations.

Thus, the environmental assessment will address the following:

- Identification of the most important (potential) consequences of project implementation with respect to
 - environmental pollution
 - human health and safety
 - secondary impacts resulting from the exploitation of borrow pits
- Review of Turkmen environmental laws and regulations relevant to the project
- Development of mitigation measures for both, direct and secondary impacts
- Development of proposals for additional environmental enhancement
- Development of recommendations for the inclusion in the tender documents

¹ When this report was prepared, no decision had been taken with regard to the question whether rehabilitation of these bridges would be included in the project or not.

1.2 **Description of the project environment**

The project area is located in the south-eastern part of the Kara Kum desert. The terrain is generally flat and gently undulating in only a few sections. The ground level lies between 180 and 210 m on average. The road environment between Tedjen and Mary is mainly composed of two types of landscape:

- ❑ Irrigated, cultivated land in the oases (Tedjen and Mary)
- ❑ desertic to semi-desertic steppe between road km 75 to 116 with sections bearing a more or less dense cover of *Saxaul* (*Haloxylon persicum*)

The road crosses a total of 23 water courses, of which only the river Tedjen is a natural one. Almost all of the land in the oases has been (or still is) subject to extensive human interference and uses such as the construction of the gas-pipeline, the electricity and telecommunication lines, the construction and maintenance of irrigation and drainage facilities, agriculture, grazing, urban development and last but not least the construction of the road itself. Further, the planning area suffers to a great extent from severe salination of soils, so that significant natural habitats do not remain. Apart of the rows of trees that have been planted or are currently being planted in the immediate vicinity of a number of road sections, the overall impression of the project area is that of a very monotone, deserted landscape.

The *immediate* road environment can be characterized as follows: Beginning at the junction Tedjen / Serakhs a deep and severely eroded drainage channel runs parallel to the southern side of the road, in rather close distances of 10 to 30 m. This channel follows the road on the right side over more than 70 km up to Hauz Khan. For extended length excavated material from this channel has been heaped up to heights of 2 to 3 m alongside the road. In March 1997, during the course of the field investigations many of these heaps, as well as a 20 to 30 m wide strip north to the road, were levelled in preparation for tree planting. These activities are mainly based on a Presidential Decree, that calls for the planting of trees along all of the M 37 between Turkmenbashi and Mary (see also point 3.1).

The initiative for the implementation of these plantations lies with the Etraps Tedjen, Murgab, Niasov and Mary as well as the road maintenance departments (LEO) of Tedjen and Mary.

For most of the 70 km section between Hauz Khan and Mary the former M 37 runs as a narrow paved road at variable distances from the actual M 37, crossing it at several locations.

The height of embankments of the M 37 project road section varies between 1 and 1.5 m with a rather steep slope of 1:1 or 1:1.5 (horizontal : vertical). Vegetation is scarce, but there is actually no evidence of erosion.

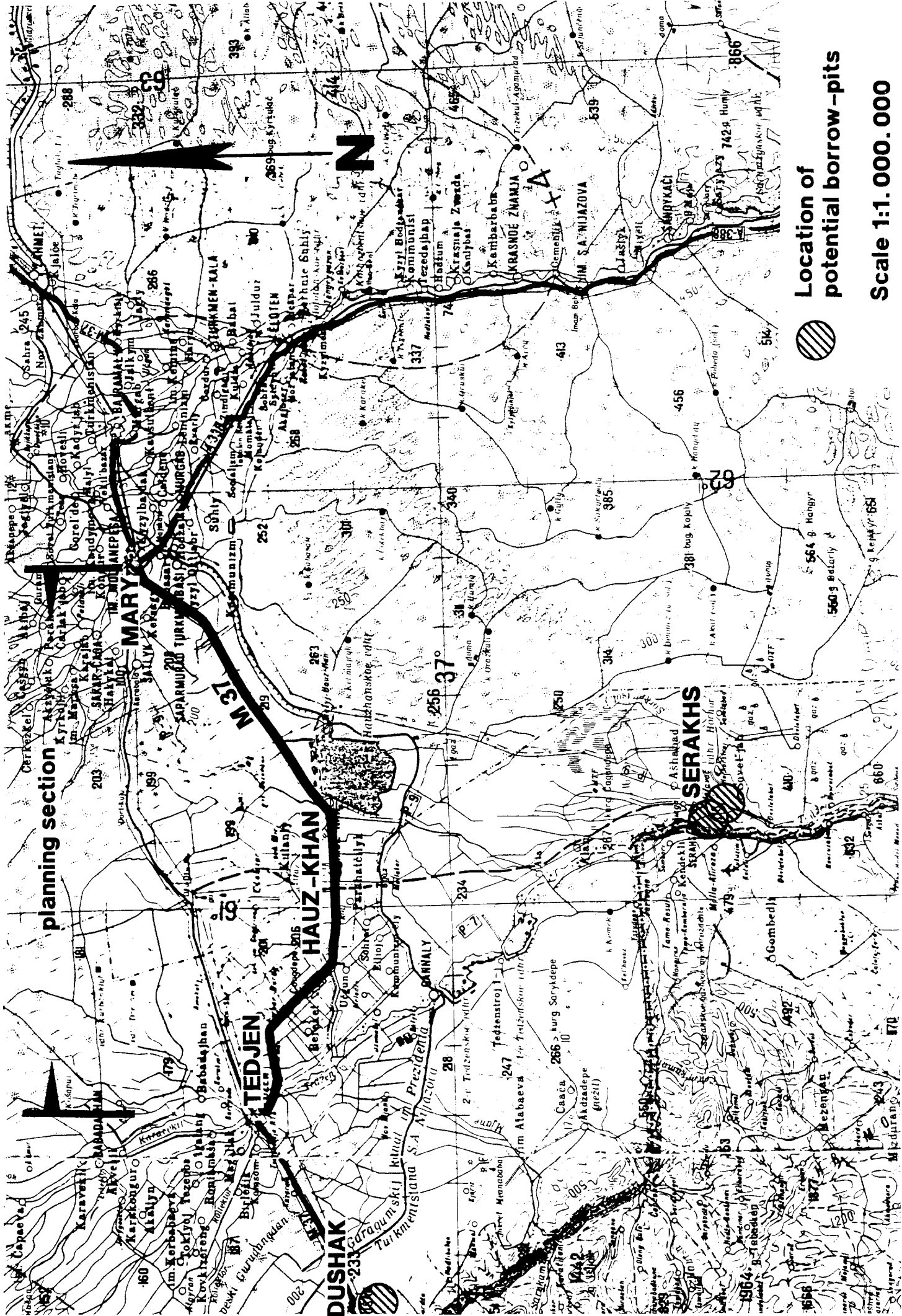
1.3 **Proposed borrow pits**

With reference to the geotechnical investigations three potential sources for construction *materials* have been identified. While the existing borrow pit at Dushak lies at a distance of about 7.5 km from the M 37 and some 50 km south-west of Tedjen, the borrow pits at Serakhs are located at a distance of about 120 km south-west of Mary (see map 1). The present situation at these sites can roughly be described as follows:

Dushak

The first mining operations at Dushak date back to the late 60s. Today this borrow pit is a one of the main sources of materials for industrial and construction uses in the country (coarse gravel with a high sand fraction). Data on the actual area of this mining site are not available. Excavations reach down to 8 m below the surrounding surface but groundwater is not met at this level. As can be seen on pictures 5 and 6 (appendix 3) mining is carried out by electro-powered machines.

The existing crushing and sieving plant is directly connected to the main railway line Ashgabad - Mary. Moreover, a narrow paved road exists, which links the borrow site to the M 37. This road is in rather bad condition and partly lined by settlements at distances of about 30 to 50 m on average.



planning section

HAUZ-KHAN

SERAKHS

Location of potential borrow-pits



Scale 1:1.000.000

Recultivation of exploited parts is actually not being done at this borrow pit. Topsoil is removed and stored some 500 m away from the present borrow site. However, natural regrowth has produced some sparse herbaceous and grass vegetation in the eldest parts of the borrow pit.

Serakhs

At Serakhs two borrow pits are used by the maintenance department of Turkmenautoellari (LEU) for various construction and maintenance activities:

One borrow pit called '**Khor-Khor**' is located about 13 km south-east of Serakhs which is about the same distance from the new railway line. The first mining activities at Khor-Khor date back to the mid 1950s, but more intensive excavations began in 1978. Data on the actual extension of this borrow pit are not available. The material which is encountered below a depth of 1.5 to 1.8 m at Khor-Khor is coarse gravel with a high proportion of sand and sandy loam.

At this site material extraction reaches to 10 to 15 m below ground surface. Small patches of reed at the bottom of the borrow pit indicate moisture, but it is unlikely that groundwater would be met at this level already (see picture 7, Appendix 3). According to the head of the local road construction administration, groundwater level may be expected 15 m below surface level. It is highly likely that actual occasional water influx to the borrow pit would originate from irrigation in the surrounding agricultural lands.

The older, rather shallow parts of the borrow pit are characterized by (uncontrolled) waste dumping (see picture 8). Since no alternative official dump site or organized waste management exist, this situation seems to be officially accepted.

A recultivation plan exists for Khor-Khor, but actually no steps have ever been taken in this regard. The first reason for this is that no suitable machines are locally available for these works. Secondly, most of the top soil is used for the local fabrication of loam-bricks, so that hardly any material remains for recultivation.

In the case of Khor-Khor the only official road that connects the site to the M 37 in direction of Hauz-Khan leads directly through the village of Serakhs.

The **second borrow pit at Serakhs** forms part of the higher terrace of the river Tedjen which represents the national border line between Turkmenistan and Iran. Accordingly the site is located within a guarded and fenced border strip where access is restricted.

At this site the first exploitation dates back to 1990. According to information from local staff inundation of the vast floodplain of the river Tedjen between March and May regularly includes the area of the present borrow site. During this period the area of the floodplain is subject to considerable shifts so that the material that is extracted from here consists of very new deposits of gravel with admixtures of sand and loam. Given the natural dynamics within this site there is only very little or no evidence of vegetation.

For this borrow pit no license exists. LEU-staff favour mining at this site since the material is looser and easier to extract than at Khor-Khor.

The distance to the new single line railway which leads south is less than 1 km but there is no provision for material transfer from rail to road. This railway crosses the M 37 west of Hauz Khan at about km 60. According to LEU-staff road traffic in the direction of Hauz-Khan would again have to pass through the village of Serakhs. In the Tedjen direction only a few single houses exist along the paved road on one side at distances of about 30 to 50 m.

2 Legal and administrative framework

The compilation of the relevant legal and administrative framework aims at

- the identification of the national requirements for impact mitigation or other environmental protection measures in road rehabilitation and borrow pit operations
- the provision of a list of key permits and regulatory requirements that are relevant to the present project and the measures that have been proposed.

2.1 Laws and regulations

The Consultant has reviewed the current Environmental laws of Turkmenistan which are compiled in a booklet entitled: 'Environmental Protection and Public Health for The People of Turkmenistan, Collection of Laws for the period 1989 to 1995'. In order to obtain first hand information, representatives of 'Ministerstwo Prirodopolsowanja Ohrana Okruschajuschej Sredi' ('Ministry of Nature Exploitation and Environmental Protection', referred to as 'Ministry of Environment' in the following) were visited. In summary the following laws and regulations will have to be considered:

The '**Turkmen Law for Nature Protection**' (12 November 1991) represents a general framework for all National objectives in the area of environmental protection. With regard to the current project 2 sections of this law are relevant. Under section 16 the law determines that for any project with a potential for adverse environmental impacts measures for environmental protection or mitigation measures have to be considered. Section 20 relates to pollution issues in general. It requires effective measures for the protection of groundwater and drinking-water from pollution which may arise from the disposal, storage and processing of waste. Since the law does not give any definition of 'waste' in this context, it is assumed that it includes those waste materials, that commonly result from operations within the contractor's yard and spoil materials from construction activities.

According to article 3 of the '**Turkmen Law On State Ecological Expertise**', (June 1995) 'State Ecological Expertise' is compulsory for projects which are expected to be associated with a 'transformation of the natural human

environment'. A supplement to this law was published on 13 November 1996. This paper defines the type of projects which need compulsory 'State Ecological Expertise' as well as the procedures. It also gives a rough concept of the methodology to be applied. Accordingly a project would be appraised from the point of view of the ecological impact on the environment. Based on this appraisal, the Ministry of Environment would approve or reject the project or make approval subject to conditions. However, according to the supplement to the law, the present project of road improvement does not fall under the requirements of the law.

Decree on the Development of Nurseries and Green Spaces in Turkmenistan, November 9th 1992

This Presidential Decree determines, among other things, that within a period of 2 years after publication fruit trees and other decorative trees shall be planted along the M 37 between Turkmenbashi, Ashgabad and Mary. The responsibility for the enforcement of these plantations lie with the Velayats Ahal (Ashgabad) and Mary (Mary), while the Ministry of Environment and the Academy of Agriculture (today Ministry of Agriculture) are in charge of the procurement of planting material.

SNIP-Regulations (= Russian construction norms and rules) and GOST standards (= state standards)

Various lists and publications of the existing official standards that could be relevant in the present study were also reviewed, but many of these documents could not be made available. It can be presumed, however, that these documents (which are all between 15 and 20 years old) would be rather general and broad in their statements, so that no valuable additional findings are expected here.

With respect to environmental issues, the following official regulations would have to be considered when roads are newly built or rehabilitated:

SNIP-Regulations 2.05.02-85

This paper is a former Soviet Union (FSU) **Regulation on Road Construction**. Actually, these FSU-regulations will be applied until the recently drafted Turkmen SNIP-regulations for the road construction sector will be officially approved².

² According to the Director of the Turkmendorproyekt, the date of official approval of the National Regulations is not yet determined. However, major changes that would affect regulations of environmental concern are not expected.

Environmental issues are dealt with under point 3 of this document (3.1 - 3.18). Most of the statements under this section are very general and do mainly apply to impact avoidance or mitigation on new road projects. Section 3.4 deals with topsoil protection. It specifies the removal and reuse of fertile topsoil from any land that is to be occupied by a new road or temporarily used for construction. Section 3.5 is more specific to that regard and contains detailed information on topsoil protection and qualities that would require special handling / precautions during construction with the intention to preserve fertile soils (namely top-soils with granulometric compositions from clayey to sandy and densities not exceeding 1.4 g/cm³). Point 3.7 makes provisions on the minimization of dust-development in cotton-producing areas. This could be relevant for the road section between Tedjen and Hauz Khan and the time between May and October. Point 3.16 finally states that in unstable locations or in locations of highly sensitive ecological systems, the Project shall develop suitable mitigation measures aimed at the minimization of adverse environmental impacts.

The document does not give any specifications about the handling or storage of harmful substances or any other preventive measures for the protection of groundwater, surface water or soils from pollution during construction / within the contractor's yard, nor does it make reference to other relevant regulations.

Also, standard procedures for the preservation or the protection of trees growing adjacent to a road or the construction site are not specified.

Construction Norms of Turkmenistan CNT 3.02.011-94

These regulations are only *indirectly* linked to the present project, since they mainly refer to the construction of towns and the planning and construction of/in cities, villages and settlements. Under point No. 9 (Environmental Protection) reference is given to the protection and rational use of natural resources (9.1 - 9.4), the protection of atmosphere, water units and soil against pollution (9.5 - 9.7), the protection against noise, vibration, electric and magnetic fields and radiation (9.9 - 9.11) in general terms. Point 9.8 refers to the protection of soils in general and also to the general obligation to preserve top soil and to restore or recultivate borrow pits. The regulation of the microclimate is addressed under point 9.12, where the positive effects of green plants on the human environment are pointed out.

As the aforementioned SNIP-Regulations all statements given in this paper are again non-specific.

BCH 8-89: Regulation on Environmental Protection in Construction, Rehabilitation and Maintenance of Roads

This document includes comprehensive regulations on environmental protection in road construction, rehabilitation or maintenance activities (among others: use of soils, protection of water resources, protection of forests, flora and fauna, use, preparation and storage of road construction machinery and materials, provisional structures, provisional roads, fire protection, borrow pits and material transport, avoidance of dust, protection of soils from pollution, prevention of soil erosion etc.).

The appendices to this document also include standards for:

- the maximum permitted concentrations of toxic substances
- noise control measures
- soil pollution through losses of oil and fuel from construction equipment
- quality standards for surface waters

SNIP III 4-80: Norms for Construction Safety

This document refers to construction activities in general and comprises, among others, detailed regulations on worker's health and safety. With regard to the present project the chapters 2 and 5 may be of relevance (organization of the construction site, the work sites and transport works). It also determines the maximum permissible concentration of toxic substances in the air, which could be relevant, among others, for road marking operations (Appendix 9).

Safety Regulations for Construction, Rehabilitation and Maintenance of Roads 1978 (corresponds to SNIP III A-11-70)

This document is a comprehensive compilation of safety rules for almost all aspects and stages of road construction, e.g. requirements for the technical safety for work with road construction equipment, the construction of dams, the rehabilitation and maintenance of bridges and culverts, loading and unloading operations, operation and maintenance of asphalt plants, work with toxic substances, work in quarries and borrow pits, work with compressors, mobile power plants, operation and maintenance of road construction equipment etc.

GOST 13508-74

This document deals with road marking and describes the requirements and standards of white lining for the various road categories, which is an important aspect of road safety.

Mining licenses

Regularly renewable licences regulate the extension and direction of the progressing mining activities at the borrow pits. These licenses may be issued to different contractors at the same time and would in general allow for the extraction of a fixed volume of material within a certain time frame. Licenses are issued by the respective Hekimlik (Dept. for Construction) and would normally include the obligation for site restoration (without however specifying how such restoration is to be carried out).

2.2 Current planning practise

Actually, the general practice in road planning is such, that Turkmenorproyekt would only inform other official bodies (Ministries, Velayats, Hekimliks, energy and water suppliers, etc.) about the project *on completion* of the design documents. Approval is granted or may be subject to conditions that are, if necessary, incorporated into the final design.

With respect to environmental issues a project would proceed more or less automatically through the permitting agency channels without further suggestions or comments. This statement does also apply to the previous and actual cooperation between Turkmenorproyekt and those bodies that are officially in charge with environmental matters. The process in fact is mainly a formal and not a consultative one.

One example for the current practise is a recent road construction project (45 km of *new* road from Ashgabad-Gaudan to Bandjiran on the Iranian border). The final design documents were handed out to the Ministry of the Environment at the very end of the proceedings. In these documents environmental issues are discussed in one short paragraph with only a few very general statements on the design features of the planned road and the intention to plant trees. Based on this, approval was granted by the Ministry of Environment without any comments within one week.

Conclusions

The existing legislation and regulations do in fact include a general conception of avoiding or minimizing construction-related impacts and also health and safety regulations seem to be adequate. From this point of view and also considering (the relatively few) requirements for the project under consideration it is

assumed, that there are in general sufficient provisions to ensure environmentally sound planning and construction practices which would also meet EBRD-standards for similar road rehabilitation projects. Yet no bodies / institutions or mechanisms have been established, that would pursue the consistent implementation of the full range of existing laws and regulations.

The next project stages will have to specify mechanisms which will ensure the consistent implementation of the steps to take and measures to be carried out.

The following chapter summarizes the legally required environmental protection and safety measures and also contains additional measures for environmental improvement and enhancement, which do largely follow World Bank recommendations for similar road rehabilitation projects.³

A tabular summary of these measures is given in Appendix 2.

³ The World Bank 1994: 'Roads and Environment: A Handbook'

3

Environmental impacts, avoidance and mitigation measures

The Consultant undertook two visits to the project road section between Tedjen and Mary and one to the proposed borrow areas at Dushak and Serakhs. Project features were discussed with representatives of Turkmendorproyekt, representatives of the Ministry of Environment, the Ashgabad Ecology Club. The conclusions are as follows:

Environmental impacts

As the project is limited to the repair of the pavement on an existing road *no significant impacts* are to be expected. Possible adverse impacts would be those that are caused by the purely *construction related activities*, the *temporary use of land* for the contractor's yard(s) as well as the extraction of construction material from *existing borrow pits*.

Human Health

As the project will improve the surface and the 'furniture' of an existing road, potential negative impacts on human health would be restricted to the construction period where workers may be exposed to exhaust fumes, noise, dust or deal with potentially harmful substances and materials. Further noise impacts are not considered to be an issue in the present case because outside Tedjen and Mary no settlements exist along the road.

Human Safety

With regard to road users travelling safety will be improved through a smoother road surface and a better road furniture (guard rails, road marking, traffic signs etc.). During construction however, safety could be affected by construction traffic, activities within the contractor's yard and works in borrow pits.

Measures

The measures to be specified as the planning proceeds will thus have to focus on the activities within the contractor's yard(s) and the management of construction works. The concept will have to address aspects like ground and surface water protection, dust control, waste management, materials handling and storage areas, worker's health and safety as well as road safety.

Project-related impacts as well as a *general concept* of suitable mitigation and additional environmental enhancement measures is discussed in some broader terms below (see 3.1 - 3.4). Based on this a set of safeguards will be compiled that need to be built in into the tender documents in order to prepare the implementation of these measures and to ensure, that contractors will follow environmentally sound construction practises (see point 4). Where norms and regulations exist, these will be stated (see tabular summary, Appendix 2).

3.1 **Establishment, setup and operation of the work site**

Impacts

The location of work facilities is a key environmental issue during the establishment of the construction site. Depending on the site that is chosen, the installation of equipment and storage of materials may cause traffic disruption, noise and dust affecting road users and neighbouring residential areas (the latter could refer to the peripheries of Tedjen or Mary, if a construction camp was installed there). During harvest seasons temporary detours or road closures could create additional problems. Pollution of soils, surface and ground waters could result from equipment cleaning and materials storage and handling. Finally, site establishment could cause the destruction of valuable vegetation.

Mitigation measures

Reasonable siting of the contractor's yard would not exclusively take technical or economical aspects into account but would also consider environmental requirements. Without anticipating further decisions to this regard the following is proposed: The contractor's yard(s) should only be established beyond a minimum distance as defined by existing regulations from the river Tedjen or any irrigation channels, which are important sources of drinking water and fish for the local population. Also, the potential existence of fresh-water wells in the possible area of influence should be considered (see point 4 for further detail). Site selection and preparation shall avoid, as far as possible, the removal of trees or bushes and also the areas with natural growth of Sakxaul (chainage km 75 - 116). Where trees are growing in the immediate vicinity or within the selected site, they should be protected against damage by suitable measures. Also, site preparation should include removal and storage of topsoil.

Depending on the number of workers and the mode of accommodation (i.e. construction camp with containers or other accommodation facilities), provisions will also have to be established for the proper treatment of sewerage and waste.

If not handled properly, storage and handling of hazardous substances such as detergents, bitumen, lubricants, oil, fuels, paint etc. can be considerable sources of groundwater pollution and the pollution of surface water or soil. In order to prevent these impacts a set of binding safety provisions needs to be established. The proper implementation of these regulations shall be ensured by clearly defined responsibilities and compliance to be monitored by an inspector or the construction supervision team.

Also, it must be assumed, that the awareness about the adverse impacts potentially arising from operations within the contractor's yard (and also construction activities in general) will probably be very low among the workers. It is therefore recommended that the construction supervision shall provide some on site training or briefing for the workshop personnel as well as for those operating and maintaining machines and equipment. Alternatively the contractor shall provide a method statement of his proposals.

Another important aspect of contractor responsibility is the restoration of work areas, work depots and material storage sites. As has been mentioned before (see point 2.1), site restoration is compulsory according to local regulations, so that land that has been temporarily used shall be restored to the initial state. This would also include respreading of top soil, removal of all scrap or waste material from the work site. The contractor shall submit a method statement for the establishment, maintenance and restoration of site compounds.

3.2

Activities within the construction corridor

Impacts

While this report was being prepared, the design of technical improvement requirements of the various road sections was still ongoing. Consequently, only very general presumptions can be made with regard to the impacts that could be related to the construction phase, the temporary diversion of traffic or traffic management during construction. Safety of road workers and other road users can be put at risk by inadequate traffic management and work zone controls.

Also, attention should be paid to the existing stands of trees. In some sections planted trees / natural tree vegetation grow very close to the roadside in double or more rows. If suitable protection measures are not provided, destruction of roadside trees is very likely. In the sections between km 75 and 116 the destruction of the natural vegetation could trigger sand drift from the adjacent dunes.

The road has a total of 23 bridges. Most of these will have to be repaired in the medium term, while for 2 urgent replacement has been recommended because of structural instability (see Inception Report, January 1997). The construction of new bridges is expected to require some major earthworks on the sensitive embankments of the streams and, if no further precautions are taken, soil erosion and water pollution could be caused.

Depending on the local soil properties soil compaction may be caused by construction equipment moving around the construction site which may harm the soil's potential for future agricultural use or planting measures.

Finally, abandoned machinery (scrap) and waste materials could disfigure the landscape.

Mitigation measures

With regard to traffic and worker's safety, potential risks and disturbances for local residents can be avoided or mitigated through a well designed traffic management plan. Within settlements, where material transport may disturb local residents, minimization of dust development can be achieved by periodically watering the transport roads and using covered trucks.

As already mentioned, an old paved road runs parallel close to the M 37 in the sections between Hauz Khan and Mary (total length: \approx 70 km). If, for any reason, single lane traffic should not be possible or efficient during construction, the use of the old road should be considered instead of building an additional road for the temporary diversion of traffic. This would minimize the need for land acquisition during construction and restoration of the site after completion of works. As determined by the existing legal requirements and regulations all top soil shall be removed and stored properly before the beginning of any activity outside the road itself.

The actual planning practices in the country do not consider the protection of road side trees in any standardized or systematic manner, so that special precautions should be taken during construction for that purpose. In the sections km 75 to 116 natural growth of *Haloxylon persicum* (Sakxaoul) does often reach immediately to the shoulders of the road so that construction operations in these sections should be carried out with special precautionary measures.

In order to promote more considered construction operations it is therefore suggested to place the responsibility for the effective protection of roadside-trees with the contractor (i.e. in the contract documentation). The contractor, possibly in cooperation with an inspector (see point 4.7), would instruct all workers on this issue.

In the case that bridges are replaced, the material (reinforced concrete) shall be removed and disposed of properly in suitable locations. Also, careful work procedures are necessary in order to avoid or minimize the risks of erosion or pollution and additional siltation of watercourses.

Wherever possible, processing and reuse of existing materials (pavement material or material from demolished bridges for example) should be considered. This would help to avoid or minimize the need of waste disposal and also reduce adverse impacts potentially resulting from material extraction and transport.

Finally, all land that has been temporarily used for construction or deviation of traffic will have to be restored to the initial state. This shall also include the removal of all machines and waste material from the construction site and the reuse of previously stockpiled topsoil.

3.3 Material extraction and transport

Impacts

Borrow sites in Turkmenistan which provide road building materials have had substantial adverse impacts on soils, water, the natural environment and human health in the past. Although licensing would generally include the requirement to recultivate or protect the borrow site, this doesn't happen in practice. Non-compliance however doesn't have any consequences for contractors, omission is neither pursued nor fined. According to information obtained from the Ecological Club of Ashgabad, uncontrolled waste deposition is the order of the day in many

borrow sites. As mentioned before, waste dumping does in fact take place at Khor-Khor in some older parts of the borrow pit that are located near to a former collective farm and in the direction of the village (see picture 8). Given the location of the borrow pit it is not to be expected, that further project-related mining would induce additional activities to this regard in other parts of the borrow pit

For both cases, the borrow pit at Dushak and also Khor-Khor at Serakhs, further material extraction would not create additional impacts in terms of new quality of impacts to be expected since extensive mined areas already exist. Also, project-related additional material extraction will not disfigure the landscape significantly nor will it lead to considerable losses of valuable vegetation. Provided that material extraction does not exceed the present excavation level (8 m below surface at Dushak and 10 to 15 m at Khor-Khor) no additional impairment of groundwater resources is to be expected.

In the case of the second borrow pit at Serakhs, material extraction takes place in some kind of 'no-man's-land' within the immediate border area. Adverse impacts on the landscape are assessed to be of minor importance since access to the area is severely restricted. Also in the last few years, the regularly recurring floods and the reported high velocity of the river have allowed for impact mitigation by means of natural processes to a considerable extent. In this context, mention should be made of an alleged Iranian dam project on some upper parts of the river. Such a project would surely lead to a complete change of the natural dynamics in all downstream sections of the river. However, since further details of this could not be obtained, further statements to that regard shall be avoided.

Noise and dust development related to material extraction are not expected to create problems since settlements are located in sufficient distances from the potential borrow pits in all three cases.

Noise and dust development resulting from material transport could create problems in the case of the borrow pit at Dushak, since settlements closely line the road connecting the site to the M 37. Also this road is very narrow and in poor condition. Heavily loaded trucks and two way traffic could be expected to worsen the situation and increase disturbance to the neighbouring settlements.

Depending on the direction of transport traffic (Mary or Tedjen) this issue would also have to be considered in the case of the Serakhs borrow pit. Moreover, it is assumed that the existing road network at Serakhs would not allow for the avoidance of the village itself. However, since no figures exist on the expected amount of transport traffic no other detailed statements can presently be given in respect of the nuisances that could result therefrom.

Any evaluation of the quality and dimension of potential environmental impacts that would be related to additional (yet unknown) quantities of material extraction from the proposed borrow sites can only be general in the present cases. The main reason for this is the lack of useful and reliable base-line data. According to impressions from the visual evaluation, purely project-related, additional material extraction would not create serious additional or new impacts on the natural surroundings, animal or plant life, groundwater or landscape in the cases of Dushak and Khor-Khor.

Comparing the physical surroundings and the actual state of the three proposed sites it is assumed, that the borrow site that is located in the floodplain of the river Tedjen would probably bear the highest risk of, however uncertain, adverse environmental impacts. Although no detailed information on the local situation was available, it should be considered, that the ecological sensitivity and value of river ecosystems (which include the natural floodplains) would in general exceed that of adjacent terrestrial habitats. Since figures on necessary volumes of materials are not yet available and also given the fact that the area was not accessible for evaluation, this subject cannot be explored in greater depth. One further argument which adds to this view is that no one could presently estimate the influence of the aforementioned possible dam project in Iran on this complex and sensitive ecosystem.

Measures

With regard to site selection for building material the omission of river gravel extraction from the Tedjen river would be understood as a contribution to impact mitigation. An alternative approach to this would be to carry out an environmental impact assessment or other kind of thorough investigation specifically considering the ecological potential of the possible area of influence and the consequences of further material extraction at this site.

As a first step to avoid or reduce transport-related annoyances for local residents it should be considered to what extent the existing railway transport can be integrated into the material transport plan. Especially in the case of Dushak, where all processing facilities exist in the site, this option should be considered in earnest.

If transport through the village cannot be avoided in the case of Serakhs, roads shall be periodically watered. The use of covered trucks will mitigate dust development. In both cases a well designed traffic management plan should consider traffic safety and make statements on working hours for material transport. Again a contractor's method statement on material handling and transportation should be sought for approval.

Local people should be informed of construction works to be carried out in advance of their start in order to allay fears and complaints.

3.4 Proposals for additional environmental enhancement

Sand drift control

Sand drift is not a general problem on the project road, but a typical one in the sections between km 81 - km 94 and km 99 - km 103. As can be seen on pictures 3 and 4 dunes have moved on to the shoulders of the road in several locations. According to locally obtained information sand is frequently blown onto the carriageway in these sections. This circumstance could represent a safety risk for road users, especially since the average travelling speed is expected to increase with the improvements to the road.

In order to alleviate this potential safety risk, methods to prevent sand drift should be applied locally. An example for a simple and successful local practice of sand drift control is shown in picture 4a. This method is based on the use of rushes (local term: *Kamish*) which are easily available from the nearby irrigation and drainage channels. Cuttings with a length of about 0.6 m are stuck into the sand to about half of their length in dense single rows and in pattern similar to a fence or a net.

According to LEU-staff the average life span of these arrangements is 5 to 10 years and the efficiency is well acknowledged. It is recommended to include a

plan for the local application of this method, especially in those sections, where the dunes reach to the edges of the road (i.e. km 87 - 88 and km 92 - 94).

Tree planting

As mentioned before, many sections of the M 37 are already lined by younger and mature rows of planted trees. Additionally, a large-scale tree-planting campaign is currently carried out along all of the M 37 between Tedjen and Mary.

According to a Presidential Decree (see point 2.1) further tree planting is planned for on the remaining road section in the longer terms. Given that context it is felt that the present project should take up this concept and make tree planting an integral part of the planning. Actually, the Ministry of Environment stated that the project would be deemed 'incomplete' without this element of tree planting.

Details on suitable sections of the M 37 that should be preferably selected for those measures were discussed with representatives of the Forestry Department of the above Ministry. As was mentioned before, intensive planting is presently going on in so many sections of the road, that presently an inventory of the status quo would be useless. Accordingly, it is suggested that a record of missing sections be carried out on completion of construction operations in order to identify those sections, that shall be completed within the project. At the same time this process would allow for the replacement of construction-related damage or loss of trees which could not be avoided. Moreover, this record shall make statements on the availability of water from the existing channels since regular irrigation of new plantations is a prerequisite for successful growth. The schedule for the inventory and the tree-plantations shall also consider that planting shall be carried out as soon as possible after completion of construction operations of a particular section. Planting itself would be limited to the time between December and 15 March.

The planting programme shall exclude the sections between km 75 and 116 where emphasis is put on the preservation of the existing natural vegetation that is especially adapted to the sandy underground and the given natural growing conditions.

Apart from the road-side itself, further suitable locations for tree planting would be around the 25 bus stops that are located on both sides of the road between Tedjen and Hauz-Khan (km 0.65 and 69.8) and the road-side bazar at about km 10.0 (left). This option was proposed to representatives of the Ministry of

Environment and the Chief of the Road Maintenance Department (LEU) of Turmenautoellari in Ashgabad and highly appreciated by all. As for the other tree plantations, the availability of water for irrigation shall be carefully considered at each individual site.

The actual design of the present bus stop facilities only provides some shade during a few hours of the day. Tree plantations would improve on that situation, even though it would take some years before the planted trees would become effective in that regard. Some of the bus stop facilities are in a poor technical condition and may need replacement in the near future. In this case proper timing of the two measures shall be considered.

4. Recommendations for the preparation of tender documents

Based on the findings according to point 3, the following contains elements of guidelines that should be included in the tender documents or added to construction contracts. This shall ensure that environmentally sound construction practices are followed and adverse impacts avoided or mitigated. In addition to this, all regulations that are stated in tables 1 - 4 (appendix 2) shall be applied during all stages of the project.

4.1 Establishment, setup and operation of the work site (= contractor's yard)

Site selection contractor's yard

The contractor shall submit documents for approval (short statement and site plan in appropriate scale) which indicate

- the location of the site(s)
- the surface area required (incl. access)
- the actual characteristics of the proposed site(s) with respect to soil and groundwater conditions, drinking water intakes, irrigation channels, actual land use, adjoining land uses, distance to settlements, existing vegetation (by quality and quantity)

The documents shall give evidence that environmental impacts that might be related to the site selection (see point 3.1) have been perceived and will be avoided or at least mitigated.

Site preparation

The contractor shall indicate efforts to maintain / protect vegetation within the selected site (trees or bushes) and consider the removal and storage of topsoil as well as the proposed location for topsoil storage. Also, the contractor's site installation shall be bordered by a fence or other means.

The contractor shall provide details on his site installation and indicate the number of workers to be employed, the time period of employment as well as the proposed mode of accommodation. This shall also include information on the treatment of sewerage and waste. Also, the contractor shall provide a recovery system for used motor oil. Prior to the commencement of works the site installations shall be inspected for approval.

Work site operation

Prior to the commencement of works, the work site personnel shall be instructed in site on safety rules for the handling and storage of hazardous substances (fuel, oil, lubricants, bitumen, paint etc.) and also the cleaning of equipment. In preparation of this the contractor shall establish a short list of materials to be used (by quality and quantity) and provide a rough concept explaining the training / briefing that shall be provided for the construction personnel.

Work site restoration

Upon completion of works the contractor shall execute all work necessary to restore the sites to their original state (removal and proper disposal of all materials, wastes, installations, ground surface, spreading and levelling of stored top soil). Prior to official delivery / acceptance an inspector shall prepare a report confirming that such site restoration has been completed (see sub-chapter 4.8).

4.2 Construction (= road corridor and adjacent land)

The contractor shall ensure, that clearing is limited to surfaces absolutely necessary for the road project and preserve and protect, as far as possible, trees within or in the vicinity of the construction corridor. This will be of special importance in the section chainage km 75 to 116. Here, the works shall be strictly limited to the existing road corridor in order to prevent damage or destruction of the natural vegetation (especially *Haloxylon persicum*).

Where the use of neighbouring lands for traffic diversion or working activities cannot be avoided all top soil shall be carefully stripped and stored for re-use.

Wherever possible, recycling of material shall be considered (would apply to the reuse of asphalt or surplus material) to be built into the subbase where it is renewed.

Also, a well designed traffic management plan for both construction vehicles and (potentially) diverted traffic shall be established.

Site Restoration

All land that has been temporarily used shall be restored to the previous state on completion of works, including reuse of stored topsoil.

4.3 Borrow pits: site preparation and material extraction

The contractor shall remove and properly store topsoil. During mining operation the exposure of groundwater shall be avoided. In order to make revegetation possible top soil shall be spread over temporarily used area.

The contractor shall prepare a recultivation plan which indicates the location to be used for material extraction and the kind of measures to be taken in that area after completion of mining operations.

4.4 Transport traffic

The contractor shall prepare a transport management plan which indicates the proposed haul routes (preferably by using a map of suitable scale) and also propose measures for road safety (temporary measures during construction, information, warnings). He shall make indications on the proposed working hours which shall consider the mitigation of disturbances for the local residents (restrict hours of operation, e.g. no night-time or weekend working). Locations that would require temporary watering of transport roads shall be indicated. Also, the use of covered trucks shall be considered in this context in order to avoid spillage of material.

In order to allay fears and complaints of local people project signboards shall be installed, to inform on construction works to be carried out in advance of their start.

4.5 Tree planting

The Turkmen standard for road-side plantations is considered to be 2 or 4 rows of trees with 3 plants every 6 metres. In order to prepare the planting measures the following steps shall be carried out on completion of construction works or as works are progressing:

- Mapping of remaining gaps for tree plantations along the M 37 (km 0 - 74 and 116 - 143) and soil conditions (especially the degree of salination since this would influence the planting scheme (see fig. 1).
- Determination of necessary earthworks for the preparation of tree planting (by quality and quantity)
- Determination of sections where existing trees were destroyed during construction
- Evaluation of 25 bus stops between Tedjen and Hauz Khan and road side bazar at km 10.0 (left) with regard to suitability for tree planting (see fig. 2)
- Evaluation of local availability of irrigation water from near-by channels
- Prepare data on the necessary measures for irrigation (e.g. amount of earthworks)
- Determination of necessary planting material (by quantity and quality)
- Preparation of a time table for implementation

Provided that watering can be assured by local irrigation facilities the following species should be considered for planting along the road, around the bus stops or at the bazar:

<i>Ailanthus altissima</i>	<i>Maclura aurantica</i>
<i>Eleagnus angustifolia</i>	<i>Morus alba / nigra</i>
<i>Fraxinus pennsylvatica</i>	<i>Ulmus pinato-racemosa.</i>

Where soils are sandy the most suitable species *would be the local Sakxaul* or *Haloxylon persicum*.

Where high salt concentrations prevail soil preparation will have to include two cycles of thorough earth „rinsing“ prior to planting. Planting itself shall be carried out between December and mid March. Trees would be available in sufficient numbers from the Forestry Department's own tree nurseries.

According to information from the Forestry Department maintenance requirements in the first 5 years would be watering 5 to 10 times per year and manual soil treatment twice to five times per year. In this way 80% success can be expected.

Tree planting itself is usually carried out jointly by the Ministry of Environment (Forest Dept.) and Turkmenautoellari (LEU = Maintenance Dept.). Since these two institutions actually dispose of the best practical experience in this field, they should be consulted to advise on assignments of local specialists to carry out the measures as described above.

4.6 Sand drift control

The contract shall include all necessary sand drift control measures in the road section between km 87 to 88 and 91 to 94. Preferably the method that was described before shall be applied, also including the plantation of *Haloxylon persicum* within the Kamish-rows (see Figure 3).

The contractor shall work closely together with Turkmenautoellary's LEO from Mary or the Ministry of Environment (Forest department) who have the necessary practical experience.

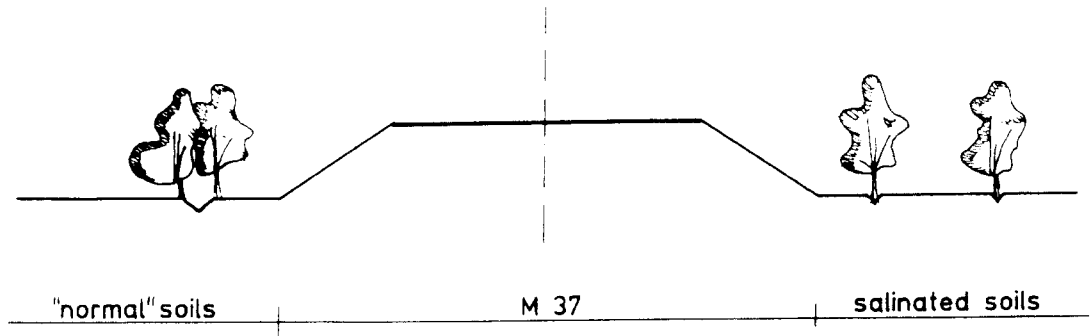


Figure 1: Comparison of recommended planting schemes according to different soil conditions

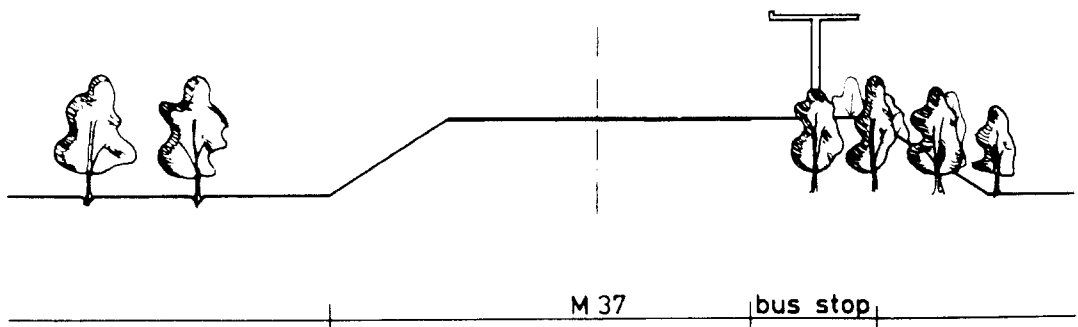


Figure 2: Tree planting at bus stop

4.7 Road safety

A smoother road surface itself will have a positive effect on road safety in general. Further improvements are expected from appropriate road marking (white lining according to GOST 13508-74, standard for road marking, preferably using detergent-free products) and guard rails where the embankments exceed 2 or 3 m height (to be determined individually). For the bridges appropriate safety equipment shall be provided (hand rails etc.).

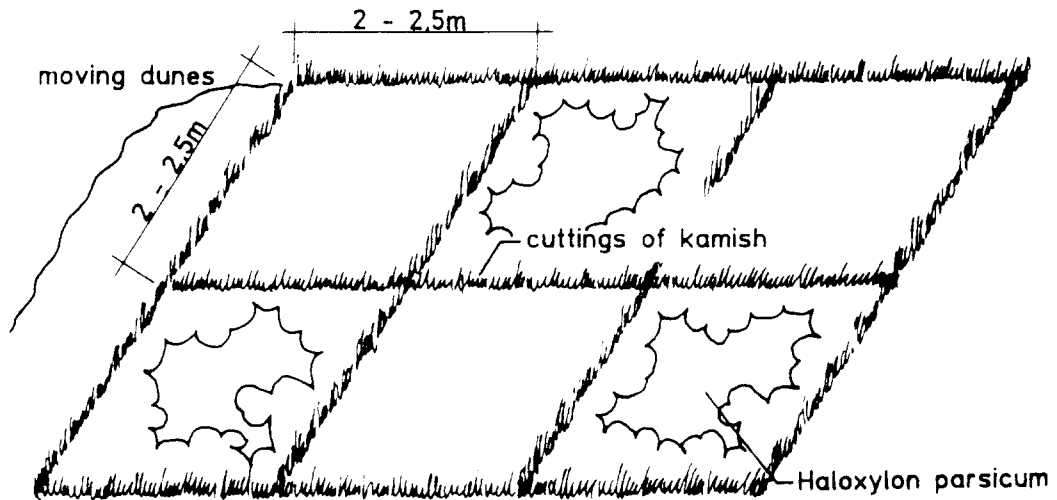


Fig. 3: Sand drift control - method as recommended by the Forest Department

4.8 Monitoring

In order to ensure the correct preparation and implementation of all remedial and mitigation measures an inspector shall be designated under the Project. This inspector shall supervise site preparation, site installation, worker's training / briefing, construction, advise on the design and the execution of measures for sand drift control, advise on and supervise site restoration (contractor's yard, construction sites, quarries). Also, tree planting shall be monitored.

A regular (monthly?) report shall be submitted by the inspector summarizing information on environmental improvements / measures during the construction period:

- steps taken by the contractor to preserve the environment
- data on quarries (safeguards, area, depth, recultivation, regular update of characteristics)
- trees planted (location, number, state of irrigation facilities etc.)

This inspector shall report to the Resident Engineer and cooperate closely with the appropriate official bodies.

5. **Key permits**

According to the existing planning regulations, permits / approvals would be required from the following institutions (this list is a complete one and is not restricted to purely environmental aspects):

Velayat Ahal

Etraps / Hekimliks (Dept. for Architecture)

- | | |
|---------|---|
| Kahka | borrow pit license Dushak |
| Serakhs | borrow pit license Serakhs |
| Tedjen | road construction corridor, also including contractor's yard,
traffic diversion: Dept. of Land Use |

Velayat Mary

Etraps / Hekimliks (Dept. for Architecture)

- | | |
|--------|--|
| Mary | road construction corridor, also including contractor's yard,
tree planting along road and creation of irrigation facilities |
| Murgab | road construction corridor, also including contractor's yard,
tree planting along road and creation of irrigation facilities |
| Niasov | road construction corridor, also including contractor's yard,
tree planting along road / police post Hauz Khan and creation
of irrigation facilities |

Ministries:

Railway	any change on railways
Construction Material	borrow pits Dushak and Serakhs
Economy & Finance	???
Agriculture & Food	???
Water Management & Irrigation	Borrow pit Dushak and Serakhs (on the river Tedjen); water suppliers

Velayats:

Dept. of Oil & Gas	crossing of gas pipelines
Dept. of Energy & Industry	crossing of energy lines
Dept. of Communication	crossing of telecommunication lines

Etraps:

Dept. for Irrigation:	crossing of water pipelines. In cases of changes on water pipelines: technical specifications
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Gas stations Hauz Khan

Manager	Tree planting on gas station
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**APPENDIX 1:
List of people contacted**

Almuradov, Mamed	LEU Ahal, Chief of Maintenance Department
Atamuradov, Begensh	Ministry of Nature Exploitation and Environment Forestry Department
Baliyev, Sihmurat	LEU Ahal, DCU 10 Serakhs
Berkeliev, Timur	Ashgabad Ecology Club CATENA
Brozda, Olga	Turkmentorproyekt, Director
Danielowa, Ludmilla	Ministry of Environment Senior Expert for Ecological Expertises
Glasovski, Vladimir	Ministry for Nature Exploitation and Environment Head of Department for Environmental Protection
Kuliyev, Akmukhamed	Ministry of Nature Exploitation and Environment Deputy minister-chief forester
Mirgorodski, Leonid	Turkmentorproyekt, Senior Engineer

**APPENDIX 2:
Tabular Summary Potential Impacts, Measures And Regulations**

Table 1: Establishment, setup and operation of the work site - potential impacts, measures and regulations

Potential Impact	Measures	Regulations
Loss of or damage to roadside trees and bushes	<ul style="list-style-type: none"> • preserve / protect single trees and bushes within or adjacent to the work site 	<p>BCH 8-89 no. 2.3.4 - 2.3.7</p>
Loss of valuable topsoil	<ul style="list-style-type: none"> • remove and store topsoil 	<p>SNIP 2.05.02-85, no. 3.4 and 3.5</p>
Pollution of soils, surface and ground waters	<ul style="list-style-type: none"> • avoid water protection zones and surface waters, restrict activities in areas near to rivers or streams / irrigation facilities • proper storage, use a. handling of hazardous materials (detergents, lubricants, fuel, oil, paint...) • designate inspector for the supervision of all measures and activities, define clear responsibilities 	<p>BCH 8-89, no. 2.2.5, 2.2.9, 2.2.10; BCH 8-89 no. 2.4.11</p>
Noise development	<ul style="list-style-type: none"> • temporary sealing of contractor's yard (storage area of machines, filling and washing sites, workshop, storage areas for hazardous substances), installation of oil-fuel separator • proper treatment of sewerage and waste from worker's accommodation • raise awareness of workers and other personnel on use and handling of hazardous materials by on-site training / briefing 	<p>Safety Regulations for Construction, Rehabilitation and Maintenance of Roads (corresp. to SNIP III A-11-70) Chapter 11; BCH 8-89 no. 2.2.1, 2.2.4, 2.2.5; SNIP III-4-80</p>
Dust development	<ul style="list-style-type: none"> • on completion of works: restore site (work areas, work depots and material storage site) to initial state; respread top-soil • remove machines and waste material 	<p>--</p>
Traffic disruption and worker's safety	<ul style="list-style-type: none"> • define clear responsibilities, monitor compliance by inspector or construction supervision team • use machinery corresponding to existing noise regulations • work site establishment to avoid neighbourhood of settlements • adopt dust control measures • develop well designed traffic management plan 	<p>--</p>
Risk for worker's health and safety	<ul style="list-style-type: none"> • apply and supervise safety regulations for road works 	<p>BCH 8-89 no. 4.1.1 (applies to roads within settlements)</p>
		<p>BCH 8-89 no. 2.4.2</p>
		<p>--</p>
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		<p>(BCH 8-89 no. 2.2.1 and 2.2.4)</p>
		<p>--</p>
		<p>--</p>
		<p>--</p>
		<p>--</p>

Note: Measures in bold are mandatory due to existing regulations; (...) recommended measures only partly covered by existing regulations
 -- indicates additional recommended measures

Table 2: Activities within the construction corridor - potential impacts, measures and regulations

Potential Impact	Measures	Regulations
Risk for worker's health and safety	<ul style="list-style-type: none"> • apply and supervise safety regulations for road works • in case of works on bridges and culverts apply and supervise specific regulations • develop well designed traffic management plan 	Safety Regulations for Construction, Rehabilitation and Maintenance of Roads (corresponds to SNIP III A-11-70) Chapters 2, 9, 11; see above, Chapter 6 (SNIP III-4-80 no. 2.20)
Destruction of roadside trees	<ul style="list-style-type: none"> • preserve / protect trees within or adjacent to the construction corridor 	BCH 8-89 no. 2.3.4 - 2.3.7
Surface water pollution	<ul style="list-style-type: none"> • respect protection zones along streams and rivers 	BCH 8-89 no. 2.2
Noise development	<ul style="list-style-type: none"> • use machinery corresponding to existing noise regulations • limit working hours 	BCH 8-89 Annex 2
Dust development	<ul style="list-style-type: none"> • adopt dust control measures 	--
Worker's health	<ul style="list-style-type: none"> • apply health and safety regulations for road construction equipment 	BCH 8-89 no. 4.1.1
Generation of waste from road rehabilitation	<ul style="list-style-type: none"> • reuse material wherever possible 	BCH 8-89 no. 2.4 and Annex 2; SNIP III-4-80
Traffic disruption	<ul style="list-style-type: none"> • develop well designed traffic management plan 	--
For better control of measures	<ul style="list-style-type: none"> • contractor to provide a method statement 	--
Additional environmental enhancement measures	<ul style="list-style-type: none"> • tree-planting • sand drift control 	--

Table 3: Material extraction and transport - potential impacts, measures and regulations

Potential Impact	Measures	Regulations
<p>Disturbances of local residents through material transport (noise, dust)</p> <p>loss of valuable topsoil</p> <p>safety risks because of material transport through settlements</p> <p>risk for worker's health and safety</p>	<ul style="list-style-type: none"> • consider possibility of material transport by railway • inform local people about project (responsibilities, purpose, duration...) • apply measures for dust control • remove and store topsoil • develop of well designed traffic management plan • apply and supervise safety regulations for works in quarries and borrow pits 	<p>--</p> <p>--</p> <p>(BCH 8-89 Nr. 3.4), no. 4.1.1</p> <p>SNIP 2.05.02-85 no. 3.4 and 3.5</p> <p>(SNIP III-4-80) no. 2.20)</p> <p>Safety Regulations for Construction Rehabilitation and Maintenance of Roads (corresponds to SNIP III A-11-70) Chapter 12</p>

Table 4: Further opportunities for positive environmental enhancement

Aim	Measures	Regulations
Improvement of road safety	<ul style="list-style-type: none"> • white linings (preferably using environmentally friendly products) • crash barriers in road sections with embankments > 3m height • sand drift control 	GOST 13508-74
Tree-planting	<ul style="list-style-type: none"> • mapping of remaining gaps for tree planting • determination of necessary earth works • determination of number of trees destroyed during construction • evaluation of bus stops for suitability of tree planting • evaluation of existing irrigation conditions • prepare data on measures required for tree irrigation • determination of quantity and quality of planting material 	-- GOST --

**APPENDIX 3:
Photographs**



Picture 1: Road section between Tedjen and Hauz Khan (~km 33), where road sides are currently being prepared for tree planting



Picture 2: Typical aspect of natural vegetation between at about road km 98 where Sakxaul (*Haloxylon persicum*) reaches up to the edges of the shoulders



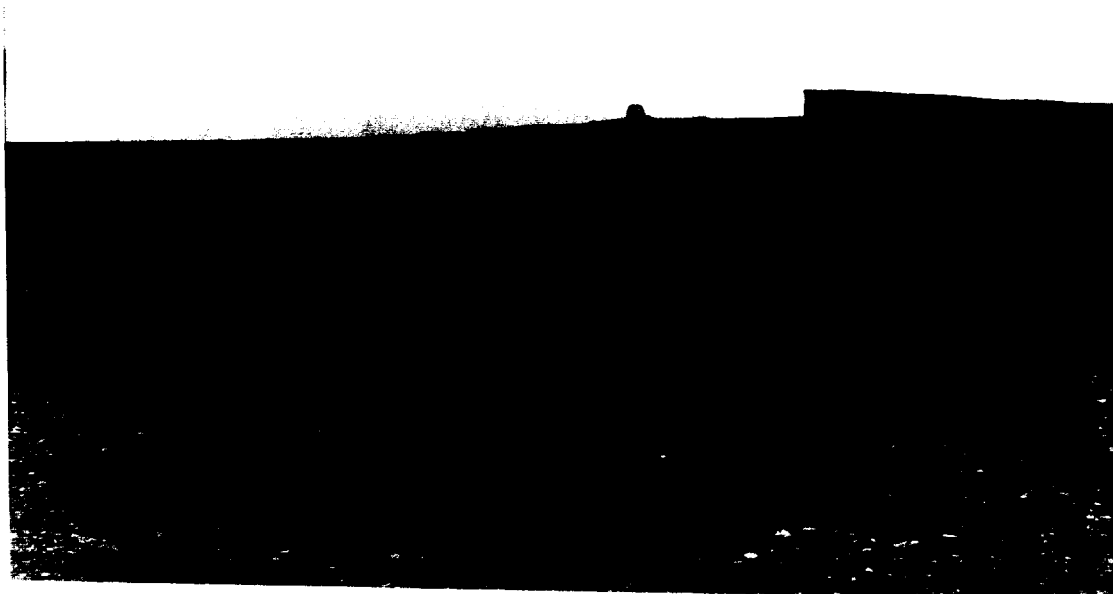
Picture 3: Moving sand dunes between road km 88 ad 91,5. In these locations measures for sand drift control are recommended



Picture 4: see above



Picture 4a: Proposed method for sand drift control with *Kamish*



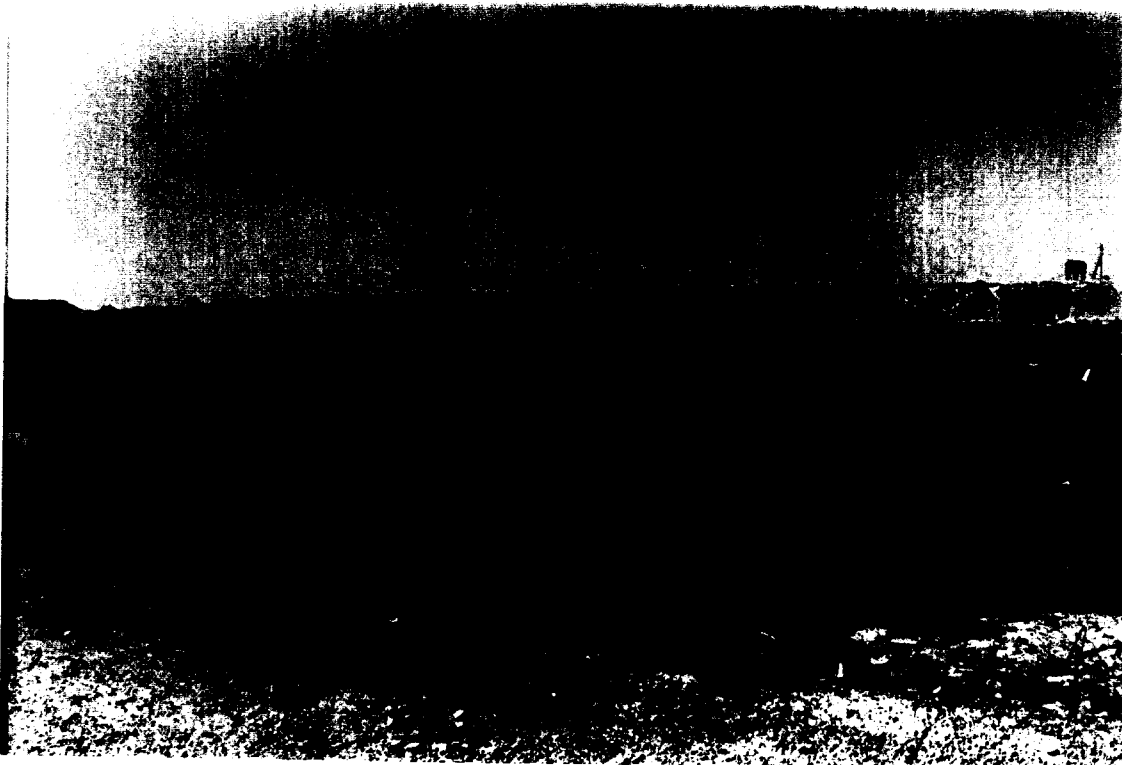
Picture 5: Proposed borrow pit at Dushak, aspect of the present borrow site



Picture 6: Same borrow pit, view over some older parts of the borrow area



Picture 7: Borrow pit at Serakhs ('Khor Khor') with aspects of spontaneous growth of rushes in local depressions



Picture 8: Aspect of some older parts of the same borrow pit with wide-spread waste in the background. The water at this location originates from a nearby factory for loam bricks

