UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

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ROAD RESOURCES MANAGEMENT PROJECT

PAKISTAN

FIELD CONSTRUCTION MANUAL

MAY 1991

CONSTRUCTION CONTROL SERVICES CORPORATION

USAID CONSULTANTS FOR ROAD RESOURCES MANAGEMENT PROJECT

43/10/F, P.E.C.H. Society, Block 6, Karachi-29 Tel: 442135

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LOUIS BERGER INTERNATIONAL, INC. & ASSOCIATED CONSULTING ENGINEERS

EAST ORANGE, NEW JERSEY 07019 KARACHI-8, PAKISTAN

FIELD CONSTRUCTION MANUAL

MAY 1991

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FIELD CONSTRUCTION MANUAL

1. INTRODUCTION

1.1 General

1.1 This manual has been prepared by the USAID Road Resources Management Project to guide local district council officials and engineers in the implementation of those construction management and contracting practices necessary to properly construct, rehabilitate and maintain the rural roads of the Sindh Province. By following the procedures described in this manual, district council staff will be able to adequately and positively affirm and document that work has been performed employing correct construction practices and procedures and in compliance with the contracting and reimbursement requirements of USAID funded construction contracts. All inspection and reporting procedures must be performed and/or presented in a neat, correct and timely manner to facilitate rapid project progress and a high standard of workmanship.

1.2 Scope

This Construction Manual encompasses inspection and reporting of all B.O.Q. items currently being used in the standard design for asphalt paved rural roads. Addenda to this manual will be issued, as required, to accomodate future changes in B.O.Q. items.

Urdu and Sindhi versions of this manual are also available. In the event of any discrepancy, the procedures, standards and specifications of the English version will prevail.

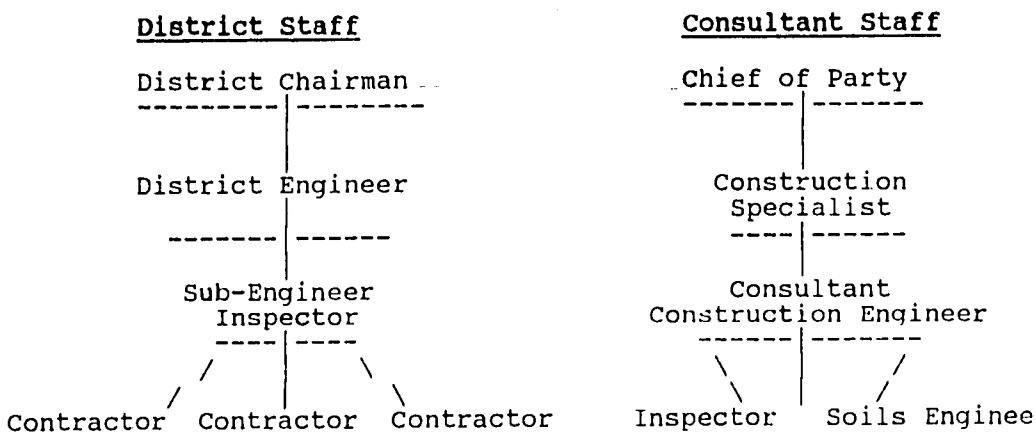
1.3 Abbreviations

B.O.Q.	Bill of Quantities
C.B.R.	California Bearing Ratio
C.C.E.	Consultant Construction Engineer
C.S.	Construction Specialist
D.C.	District Council
D.E.	District Engineer
M.D.D.	Maximum Dry Density
USAID	United States Agency for International Development

2. FIELD CONSTRUCTION/INSPECTORS DUTIES, RESPONSIBILITIES AND REPORTING PROCEDURES

This section discusses the organization of District Council and Consultant staff as it relates to engineering project management and describes the reporting procedures which must be followed.

2.1 Organizational Chart



2.2 Duties & Responsibilities of District Council Personnel

District Council management and engineering personnel have numerous responsibilities and specific duties which are fixed by law and the norms of good public administration contracting practice. Most of the duties described in this section apply to all construction contracts. Specific additional responsibilities, peculiar to those contracts funded by USAID or other international funding agencies, are also mentioned in this section.

2.2.1 District Chairman

The District Chairman is responsible for Award of Contract, final Authorization of Payment to contractors and compliance with all legal contracting requirements and procedures for requesting reimbursement of funds from USAID.

2.2.2 District Engineer

The District Engineer is responsible for all dealings with the contractor during the execution of the work. This includes performance of all required materials testing, field testing and implementation of all requisite, or prudent, construction quality control procedures. In fulfilling this responsibility to assure that the project is executed in compliance with all terms of the contract, the District Engineer must notify the contractor immediately of all deviations from the contract specifications, including non-compliance of materials, substandard quality of work or improper work procedures, so that the contractor may take remedial action promptly, without incurring unnecessary financial losses or undue additional costs which would result from prolonged application of improper materials or procedures.

The District Engineer will reject or accept each B.O.Q work item performed by the contractor and will verify quantity measurements as the first step in authorizing payment of contractor invoices.

The District Engineer will appoint a sub-engineer to assume responsibility for the daily supervision of each project, including acceptance or rejection of contractor work and materials.

2.2.3 Sub-Engineer

The Sub-Engineer is an appointed agent of the District Engineer and, as such, is responsible for daily supervision of the activities at the contractor in the execution of the project. The Sub-Engineer will affirm that all required tests are carried out in a timely manner and that all materials used and all procedures followed are in compliance with the contract specifications. The Sub-Engineer will immediately notify both the District Engineer and the contractor whenever any deviation from contract plans or specifications is observed. The Sub-Engineer will also immediately notify the District Engineer of any technical problem, construction difficulty or contractual dispute which may arise and which is outside the scope of his professional expertise or level of competency.

2.2.4 Inspector

2.3 Duties and Responsibilities of Consultant Personnel

In the context of the Road Resources Management Project, a team of Construction Engineers and Inspectors has been assembled to guide and assist the District Councils in

meeting their technical and administrative responsibilities in project management of rehabilitation and construction projects funded by USAID. The duties and responsibilities of Consultant Staff described below apply specifically to USAID funded projects and could be applied generically to any project funded by any of the international financial institutions such as the World Bank and the Asian Development Bank. Additionally, District Councils may wish to utilize a similar consultant advisory structure for locally financed projects where specialized expertise may be desirable or where the complexity, size or sheer number of ongoing projects exceeds the administrative capacity of the District Council staff.

2.3.1 Construction Specialist

The Construction Specialist is the leader of the Consultant Construction Engineering Team. It is his responsibility to set standard testing requirements and procedures and construction management criteria to be implemented in the field. He will coordinate directly with the District Engineer in implementing construction scheduling policy and procedures and resolving complex technical and contractual matters. The Construction Specialist serves in a consultative capacity only. He will have no direct responsibility for contractor supervision or any contractual matter which is within the

purview of the District Engineer. The Construction Specialist acts as agent for the Consultant in advising USAID of compliance with all contractual and procedural requirements of the agency and eligibility of work for reimbursement with project funds. In this capacity, he will notify the District Engineer of any indication of non-compliance with contract plans or specifications that may result in any item of work being declared ineligible for reimbursement by the funding agency.

In addition to implementing and enforcing the construction inspection procedures set forth in this Manual, the Construction Specialist and his technical staff will provide on-site training to District Council Sub-engineers and inspectors, explain field testing requirements and detailed inspection procedures.

2.3.2 Construction Engineer

A Construction Engineer is assigned to each of the Consultant field offices to provide on-sight supervision of each project during all critical phases of construction and to participate with the District Engineer in all field measurements necessary to certify contractor invoices for payment. He also acts as technical liaison with the District Engineer, meeting with him as often as necessary to assure timely completion and the high level of quality control, which can only be accomplished by highly effective channels of communication and frequent project review meetings.

The importance of effective communication & coordination of activities with the District Engineer cannot be over emphasized, as it is the responsibility of the District Engineer to enfore the terms of the contract. The Construction Engineer acts only in a consultative capacity and has no direct authority over the Contractor. Violation of contract provisions and sub-standard quality of material and workmanship will be reported immediately to the District Engineer in writing, forwarding an advice copy to the Construction Specialist and the Chief of Party.

In addition to implementing and enforcing the construction inspection procedures the Consultant Construction Engineer or his field inspector will provide on-site training to District Council inspectors, and will explain field testing requirements and detailed inspection procedures as they are required.

2.3.3 Soils Engineer

The Soils Engineer will be consulted to determine the suitability of proposed sources for embankments and base materials if previously approved sources are not available for a specific project or if carriage distances are excessive. He will also be consulted to determine appropriate procedures to bring materials to optimum moisture content, prior to compaction.

2.3.4. Inspector

At least one Inspector shall be assigned by the Consultant to supervise all construction and field testing activity at each project. All inspection procedures indicated in this Manual will be conscientiously implemented and enforced by the field inspection team. The Inspector will immediately notify the Construction Engineer and District Engineer (or Sub-Engineer) in writing of any deviation from contract plans or specifications. It is the responsibility of the District Engineer to take remedial action to enforce the terms of the contract. The Consultant may assign a Senior Inspector, or Chief Inspector, to direct and oversee the daily activities of consultant Inspectors and to provide expert guidance in the supervision of construction and rehabilitation activities and materials evaluation. The entire staff of Inspectors will provide on-the-job training to District Council Sub-Engineers and inspection staff and will explain field testing requirements and inspection procedures.

3.0 Typical Contract Work Items

This section describes the typical activities which a contractor must perform in the execution of a standard rehabilitation contract.

3.1 Clearing and Grubbing

All vegetation and other debris, except those trees to be retained as directed by the District Engineer, will be removed from areas where additional embankment material is to be placed or reworked, i.e. shoulders and slopes.

This activity must be completed and verified by inspection prior to placement of additional embankment material.

3.2 Embankment

The toe of the slope will be established based on the elevation of the finished center line and the cross-section. The toe will be located by the surveyors and marked by a stake.

When substantial ditch work yields quantities of material that can be used in the embankment, such ditch work will immediately follow clearing and grubbing and staking of the toe. The width of ditch should be staked outside the toe with elevation of cut indicated based on the established gradient. Material cut from the ditch will be placed in the embankment if suitable, or removed to an area designated by the engineer if unsuitable.

Embankment work up to the elevation of the existing road must be completed before the base work is started. This will allow the roller to be used at the elevation of the existing road if the shoulder width is less than the roller width. The roller should be used in all cases where the width is sufficient for its use when adding embankment material. When the design calls for a 7 foot shoulder the step procedure (described separately) is to be followed. Cuts into the embankment for this purpose are to be measured for payment to the contractor.

All embankment material to be compacted, both that added to the embankment and that being reworked, must be brought to optimum moisture content by adding water. The soils engineer will advise what the optimum moisture content is for the particular material and the best procedure for attaining that moisture content. As a guide the material should remain in a ball squeezed in the hand but should not exhibit free moisture or flow through the fingers when near optimum moisture content.

Where the embankment is to be widened, new embankment material should be spread in lifts no greater then 6 inches in depth, at optimum moisture content, from the staked toe to the edge of the existing embankment. If this width is insufficient to allow the use of a roller, a tractor or suitable alternate acceptable to the District Engineer must be used to obtain as much density

as possible by compacting 100 % of the area using the tractor tire. The embankment should be constructed somewhat wider than the final slope during compaction and cut back to proper slope after compaction. Although it will not be possible to obtain a true 95 % modified AASHTO by this method, experience has shown that a satisfactory density approaching 95 % can be achieved. Areas compacted by tractor tire should be tested and a determination of acceptability should be made by the District Engineer prior to beginning subsequent lifts. In no case should a density below 85 % modified AASHTO be considered acceptable for the lower lifts.

The soils engineer will determine the number of required passes. When the widened embankment has reached a level 6 inches below the existing surface, the shoulder should be bladed to a level 6 inches below the pavement to form a uniform plane from the edge of the pavement to the upper most point of the slope. The material cut from the shoulder will be mixed with new material, brought to optimum moisture as determined by the Soils Engineer and spread to a uniform depth. The roller will then compact the material to 95 % modified AASHTO. The density will be checked by the inspector using the sand cone or core cutter method. The procedure for density testing will be demonstrated and supervised by the soils engineer. The District Engineer, in consultation with the Construction Engineer or the Soils Engineer, will specify the number

of passes of the roller required to produce the necessary density. The District Engineer, Sub-Engineer and/or Inspector will continue to monitor by sand cone or core cutter method to verify that density is consistently achieved. The sub-engineer and the inspector will continually monitor the number of passes made by the road roller to determine that density is consistently achieved. Likewise, supervisory procedures will assure that optimum moisture is being maintained, possibly allowing frequency of testing to be reduced at the discretion of the District Engineer with concurrence of the Construction Specialist or Construction Engineer.

After the embankment is brought to the elevation of the existing base, with proper density and shaping of slopes, the base construction will begin.

As each lift of the base is completed the shoulders will be brought to the same elevation so that the roller can compact the shoulder by overlapping the base.

3.3 Base Construction

Following the procedures in the specifications, the coarse aggregate for the base is to be watered and rolled followed by screenings placement and again watered and rolled such that all fines are washed into the surface voids. During placement of the coarse aggregate the loose depth and compacted depth will be determined by

District Engineer or Sub-Engineer in collaboration with the Construction Engineer or Inspector.

The surface shall be brought to final section by the use of templates, straight edge, or other means approved by the District Engineer. before the addition of screenings to the final surface. Screenings shall not be used to fill depressions or bring the surface to section.

Extreme care must be taken that excess screenings are not used and that screenings do not cover the surface. The contractor shall apply only sufficient screenings to fill the voids of the large aggregate. After watering and rolling, any excess screenings must be removed so as to expose the coarse aggregate. The final base surface shall be made up of coarse aggregate with only the voids filled by screenings. The surface shall be free of dust and fine aggregate.

The density of the base shall be verified with respect to contract specifications using the sand cone method. The Sub-Engineer, guided by the Construction Engineer or Inspector, will record the number and location of the truck loads of base material delivered to the project site. This record will document materials quantities utilizing the form prepared for that purpose (See Section No. ----). The original form will be presented to the District Engineer for reconciling with contractor invoices and a copy will be retained in the Consultant's project file.

3.4 **Cross Sections**

Sufficient cross-sections of the existing road shall be taken immediately upon issuance of the initial work order and again upon completion of construction. These measurements will determine billable earthwork and base quantities. They shall be taken jointly by the District Engineer and the contractor under consultant supervision. The frequency of cross-section surveys must be sufficient to give an accurate measurement of quantities. The District Engineer, in consultation with the Construction Engineer or the Construction Specialist, will determine the interval between cross-sections. The contractor shall agree to the measurement and payment procedure in writing prior to beginning the work, if said procedure is not clearly specified in the contract.

3.5 **Surface Dressing**

Before the first coat of asphalt is applied, the Inspector will determine that the surface is clean and free of dust. The Inspector will verify that the temperature of the asphalt is within the required limits. Aggregate will be inspected when delivered to determine that it is dust free.

The aggregate must be spread on the asphalt immediately after the asphalt reaches the surface. Placement of aggregate must not be delayed until a width of pavement is covered with asphalt but shall be placed immediately, while the asphalt remains within the required temperature limits. The roller shall follow immediately. This

procedure shall be followed for all courses of surface dressing.

The Sub-engineer, in collaboration with the inspector, must record the amount of asphalt used as determined by the number of barrels consumed and the amount used from any storage unit by measurement of depth before and after construction. This amount must be reconciled with the record of asphalt delivered and that remaining on hand. The area covered must also be recorded and the rate used per 100 square feet determined to ensure conformance with specifications and BOQ.

Quantities used and area covered are also to be recorded for aggregate to ensure application rates comply with the specifications.

In areas where water cannot flow freely from the embankment such as through villages or other congested areas, ditch gradients must be checked by the surveyors to insure that water will not be ponded. Any necessary corrections must be made by the contractor.

3.6 <u>Summary of Consultant/D.E. Supervising Staff Duties</u>

1) All material must be properly tested and approved prior to delivery to site.

2) Record contractors resources and activities.

3) Inspect clearing and grubbing.

4) Verify that the embankment is compacted at optimum moisture content (90 % or as required) and that the roller makes the specified number of passes to

reach the required density as determined by the District Engineer in consultation with the Construction Specialist, the Construction Engineer or the Soils Engineer.

5) Check that proper design cross sections are being constructed.

6) Check that the base is placed to proper depth.

7) Determine the density of embankment, base and shoulder by means of sand cone method or such alternative approved method as may be specified by the District Engineer in consultation with the Construction Specialist, the Construction Engineer or the Soils Engineer.

8) Verify that embankment and base quantities are properly measured.

9) Verify that surface of base course is properly exposed and dust free before asphalt is applied.

10) Check the asphalt temperature prior to application to verify compliance with specifications.

11) Verify that the rate of application of the liquid asphalt complies with contract specifications.

12) Ensure that the aggregate is spread immediately after application of asphalt.

13) Ensure that the aggregates for surface dressing are dust free.

14) Verify that the rate of application of aggregate for surface dressing complies with contract specifications.

15) Ensure that the roller immediately follows aggregate spread.

16) Ensure that fine aggregates are used only to fill the voids in the base course and are not used as a layer.

Construction procedure in detail/specification will be supplied separately for each road.

17) Ensure each layer is laid only after approval of the previous layer.

18) Ensure that all procedures established in the Description of Duties are followed.

3.7 Summary of Duties Related to Inspection of BOQ Items

Daily Report

1) The Sub-engineer, in collaboration with the Inspector, will utilize the approved format for reporting daily contractor activities, utilization of contractor resources and progress toward completion of BOQ items.

2) Clearing and grubbing

All vegetation and other debris must be removed to the roots level in all shoulder, embankment and other areas where additional material is to be placed or reworked, except for trees which will be retained or removed in accordance with specific instructions from the District Engineer.

3) Embankment

All embankment material in place shall be

compacted at optimum moisture content. To attain optimum moisture content, the contractor shall water the area prior to compaction in accordance with instruction of the District Engineer in consultation with the Soils Engineer, or the Construction Engineer. Said instruction shall be based on a determination of what the optimum moisture is for a particular material.

Where the embankment is to be widened, the new embankment material should be spread in lifts not to exceed 6 inches in depth prior to compaction.

4) Cross Section Inspection

District Council surveyors will assist the field inspection team in verifying that proper design cross-sections are being constructed. In the absence of a District Council surveying party, a private surveyor will be contracted or a survey team will be provided by the consultant to verify that the cross-sections are constructed in compliance with the contract specifications.

5) Depth of Base

The depth of base shall be specified in the design and the base shall be constructed to this design depth. Placement of base in loose depth and compacted depth will be measured by the District Engineer or Sub-engineer in collaboration with the Construction Engineer or Inspector.

6) **Compaction Testing**

The District Engineer or Sub-engineer in collaboration with the Construction Engineer or Inspector, will test the density of the compacted area employing the sand cone method or the core cutting method, as specified by the District Engineer. Tests shall be performed at every 150 meters for embankment and shoulders. Tests shall be performed at every 75 meters for the base course.

The procedure and calculation will be demonstrated by the Construction Engineer or Soils Engineer at each project work site.

7) **Verification of materials quantities (embankment base and shoulders).**

Embankment, base and shoulder materials quantities will be verified by District Engineer or Sub-Engineer in collaboration with the Construction Engineer or Inspector. Quantities will be verified by taking the average depth of several test pits bored per instructions of the District Engineer.

8) **Initial Asphalt Application**

The Sub-engineer, in collaboration with the Inspector, shall determine that the surface of the base is clean and free from dust before application of the first coat of liquid asphalt cement.

9) **Asphalt Temperature**

The temperature of the liquid asphalt will be checked prior to and during spraying to ensure that the application temperature complies with the specifications.

10) **Rate of Application of Asphalt Cement**

The District Engineer or Sub-engineer shall verify the rate of application by measuring the quantity of asphalt in the distributor before and after application and dividing the material used by the area sprayed.

Control of rate of application shall be continuous throughout the construction process. The District Engineer will determine the length of roadway which corresponds to the correct area to be covered by one "refill barrel" loaded into the asphalt distributor. A flag shall be placed at the shoulder at each of these corresponding lengths prior to initiating the asphalt application. The Inspector shall verify that one "refill barrel" is consumed each time the asphalt distributor passes a flag. The detailed procedure for calculating the frequency of flag placement and field verification of the application rate is illustrated with examples in Section ----- of this Manual.

11) **Application of Aggregate**

The contractor must spread the aggregate immediately after the asphalt is sprayed.

12) **Quality of Aggregate**

The Sub-Engineer will verify that aggregate for surface dressing is from approved source and, at time of application, is free from dust and organic material.

13) **Rate of Application of Aggregate**

The Sub-engineer will verify that the rate of application of aggregate conforms to the contract specifications. To verify this he shall determine the amount of aggregate applied by counting the number of trucks and dividing the amount of materials used by the area covered. A detailed procedure for field control of the rate of application of aggregate cover is described in Section ------ of this Manual.

14) **Compaction of Aggregate**

The Sub-engineer will ensure that the roller follows immediately after the aggregate is spread. No more than 12 minutes shall elapse between the time that the hot asphalt is applied to the road and the time that the roller makes its final pass. The number of passes required to properly imbed the aggregate cover shall be specified by the District Engineer and verified in the field by the Sub-Engineer.

15) **Filling of voids in the base course**

The Sub-engineer shall be on site during the construction of the base course to verify that fine material is used only to fill the voids. Use of fines as a layer or "sand cushion" is strictly prohibited.

16) **Approval of each Course**

The contractor shall not proceed with surface dressing until approval for the base course, or any previous course of surface dressing, is granted in writing by the District Engineer or Sub-Engineer.

17) **Approval of certain materials and Aggregate**

All construction material delivered to the site shall be properly tested and approved prior to use.

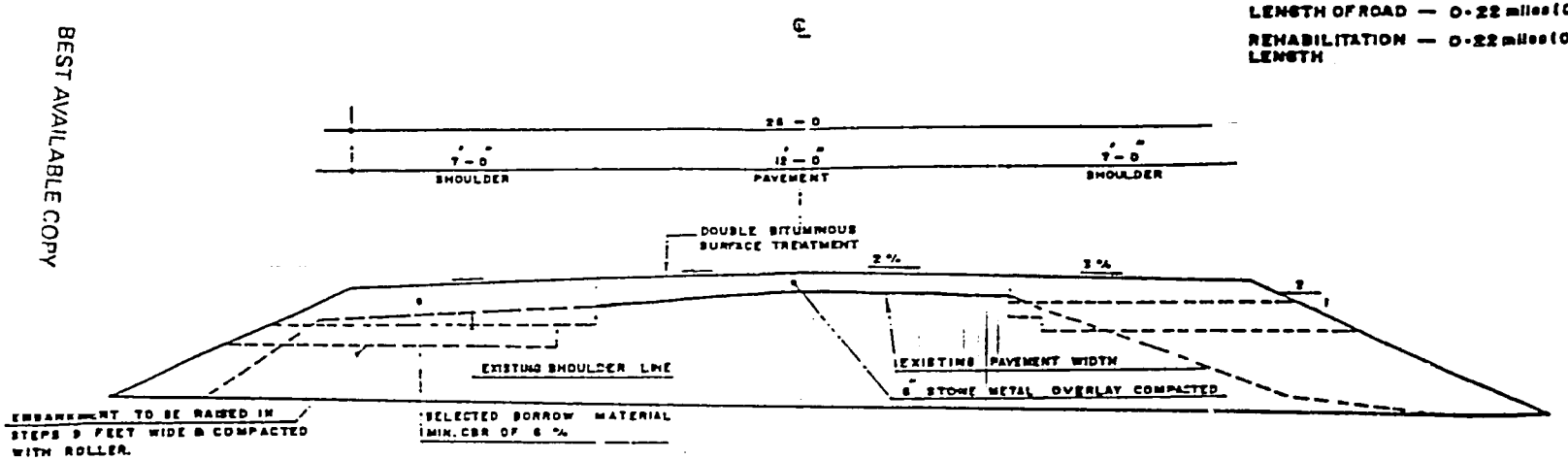
18) **Approval of Bituminous Materials**

The contractor shall supply a manufacturers certificate affirming that the asphalt used for surface dressing meets the contract specifications. In the absence of a manufacturer's certificate, a certificate from an approved materials testing laboratory may be accepted at the discretion of the District Engineer. In this case, the asphalt sample shall be taken in the presence of the District Engineer or Sub-engineer from material delivered to the project site. Each

delivery shall be subject to the same certification requirement.

DISTRICT: — JACOBABAD
ROAD NAME — KANDHKOT–KASHMO
ROAD TO VILLAGE R
ROAD NO. — JA(N)6
LENGTH OF ROAD — 0·22 miles (0·350 K
REHABILITATION LENGTH — 0·22 miles (0·350 K.

3: TYPICAL CROSS SECTION
(REHABILITATION OF ROAD)



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SHOULDER AND EMBANKMENT

APPROVED SELECTED MATERIAL IN LAYER OF 150 mm (6") THICK SHOULD BE COMPACTED AT OPTIMUM MOISTURE CONTENT (O M C) TO MINIMUM 95 % MODIFIED AASHTO COMPACTION EXCEPT MATERIAL TWO FEET BELOW FINISHED ELEVATION AND AREA WHERE ROLLER CAN NOT OPERATE.

POTHOLES LOOSE MATERIAL OR WEAK AREAS SHALL BE CORRECTED PRIOR TO OVERLAY AS DIRECTED BY THE ENGINEER.

SURFACE TREATMENT 2 APPLICATIONS (D.B.S.T.)

I) — 40 lbs. BITUMEN PER 100 SQ.FT. 5·5 C.FT. CHIPS OR BAJRI 3/4" TO 3/8" PER 100 SQ. FT.

II)— 25 lbs. BITUMEN PER 100 SQ.FT. 2·75 C.FT. CHIPS OR BAJRI 3/8" TO ⅛" PER 100 SQ.FT.

FORM LETTER FOR RECOMMENDING AWARD OF CONTRACT

DATE

Director General
Rural Development
Government of Sindh
Karachi.

Sub: ROAD RESOURCES MANAGEMENT PROJECT, 391-0480
EVALUATION OF TENDERS FOR REHABILITATION OF
ROAD FROM ___(1)___ TO ___(2)___ ___(3)___ IN ___(4)___ DISTRICT

Dear Mr.

1. The tenders for the subject road rehabilitation project were received in the office of the District Engineer on ___(5a)___, 1990 and opened on ___(5b)___ in the presence of the District Chairman and interested tenderers.

2 A total of ___(6)___ registered contractors were issued the tenders.

The following tenders were received:

CONTRACTOR	TENDER AMOUNT
(7)	(8)

3. One copy of Tender Notice along with a copy of each tender is attached for your review. Also attached is a copy of the TENDER EVALUATION PROFORMA, duly completed by the District Council and signed by the District Council Chairman and the District Engineer. Evaluation Proforma includes a listing of all the tenders received and the amount of the tender. The "REMARKS" column indicates if any tenders were disqualified and for what reason. Also enclosed is the Itemized Tender Summary table/chart which was used to determine the reasonableness of the tender.

4. The lowest responsive contractor is ___(9)___ with a tender amount of ___(10)___ which is ___(11)___% above/below the District Engineer's estimated cost.

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5. The lowest responsive tender of ____(12)____, being found quite reasonable is therefore recommended for approval by USAID.

Yours truly,

CHAIRMAN
DISTRICT COUNCIL _____ _____

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INSTRUCTIONS FOR FILLING THE TENDER EVALUATION PROFORMA LETTER

No.1 State the Origin of the Road.

No.2 State the Destination of the Road.

No.3 State the road project number.

No.4 State the name of the District.

No.5a State the date on which the tenders were received.

No.5b State the date on which the tenders were opened.

No.6 State the total number of tender documents issued.

No.7 State the names of the participating tenderers.

No.8 State the tender amounts.

No.9 State the name of the lowest responsive tenderer.

No.10 State the amount of the lowest responsive tenderer.

No.11 State percentage above or below the District Engineer's estimated cost.

No.12 Repeat the amount of the lowest responsive tender, spelled out in capital letter, followed by the amount in numerals in parentheses.

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ROAD PROJECT FILE

DISTRICT _____

Name of Road & Number _____

- Total length of Road. _____
- Rehabilitation Length. _____
- Rehabilitation percentage. _____
- Ranking. _____
- Estimate. _____
- Contract Amount. _____

Design

- Condition Survey. _____
- Cross Sections. _____
- Design Stage. _____

  In progress _____

  Completed _____
- Typical Section Drawn. _____
- Estimation. _____
- Submit Design to District Council. _____

Pre-Construction

Bidding Process

- Pre-Bid Conference. _____
- Advertise. _____
- Bid opening by District Councils. _____
- Initial evaluation by D.C's to Consultant (Bid Evaluation Proforma). _____
- Further evaluation by Consultant and USAID (Rate analysis). _____

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- Consent by Consultant & USAID. _____

- Approval by Chairman or District Council. _____

- To D.G.R.D. and USAID for approval. _____

- Written approval by USAID (PIL). _____

- Placement of work orders by District Councils. _____

<u>Construction</u>

- Initial meeting with District Engineer, Contractor and Consultant to discuss measurements and material testing. _____

- Initial field measurements taken. _____

- Initial materials tests performed. _____

- District Engineer notifying Consultant that proposed materials and methods are satisfactory. _____

- Consultant acknowledges in writing. _____

- Construction commenced. _____

- Construction period. _____

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5. TESTING PROCEDURES AND FREQUENCY OF TESTING FOR EACH BOQ ITEM

5.1 BOQ Items Testing Requirements

Clearing and Grubbing: There shall be no roots/organic matter as verified by visual inspection.

Embankment and Shoulder Material

1) CBR shall be verified every 1500 cubic meters.
2) MDD shall be determined value every 1000 cubic meters.
3) Field density test shall be taken every 100 meters.

Base:

Los Angeless Abrasion test may be required every 1000 cubic meters at the discretion of the District Engineer.

Surface Dressing

One penetration test of bitumen shall be made for every lot if the Contractor is unable to provide the manufacturers' certification of the same. The District Engineer, at his discretion, may call for spot checking of any lot by ordering additional penetration test.

Road Signs

Designs will be approved by the District Engineer in consultation with the Construction Engineer.

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5.2 **Embankment and Shoulder Material**

- CBR shall be determined every 1500 m^3 using AASHTO testing procedure as described in T-193
  Classification every 1500 m^3
  MDD value shall be determined every 1000 m^3 using AASHTO testing procedure as described in T-180 D.

5.3 **Aggregate for Base**

Aggregate samples shall be subjected to approved abrasion test for every 1000 m^3. (Test will be carried out from A to D grading, whichever is applicable) AASHTO T-96-77 (1982).

5.4 (c) **Surface Dressing**

If, as stated in Section ---- Note, the Contractor fails to bring the manufacturer's certificate, a sample of the bitumen must be sent to the commercial laboratory for complete testing. Expenses will be borne solely by the Contractor.

All above tests will be performed in a Commercial Laboratory approved by the District Engineer and the Consultant.

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5.5 Field Testing by DC/Consultant's Field Staff

a) Field density by sand cone method T-191

This test will be carried out by District Engineer or Consultant's field staff to check the compaction (field density) of a compacted layer at every 150 meters.

Apparatus

1) Density Apparatus

The density apparatus will consist of 4 liter jar and a detachable appliance consisting of a cylindrical value with an orifice 1/2 in. (12.7 mm) in diameter and having a small funnel continuing to a standard G mason jar top on one end and a large funnel on the other end. The valve shall have stops to prevent rotating the valve past the completely open or completely closed position and a base plate rounded or square type 12" by 12" having holes on each corner for fasteners.

2) Sand: Any clean, dry, free flowing, uncemented sand, generally passing No. 30 sieve and retained on No. 50 sieve or passing No. 16 sieve and retained on No. 30 sieve.

3) Balance: A balance or scale of 10 kg. capacity.

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4) Drying Equipment: Stove or oven or other suitable equipment for drying moisture content samples.

5) Miscellaneous Equipment: Small picks, chisels, spoons for digging test holes; frypans or any suitable container for dry moisture sample; and suitable container for retaining the density sample, etc.

Procedure

1) Determine/select the bulk density of sand to be used in the field test.
2) Determine the mass (amount) of sand to fill the funnel.
3) Fill the jar with sand and weigh the assembled apparatus and record the weight.
4) Fix the base plate and make the hole on a compacted layer.
5) Seat the inverted apparatus on a clean, level surface of the base plate and open the valve until the sand stops running. Close the valve sharply and weigh the apparatus with remaining sand and determine the loss of sand by weight. This loss represent the mass of sand required to fill the hole and funnel.
6) Weigh the material that was removed from the test hole.
7) Mix (or stir) the material thoroughly and secure a representative sample for moisture determination.

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5.6 **Field density by core cutter:**

The drive cylinder method is used to determine the in place density of soil. It is used satisfactorily in moist, cohesive, fine grained material only.

Apparatus:

The essential elements of the apparatus consist of a calibrated drive cylinder with a detachable driving head, and a drive hammer.

Balance:

Any standard laboratory balance with a capacity equal to the mass of soil and cylinder is acceptable.

Drying Equipment:

A stove or oven is suitable for drying moisture samples.

Miscellaneous Equipment

shovel is required for digging out the cylinder after it has been driven into the soil; a steel straight edge with one end sharpened is needed to cut the ends of the sample flush with the cylinder; and tin cans or other suitable containers for retaining the moisture samples etc.

Procedure

The surface to be tested should be smooth and brushed clean of loose particles, the drive cylinder/core cutter is placed on the soil surface and then its driven into the soil with a hammer.

After it is completly driven into the soil, the cylinder is removed by excavating around the circumference with shovel. Both surfaces of the cylinder are then smoothed with a straight edge and the filled cylinder is weighed.

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Calculations

Subtract the weight of the empty cylinder from the total weight of cylinder and soil sample; this will give you the wet weight of the sample.

Divide the weight of the sample by the volume of cylinder. This will give you the wet density of the sample.

Calculate the moisture content to determine the dry density.

Finally divide the field dry density by the lab density and multiply it by 100 to calculate the compaction percentage. As sample Calculation Sheet is located in Section----------.

5.7 Procedure/description of following tests

1) California Bearing Ratio (CBR)
2) Proctor Test for Maximum Dry Density (MDD value)
3) Los Angeles Abrasion Test

5.7.1 California Bearing Ratio (CBR).

Scope

This test determines the bearing capacity of soils and soil aggregates when they are compacted in the laboratory at optimum moisture content to varying degrees of density using a 5.5 Lbs. (2.49 kg.) hammer dropped from a height 12".

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Apparatus

Molds:- The molds shall be cylindrical made of with an internal diameter of 6.0" + 0.026 inches and a height of 7.0" ± 0.016 inches, produced with an extension collar approximately 2.0" in height and a perforated base plate.

Spacer Disk:- A circular spacer disk made of metal (150.8 ± 0.8 mm) in diameter and (61.4 ± .01 mm) in height.

Reamer:- A reamer weighing 5.5 lbs. (2.49 kg) and having a 2" (50.8 mm) diameter circular striking face. It is equipped to control the height of drop to a free fall of 12".

Apparatus for measuring Expansion:- This consists of a swell plate with adjustable stem and a tripod support for a dial indicator. The swell plate is made of metal (149.2 mm) indicator and is perforated with (1.6 mm) diameter holes.

Dial Indicators:- Dial indicators shall have a 1" (25 mm) throw and read to 0.001" (0.05 mm).

Surcharge Weight:- One annular metal weight with a center hole (54.0 mm) in diameter and several slotted or split metal weights all (142.9 mm) in diameter and each weighing 5 ± 0.1 lbs. (2.27 ± 0.04 kg).

Penetration Piston:- A circular metal piston with a diameter of 1.954 + 0.005" (49.63 ± 0.13 mm) (area = 3 2 inches 1935 mm.).

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Loading Device:- A compression type apparatus capable of applying a uniform pressure up to 10,000 lbs (44.5) at a rate 1.3 mm per minute.

Soaking Tank:- A tank suitable for maintaining the water level 1" (25 mm) above the top of the specimen.

Drying Oven:- A thermostatically controlled drying oven capable of maintaining a temperature of $110^{o} + 5^{o}$ c for drying moisture samples.

Miscellaneous:- Miscellaneous tools including mixing pans, spoons, straightedge, filter paper balance etc.

Sample:- Approximately 15 lbs. (6.8 kg) sample for each mold, material passing 50.0 mm (2") sieve and retained on the 19.0 mm (3/4") sieve, shall be replaced by the material passing 19.0 mm 3/4" sieve and retained on 4.75 mm.

<u>Procedure</u>:-

(a) Normally 3 specimens must be compacted so that these compacted densities range from 95% (or lower) to 100 %. Generally 10, 30 & 65 blows per layer are given for compacting specimen No. 1, 2 and 3 respectively.

(b) Clamp the mold to the base plate attached to the collar, insert the spacer disk into the mold and place the course filter paper on the top of the disk.

(c) Mix the material by adding different quantities of water, so as to reach the optimum mixture.

(d) Compact the mixture in three equal layers by giving 10 blows to each layer; use the same procedure compacting for the remaining two molds, giving them 30 and 65 blows per layer respectively.

(e) Take a small amount of material from each sample for determining the moisture content.

(f) Remove the extension collar and trim the compacted soil with the straight edge, so that there should be no surface irregularities. Remove the spacer disk. Place a courser filter paper on the perforated base plate, invert the mold, clamp the perforated plate and fix the collar. Weigh the mold with soil.

Soaking:- Place the swell plate with adjustable stem on the soil sample in the mold and apply sufficient annular weights. Place the tripod with dial indicator on top of the mold and make internal dial reading. Immerse the mold in water, maintaining the water level at least 1.0" above the top of the specimen. Soak the specimen for 96 hours. At the end of 96 hours take the dial reading and calculate the swell percentage as follows:

$$\text{Percent Swell} = \frac{\text{change in length in inches} \times 100}{4.584}$$

Penetration Test:- Remove the specimen from water and place on machine for penetration test, and apply the

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loads to the penetration piston at the rate of 0.05 (1.3 mm) per minute. Record the load when the penetration is 0.025, 0.050, 0.075, 0.100, 0.125, 0.150, 0.175, 0.200, 0.250, 0.300.

Calculation:- CBR is generally selected at 0.100 and 0.200 penetration. A sample calculation sheet attached.

<u>Proctor Test for Maximum Dry Density (MDD)</u>

5.9 <u>Scope</u>:- This method of testing is used for determining the relationship between the moisture content and density of soil when compacted in a mold of a given size with a 10 lbs. (4.54 kg.) reamer dropped from a height of 18".

<u>Apparatus</u>:-

Molds:- The mold shall be a solid wall metal cylinder having an internal diameter of 6" + 0.016" and a height of 4.584" + 0.005".

reamer:- Metal reamer having a flat circular face of 2" + 0.02" weighing 10 lbs. (4.54 kg). The reamer should be equipped with a suitable guide sleeve to control the drop height of 18".

Balance and Scale:- A balance or scale of at least 12 kg. capacity.

Dry Oven:- Thermostatically controlled drying oven for moisture determination.

Straightedge:- A hardened steel straight edge at least 10" in length with one edge sharp.

Sieves:- 19.0 mm (3/4") and 4.75 mm (No. 4) sieve.

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Mixing Tool:- Miscellaneous tools include mixing pans; spoon; trowel; spatula etc.

Sample:- Select approximately 11 kg. from thoroughly mixed sample and pass the sample through 19.0 mm (3/4") sieve. The material retained on 3/4 sieve should be replaced by the material passing 3/4 sieve and retained on No. 4 sieve.

Procedure:- Compact the material in a 6" dia mold in five equal layers to a total compacted depth of about 5", compact each layer with 56 uniformly distributed blows from the reamer. Repeat the test procedure at least five more times to obtain five or six points for more precise calculation of optimum moisture and maximum dry density (MDD).

Calculation:- Weigh the compacted mold and substract the weight of the mold. Divide the soil weight by the volume of the mold. This will give the wet density. Put the sample in the dry oven for moisture to calculate the dry density.

Use the attached calculation sheet.

5.9 <u>Los Angeles Abrasion Test</u>

<u>Scope</u>:- This procedure is used to test sizes of course aggregate smaller than 37.5 mm (1-1/2") for resistance to abrasion using the Los Angeles testing machine.

Apparatus:- Los Angeles testing machine is equipped with a counter, the machine shall consist of a hollow steel cylinder closed at both ends having an inside diameter of

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711 ± 5 mm (28 ± 0.2") the cylinder shall be mounted on stub shafts attached to the end of the cylinder but not entering it, and mounted in such a manner that it may be rotated with the axis in a horizontal position. An opening in the cylinder shall be provided for the introduction of the test sample. A suitable dust-tight cover shall be provided for the opening with means for bolting the cover in place.

Abrasive Charge:- The abrasive charge consists of steel spheres each averaging 46.8 mm in diameter and each weighing between 390 and 445 grams. The abrasive charge, depending upon the grading of the test sample which is as follows:

Grading	No. of Spheres	Mass of charge g.
A	12	5000 ± 25
B	11	4584 ± 25
C	8	3330 ± 20
D	6	2500 ± 15

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Test Sample:- The test sample shall consist of clean aggregate from the material to be tested. If the sample is dirty or coated, wash until clean. Next sample to a constant temperature of 110 + 5 ^{o}c. The different grading and aggregate sizes are as follows:-

Sieve Size		Mass of indicated sizes grading			
Passing	Retained on	A	B	C	D
1 1/2"	1"	1250+25	-	-	-
1"	3/4"	1250+25	-	-	-
3/4"	1/2"	1250+10	2500+10	-	-
1/2"	3/8"	1250+1	2500+10	-	-
3/8"	1/4"	-	-	2500+10	-
1/4"	No. 4	-	-	2500+10	-
No. 4	No. 8	-	-	-	5000+10
Total	-	5000+10	5000+10	5000+10	5000+10

Calculation:- The difference between the original mass and the final mass of the test sample shall be expressed as a percentage, after 500 revolution (as the test is carried out by 500 revolution).

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6. SAMPLE OF TESTING FORMS

6.1

IN-PLACE DENSITY DETERMINATION AASHTO T-191

LOCATION	WEATHER	DATE
TYPE OF WORK	LAYER NO.	MATERIAL

TESTED BY		CHECKED BY		
DENSITY DETERMINATION				
LOCATION				
Wt of Sand + Jar	gm			
Wt of Sand Residue + Jar	gm			
Wt of Sand in Temp/Cone	gm			
Wt of Sand in Hole	gm			
Density of Sand	gm/cm^3			
Volume of Hole	gm/cc			
Wt of Soil + Pan	gm			
Wt of Pan	gm			
Wt of Soil	gm			
Wt Density	gm/cm^3			
% Moisture by Speedy				
Dry Density	gm/cm^3			
Max. Dry Density	gm/cm^3			
% Relative Compaction				
Required Compaction				
MOISTURE DETERMINATION				
Wt of Wet Soil + Can	gm			
Wt of dry Soil + Can	gm			
Wt of Water	gm			
Wt of Can	gm			
Wt of Dry Soil	gm			
Moisture Content	%			

Remarks: _____

Signature _____ Title _____
District Council Rep.

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Signature _____ Title _____
CCSC Rep.

6.2

IN-PLACE DENSITY BY DRIVE CYLINDER METHOD

LOCATION	WEATHER	DATE
TYPE OF WORK	LAYER NO.	MATERIAL
TESTED BY	CHECKED BY	

DENSITY DETERMINATION					
LOCATION					
Wt of Cylinder + Soil	gm				
Wt of Cylinder	gm				
Wt of Soil	gm				
Volume of Cylinder	gm/cc				
Wet density	gm/cm^3				
% Moisture					
Dry Density	gm/cm^3				
Max Dry Density	gm/cm^3				
% Relative Compaction					
Required Compaction					
MOISTURE DETERMINATION					
Wt of Wet Soil + Can	gm				
Wt of dry Soil + Can	gm				
Wt of Water	gm				
Wt of Can	gm				
Wt of Dry Soil	gm				
Moisture Content	%				

Remarks: _____

_____

_____

Signature _____ Title _____
District Council Rep.

Signature _____ Title _____
CCSC Rep.

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6.3

COMPACTION TEST

Client _____ Contract No. _____ Date _____

Sample _____ (from-to) _____

Location _____ Material _____

Mold No. _____ Dia Mold _____ Vol. Mold _____

Blows/layer _____ No. of layers _____ Wt. Rammer _____ Drop _____

UNIT WEIGHT DETERMINATION	Trial No.		2	3	4	5	
	Weight (grams)	Mold + Wet Soil					
		Mold					
		Wet Soil					
	Wet Density gms/c.c.						
	Dry Density gms/c.c.						
WATER CONTENT DETERMINATION	Container No.						
	Weight (grams)	Tare + Wet Soil					
		Tare + Dry Soil					
		Water					
		Tare					
		Dry Soil					
	Water Content %						

Maximum dry Density

gm/cm³

Optimum Moisture Content

Tested By _____

Designation _____

Date _____

Approved By _____

Designation _____

Date _____

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PIT NO / LOCATION _____

SAMPLE NO. _____

MOLD WT. _____

TESTED BY _____

DATE _____

MOLD VOL _____

CHECKED BY _____

6.4 CALIFORINA BEARING RATIO TEST

DRY DENSITY	10 BLOWS	30 BLOWS	65 BLOWS	MOISTURE CONTANT	10	30	65	AFTER TEST		
MOLD NO.				CAN NO.						
SOIL + MOLD				CAN + WET SOIL						
MOLD WT.				CAN + DRY SOIL						
SOIL WT				WATER						
VOL OF MOLD				CAN WT						
WET DENSITY				DRY SOIL WT						
% MOISTURE				% MOISTURE						
DRY DENSITY										

	NO OF BLOWS = 10					NO OF BLOWS = 30					NO OF BLOWS = 65				
PENETRATION	DIAL READING	LOAD LBS	STRESS PSI	STAND AREA LOAD	CBR VALUE	DIAL READING	LOAD LBS	STRESS PSI	STAND AREA LOAD	CBR VALUE	DIAL READING	LOAD LBS	STRESS PSI	STAND AREA LOAD	CBR VALUE
0.025															
0.050															
0.075															
0.100				1000					1000					1000	
0.125															
0.150															
0.175															
0.200				1500					1500					1500	
0.250															
0.300															
0.350															
0.400															

SWELL

NO OF BLOWS	TIME	DIAL READING	SWELL

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6.5 CALIFORNIA BEARING RATIO (C.B.R)

MAX DRY DENSITY g/cc.

PROCTOR MODIFIED:

OPT MOISTURE CONTENT ..... %

BLOWS PER LAYER No.	10	30	65
DR DENSITY g/cc.			
SOAKED C.B.R			

OF MAX. DRY DENSITY ..... g/cc.

C.B.R at OF MAX DRY DENSITY:

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[redacted]

RECORD OF NONCOMPLYING TESTS

Project Title _____ Project No. _____ Contract No. _____

Contractor _____ Type of Work _____

GENERAL INFORMATION AS TO TYPE OF TEST, RESULTS, AND OTHER AVAILABLE PERTINENT DATA (Cite ASTM, ACI, ANSI, AWS, etc., as applicable)	QUANTITY INVOLVED	ACTION TAKEN
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7. BORROW AREAS

7.1 GENERAL COMMENTS

Borrow areas should be selected in accordance with the following criteria:

1. Borrow areas shall be designated as close to the job site as possible;
2. Borrow areas must meet all quality tests as set forth in the contracts specifications;
3. Borrow areas shall be selected, to the extent possible, such that they will not be subject to flooding or waterlogging during the contract period.

While the plans may indicate approved borrow areas; it is the contractor's responsibility to ensure that satisfactory the borrow material is available and approved by the District Engineer or his authorized representative. The District Engineer has the authority to call for quality control testing at any time during the construction. It is the contractors responsibility to utilize only material which will meet the specifications and quality control standards of the contract.

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8. JOB FILES AND RECORD KEEPING

8.1 General

Project job files must be adequately maintained, updated and complete in all aspects. The following documents shall be prepared and filed in a timely manner to assure accurate and complete records:

1. Daily progress reports
2. Daily Report Form
3. Approval Slips
4. Reports of Laboratory Testing
5. Photographs (as required to document progress)
6. Record of Meetings
7. Record of Management Actions (Problems encountered and solutions)
8. Agreements, commitments or approvals required (other agencies)
9. Project Status Report

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8.2 DAILY REPORT FORMS

1. Name of Contractor _____ 2. Date _____

3. Weather _____ 4. Air Temp _____

Contractor Personell:

5. Engineers _____

6. Foreman _____

7. Operators _____

8. Labour _____

9. Equipment:

Name	10 Place of Work	11 Nature of Work	Remarks
			Note: in remarks it should be clearly mentioned that the machine is working, idle or dead lined, place and type of work.

12. Material:

13. Quantity & type of material stocked at site _____

Quantity & type of material received from _____

14. Time _____

Quantity of Material Received with time	15 Quantity of Material Utilized	16 Balance

Remarks:

Signature _____ Title _____
District Council Rep.

Signature _____ Title _____
Consultant Rep.

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8.2 SURFACE TREATMENT

17. Location _____ 18. Date _____ 19. Weather _____

20. Air Temp _____ 21. Width of Application _____

22. Quantity & type of material stocked at site _____

_____

23. Material utilized _____ 24. Balance Left _____

25. Temp of Asphalt _____ 26. Time _____

27. Rate of Application _____

Remarks:

EMBANKMENT/SHOULDER/BASE

28. Location _____ 29. Date _____ 30. Weather _____

31. Air Temp _____ 32. Layer No. _____ 33. Loose Thickness _____

34. Compacted Thickness _____

35. No. of Density Test Performed _____

36. Quantity of Material Placed _____

Remarks:

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Signature _____ Title _____
Distt Council Rep.

Signature _____ Title _____
Consultant Rep.

8.4 Instructions for completing the Daily Reports

1. Contractor: The individual firm contracted for performance of the specified work.
2. Date: Day, Month and Year.
3. Weather: Average atmospheric condition during the day i.e. weather clear/cloudy/ rainy; temperature; windspeed (if over 15 mph).
4. Air Temperature: Climatic temperature usually measured in a morning and at 12:00 noon.
5. Engineer: The duly authorized representative of the contractor at the project site, acting directly or through his duly authorized representative who is responsible for engineering supervision of the work.
6. Foreman: The on site representative of the Contractor duly authorized to receive and execute all instruction of the engineer and to supervise and direct the contractor's working crew at site.
7. Operators: The duly authorized machine operator's responsible to operate the Construction machine.
8. Labour: Workmen employed by the contractor for the execution of the work.
9. Equipment: The machine owned or rented by the Contractor for the execution of the work such as; Rollers, Farm Tractors, Concrete mixers and Hand compactors etc.
10. Place of Work: The exact place of work of the particular machines shown in column 9.

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11. Nature of work: The actual nature of work i.e. either the machine working on levelling, spreading, etc., and to remention in remark column clearly that the machine is working, ideal or dead lined with the exact location.

12. Material Received: The approved material received for the construction of embankment, base or shoulders.

13. Quantity: Quantity of materials as described in column 12 measured either in cubic feet, sq. feet, cubic meter or sq. meter.

14. Time: The receiving time of the material on a job site.

15. Quantity of Material Issued: The exact Quantity of Material used in job, expressed in sq. feet, cubic feet, sq. meter or cubic meters.

16. Balance Left: The quantity of material left unused at the end of day work i.e. column 13 minus column 15 will give the quantity balance.

8.5 Surface Treatment

17. Location: That particular area in which the work is in operation.

18. Date: Day, Month and Year.

19. Weather: Climatic condition.

20. Air Temperature: Climatic temperature measured in minimum and maximum.

21. Width of Application: Spray of liquid Asphalt on particular/specified area i.e. width, should be mentioned in feet or meters.

22. Quantity & Type of Material stock at site: The binder, aggregate and sand stock at site for the surface treatment operation.

23. Material Utilized: The quantity of material used in surface treatment operation.

24. Balance Left: The quantity of material left at the close of days work i.e. column 20 minus column 21.

25. Temperature of Asphalt: Measured by means of Thermometer in degree C or F.

26. Time: The time of temperature taken.

27. Rate of Application: The quantity of Asphalt/Binder sprayed in the particular area expressed in liters per sq. or cubic feet or meters.

8.6 <u>Embankment/Shoulder/Base</u>

28) Location: That particular area in which operation is in progress.

29. Date: Day, Month and Year.

30. Weather: Climatic condition.

31. Air temperature: Climatic temperature measured in degree C or F to a minimum and maximum ranges.

32. Layer No: No. of layer i.e. Ist, 2nd or3rd etc.

33. Loose Thickness: The loose material spread for compaction.

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8.9 Status of Payment

Payment # 1

- Field measurements taken for Invoicing. _____
- Invoice submitted by Contractor. _____
- Invoice checked by District Council. _____
- Invoice submitted and checked by Consultant and cleared by USAID. _____
- Funds received by Contractors from D.C. Chairman. _____

Payment # 2

- Field measurements taken for Invoicing. _____
- Invoice submitted by Contractor. _____
- Invoice checked by District Council. _____
- Invoice submitted and checked by Consultant and cleared by USAID. _____
- Funds received by Contractors from D.C. Chairman. _____

Payment # 3

- Field measurements taken for Invoicing. _____
- Invoice submitted by Contractor. _____
- Invoice checked by District Council. _____
- Invoice submitted and checked by Consultant and cleared by USAID. _____
- Funds received by Contractors from D.C. Chairman. _____

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Payment # 4

- Field measurements taken for Invoicing. _____
- Invoice submitted by Contractor. _____
- Invoice checked by District Council. _____
- Invoice submitted and checked by Consultant and cleared by USAID. _____
- Funds received by Contractors from D.C. Chairman. _____

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9. FINAL EVALUATION OF QUANTITY AND QUALITY

The final evaluation of quantity and quality has been determined/ calculated with the AID or the following:

1. Status of payment.
2. Daily reports form.
3. Photographs.
4. Field test results.
5. Commercial laboratory test results.
6. General appearance.
7. Final measurements of BOQ Quantities.

10. CLOSING OF JOB FILES AND HISTORICAL

The closing of job files and historical includes the complete history and all supporting documents regarding the project including, but not limited to the following:

1. History of the project from conception through completion.
2. Record of photographs before and after design.
3. Record of photographs before and during construction.
4. Record of photographs after the 100 % completion of the road.
5. Daily report forms.
6. Approval slips.
7. Test results.
8. Record of meeting.
9. Problems encountered during construction and their solution.
10. Record of visits of different agencies.
11. Any and all documentation regarding project.
12. Final comments on the job.

All must be kept in sequence in the files. Thus aiding in a accurate and factual recap of the project.