

XD-APP-265-A
SN-34721

2681207/P3

EVALUATION OF PILOT PROGRAM ACTIVITIES
CONSTRUCTION OF APPURTENANT STRUCTURES ON FOOD FOR WORK ROADS

FIRST INTERIM REPORT

15 MAY 1983

by Dan Hallett

SCOPE OF REPORT

This First Interim Report reflects information obtained in 17 interviews and 12 construction site visits conducted from 18 April 1983 to 5 May 1983. Interviews were held with Upgraded Thana and other involved officials and technical staffs in 10 (of the 13) Local Government Pilot Thanas¹, the CARE-Rangpur Unit Administrator, Thana personnel involved in all 3 CARE pilot Thanas, and 3 (of the 6) Union Parishad Chairmen who are participating in the CARE pilot. The table on the following page summarizes the interviews and site visits conducted in preparation of this report.

Although the scope of these interviews covered both completed and anticipated pilot activities, only those activities which were completed by the large majority of Thanas seen at the time of this initial round of interviews are presented in detail in this First Interim Report. Some discussion of future pilot activities is also included in this report in the hope that the information provided will foster some minor corrective changes in these upcoming activities during the interlude between reports.

The fundamentally different approaches used in the Local Government Pilot and CARE Pilot necessitate separate discussions of these two programs, as presented forthwith.

¹ Mr. Gene George of the RDE section of USAID-Dhaka conducted the interview in Fatikchari Thana in Chittagong District in my absence.

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<u>Pilot Program</u>	<u>Thana/(Union)</u>	<u>District</u>	<u>Interview Date</u>	<u>No. Structures Seen</u>	
Local Government	Mirzapur	Tangail	18 April	3	
	Madarganj	Jamalpur	19 April	1	
	Shymnagar	Khulna	24 April	-	
	Shailakupa	Jessore	25 April	-	
	Alamdanga	Kushtia	26 April	-	
	Serajdikhan	Dhaka	28 April	3	
	Ishurdi	Pabna	1 May	1	
	Puthia	Radjshahi	2 May	-	
	Shariakandi	Bogra	3 May	-	
	Fatikchari	Chittagong	5 May	-	
	CARE	Pirganj	Rangpur	4 May	n.a.
		(Madankhali)	"	4 May	-
Lalmonirhat		"	5 May	n.a.	
(Borobari)		"	5 May	1	
(Ghariaaldanga)		"	5 May	3	
Kotwali		"	5 May	n.a.	
[CARE U.A.]		"	4 May	n.a.	

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LOCAL GOVERNMENT PILOT

The major purpose of the Local Government Pilot (beside providing necessary appurtenant structures on FFW roads) is to gain valuable information on the performance of Upgraded Thanas in the execution of a relatively large road construction project. It was understood at the outset that since this is the first major construction program undertaken in these newly Upgraded Thanas, uniform guidance from the Ministry of Food was necessary for the overall success of this pilot program. To this end, the Ministry sent two memoranda, on 7 February and 20 February, addressed to the 5 Zonal Martial Law Administrators (ZMLAs) and the 4 Divisional Commissioners, specifying the purpose, scope, scheme selection criteria, time schedule for major program phases, and pertinent details of local administration.

It was the hope of all those persons involved in the higher levels of administration of this pilot program that the entire first phase of activity, from the conception of schemes to the issuance of work orders to contractors, would be completed by the time of the first evaluation visits. This was not the case due to unforeseen communication difficulties; specifically, the ZMLAs only relayed the scheme selection criteria from the above-mentioned 20 February memorandum to the selected District Deputy Commissioners (DCs) and Thana Nirbahi Officers (TNOs) instead of the entire contents of the memo as directed by the Ministry. A subsequent memo issued by the Ministry to the involved DCs on 14 April prompted further release of small pieces of instructional information from the DCs to the TNOs through their Additional Deputy Commissioners in the form of telegrams. This erratic and piecemeal release of basic instructional information from the Ministry to the Thanas led to general confusion and hesitancy on the part of the TNOs.

As a result of this "communication gap", schedules and instructions, as originally ordered in the 20 February memo, were not adhered to on a uniform basis throughout the country. For example, although all of the Thanas submitted their selected schemes in February as per the Ministry's orders, several Thanas submitted schemes for considerably less funding than the 16 lakh taka total allocated per Thana as mentioned in the memo. Work orders were to be issued by March 15, but in only 3 Thanas (Mirzapur, Madarganj, and Serajdikhan) were work orders issued in March, and only Ishurdi Thana issued work orders since then (in April). Also, since the TNOs did not receive confirmation - and in some cases, the basic knowledge - that 50% of the money for construction was available in the District bank until the DCs informed them in the fourth week of April, in most of the pilot thanas, tenders were not floated for contractor bidding by the time of this initial evaluation visit. Further evidence of the inconsistency in scheduling as well

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as the quality of work will be brought up throughout the remaining pages of this report.

It is important to note that although a large degree of confusion and hesitancy did exist in the early stages of the development of this pilot, the Thanas involved demonstrated considerable flexibility and hard work in meeting tightened time schedules, and the ultimate quality of work was not compromised considerably. (In several cases, my personal assurances regarding the guarantee of funding and the importance of this pilot project prompted immediate development of tender documents and other preparatory actions prior to the late April guarantee of funds from the DCs.) Finally, it should be noted that all the TNOs involved expressed confidence that these pilot structures will be completed by the 30 June deadline.

Scheme Selection

All of the Upgraded Thanas involved in the Local Government pilot submitted their schemes to the Ministry through their respective DCs in February as per the individual instructions they received from the ZMLA/Divisional Commissioner. In addition, all of the basic scheme selection criteria in the Ministry's instructions were strictly adhered to in all Thanas.

The location of schemes (structures) selected largely reflected the limiting 5-day time period given by the Ministry to perform pre-survey activity and to submit schemes. In general, site selection was determined by referring to priority sites as enumerated in the Thana Planbook. This was followed by site pre-surveys conducted by the Thana Technical Staff (TTS) in consultation with local residents - who were most familiar with the depths of flood water and both road and channel transport requirements - and final approval by the Thana Parishad (TP) or Thana Project Implementation Committee (TPIC, where established). The exception to this procedure was Serajdikhan Thana where the executive engineer of the Zilla Board chose the schemes in consultation with local residents, and the DC approved them after the TP's initial approval. The use of scientific methods for soil identification and testing was not employed in the pre-survey activities in any of the Thanas.

It should be noted that a legitimate concern was expressed in several Thanas that a lack of basic surveying equipment (e.g. levels, measuring tapes, plumb bobs, etc.) for use by the TTS likely limited the accurate assessment of quantitative details necessary to determine the most cost-effective structure size and site location. In addition, during the construction phase it will be awkward (at best) when the Thana supervisors will have to borrow tapes, levels, etc. from the contractors to perform intensive supervision,

make accurate judgements regarding work progress, and make running bill estimates.

The types of structures selected also reflects the limited time frame available to the TTS for scheme submittal. In most cases, this meant the selection of structure types that were merely familiar to the staff. Since prior to upgrading, the TTS had little or no collective experience with paka ("permanent" - as opposed to earthen) road construction, the newly acquired Thana Engineer (TE) was likely to be the only engineer on staff with any scope of experience from which to choose. (In several cases, the TE had not arrived at this new Upgraded Thana position until after the February scheme selection deadline; and in many other cases, he was not involved at all in the development or even the review of final designs.) Time constraint, lack of paka construction experience, and the absence of specific instructions to use - or familiarity with-the Design Manual (see the 'Design Preparation' section) led the TTS to rely on types of structures generally adopted by the Zilla/District engineers.

Since in all cases the schemes were approved by the Thana Parishad, there was a strong tendency in most Thanas to build the most number of structures with the money at hand (promised) in order to satisfy as many Unions as possible. In addition, the 20 February Ministry memo did not indicate the possibility of future significant paka construction on earthwork roads in the pilot Thanas. In fact, it stated specifically that in the event of a successful pilot program, other Upgraded Thanas will be selected for next year's program; and this also may have played a role in "stretching" the number of schemes selected for this pilot program. With the exception of Mirzapur Thana, these same factors also directly led to the use of a 1:2:4 reinforced concrete mix ratio as used by District/Zilla engineers as opposed to the richer and more expensive 1:1½:3 mix ratio called for in the Design Manual.

The result of all of the above mentioned concerns was a relative lack of diversity in the types of structures chosen for this pilot. Bridges and open foundation culverts made up 111 out of the total 157 schemes chosen by the 10 pilot Thanas visited; the TTS members involved were evidently most comfortable designing these types of structures. Pipe culverts were only used in Mirzapur and Serajdikhan Thanas because they have reasonably close access to Dhaka - one of the few cities in the country where there are manufacturers of such pipe. Ishurdi Thana included 8 reinforced concrete arch culverts and Puthia Thana included one 10-foot span sluice-gate bridge. There are a total of 16 bridges in the 10 Thanas of 30- to 40-foot span. In Serajdikhan, where scheme selection and design were controlled by District/Zilla staff, two 90-foot bridges and one 75-foot bridge (this bridge is included in the pilot program, but funded by District funds beyond the Ministry's 16 lakh taka disbursement) were designed by a Dhaka-based consulting engineering firm.

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Design Preparation

It was hoped at the outset of this pilot program that the Design Manual For The Construction of Culverts, Small Bridges and Sluices prepared by the Ministry of Local Governments (MLG) would be used as the basic guidance document for all phases of the pilot. This manual had been distributed through the Districts to all Thanas in the country over one year ago along with a standing order from the LGRD Works Program to use it for all future paka road construction. At the time of this initial evaluation visit, all the Thanas, except Serajdikhan Thana, had at least one copy of the Design Manual on hand (although 3 copies were originally supposed to be distributed to each Thana). Fatikchari Thana had received their copy of the manual only two weeks prior to the evaluation visit. Five out of the ten Thanas visited claimed to have used the Design Manual (to one degree or another) in designing their structures for this pilot program. One common reason given for the sparse use of the manual (beyond the fact that there was no direct order to do so included in the instructions passed down plus the reasons stated in the previous "Site Selection" section) was the fact that since the DCs (with the exception of Dhaka and Tangail Districts) told their TNOs not to submit designs until they received specific orders to do so (i.e. when the District received the project funds from the Ministry), the Thanas, at that point in time, were still not sure this pilot program would actually become a reality, and were, therefore, not motivated to further familiarize themselves with the Design Manual. In most cases, the DCs finally gave the TTSs only one to four days to submit all their designs, and most TTSs had to either seek assistance from the executive engineer (3 Thanas) or refer to an older PWD standard design manual with which they were more familiar.

All designs were available in the Thana Offices for my review, and to the credit of the TTSs involved, in general, the designs seen were good. Of the 10 Thanas visited, 5 Thanas had totally complete designs, 3 others were complete except for reinforcing bar bending schedules (which they later said they would include in the design "packages" given to the contractors at the site), one had drawings that were not completely dimensioned, and one did not include the wingwall in the plan view (in Shariakandi, where only one day was given to sketch the design, and only one 10-foot span culvert was submitted as a sample design for all their structures). In 3 Thanas, the designs were made by District/Zilla-level engineers.

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Tender and Contract Development

The quantitative details used in the tendering documents were generally developed by the TTS (or in the case of Serajdikhan Thana, by the Zilla Board engineer) at the time of design development. In all Thanas, the MLG's standard format was used for quantity estimation.

In those Thanas where time was an extreme constraint (or where specific instructions were given by the DC), Zilla Board (ZB) rates were used for unit price estimates. The ZB rates obtained in at least 4 Thanas did not reflect current market rates since they were known to be two years old. To help alleviate this problem, and also to cover other possible cost overruns, most Thanas wrote up to 5% contingency money into each scheme (or kept it in the Thana account as a lump sum - with the DC's approval). In several cases, the DC arranged for cement to be available in the District town in a sufficient quantity and at a guaranteed price. (Cement prices on the ZB schedule was generally listed as 105 Taka per bag, while the present market price was known to be 135 to 150 Taka per bag.) Other rates used in the Thanas visited were from Roads and Highways, MLG, Public Works Department, or Water Development Board schedules.

In accordance with generally followed practice, a total of 10% of the contract value was collected (held) from the awarded contractor to cover earnest money (2 to 3 %) plus security money. This money is to be reimbursed to the contractor either 6 months or one year after the completion of work. In contrast, the use of contingency money varied considerably. In 3 Thanas (Madarganj, Ishurdi and Fatikchari), no contingency was included in the contract; in Serajdikhan Thana, less than 1% was included as a lump sum contingency; in Mirzapur Thana, approximately 7½% of the contract price was kept in contingency as a lump sum; and in the remaining four Thanas, a 5% contingency was withheld in the Thana account. In all cases, the contingency money will be used to cover cost overruns, and in 4 Thanas it was also used for tender preparation costs (advertising, design printing, stationery, etc.).

At the time of this initial round of visits, tenders were floated by 5 Thanas. The tenders had not been floated in 4 of the other Thanas because they were still waiting for orders from their respective DCs to proceed, pending the receipt of project funds at the District bank. Finally, in Shariakandi, only some of the schemes were tendered due to communication misunderstandings.

In all the Thanas, with the exception of Ishurdi Thana, tenders were floated in a District daily newspaper; in Ishurdi Thana, they were floated in government offices throughout the District (and response was extremely good). In most cases, tenders were floated for 7 days.

Contract Letting

Since a majority of the Thanas had not completed the tender floating at the time of this visit, a summary discussion of the results of this process will have to be deferred to the Second Interim Report. The following paragraphs present the highlights of the results obtained through this original round of interviews.

Tenders completed floating in 5 Thanas. In all cases, contractor participation was good, and bids were not accepted by the Tender Committees at over the estimated costs. In the several cases where the lowest bids were above the tender estimate, the contractors negotiated with the Tender Committees down to the tender estimate.

In Fatikchari Thana, all the bids were 15% to 20% over the tender estimate, and a re-tender was issued. When the results of the second tender were the same, all the contractors were asked if they would do the work at the tender's estimated cost; upon receiving negative answers, the Tender Committee proceeded to recommend awards, but they had to await District approval.

Availability of Construction Materials

With the single exception of Madarganj Thana, where all construction materials had to be obtained in the District center of Jamalpur (a 2-hour drive on very rough roads), all Thanas reported that good quality first-class bricks as well as sand and bamboo are available locally. Cement and reinforcing bars are available in nearby Sub-Division and/or District centers and in many cases, these materials were supplied at a guaranteed price by the PWD or the WDB. As previously mentioned, reinforced pipe culverts were only available in Dhaka, and therefore, only Mirzapur and Serajdikhan Thanas incorporated them in their scheme selection. It should be noted that pipe culverts are relatively inexpensive and would have served well as a lower-cost alternative to many of the smaller open foundation culverts in many of the Thanas, but their lack of availability precluded their consideration.

Site Supervision

Although a complete evaluation of the level of supervision at the construction sites will be reserved for future reports, it should be noted at this point that a great deal of concern was expressed by the Thana staffs as to the intensity of supervision that can be accomplished once

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full-scale construction is underway.

All the TNOs stated that their entire technical staffs will be used to supervise the construction work. Given the fact that the total number of structures that must be inspected by each potential staff member varies from 2 structures per supervisor to 6 structures per supervisor, even if all the supervisors are available full-time for the two straight months of construction activity anticipated (and this is highly doubtful since other Thana technical activities will be ongoing as well), in most cases, the intense level of supervision required will likely be lacking.

In addition to the basic facts stated above, transportation provisions for the supervisors to the job sites is the primary concern stated by the TNOs since, in the large majority of cases, the technical staffs have no assigned jeeps or motorcycles. In a few Thanas, it was reported that one or two motorcycles will be borrowed (on occasion) from other Thana-based departments. In other cases, personal bicycles will be used when available; but bicycles will not be adequate for the supervision coverage necessary, considering the distances and road conditions involved.

According to the 20 February memo from the Ministry of Food, the District-level technical staffs are to assist in supervision of this pilot program as required. From interviews conducted at 10 Thana Offices, only two TNOs (in Ishurdi and Serajdikhan Thanas) stated that they will receive supervisory assistance from the District. It is hoped that the remaining Thanas will receive supervisory assistance from the District level in the form of staff and motorized transportation so that this most critical phase of the construction process can be accomplished in a comprehensive manner.

Construction Site Visits

A total of 8 construction sites were seen in this initial visit in only 4 Thanas, and all projects were in the early stages of construction. Although it could be stated that, in general, construction practices looked adequate and work progress was good, any conclusions concerning overall construction practices and levels of supervision will be reserved for future reports.

One site visit is worthy of note in this report since it indicated a flaw in site selection practices. In Ishurdi Thana, the site for a proposed 40-foot span bridge to replace an old 20-foot span bridge was visited. This bridge serves river traffic during flood season. It was evident upon inspection of the drainage pattern that the road alignment is skewed at about a 40-degree angle from a perpendicular with the river's course, and no plans were made to re-align this highly elevated earthwork road to provide a perpendicular crossing with the river channel.

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CARE PILOT

From its conception, the CARE pilot was highly experimental in nature, involving many innovative management procedures as well as technical designs and construction techniques. CARE chose to emphasize the Union-level as the main focus of activity, with the Thana-level involvement largely restricted to technical design and general project oversight, and with CARE itself providing overall technical guidance and monitoring of all the pilot phases.

For this pilot experiment, CARE selected three Thanas in Rangpur District based on their good performance in the Food For Work program and their easy accessibility. Two Unions were then selected in each Thana based on their FFW performance, need for appurtenant structures and willingness to participate. All three Thanas chosen were not upgraded, and the selection of Unions in two of the Thanas (Pirganj and Lalmonirhat) was done without consulting with the Circle Officers in charge (much to their consternation).

Guidelines enumerating the responsibilities of the various participants in the pilot were distributed at the inception of the program. The pertinent particulars of this guidance package and the resulting outcome will be described in the remaining sections of this as well as future reports.

Financing

The financing of projects varied in each Thana. In Kotwali Thana, the projects were financed totally by CARE; in Lalmonirhat Thana, 2½ % of the total contract money required for each project was deposited in a Thana bank account by the Union Parishad (UP) involved before CARE contributed the remaining 97% to each account; and in Pirganj Thana, the same procedure was involved as was in Lalmonirhat Thana, except that the UP's contribution was 5%, with CARE providing the remaining 95%.

CARE felt that the "small" contributions by the UPs involved would motivate them in carrying out their many responsibilities in this pilot. In reality, the Union Parishad Chairmen (UPCs) interviewed expressed their willingness to contribute financially to these projects, but they had limited resources from which to draw their funds. Their contributions came from their road maintenance accounts (up to 25% of the annual road maintenance budgets), and therefore, all the UPCs interviewed expressed concern that they could not afford a similar program that involved any more structures per year than was included in this present pilot without creating an extreme hardship in these and other Union accounts.

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CARE informed each Union that the project accounts would be closed on 31 May, whether the projects are completed or not, and that CARE would withdraw the remaining project funds at that time.

Scheme Selection

The major part of the scheme selection process had its beginnings in CARE's initial conception of the pilot program. CARE based the scheme selection on a desire to include a good cross-section of structural types with small spans. This was done to assure the inclusion of some of the more cost-effective structural types in this pilot. An overall budget for the pilot was then prepared using this variety of schemes, based on a desk calculation of average costs per scheme. With this budget and scheme variety in hand, CARE staff participated in scheme selection with the UPC (and generally) one member of the Thana Technical Staff (TTS).

The UPCs were first asked to submit a priority list of the 5 most important structures needed in their respective Unions. This was followed by visits to the selected scheme locations with CARE staff, the UPC, and the TTS member(s) to determine the final site, structural type, and size, using a CARE pre-survey form as guidance. Of course, the scheme types and sizes chosen were ultimately adjusted to fit the pre-conceived varieties that CARE had originally planned.

In the end, a total of 19 schemes were selected. Of this total, there are 5 single-ring culverts, 3 double-ring culverts, one arch culvert, and 9 open foundation culverts.

Design Preparation and Cost Estimates

In all cases, the TTS were given approximately one week to prepare the structural designs. CARE did not give the TTS specific instructions to use any particular manual or other guidance in the preparation of these designs - in fact, the TTSs were encouraged to be creative. (In Kotwali Thana, CARE asked the TTS to develop 3 different designs for each scheme).

Upon completion of the designs, the CARE technical staff reviewed and corrected them in the presence of the TTS member(s) involved. Unfortunately, copies of the final designs were only given to the UPCs, and not to the TTSs in Lalmonirhat at Pirganj Thana, and this was not appreciated by the Thana staffs.

It should be noted that in the entire design process, there were no engineers involved (TTS or CARE) who had either a 4-year degree or any significant experience in appurtenant structure design. Among the several designs seen, most were incomplete in one way or another. Drawings of reinforcing bars and instructions as to their placement were not included in the design packages of the ring culverts, and several designs were unclear and not totally labeled.

CARE instructed Pirganj and Lalmonirhat Thanas to use Zilla Board (ZB) rates in preparation of cost estimates. After contracts were already let in these Thanas, CARE realized that the ZB rates used were three years old. The CARE Rangpur Unit Administrator then asked CARE-Dhaka if they would supply a 15% contingency fund to be added to each project to alleviate the foreseen cost overruns, but CARE-Dhaka said no and told the Unit Administrator to tell the UPs to make up these costs themselves. Interviews with the UPCs involved indicated they did not have the funds at hand for this contingency and that they would likely tell their respective contractors/craftsmen to stop work when the present funds in the account are exhausted. Fortunately, the TTS in Kotwali Thana was told to develop their own estimates; they compared three schedules, and decided to use the most current Roads and Highways schedule.

Tendering and Contracting

In Gharialdanga Union-Lalmonirhat Thana and in Madankhali Union-Pirganj Thana, the UPs were instructed to tender for local contractors within their Union, while in Borobari Union-Lalmonirhat Thana and in Chatra Union-Pirganj Thana, the UPs were told to select local craftsmen - with both Unions in both Thanas using their "normal procedures" for tendering/selecting. In Gharialdanga Union, tenders were floated as a "formality", and according to Lalmonirhat Thana staff, the UPC chose one contractor (his son) to do all 3 schemes; the Thana office was also upset that the UPC was not required to choose from the Thana's list of registered contractors. Pirganj Thana convinced CARE that the Madankhali UPC should choose only registered contractors. This Union floated tenders Union-wide (as per CARE's instructions) for 7 days, and 3 contractors reponded with 30% to 40% overbids, after which the UPC awarded both schemes to the one contractor who was willing to do the work at the tender's estimated cost. In neither case was earnest or security money required from the contractor. (It should be noted that there was initial confusion in the instructions from CARE: in one CARE circular distributed to the involved parties, entitled "Banking and Fund Release Procedures", it was stated that the Thana Parishad would float tenders in these Thanas - and this was in direct contradiction with the general instructional memorandum.)

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In Borobari Union-Lalmonirhat Thana and Chatra Union-Pirganj Thana, the UPCs chose the best local craftsmen available within their Union, bargaining them down to the estimated contract cost. In Borobari Union, a contingency of 3% was included as a lump sum in the contract.

Kotwali Thana was instructed to prepare the tender for Haridevpur Union and to float the tenders only within the Union itself. (The CO stated that he would have preferred to float the tender Thana-wide). A total of 10% of the contract price was collected from each winning contractor for earnest plus security money to be refunded six months after the completion of the construction. Four bids were submitted per scheme, and the three contractors chosen were those who submitted bids at the tenders estimated costs. In Satgara Union, the UPC chose the most qualified craftsmen in his Union.

Payment Provisions

In all Thanas, contractors/craftsmen are to submit running bills/muster rolls (under no specified schedule) to the UPC, with measurements verified by the TTS. In both Unions of Pirganj Thana and in Borobari Union-Lalmonirhat Thana, the UPC co-signs payment drafts with the Thana Development Committee Chairman (TDCC) (or his designate); in both Unions in Kotwali Thana and in Gharialdanga Union-Lalmonirhat Thana, payments are totally controlled by CARE.

In order to comply with these payment procedures, Lalmonirhat Thana had to create a TDC. In Pirganj Thana, where all project payments have to be co-signed by the TDCC, the Thana officials and the UPCs are upset because the TDCC is not readily available and is showing little interest in the projects.

Construction Materials

The UPCs were instructed to purchase all materials required for projects done by local craftsmen. The CARE-Rangpur Unit Administrator ordered all pipe culverts to be cast at the construction site, although ready-made pipes are available in Rangpur. The UPC of Borobari Union-Lalmonirhat Thana stated that since locally available bricks were not of first-class quality, bricks were purchased from another Sub-division.

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Supervision

In accordance with CARE's instructions, all UPCs were trained by their respective TTSs in design interpretation and the art and science of construction site supervision. The UPCs (and their designates) are to provide full-time site supervision, the TTSs are to assist supervision during critical construction phases and to verify running bill estimates, while CARE will do occasional spot-check supervision. (One UPC stated that he didn't feel qualified to supervise, even after training.)

Construction Site Visits

On-site construction of reinforced concrete pipe culverts was observed in Gharialdanga Union-Lalmonirhat Thana. The UPC stated that CARE staff instructed the contractor as to all pertinent aspects of this experimental construction activity, and that CARE staff and TTS supervised the first day of pipe construction (and were not present in the two days since then).

One reinforcing bar frame was seen prior to placement. The hooked ends were not properly aligned and the length of the rods beyond the hooked portion was too short.

Four-inch (approx.) wooden boards, vertically aligned, were strapped together with metal bands to form the shuttering (mold) into which the completed reinforcing rods were initially placed, followed by the pouring of concrete. (There was no evidence of the use of lateral wooden braces, wooden spacers, or wires connecting the horizontal braces; all this is necessary to maintain a uniform shuttering.) The resulting pipes produced showed the telltale signs of an unsealed mold, with the water-cement leaking out of the spaces between boards and khoa chips visible in vertical lines (4 inches apart) - a visible indication that the strength of the concrete is reduced due to the loss of cement through the cracks. In addition, the thickness of each ring seen varies from 2½ inches to over 3 inches for the nominally 3-inch thick pipe.

There was no shuttering in evidence on the bottom edge of each pipe - it seemed to be only resting on the muddy earth. Since these pipes were still being cured, the final result on the edges of the pipes pressed into the earth is yet to be seen; best judgement indicated that this edge will be uneven, with reinforcing bars visible at the surface since no wooden seats were seen in place to keep the bars from sinking to the bottom. One hooked end of a reinforcing bar was seen protruding ½-inch above the exposed edge of one of the completed pipes.

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It was stated that the shuttering was removed 3 or 4 hours after the concrete was poured in some cases, and up to 15 hours in other cases, while proper engineering practice generally calls for about 3 days of setting before shutters should be removed from vertical structures.

Finally, at the site of the double-ring pipe, it was observed that although the contractor had sunk a shallow tubewell at the site, the head of the well was missing, leading to the obvious conclusion that muddy ditch water at arm's-reach away from the workers was being used for the curing operation observed. If this ditch water was also being used for concrete mixing, the result would be a weakened concrete that will likely limit the life of the culvert. This practice is itself a testimony to the importance of intensive site supervision.

(It should be noted that proper construction techniques that could have been easily adapted to this experiment are simply explained in the Design Manual.)