

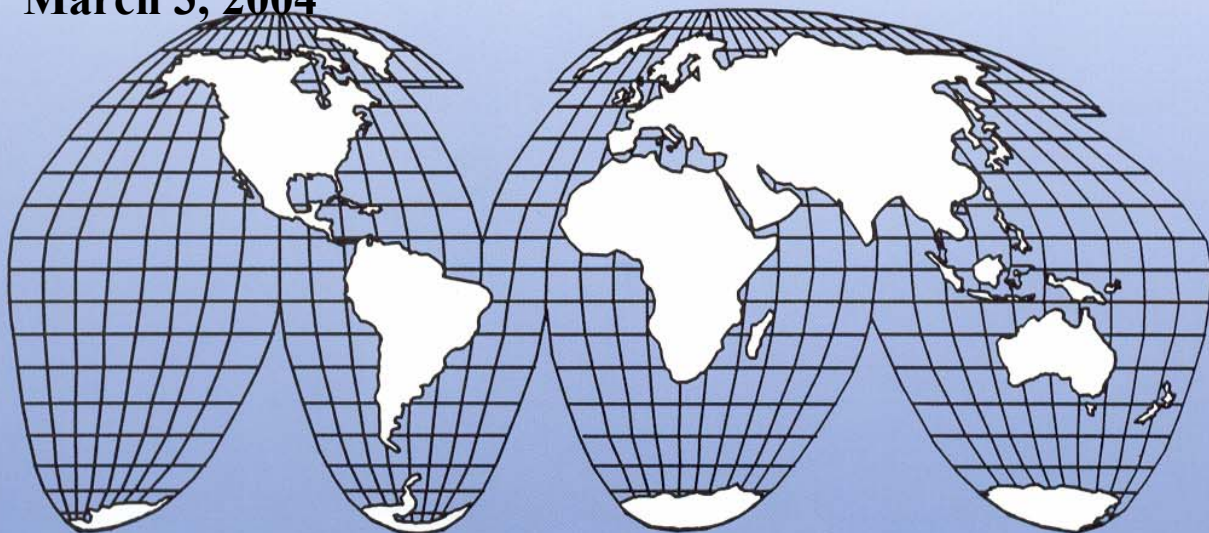
USAID

OFFICE OF INSPECTOR GENERAL

Audit of the Post-Project Condition of Roads and Bridges Constructed in Honduras Under the Emergency Reconstruction of Roads and Bridges Activity

Audit Report No. 1-522-04-006-P

March 3, 2004



San Salvador, El Salvador



March 3, 2004

MEMORANDUM

FOR: USAID/Honduras Mission Director, Paul Tuebner

FROM: Acting Regional Inspector General/San Salvador, Christine M. Byrne

SUBJECT: Audit of the Post-Project Condition of Roads and Bridges Constructed in Honduras Under the Emergency Reconstruction of Roads and Bridges Activity (Report No. 1-522-04-006-P)

This memorandum is our report on the subject audit. In finalizing this report, we considered your comments on our draft report and have included your response in Appendix II.

The report includes one recommendation. Since USAID/Honduras has taken final action on the recommendation, the recommendation is closed on issuance of this report.

Once again, thank you for the cooperation and courtesy extended to my staff throughout the audit.

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Summary of Results

As part of its fiscal year 2003 audit plan, the Regional Inspector General/San Salvador performed this audit to determine whether the USAID/Honduras-financed roads and bridges were in adequate condition one year after the project completion date (page 6).

USAID/Honduras-financed roads and bridges repaired or reconstructed under the Emergency Reconstruction of Roads and Bridges Activity (RECAP Activity) were in adequate condition one year after the project completion date (pages 6 to 10). However, two bridges had structural damage, and we made a recommendation that will bring this damage to the attention of the Government of Honduras so that it can prioritize its maintenance budget to repair these two bridges (pages 10 to 13).

USAID/Honduras agreed with the reported finding and notified the Government of Honduras about the need to evaluate the damaged bridges so that it could prioritize the corrective measures needed. The Mission has taken final action on the recommendation, and the recommendation is closed on issuance of this report (page 13).

Background

Hurricane Mitch struck Honduras in October 1998. Its impact on Honduras' road and bridge network—reputed to be Central America's best before the disaster—was acute. In May 1999, Congress passed the Emergency Supplemental Appropriations Act, creating the Central America and the Caribbean Emergency Disaster Recovery Fund, which provided \$621 million in reconstruction aid for countries hit by Hurricanes Mitch and Georges and for earthquake damage to Colombia. Because of the extent of damage caused by Hurricane Mitch, Honduras received \$291 million. According to our analysis of the Emergency Reconstruction of Roads and Bridges Activity (RECAP Activity) final report,¹ USAID/Honduras repaired or reconstructed, at a cost of \$48 million:² 1) 1,200 kilometers of unsurfaced secondary roads, 2) 69 bridges, 3) 321 major drains, and 4) 16 kilometers of cobblestone streets in rural communities. This work took place in six Honduran departments (equivalent to U.S. states): Atlántida, Choluteca, Colón, Olancho, Valle and Yoro.

The specific objectives of the RECAP Activity were to accelerate and make more durable the economic reactivation of families acutely affected by Hurricane Mitch, and to create conditions conducive to future generation of more jobs, increased income and more social and economic development. This was to be accomplished

¹ The report was issued by the Honduran Social Investment Fund, the Government of Honduras entity in charge of reconstructing the RECAP Activity roads and bridges, on September 16, 2002.

² RECAP Activity funding consisted of \$48 million in USAID funds for construction costs and \$3 million in Government of Honduras contributions for administrative expenses.

principally by reconstructing and repairing farm-to-market roads and bridges which would, to the extent possible, ensure year-round uninterrupted access between farmlands and their markets. Reconstruction techniques aimed to reduce needed maintenance and, thus, enhance sustainability during the five years following the completion of the RECAP Activity and mitigate the potential damage of heavy rainfalls and floods.

The Government of Honduras agreed to maintain roads and bridges repaired or reconstructed under the RECAP Activity. The Fondo Vial is a Government of Honduras agency responsible for maintaining roads and bridges, including all those repaired or reconstructed under the RECAP Activity. Our audit covered the time period from August 2002 (completion date for the RECAP Activity) to December 4, 2003 (date of our last site visit).

Audit Objective

As part of its fiscal year 2003 audit plan, the Regional Inspector General/San Salvador performed this audit to answer the following question:

- Were USAID/Honduras-financed roads and bridges in adequate condition one year after the project completion date?

Appendix I describes the audit's scope and methodology.

Audit Findings

Were USAID/Honduras-financed roads and bridges in adequate condition one year after the project completion date?

USAID/Honduras-financed roads and bridges repaired or reconstructed under the Emergency Reconstruction of Roads and Bridges Activity (RECAP Activity) were in adequate condition one year after the project completion date. Of the 564 kilometers of roads inspected out of 1,200 kilometers repaired or reconstructed, 77 percent (432 kilometers) were in adequate condition.³ Of the 41 bridges inspected out of 69 repaired or reconstructed, 95 percent (39 bridges) were in adequate condition.⁴ However, two bridges had structural damage that could significantly reduce their useful lives. The following sections will discuss the conditions of the roads and bridges separately.

³ We established that if over 75 percent of the kilometers of roads were in adequate condition, we would consider that the roads were in adequate condition. (Refer to the Methodology section.)

⁴ We established that if over 85 percent of the number of bridges were in adequate condition, we would consider that the bridges were in adequate condition. (Refer to the Methodology section.)

Condition of Roads

Roads were evaluated based on both critical and noncritical factors. The critical elements consisted of: 1) the existence of potholes (see Figure 1); 2) the leveling of the surface camber (arched surface); 3) the presence of corrugations;⁵ 4) the existence of erosion channels on the roadway, shoulders or ditch slopes; and 5) the adequacy of road drainage. Noncritical elements⁶ include the condition of culverts (drains under roads), the presence of vegetation in road shoulders, and the proper compression of pothole filling material. To determine that a road was not in adequate condition, three or more critical elements had to be rated negatively.⁷ An independent civil engineer, under contract with the Regional Inspector General/San Salvador, agreed that the above criteria were appropriate to determine whether roads were in adequate condition.



Figure 1 - Photograph of auditor assessing road condition on Road #210, Choluteca, Honduras, September 2003

⁵ Corrugation or “washboarding” describes patches of ridges and depressions in unpaved roads.

⁶ Information on noncritical elements was not considered in determining whether a road was in adequate condition, but was gathered for possible discussion with Government of Honduras officials.

⁷ However, a road with one or two *excessively* negative critical elements could have been deemed not to be in adequate condition. This only occurred in one situation: for Olancho Road #10.

Based on the above criteria, 432 kilometers (77 percent) of roads inspected were in adequate condition. Of the 564 kilometers of roads inspected, the following number and percentage of kilometers met the below critical factors:

Table 1 – Adequate Kilometers by Critical Factors		
Critical Factor	Number of Kilometers that Met Factor	Percentage of Kilometers that Met Factor
Adequate Road Drainage	433	77%
Surface Correctly Leveled	431	76%
Absence of Corrugations	412	73%
Potholes Filled	389	69%
Absence of Erosion Channels	344	61%

Within each department (equivalent to a U.S. state), the number of kilometers in adequate condition, the number of kilometers inspected, and the percentage of kilometers in adequate condition were as shown:

Table 2 – Adequate Kilometers by Department			
Department	Number of Adequate Kilometers	Number of Kilometers Inspected	Percentage of Adequate Kilometers
Colón	83	86	97%
Yoro	82	87	94%
Valle	70	78	90%
Choluteca	80	121	66%
Olancho	73	115	63%
Atlántida	45	77	58%

The Special Objective Grant Agreement between the Government of Honduras and the United States, dated June 9, 1999, stated that the Government of Honduras agreed that, at the conclusion of the RECAP Activity, it would continue to provide long-term maintenance to roads and bridges repaired or reconstructed under the RECAP Activity. Fondo Vial had a road maintenance plan and made concerted efforts to maintain the RECAP Activity roads. Our analysis of RECAP Activity and Fondo Vial documentation revealed that the Fondo Vial spent more money per kilometer on RECAP Activity roads than on the unpaved road network in Honduras as a whole, as shown in the following table:

Table 3 - Fondo Vial Expenditures per Kilometer				
Road Network	Time Period	Kilometers in Road Network	Annualized Maintenance Expenditure	Amount Spent per Kilometer
All Unpaved Roads	Calendar Year 2002	8,925	\$20,394,326	\$2,285
RECAP Roads	September 2002 to July 2003 ⁸	1,200	\$ 3,449,125	\$2,875

(Source: Fondo Vial. Data was not audited.)

Condition of Bridges

Bridges were evaluated based on both critical and noncritical factors. The critical elements consisted of: 1) deck, 2) concrete slabs,⁹ 3) concrete beams, 4) piers, and 5) streambed.¹⁰ Noncritical elements include the approach slab,¹¹ backwall,¹² and abutments.¹³ For metal (Bailey) bridges, the condition of the steel beams and the bearings¹⁴ were also critical factors. Both critical and noncritical elements had several critical or noncritical sub-elements within them. If any one of the critical sub-elements within a category was deficient, the category was rated negatively. Furthermore, if three or more critical categories rated negatively, the bridge was deemed not to be in adequate condition. However, a bridge with one or two excessively negative critical elements could have been deemed not to be in adequate condition, as was the case with Los Achiotes and Zopilote bridges (see next section). An independent civil engineer agreed that the above criteria were appropriate to determine whether bridges were in adequate condition.

⁸ Total expenditures for the 11-month period were \$3,161,698, which we multiplied by 12/11 to compute the annualized figure of \$3,449,125.

⁹ A concrete slab is a broad, flat, thick piece of concrete that covers, either by itself or with other parallel slabs, the bridge's surface between the supporting abutments (see footnote number 13).

¹⁰ A streambed is the channel through which a natural stream of water runs or once ran. Maintenance of the streambed is critically important, as stream scour (an undermining of the structure's foundation) is a major cause of bridge failure.

¹¹ An approach slab is a surface of concrete that provides a transition between the road and the bridge. These slabs should be kept as smooth as possible to prevent undue impact to the bridges, especially from trucks.

¹² A backwall is a small vertical wall at the end of a bridge that extends up from an abutment (see footnote number 13) and supports an approach slab (see footnote number 11).

¹³ An abutment supports an end of a bridge and transfers the load from the superstructure (the entire portion that primarily receives and supports traffic loads) into the ground.

¹⁴ A bearing is a support element transferring loads from superstructure (the entire portion that primarily receives and supports traffic loads) to the substructure (the abutments, piers and other parts of the bridge that support the superstructure) while permitting limited movement capability.

Of the 41 bridges inspected, 39 (95 percent) were in adequate condition. Of the 39 bridges in adequate condition, 29 (74 percent) had all five critical elements in adequate condition. With one exception, the remaining 10 bridges had one or two negative critical factors.¹⁵ The only two bridges in inadequate condition were in the department of Olancho.

Two Bridges With Structural Damage Should be Repaired

Based on the independent engineer's assessment, two bridges in Olancho (Los Achiotes and Zopilote) were not in adequate condition. The engineer stated that the main causes were construction deficiencies and low quality of materials used, while the secondary cause was the lack of preventive maintenance. As a result, as the condition of the bridges deteriorates, the road access of the farmers affected by Hurricane Mitch to the markets where the products are sold could be negatively affected, impacting their ability to recover economically following Hurricane Mitch.

On the Los Achiotes bridge, the steel in the reinforcing bars¹⁶ was exposed.¹⁷ (See Figure 2 below.) The steel also presented signs of corrosion, which could rapidly reduce the strength of the steel and the load carrying capacity of the beams, reducing the bridge's useful life. The concrete beams also had surface gouges. Water filtered down through the deck, since the expansion joints between the tiles were open and allowed the passage of water. Near the ground level, the pier showed signs of stream scour.¹⁸ Last, on an approach road, soil was forming a natural dam, which could create further weakening when it rains. The civil engineer estimated that this bridge could last for two more years, until the end of the year 2005.¹⁹

¹⁵ Corozal bridge in Olancho had three negative critical elements, but was deemed to be in adequate condition. Only one critical sub-element failed within each of the three failed critical categories, and the independent engineer assessed the bridge to be in good condition.

¹⁶ A reinforcing bar is a steel bar, plain or with a deformed surface, which bonds to the concrete and supplies resistance to the concrete.

¹⁷ The project's certificate of final delivery (a certificate documenting the bridge's completion, and signed by the Honduran Social Investment Fund, the supervisory contractor for the repair, and the contractor that built the bridge) mentioned that work to protect the steel in the beams was planned, but did not mention whether such work was performed.

¹⁸ Stream scour is the condition whereby a water stream erodes the concrete of the pier, undermining the bridge's foundation.

¹⁹ According to the Special Objective Grant Agreement, reconstruction techniques aimed to enhance sustainability during the *five* years following the completion of the RECAP Activity. As this bridge was completed by October 2001, it should be sustainable until October 2006. Since the engineer's estimate of the end of 2005 is not materially far from October 2006 and this is an estimate, the engineer estimated that the bridge could last for the period intended.



Figure 2 – Photograph of concrete beams with corroded steel strands and filtered-down moisture below Los Achiotes bridge in Olancho, Honduras, September 2003

Zopilote bridge presented several types of damage that could reduce its useful life. The concrete slabs on the deck of the bridge were separated. (See Figure 3 below.) As with Los Achiotes bridge, the steel in the reinforcing bars was exposed²⁰ and presented signs of corrosion, which could rapidly reduce the strength of the steel and the load carrying capacity of the beams. Last, water filtered down through the deck, and the concrete beams showed evidence of minor leakage. The civil engineer estimated that this bridge could last for four more years, until the end of the year 2007.²¹

²⁰ One of the project's two certificates of final delivery mentioned that work to protect the steel in the beams was planned, but did not mention whether such work was performed. (Zopilote bridge had two certificates of final reception for different work performed on that bridge.)

²¹ As this bridge was completed by October 2001, it should be sustainable until October 2006. Since the engineer's estimate of the end of 2007 is beyond October 2006, the engineer estimated that the bridge could last for the period intended.



Figure 3 - Photograph of separated concrete slabs on the deck of Zopilote bridge in Olancho, Honduras, September 2003

For both Los Achiotos and Zopilote bridges, the civil engineer stated that the main causes for the bridges not being in adequate condition were construction deficiencies and low quality of materials used, while the secondary cause was the lack of preventive maintenance. The civil engineer stated that corrective actions must be taken as soon as possible to prevent further damage. He specifically mentioned that repairs should be completed by May 2004, before the rainy season begins in Olancho.

According to the Special Objective Grant Agreement, reconstruction techniques aimed to reduce maintenance and, thus, enhance sustainability during the five years following the completion of the RECAP Activity. Because the repairs on the two bridges in question were completed by October 2001, and the independent engineer estimated that the bridges could last for the projected sustainability period, we could not determine that any work performed by implementers under the RECAP Activity was the cause of the current inadequate condition of these bridges. Nonetheless, because of the nature of their current condition, we believe that the Government of Honduras should be notified of the issues with both bridges. Therefore, we are making the following recommendation to prevent further damage to the two bridges.

Recommendation No. 1: We recommend that USAID/Honduras notify the Government of Honduras of the structural damage to the Los Achiotés and Zopilote bridges identified during the audit, and request that the Government of Honduras prioritize its maintenance budget to repair these bridges.

**Management
Comments
and Our
Evaluation**

USAID/Honduras agreed with the reported finding and brought the damaged bridges to the attention of the Government of Honduras. The Mission has taken final action on the recommendation, and the recommendation is closed on issuance of this report.

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Scope and Methodology**Scope**

We audited the condition of USAID/Honduras-financed roads and bridges in accordance with generally accepted government auditing standards. We conducted the audit from September 8, 2003 through January 6, 2004 at the offices of USAID/Honduras and the Fondo Vial—the Government of Honduras’ agency in charge of the Emergency Reconstruction of Roads and Bridges Activity (RECAP Activity) road and bridge maintenance. Our audit work also took place in the six departments of Honduras with RECAP Activity roads and bridges: Atlántida, Choluteca, Colón, Olancho, Valle and Yoro, and within our office in San Salvador, El Salvador.

Our audit covered the time period of August 2002 (completion date for the RECAP Activity) to December 4, 2003 (date of our last site visit). The Honduran rainy season runs from May to November. Our audit was limited to roads and bridges, and did not look at service boxes, other drainage facilities, and cobblestone streets that were also repaired or reconstructed by the RECAP Activity. Our audit did not look at the Fondo Vial’s financial records.

A scope impairment resulted from security restrictions to perform site visits. The Regional Security Officer and the Peace Corps Safety and Security Officer at the U.S. Embassy in Honduras informed us that many of the roads and bridges we originally planned to visit, as part of our statistical sample, were not in safe areas and could not be visited. Therefore, we did not use the statistical sample we had designed.

Our initial statistical sample consisted of 56 roads and 44 bridges. As a result of the scope limitations stated above, we decided to visit as many roads and bridges that we could safely visit. This resulted in our selection of 58 RECAP Activity roads out of the 112 roads rebuilt by the RECAP Activity, representing 564 kilometers (47 percent) of the 1,200 kilometers in roads rebuilt. Among the 69 RECAP Activity bridges, 45 were in safe areas. We intended to visit all 45 bridges, but we could not locate or identify 4 bridges.²² Therefore, we inspected 41 bridges, or 59 percent of the 69 RECAP Activity bridges repaired or reconstructed.

We used unverified data from the RECAP Activity and Fondo Vial to compute Fondo Vial Expenditures per Kilometer (see Table 3), since verifying such data would have taken an inordinate amount of staff hours and the benefits of such verification would not have exceeded its costs.

We assessed the Mission’s risk exposure and management control effectiveness to ensure that RECAP Activity roads and bridges were maintained. However, we

²² Subsequently, we obtained information that located or identified all four bridges.

determined that the Mission had no responsibilities over the maintenance of RECAP Activity road and bridges. The Government of Honduras had the sole responsibility to maintain these roads and bridges, as agreed in the Special Objective Grant Agreement between the Government of Honduras and the United States, dated June 9, 1999.

Methodology

To answer the audit objective, which dealt with whether USAID/Honduras-financed roads and bridges were in adequate condition one year²³ after the project completion date, we conducted interviews of USAID/Honduras, Fondo Vial, RECAP Activity,²⁴ and the Government of Honduras Ministry of Public Works, Transportation and Housing personnel.²⁵ We also reviewed records at USAID/Honduras and Fondo Vial, and performed site visits.

We determined the adequacy of the roads and bridges based on both critical and noncritical factors, as explained under the *Condition of Roads* (see page 7) and *Condition of Bridges* sections (see page 9). An independent civil engineer, under contract with the Regional Inspector General/San Salvador, agreed that the above methodology was appropriate to determine whether roads and bridges were in adequate condition. The engineer made site visits to assess the adequacy of 64.1 kilometers of roads and 6 bridges. He personally inspected 8.2 of the 132 (6.2 percent) kilometers of roads in inadequate condition.

We considered that the USAID/Honduras-financed roads and bridges were in adequate condition if over 75 percent of the road kilometers and 85 percent of the number of bridges were in adequate condition. We set the threshold for a qualified opinion at over 60 percent for roads and 70 percent for bridges, and the threshold for a negative opinion at 60 percent for roads and 70 percent for bridges. The independent civil engineer, as well as two civil engineers from the United States Army Corps of Engineers working at USAID/El Salvador, agreed that we should establish lower road thresholds than usual, since we performed the majority of the fieldwork during the rainy season.

²³ The RECAP Activity aimed to enhance the sustainability of the repaired or reconstructed roads and bridges for a five year period. (See footnote number 19.)

²⁴ The RECAP Activity was the Executing Unit for the USAID-Honduras financed activity, and operated under the Honduran Social Investment Fund, the Government of Honduras entity in charge of reconstructing the RECAP Activity roads and bridges.

²⁵ SOPTRAVI is the acronym for the Ministry of Public Works, Transportation and Housing, a Government of Honduras entity that constructs and maintains public works. The Fondo Vial, which started to operate in the year 2000, is now the Government of Honduras entity in charge of maintaining RECAP Activity roads and bridges.

**Management
Comments**

February 3, 2004

MEMORANDUM

FOR: Regional Inspector General/San Salvador, Steven Bernstein

FROM: USAID/Honduras Mission Director, Paul Tuebner/s/

SUBJECT: Audit of the Post-Project Condition of Roads and Bridges Constructed in Honduras Under the Emergency Roads and Bridges Construction Project Activity (Report No. 1-522-04-00X-P)

We would like to thank you and your staff for the performance of this difficult and time consuming audit. The subject matter of the audit performed is of paramount importance to the Mission, and the Hurricane Mitch program.

We are in agreement with your recommendation, and have already complied with the recommendation per the attached letter to Leoncio Yu-Way, Minister of the Fondo Hondureño de Inversion Social (FHIS).

Again, we appreciate the quality of the work performed, and the cooperation and coordination extended to this Mission by your staff.