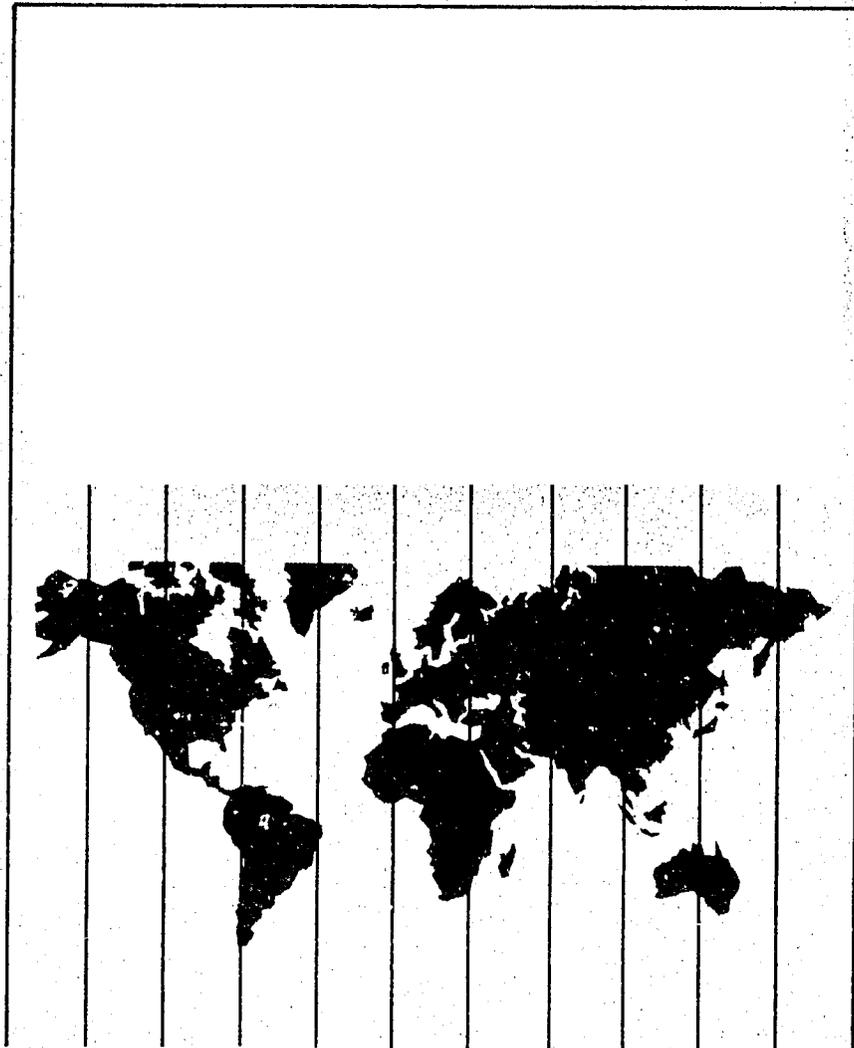


UNITED STATES  
AGENCY FOR INTERNATIONAL DEVELOPMENT

THE  
INSPECTOR  
GENERAL



Regional Inspector General for Audit  
CAIRO

PD-ABG-390

**Information on Tilting Buildings  
Adjacent to a Sewage Treatment Plant Being Built  
under USAID/Egypt's Alexandria Wastewater  
System Expansion Project No. 263-0100**

**Information Report No. 6-263-91-01-I  
November 29, 1990**

UNITED STATES OF AMERICA  
AGENCY FOR INTERNATIONAL DEVELOPMENT  
OFFICE OF THE REGIONAL INSPECTOR GENERAL/AUDIT

November 29, 1990

**MEMORANDUM FOR D/USAID/Egypt, Marshall D. Brown**

FROM : RIG/A/C, F.A. Kalhammer 

SUBJECT: Information on Tilting Buildings Adjacent to a Sewage Treatment Plant Being Built under USAID/Egypt Project No. 263-0100 (Alexandria Wastewater System Expansion)

We are transmitting herewith 10 copies of a report on the results of our inquiry on the presence of tilting buildings adjacent to the site selected to construct the Alexandria Wastewater System Expansion Project's west treatment plant. We appreciate the courtesy and cooperation extended to us by USAID/Egypt personnel and personnel of Wastewater Consultants Group and Fru-Con Construction Company.

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**Background**

The Alexandria Wastewater System Expansion Project, No. 263-0100, is designed to improve public health conditions in Alexandria, Egypt's second largest city and principal seaport, by expanding and upgrading its wastewater collection, treatment, and disposal facilities. Key infrastructure works that USAID/Egypt is financing under the project include sewage tunnels and collectors, pump stations, sludge disposal facilities, and two wastewater treatment plants.

Under a fixed-price host country contract, the Fru-Con Construction Company is now building the project's east and west treatment plants at a current estimated cost of \$94.3 million and Egyptian pounds (LE) 32.5 million. The northern boundary of the west treatment plant (WTP) construction site runs parallel to a commuter rail line beyond which a number of residential buildings have been built apparently in violation of local building codes. Among these are 13 occupied multistory apartment buildings which are visibly tilting. Geotechnical experts have studied them and warned that they are in danger of collapsing. The buildings are significantly out of plumb (See Appendix II) because their foundations, which are sinking differentially, are inappropriate for the area's weak and highly compressible soils.

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## **Information Objectives**

We recently conducted an audit of the Alexandria Wastewater System Expansion (AWW) Project and reported on our audit results in a separate report (Audit Report No. 6-263-91-01). As a concurrent inquiry, we also wanted to obtain information on the tilting buildings near the project's WTP and on how the buildings have affected project implementation. Since the purpose of this inquiry was to obtain information, this report contains no conclusions or recommendations and is not to be viewed as the results of an audit. In making our inquiry, we had the following objectives in mind:

1. How might the tilting buildings affect project implementation?
2. What actions have been taken to address the condition of the tilting buildings and their potential impact on the project?

Appendix I describes the scope of our work and the methodology we used for this inquiry.

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## **Information on the Tilting Buildings Near the Project's West Treatment Plant and on Actions Taken to Address the Danger They Pose**

### **1. How might the tilting buildings affect project implementation?**

The tilting apartment buildings, which geotechnical experts have reported to be "on the verge of failure," pose threats not only to successful completion of the WTP and the AWW project but also to the image of the United States' economic assistance program in Egypt. According to USAID/Egypt personnel, the collapse of any one of these buildings could result in the loss of lives, adverse publicity for the U.S. economic assistance program, legal actions against the U.S. Government and USAID-financed contractors, and delays in, or even non-completion of, the WTP facility and the AWW project.

In the event of the collapse of a tilting building, should circumstances prevent commissioning of the WTP, USAID could find that its investment in the plant has been made to no practical effect. Additionally, if such an event were to occur, and if construction were to be suspended indefinitely, USAID could be required to pay additional stand-by costs incurred by the contractor. According to the Fru-Con Construction Company, depending on the stage and level of work at the time of a suspension, these costs could total about \$19,800 and LE21,300 each day, or about \$594,000 and LE639,000 per month.

**2. What actions have been taken to address the condition of the tilting buildings and their potential impact on the project?**

Since 1987 USAID/Egypt and AWW project contractors have known that the tilting buildings could affect completion of the WTP. The Wastewater Consultants Group (WWCG), the project's consulting engineers, urged Government of Egypt (GOE) officials several times to remove occupants of the endangered buildings. However, the officials did not do so. In April 1989 the Fru-Con Construction Company was directed to begin building the WTP's influent pump station using a "floating box caisson," an engineering procedure that would not affect offsite structures but will cost the project an additional \$11.6 million. Notwithstanding, a tilting building could still collapse during construction of the WTP. In December 1989 this matter was brought to the attention of the U.S. Ambassador to Egypt, who, in concert with the U.S. Consul General in Alexandria, has contacted appropriate GOE officials, and urged them to remove building occupants. A committee of GOE experts recently recommended the evacuation of certain building occupants. According to the latest information available, some occupants have now been evacuated.

Following is a chronology of events, based on available documents, relating to the matter of the tilting buildings.

The Fru-Con Construction Company was required by its January 1987 contract to survey the buildings near the WTP so as to assess their structural condition before starting construction, monitor their settlement, and restrict "dewatering," that is, to limit the drawdown of groundwater under the buildings. In a July 13, 1987 letter to the project's consultant engineer, WWCG, Fru-Con reported that "extraordinary settlement of up to 130 mm has taken place during the 3-4 month period prior to any pile driving, dewatering or other significant on-site activity..." and that "as these buildings have questionable foundation design in an area of poor soils, settlement will continue until there is a major failure." The letter concluded that Fru-Con could not be held "responsible for housing outside our work area which will continue to settle in unpredictable patterns, crack and possibly collapse even if no activity takes place on site."

Later that month, WWCG wrote to the Alexandria General Organization for Sanitary Drainage (AGOSD), the AWW project's implementing agency, suggesting that the "occupants of the structures in question be removed and relocated..." because of the "excessive and unpredictable settlement patterns" that had already occurred "without major construction operations in progress." WWCG reiterated its suggestion to remove building occupants in subsequent letters to AGOSD in September and December 1987, and in November 1988. Also during this period, Fru-Con regularly provided data it had collected on the tilting buildings' subsidence to AGOSD and the local housing authority.

In its November 8, 1988 letter to AGOSD, WWCG once again urged that building occupants be evacuated since the buildings were "on the verge of collapse regardless of any construction activity." The letter also stated that Fru-Con had "discontinued excavation for the West Plant Influent Pump Station on 20 October 1988" since "further excavation is not possible without operating the dewatering system." However, the letter reported that "WWCG is working with FRU-CON to find a technical solution to allow the work to continue and minimize the impact on the offsite housing." The letter pointed out, however, that, "the problems are not solely technical" and that "AGOSD assistance is needed to evacuate the unsafe buildings while construction is underway."

In a February 6, 1989 letter to AGOSD, WWCG called AGOSD's attention to 13 buildings that "have been monitored for the last 24 months" whose "total settlement exceeded 15 cm," or whose "differential settlement exceeded 8 cm." The letter stated that, "Evacuation of these buildings is necessary within sixty days to minimize further delay on the construction of the Influent Pump Station."

In an April 2, 1989 letter to Fru-Con, WWCG directed the contractor to begin building the WTP's influent pump station using a "floating box caisson," an engineering procedure which requires no dewatering and which a former project officer described as a "complete change in construction...technology." The letter stated that, "In accordance with...the Contract, this is the Engineer's 'Start Work Order' to FRUCON to proceed with the work for the floating caisson."

We questioned Mission officials as to whether an alternative site for the WTP could have been selected. They told us that it would not have been feasible to select another site since: (1) tunnels designed to carry sewage to the plant were already under construction, (2) no alternative site exists nearby, and (3) finding a substitute site for the plant could have taken years and greatly increased construction costs.

In a May 1989 memo to the USAID/Egypt Director, a former project officer reported that, "because of the type of soils underlying the adjacent...buildings, drawdown at these buildings would increase their settlement and greatly increase the risk of collapse." Consequently, "the requirement for zero drawdown at the property line to protect adjacent buildings required a complete change in construction methods, procedures and technology, at a considerable increase in the cost to construct all the underground facilities at the West Treatment Plant.... These changes will increase costs by an estimated \$14.2 M." Recently approved change orders to Fru-Con's contract that relate directly to the decision to use the "floating caisson" methodology have increased the contract's value by \$11.6 million. (See Appendix III for photos of the influent pump station's foundation being floated into place in May 1990 using the floating caisson technology.)

An independent assessment of the condition of the tilting buildings prepared by Egyptian geotechnical experts, which WWCG commissioned in July/August 1989, confirmed WWCG's and Fru-Con's earlier observations that the buildings were indeed "on the verge of failure" due to inappropriate foundations.

In a December 1989 memo to the U.S. Ambassador to Egypt, the USAID/Egypt Director recommended that the Ambassador raise the matter of the tilting buildings with appropriate GOE officials and urge them to relocate endangered residents. Beginning in January 1990, the Ambassador and the U.S. Consul General in Alexandria raised the issue of the tilting buildings on at least two occasions with the Governor of Alexandria and once with the Minister of Reconstruction, New Communities, Housing and Public Utilities. Assurances were reportedly given that at least some tenants of the endangered buildings would be moved to other quarters.

A committee of faculty from the University of Alexandria formed at the direction of the Governor of Alexandria has concluded that the settlement and tilt of the buildings near the WTP are due to the inappropriate choice, design and execution of the buildings' foundations. On April 18, 1990 the committee recommended evacuation "as soon as possible" of five buildings "in a very critical state."

According to the latest information available, evacuation of occupants from some of the endangered buildings, at least, has taken place. It is not yet clear how many occupants, or if all the endangered buildings' occupants, will eventually be evacuated.

**Scope and Methodology**

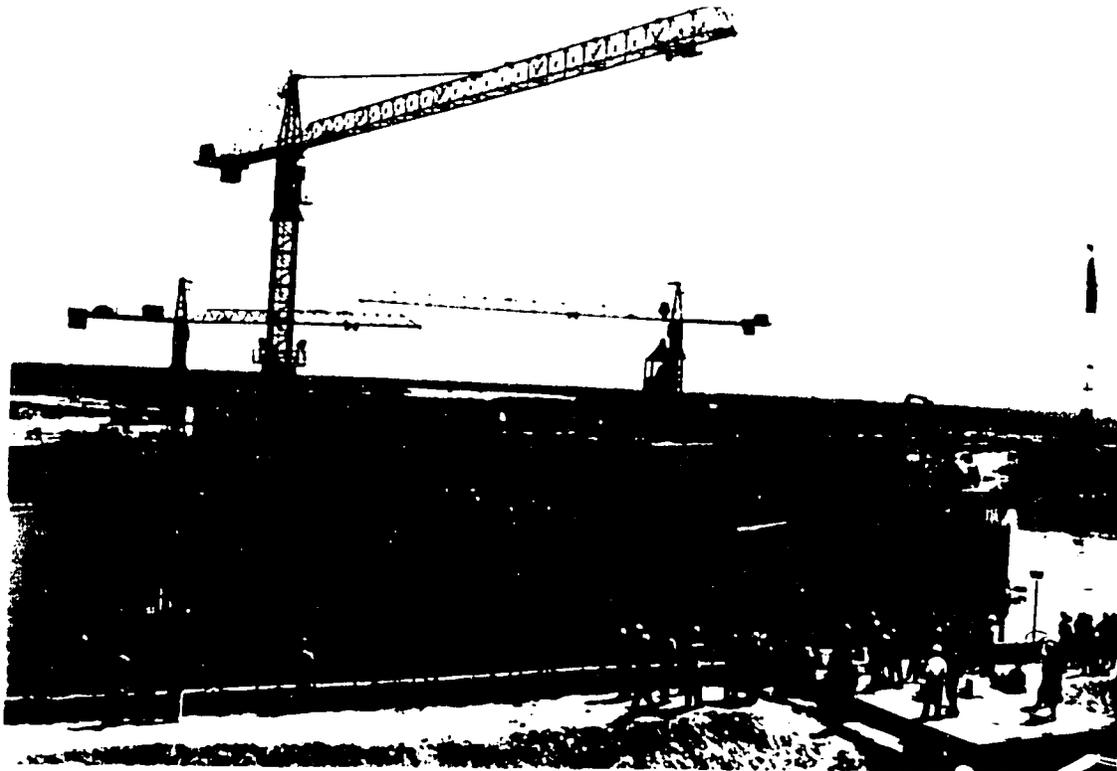
To address our inquiry's objectives, we examined (1) technical information on the condition of the tilting buildings near the West Treatment Plant prepared or compiled by WWCG and by independent Egyptian geotechnical experts, (2) correspondence from WWCG and construction contractor Fru-Con to GOE officials on the matter of the tilting buildings, (3) change orders to Fru-Con's contract involving the tilting buildings, (4) information on Fru-Con's stand-by costs in the event of a work suspension, and (5) available USAID/Egypt documents addressing the matter of the tilting buildings.

We also met several times with USAID and WWCG personnel and the U.S. Consul General in Alexandria to discuss the tilting buildings. We discussed USAID's efforts to address this matter, efforts by the U.S. Ambassador and the U.S. Consul General to urge GOE officials to relocate building occupants, and actions the GOE officials have taken in response to these efforts. We did not interview GOE officials such as the Governor of Alexandria or the housing authority head on the advice of the U.S. Consul General.

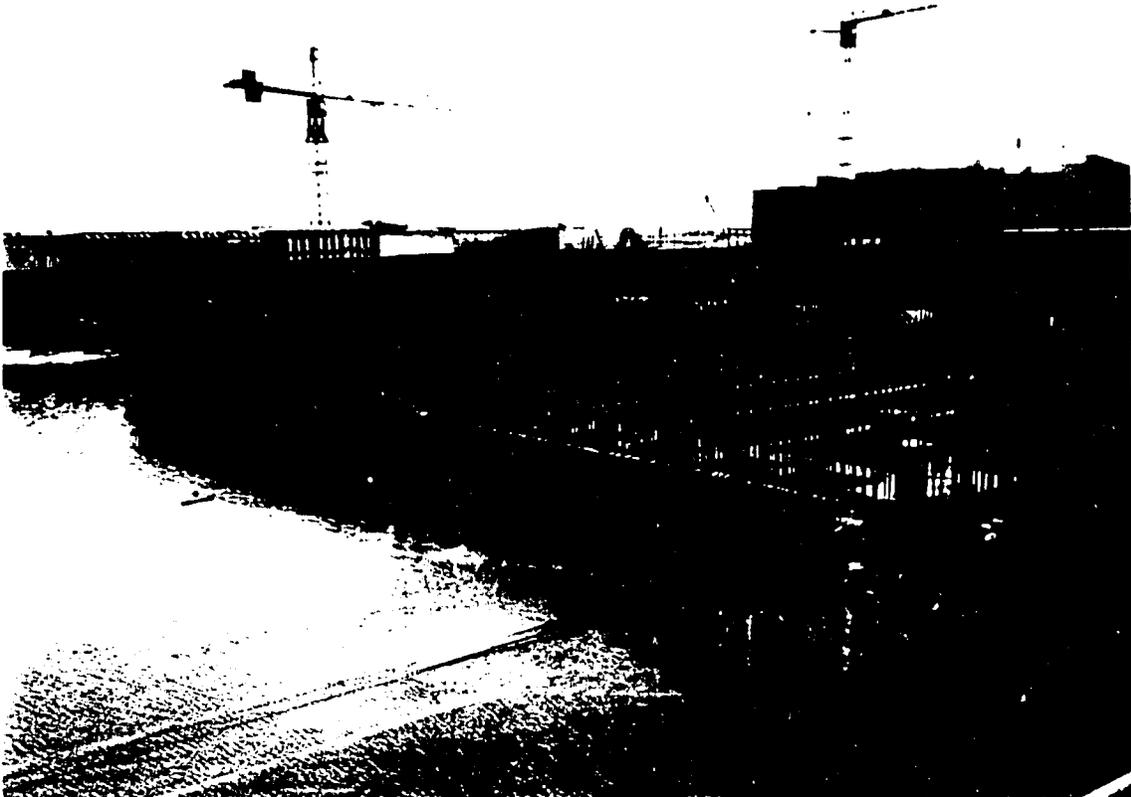


Tilting apartment buildings near the West Treatment Plant which geotechnical experts warn are in danger of collapsing.





May 8, 1990 flotation and movement of the West Treatment Plant's influent pump station foundation using the "floating caisson" technology.



Influent pump station foundation positioned within a slurry wall  
(curved underwater line at photo center). During subsequent construction,  
the foundation will gradually "sink" within the excavated pit encompassed by this wall.

**APPENDIX IV**

	<b><u>No. of Copies</u></b>
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U.S. Ambassador to Egypt, DCM, and U.S. Consul General, Alexandria	3
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Audit Liaison Office (ENE/DP)	1
Assistant Administrator, Bureau for External Affairs (XA)	2
A.I.D. Environmental Coordinator	1
Office of Press Relations (XA/PR)	1
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