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REPORT TO  
THE CONGRESS OF THE UNITED STATES



REVIEW OF CIRCUMSTANCES RELATING TO  
THE COLLAPSE OF  
THE JOHN DAY RIVER BRIDGE  
ON INTERSTATE ROUTE 80N  
IN THE STATE OF OREGON

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BUREAU OF PUBLIC ROADS  
DEPARTMENT OF COMMERCE  
AND  
CORPS OF ENGINEERS (CIVIL FUNCTIONS)  
DEPARTMENT OF THE ARMY



BY  
THE COMPTROLLER GENERAL  
OF THE UNITED STATES

DECEMBER 1966

747654 / 087849

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BY  
THE COMPTROLLER GENERAL  
OF THE UNITED STATES

DECEMBER 1966



COMPTROLLER GENERAL OF THE UNITED STATES  
WASHINGTON, D.C. 20548

B-144887

December 19, 1966

To the President of the Senate and the  
Speaker of the House of Representatives

This report presents the results of our review of the circumstances relating to the collapse of the John Day River Bridge on Interstate Route 80N in the State of Oregon.

The bridge was designed and constructed under the supervision of the Oregon State Highway Department under a contract with the Corps of Engineers, Department of the Army. Because Federal-aid highway funds were involved, the Bureau of Public Roads, Department of Commerce, in accordance with the requirements of Federal-aid highway legislation, reviewed and approved the construction plans and specifications and concurred in the award of the construction contract. The bridge, which was completed in September 1963 at a cost of about \$2,400,000, collapsed about 15 months later on December 22, 1964, as a result of scouring of the stream bed around and below the footings of pier 3, one of the bridge supports, during extreme flooding conditions.

The footings for pier 3 had been established on compacted sand and gravel approximately 14 feet above bedrock, contrary to the original contract requirement that the bridge piers be founded upon bedrock. The decision to change the elevation and foundation material for the pier 3 footings was made while the work was underway and did not affect footings for other piers of the bridge, which had been established directly on bedrock or on piles driven to bedrock as planned.

The reports of investigations of the bridge collapse by the Bureau, the State highway department, and an independent consulting firm all support the conclusion that the bridge was adequately designed in accordance with good practice, and that if the footings for pier 3 had been founded on bedrock, as designed, the pier would not have collapsed even under the extreme flooding conditions experienced.

The Bureau division office, which has the responsibility for reviewing and approving all changes, was not made aware of the change to place pier 3 footings on a sand and gravel foundation about 14 feet above the planned elevation until about 1-1/2 months after the footing had been poured. The State did not notify or obtain approval from the

Bureau before the change was made, and there were certain misunderstandings principally because the memorandum of understanding between the Corps and the Bureau did not clearly define each of the agency's responsibilities.

Although we have no basis for knowing whether an independent and thorough Bureau evaluation of the contract revision would necessarily have resulted in a decision not to allow the change to remain, we found that the Bureau relied on what it thought was a thorough review by the Corps and did not attempt to independently evaluate the change, when it was first in a position to do so, after the change took place.

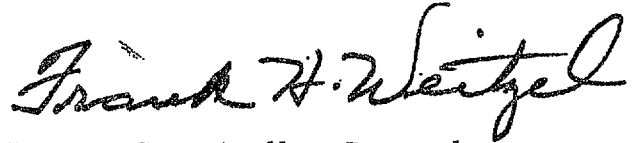
We proposed that the Federal Highway Administrator and the Chief of Engineers, to avoid future misunderstandings concerning agency responsibilities in reservoir highway relocation projects in which Federal-aid highway funds are involved, revise their memorandum of understanding to more clearly define the respective responsibilities, and limitations therein, of each agency, and that the memorandum be brought to the attention of responsible field officials of both agencies along with such interpretive instructions as are necessary to highlight the significance of the changes.

Both the Corps and the Bureau concurred with our proposal. Agency comments, including those of the State of Oregon, are discussed in greater detail in the body of this report.

We are reporting this matter to the Congress to illustrate the importance of clearly defined agency responsibilities and to point out the recognized need to revise the memorandum of understanding between the Bureau and the Corps to avoid future misunderstandings concerning agency responsibilities in reservoir highway relocation projects involving Federal-aid highway funds.

B-144887

Copies of this report are being sent to the Director, Bureau of the Budget, the Secretary of the Army, the Secretary of Commerce, and the Federal Highway Administrator.

A handwritten signature in cursive script, reading "Frank H. Weitzel".

ASSISTANT Comptroller General  
of the United States

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REPORT ON  
REVIEW OF CIRCUMSTANCES RELATING TO  
THE COLLAPSE OF  
THE JOHN DAY RIVER BRIDGE  
ON INTERSTATE ROUTE 80N  
IN THE STATE OF OREGON  
BUREAU OF PUBLIC ROADS  
DEPARTMENT OF COMMERCE  
  
AND  
CORPS OF ENGINEERS (CIVIL FUNCTIONS)  
DEPARTMENT OF THE ARMY

INTRODUCTION

As a result of congressional interest, the General Accounting Office has made a review of the circumstances relating to the collapse of the John Day River Bridge on Interstate Route 80N in the State of Oregon. The review was made pursuant to the Budget and Accounting Act, 1921 (31 U.S.C. 53), and the Accounting and Auditing Act of 1950 (31 U.S.C. 67) and was directed primarily to the activities and responsibilities, as they affected construction of the John Day River Bridge, of the State highway department; the Corps of Engineers, Department of the Army; and the Bureau of Public Roads, Department of Commerce.

The cost of the John Day River Bridge was financed largely by the Corps of Engineers as part of the reservoir project for the John Day Lock and Dam on the Columbia River. The remaining cost was financed by the State of Oregon and the Bureau of Public Roads under the Federal-aid highway program.

Our review was conducted at the Oregon Division Office of the Bureau of Public Roads and the Oregon State Highway Department offices in Salem, Oregon, and at the Walla Walla District, Corps of

Engineers, Walla Walla, Washington. We reviewed pertinent Federal-aid highway and water resources-highway relocation laws and regulations and related Bureau and Corps policies and procedures. We examined records pertaining to the bridge construction and to engineering investigations of the bridge's subsequent collapse and interviewed responsible State, Corps, and Bureau division and regional officials.

The Bureau of Public Roads is the principal agency of the Federal Government in matters relating to highways. The management of the Bureau is vested in the Federal Highway Administrator who is appointed by the President with the consent of the Senate. The names of the principal officials of the Department of Commerce responsible for the administration of the activities discussed in this report are shown in appendix II.

One of the most important functions of the Bureau is the administration of the Federal-aid highway program. Under this program, Federal funds are made available to all States, Puerto Rico, and the District of Columbia to construct and improve highways on designated Federal-aid highway systems. These systems include the interstate, primary, and secondary highway systems and extensions of the latter two systems in urban areas.

Existing legislation provides for establishing the highway systems on which Federal-aid funds may be expended and also specifies certain review and approval actions to be taken by the Bureau for all Federal-aid projects except those under the Secondary Road Plan. Except for Secondary Road Plan projects, Bureau program approval is followed by State engineering surveys and the preparation of plans, specifications, and cost estimates of each project for review and acceptance by the Bureau. The States advertise for bids and award contracts for construction with the concurrence of the



Bureau. Project agreements are entered into between the States and the Bureau on the basis of awarded contract prices and estimates of other costs relating to the project.

The Bureau periodically inspects construction work as it proceeds. According to Bureau policy statements, the principal objective of construction inspection by Bureau engineers is to ascertain whether the construction is being performed in full conformity with the approved plans and specifications and, if not, to arrange for necessary remedial actions to be taken. Final construction inspections of the projects are made by the Bureau before final payments of the Federal share of the cost are made.

The Corps of Engineers (Civil Functions), Department of the Army, is one of the principal agencies of the Federal Government engaged in water resource project construction. The names of the principal officials of the Department of Defense responsible for the administration of activities discussed in this report are shown in appendix III.

The Corps becomes associated with highway construction because existing highway facilities may need to be relocated as a result of the construction of water resource projects such as the John Day Lock and Dam being built for navigation and hydroelectric purposes on the Columbia River. Concerning State highway relocations, the Corps of Engineers is required by law to replace, or reimburse a State for the cost of replacing, existing highways with equivalent highways constructed to current State highway standards.

## BACKGROUND

The John Day Bridge was designed and constructed under the supervision of the Oregon State Highway Department under a contract with the Corps and was a replacement for the then existing bridge on the State road, designated as U.S. Highway 30, in connection with the construction of a navigation and flood control project known as the "John Day Lock and Dam, Columbia River, Oregon and Washington." Because U.S. Highway 30 at the crossing of the John Day River is being reconstructed as Interstate Highway 80N with a four-lane structure replacing a two-lane structure, the cost of the additional two lanes was financed as an interstate highway project.

The bridge replacement was required to provide a high-level crossing of the John Day River which will be part of the reservoir behind the John Day Lock and Dam being built under authority of Public Law 516, Eighty-first Congress, approved May 17, 1950. Because Federal-aid highway funds were involved, the Bureau, in accordance with the requirements of Federal-aid highway legislation, reviewed and approved the construction plans and specifications and concurred in the award of the construction contract.

The bridge was completed in September 1963 at a cost of about \$2,400,000. About \$1,500,000 of this cost was borne by the Corps, about \$800,000 was borne by the Bureau from Federal-aid highway funds, and less than \$100,000 was borne by the State of Oregon.

The bridge collapsed on December 22, 1964, during extreme flooding conditions. One person who was on the bridge was killed when two of the 200-foot deck spans supported by pier 3 fell into the river as the pier was washed out by the flood waters; two more persons were killed about 12 hours later when they drove off the end of the remaining portion. Reports of investigations by the Bureau, the State highway department, and an independent consulting

firm concluded that the primary cause of the collapse was scouring<sup>1</sup> of the stream bed around and below the footings of pier 3. The footings for pier 3 were established on compacted sand and gravel approximately 14 feet above bedrock, contrary to the original contract requirement that the bridge piers be founded upon bedrock.

The decision to change the elevation and foundation material for the pier 3 footings was made while the work was under way and did not affect footings for other piers of the bridge, which were established directly on bedrock or on piles driven to bedrock as planned. The reports of the investigations all support the conclusion that the bridge was adequately designed in accordance with good practice and that--if the footings for pier 3 had been founded on bedrock, as designed--the pier would not have collapsed even under the extreme flooding conditions experienced.

The bridge has been rebuilt by the State. As of June 30, 1966, the additional cost totaled \$880,000, of which \$560,000 represents the Federal share of emergency relief funds. In commenting on our draft report, the Bureau advised us that no Federal funds have yet been expended and that the use of Federal-aid emergency relief funds is subject to determinations and Bureau concurrence (1) that the project is eligible for emergency relief, (2) that the Corps of Engineers is not responsible for restoration of the bridge, and (3) as to whether a portion of the costs should be financed with Interstate funds. As of December 5, 1966, the Bureau's division engineer had given only conditional approval.

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<sup>1</sup>Scour is the washing away of river bottom material by the action of the water current. As water velocities increase, the extent of scour becomes greater.

OBSERVATIONS RELATING TO THE COLLAPSE OF  
THE JOHN DAY RIVER BRIDGE

Our review showed that the Bureau division office, which has the responsibility for reviewing and approving all changes, was not made aware of the change in the approved construction plans and specifications for pier 3 until after the physical change took place, which change, according to engineering reviews, resulted in the collapse of the John Day River Bridge. Although we have no basis for knowing whether an independent and thorough Bureau evaluation of the contract revision would necessarily have resulted in a decision not to allow the change to remain, we found that the Bureau relied on what it thought was a thorough review by the Corps and did not attempt to independently evaluate the change, when it was first in a position to do so, after the change took place.

The Federal-aid highway legislation provides for the Bureau to undertake certain review and approval actions on Federal-aid highway projects. Section 109 of title 23, United States Code, states that:

"The Secretary shall not approve plans and specifications for proposed projects on any Federal-aid system if they fail to provide for a facility (1) that will adequately meet the existing and probably future traffic needs and conditions in a manner conducive to safety, durability, and economy of maintenance; (2) that will be designed and constructed in accordance with standards best suited to accomplish the foregoing objectives \*\*\*."

Section 114 of title 23 requires that the construction of Federal-aid highways by or under the direct supervision of the State highway departments shall be subject to the inspection and approval by the Secretary of Commerce, and section 121 stipulates that a State shall be entitled to payment of the Federal share of

the cost of each project after completion of a project in accordance with the plans and specifications.

As a result of discussions between representatives of the Bureau and the Corps, a memorandum of understanding was developed in June 1959 between the two agencies, with respect to the procedures to be followed to permit participation of Federal-aid highway funds in the cost of betterments included in the construction of roads being replaced in connection with reservoir development by the Corps.

The memorandum recognized the basic requirements of title 23 and the regulations of the Secretary of Commerce that must be observed to permit the availability of Federal-aid funds, including those relating to the approval of plans and specifications by the Bureau. The memorandum also stated with respect to construction supervision:

"The construction work on any Federal-aid highway project (excepting certain secondary system projects) shall be subject to the inspection and approval of the Bureau's division engineer and shall be performed under the direct supervision of the State highway department and in accordance with State and applicable Federal laws. \*\*\*"

Although the memorandum is, for the most part, written along lines that indicate that the highway relocation work will be accomplished under plans and specifications prepared by the Corps and under construction contracts awarded by the Corps, it does point out the Bureau's responsibilities under the law and it states that the Bureau division engineer must review and approve all plans and specifications and changes in such plans and specifications and must inspect and approve the construction work for relocation projects involving Federal-aid highway funds in the same manner as he

would for other Federal-aid highway projects where the Corps of Engineers was not involved. In essence, the memorandum does not provide for the delegation to the Corps of any of the Bureau's basic responsibilities for review and approval actions.

The memorandum is not clear, however, as to the nature of the Corps' responsibility in those situations where the preparation of the plans and the actual construction of the relocated highway are to be accomplished by a State highway department. For example, there is no indication as to whether the Corps is required to approve the relocation project plans and specifications. With respect to changes in plans, although the memorandum states that the Corps is to notify the State promptly of any proposed changes--the assumption being that the Corps will initially propose plan revisions--it does not state whether the Corps has a responsibility for reviewing and approving plan revisions when changes are proposed by the State.

The memorandum is also silent on whether the Corps' review and approval action, if performed, is only for the purpose of determining the effect on the Corps' financial responsibility or whether the Corps is to ascertain the effect of the change on the engineering adequacy of the facility. A copy of the memorandum of understanding is included as appendix I.

Detailed information as to the circumstances and actions taken concerning the construction of the bridge and subsequent events is presented in the succeeding sections of the report.

DATA RELATING TO RELOCATION AND  
CONSTRUCTION CONTRACT PLANS  
AND SPECIFICATIONS

Contract DA-45-164 CIVENG-61-103 was an agreement between the Corps and the State of Oregon for the relocation of highways made necessary by the construction of the John Day Dam. Included in the relocation was a portion of Interstate Highway 80N (formerly U.S. Highway 30). The bridge was designed by the State under contract DA-45-164-CIVENG 59-39 with the Corps.

Under this contract the Corps performed the subsurface investigations for piers and abutments. The detailed plans, specifications, and estimates for construction of the bridge were prepared by the State and reviewed and approved by the Corps. The plans, specifications, and estimates were also reviewed by the Bureau under Federal-aid project I-80N-4(5) and approved on November 14, 1961. The Bureau concurred in the award of the construction contract by the State on January 4, 1962.

Corps of Engineers Design Memorandum No. 7, Relocations on Oregon Shore--John Day Lock and Dam, dated December 15, 1959, which contains the basic engineering criteria for the bridge, provided:

"\*\*\* Footings for the main piers will be founded either on bedrock or on steel bearing piles driven to bedrock."

\* \* \* \* \*

"Two types of foundations are planned for the \*\*\* piers. Where the bedrock is near the surface or at such a depth that it is economical, cofferdams will be built and footings poured \*\*\* directly on bedrock. \*\*\*. Where there is no bedrock above elevation 130, steel piling driven to bedrock will be used under the foundations."

These criteria were incorporated into the approved plans, specifications, and estimates by requiring that footings for the main piers of the bridge be founded upon bedrock or on steel piling

driven to bedrock. In addition, the construction contract provided that:

"Footings in rock shall be poured full against undisturbed rock, \*\*\*."

The State's detailed plans and specifications for the bridge were by reference made a part of the relocation contract between the Corps and the State. The relocation contract also provided that changes and alterations in approved plans and specifications were to be made by written agreement between the Corps and the State, subject to approval by the Bureau of Public Roads.

EVENTS LEADING TO CHANGE IN  
PLANS FOR PIER 3

On October 2, 1962, the State's Resident Bridge Engineer reported to the State Bridge Construction Engineer that the contractor wanted to place concrete for the pier 3 footings on a gravel foundation about 14 feet above the plan elevation. The following data regarding the events leading up to the change in plans is extracted from a memorandum to the files dated December 7, 1962, by the State's Bridge Construction Engineer.

"On the afternoon of October 2, 1962, I took a call from \*\*\* [the resident bridge engineer] concerning the excavation work for pier number 3. The contractor was very disturbed concerning the difficulty in excavation. \*\*\* [the contractor] talked at length at the supposedly impossible situation of excavating in cemented gravel. I said I would be on the job tomorrow at ten.

\* \* \* \* \*

"On arriving at the job I found what I would call a tightly compacted river sand and gravel rather than the semi-cemented material described by the contractor. I told \*\*\* [the contractors] I thought they were unduly disturbed and were expecting a much too easy show for



this type of work. \*\*\* [one of the partners] agreed with me that \*\*\* [the other partner] who runs the field work, was overly concerned.

"However, these footings, although they were intended to found on bedrock, were designed for 3.8 tons per square foot. The contractor thought we should stop at these elevations. I told \*\*\* [the contractors] that it was my belief also that the present material was more than adequate for 3.8 tons and therefore suitable for founding the footings provided it could be determined by drilling \*\*\* that the same material extended on down to bedrock with no soft or compressible layers."

This memorandum also stated that arrangements were then made by the State with the Walla Walla District, Corps of Engineers, for the use of a Corps rig and crew to drill test holes in the footing cofferdams to determine the composition of the material. Subsequent drilling on October 5, 6, and 8, 1962, substantiated that the compacted sand and gravel continued down the bedrock with no intervening soft layers. State records also show that the State engineers believed that there would be no problem of scour at the revised elevation.

According to a memorandum prepared by a responsible Corps official, after the collapse of the bridge, he had received a call from the State Bridge Engineer at 2 p.m. on October 9, 1962, and the proposed change to pier 3 footings was then discussed and, after the telephone conversation, the Corps official consulted the Chief, Engineering Division, and Chief, Soils Section, Walla Walla District of the Corps about the testing results and the proposed change.

According to this memorandum, the Chief, Engineering Division, decided that the Corps would interpose no objection to the change since the State highway department had designed the bridge, was going to operate and maintain it, was paying a substantial portion of

the cost, and the design change was not a major change in cost responsibility; the State Bridge Engineer was then advised by telephone that the Corps would have no objection to the State's proceeding as it saw fit.

State records show that the footings were poured on October 10 and 11, 1962, at the higher elevation, about 14 feet above bedrock. According to work sheets furnished by the Oregon State Highway Department, the decrease in the contract amount resulting from the founding of pier 3 at a higher elevation than that initially planned was about \$9,200. The decrease essentially comprised reduction in the amount of structural excavation required (790 cubic yards at \$5 a cubic yard), and lesser quantities of structural concrete (73 cubic yards at \$48.75 a cubic yard) and metal reinforcement (13,300 pounds at 12.8 cents a pound).

## EVENTS TRANSPIRING AFTER CHANGE IN PLANS

Although the relocation contract between the Corps and the State specifically required that any changes in design or specifications were to be approved by both the Corps and the Bureau, in practice the requirement for Bureau approval was not always adhered to. According to Corps officials at Walla Walla, the Corps did not seek advance Bureau approval because it considered it to be the State's responsibility to obtain such approval. The Corps' view in this regard is consistent with the 1959 memorandum of understanding which states that the responsibility for the prompt preparation and transmission of the necessary Federal-aid documents rests with the State.

Our review of the State records indicated that the earliest written notification to the Bureau of this change was on October 18, 1962, several days after the footings for pier 3 had been poured at the new elevation. The Bureau, however, in commenting on our draft report, advised us that this notification had been retained inadvertently in the State's file and that the earliest notification the Bureau received was a verbal one given about 1-1/2 months after the footings had been poured.

Although the Bureau was not advised of the proposed change prior to its accomplishment, it nevertheless gave some consideration to the matter, as evidenced by a reference to the change in a November 27, 1962, project inspection report by the Bureau's division bridge engineer. The report briefly describes the events leading to the change and the reasons therefor--the suitability of the sand and gravel to support the footings and the belief that scour would not be a problem at the higher elevation--but the report indicates neither the Bureau's concurrence nor its objection to the change.

The Bureau division engineer advised us, with respect to the change, that:

"Information obtained from the State to the effect that the material was adequate for bearing and that there was no fear of scour was the basis of the Bureau's approval or acquiescence. At the time we understood that the change had been discussed and agreed upon between the State and the Corps, and we therefore felt the matter had been thoroughly studied and considered. (Underscoring supplied.) Factors that influenced us were that it was rather late to refuse to approve the change, and also the piers would be standing in a reservoir pool within 2 or 3 years. During the 3-year period prior to full pool there was little likelihood of a 200-500 year flood, which would exceed any of record, and which would be of particularly high velocity because of low stage of Columbia River, thus inviting scour. No velocity and no scour would exist at full pool."

The Bureau also advised us that:

"A completely effective evaluation could not be made after the change was made since the material in question could not be inspected. However, if time had permitted, it is conceivable that an evaluation could have been made in the manner of the three separate investigations made after the collapse. A determination or finding of any evaluation made prior to the loss and without benefit of hindsight may have been difficult and subject to considerable argument. The only evaluation made was a consideration of the information furnished by the State Highway Department." (Underscoring supplied.)

It is therefore apparent that the Bureau, to a large degree, relied on what it believed to be a thorough study of the matter by the State and Corps. No responsible Corps engineer, however, even visited the jobsite to inspect the situation, and the subsequent discussion of the matter by a Corps official indicates that the Corps was inclined to consent to whatever the State saw fit to do

if the revision did not result in a major change in cost responsibility. In this regard, Corps of Engineers' records prepared after the bridge collapsed, with reference to the Corps' review responsibility, state that:

"During discussions with the State of Oregon State Highway Engineer, [regarding the State-Corps relocation contracts] his design construction staff, and representatives of the Bureau of Public Roads all firmly stated that responsibility for adequacy of relocated highway facilities would be in the State highway organization subject to review by the Bureau of Public Roads. It was mutually agreed that the key item for contract agreement was the amount of money the Corps of Engineers would pay as part of the John Day Project. \*\*\* [the] engineering adequacy of the structure would be the responsibility of the State [subject to the Bureau's review] and that review by the Corps was essentially with reference to its financial responsibility." (Underscoring supplied.)

It should be noted that the Bureau's reliance on the Corps was not limited to the plan change in question but apparently existed also at the plans, specifications, and estimates review stage. A memorandum prepared by the Bureau division bridge engineer on November 14, 1961, states that:

"Although the design plans have only been partially reviewed by this Office, the State has checked this design within their own department (not always true), and in addition the plans have been reviewed and approved by the Corps of Engineers. The plans are recommended for approval as submitted."

REPORTS ON ENGINEERING STUDIES  
MADE AFTER COLLAPSE OF BRIDGE

After the collapse of the John Day River Bridge on December 22, 1964, three engineering studies were undertaken to investigate the failure of the structure. One study was made by the Bureau's Chief of the central office Bridge Division, the second by the State's Assistant Bridge Engineer, and the third by a consultant engineer who conducted an independent evaluation at the request of the Governor of Oregon. These reports deal primarily with the causes of the collapse and with the engineering decisions which led to the change in the design for the pier 3 footings.

With respect to the design and engineering decisions, two reports indicate that certain calculated risks were apparently taken in the original design of the bridge piers because they were eventually to stand in reservoir pool. These risks were apparently compensated, however, by the design criteria which called for all pier footings being founded on solid bedrock or pilings driven to bedrock. According to the Bureau's evaluation:

"It is also evident that in arriving at the decision to raise the elevation of the pier footing above the bedrock the engineers were influenced to a large extent by the fact that this bridge was being built to span a part of the reservoir pool of the John Day Dam, then under construction. It was anticipated that the dam would be completed within a period of a few years and once the waters behind the dam were impounded to about normal pool stage, future floods in the John Day River would not cause flows through the bridge having scouring velocities at the piers.

"The one thing not appreciated at the time was the vulnerable position of Pier 3 in the river channel. This pier is skewed sharply to the natural channel so that it forms a formidable obstruction to incite scour at even moderate flood stages. Also, it should be mentioned that since the

bridge piers were designed to stand in a reservoir pool their hydraulic properties were poor. The designers had placed dependence for the stability of the structure during those periods of flood occurring prior to the establishment of the John Day Dam pool upon pier foundations in solid bedrock or piling driven to bedrock. Pier 3 was the only pier not so constructed."

The independent consultant dealt extensively with the scour problem in his report. He pointed out that the State's standard specifications recognized the scour problem and required that footings be at least 6 feet below permanent streambed. He stated that the State engineers apparently believed that the higher elevation at which the pier 3 footings were poured, was more than 6 feet below the permanent streambed.

He pointed out, however, that the streambed elevation data used by these engineers related to the time of construction (1962), and he stated that the Corps of Engineers' soundings and drawings and the State's design drawings--all prepared some years before construction--indicated a much lower streambed elevation, with the difference being caused by interim deposits of material on top of the streambed. In conclusion he stated:

"The Bridge Construction Engineer, in his memorandum of December 7, 1962, stated that the excavations for the footings of Pier 3 were 11 to 14 feet below the river bed. Comparing the final bottom of footing elevations with the soundings taken in 1957 and shown on the Corps of Engineers' Drawings D-7, the following is obtained:

	<u>Upstream</u>	<u>Downstream</u>
Bottom of Footing - Elevation	143.3	144.2
Lowest Streambed - Elevation	<u>146.0</u>	<u>144.7</u>
Depth below Streambed (in feet)	2.7	0.5

"Obviously, both footings were located at elevations which were extremely vulnerable to scour. The decision to locate the bottoms of footings of Pier 3 at the elevations chosen appears to have been based on an evaluation of the bearing value of the streambed material to sustain the design loads without recognizing the probability and effect of scour. The apparent conformity with the specification requirement of being at least six feet below streambed was evidently based on the streambed existing during construction.

\* \* \* \* \*

"The construction records provide ample evidence that scour occurred during the construction period, particularly around the downstream footing of Pier 3.

"Soundings in the river and the alignment of the river indicate that the locations and elevations of Pier 3 footings left them extremely vulnerable to scour.

"The abnormal surface runoff prior to the bridge collapse caused an unprecedented flow of water in the John Day River, increasing the velocity of flow in the regular channel and creating velocities at the bridge piers much higher than in the regular channel. Scour took place at the footings of Pier 3, eventually undermining them, thereby starting a sequence of events which led to the collapse of the pier and the two adjoining superstructure spans."

The State's evaluation also commented extensively on the scour problem and concluded also that, had the original design been followed, the pier would not have failed. The State report concluded that "revision of the footing elevation proved to be a costly error of judgment," that the error "was a failure of the engineers to adequately consider the effects of the forces of nature which eroded the streambed," but that "it is not conceivable that the engineering personnel could have been expected to predict such a



severe erosion condition during the time after completion of the project and before the John Day Pool was filled."

- - - -

We believe that a major factor in the Bureau's reliance on the Corps in this situation was that the division office did not sufficiently recognize that the 1959 memorandum of understanding did not delegate to the Corps any of the Bureau's basic review and approval responsibilities. As previously indicated, the memorandum is not clear as to the nature and purpose of the Corps' responsibilities with respect to these activities. As a result, effective working arrangements which would have permitted a more thorough Bureau review of the change were not followed.

So that future misunderstandings concerning agency responsibilities in reservoir highway relocation projects in which Federal-aid highway funds are involved may be avoided, we proposed that the Federal Highway Administrator and the Chief of Engineers revise their memorandum of understanding to more clearly define the respective responsibilities and limitations therein of each agency and that the memorandum be brought to the attention of responsible field officials of both agencies along with such interpretive instructions as are necessary to highlight the significance of the changes.

## AGENCY AND STATE COMMENTS

The Corps, in commenting on our draft report, concurred in our proposal and agreed to implement the necessary action to carry it out upon receipt of our official report. (See app. IV.)

The Bureau also concurred in our proposal. (See app. V.) The Bureau presented the view, however, that our proposal would not necessarily preclude breakdowns in communications of the type discussed in this report by pointing out that the contract between the Corps and the State provided that changes in approved plans were to be made by written agreement between the Corps and the State subject to approval by the Bureau.

While we agree that our proposal will not necessarily preclude all breakdowns in communications of the type discussed in this report, we believe that a revised memorandum of understanding, clearly defining the responsibilities and limitations of each agency and brought to the attention of responsible field officials with interpretive instructions specifically pointing out the significance of the changes, should have the effect of significantly mitigating the possibility of this type of communications breakdown from happening again.

The State of Oregon commented (see app. VI) that our draft report was factual as far as it went, but the State emphasized the fact that the pier withstood the high water of 1962-63 and 1963-64 and that the intensity of the December 1964 storm and flood and the magnitude of the resulting highway and bridge damage should be described.

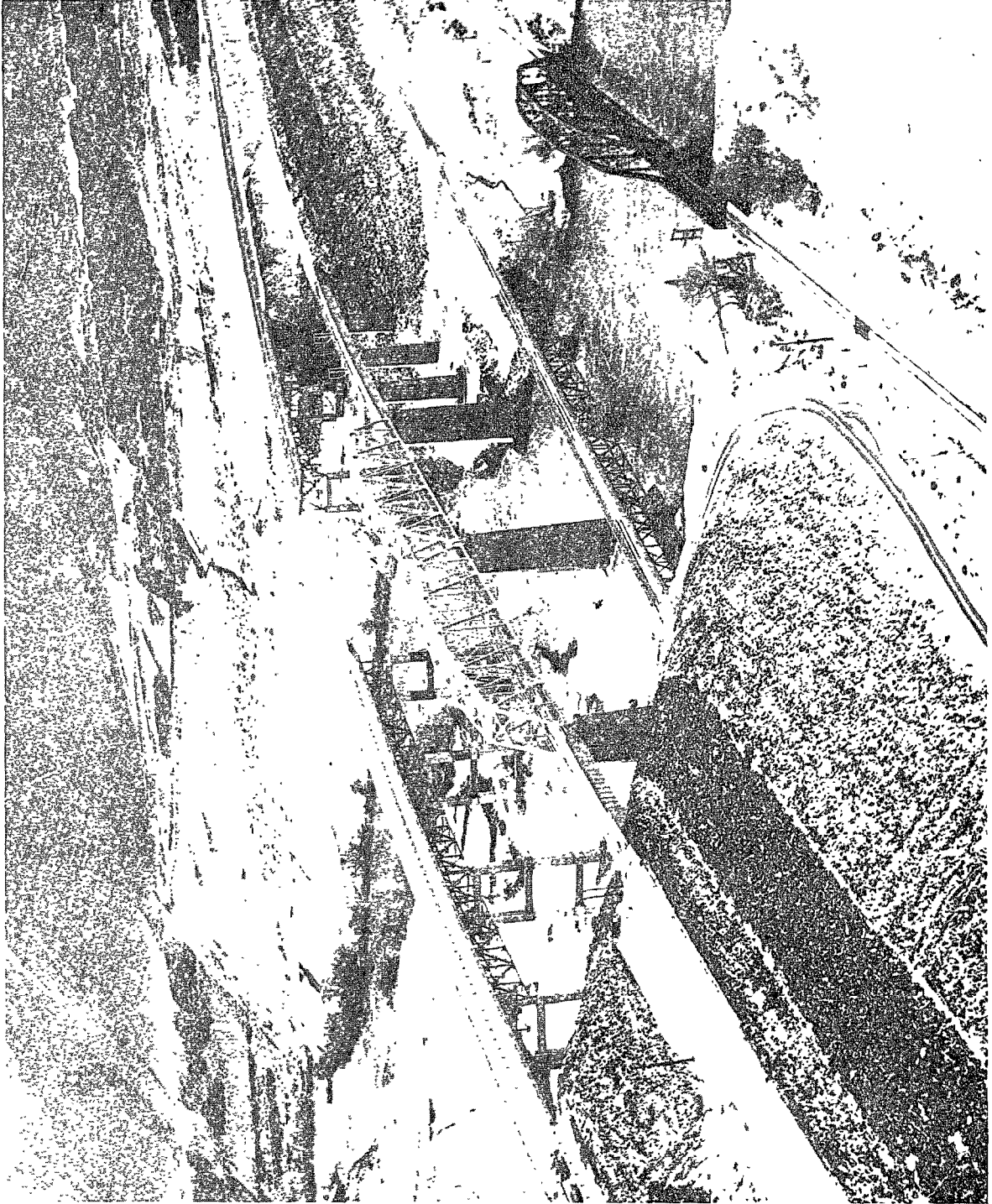
With regard to the extreme flooding conditions, we noted that three other bridges that were located parallel and in proximity to the John Day Bridge and were in place before the flood (see

photograph taken on November 25, 1964, p. 22) did not suffer extensive damage as a result of the flooding conditions of December 22, 1964 (see photograph taken on December 23, 1964, p. 23) and that, of these bridges, only the John Day Bridge, which was not built to original approved specifications, suffered extensive damage.

On the basis of this experience and of the conclusions reached in the engineering studies undertaken to investigate the failure of the structure, it seems reasonable to conclude that, had the John Day Bridge been built to the original specifications, it would not have collapsed even in the extreme flooding conditions of December 22, 1964.



PHOTOGRAPH OF JOHN DAY BRIDGE BEFORE  
COLLAPSE--TAKEN ON NOVEMBER 25, 1964



PHOTOGRAPH OF JOHN DAY BRIDGE AFTER  
COLLAPSE-- TAKEN ON DECEMBER 23, 1964

APPENDIXES

U. S. DEPARTMENT OF COMMERCE  
BUREAU OF PUBLIC ROADS  
WASHINGTON 25, D. C.

APPENDIX I  
Page 1

IN YOUR REPLY PLEASE  
REFER TO FILE NO. 26-01

June 9, 1959

Major General E. C. Itschner, U.S.A.  
Chief of Engineers  
Department of the Army  
Washington 25, D. C.

Dear General Itschner:

As you know, representatives of this Bureau and your office have discussed several questions relative to the procedures necessary for the participation of Federal-aid highway funds in the cost of betterments included in the construction of roads being replaced due to reservoir development by the Corps of Engineers.

Under title 23 of U.S.C. and the regulations of the Secretary of Commerce having the effect of law, certain basic requirements must be observed to permit our making Federal aid available. The purpose of this letter is to request your concurrence in the understandings and conclusions set forth hereinbelow.

1. Right-of-way acquisition. Federal-aid participation in the acquisition of rights-of-way by or in behalf of a State is restricted to the cost of rights-of-way actually acquired and dedicated for highway purposes subsequent to the Bureau authorization to proceed with right-of-way acquisition for the project for which such costs are incurred. Such costs may include costs incurred and paid pursuant to State law for damages to property resulting from the taking of rights-of-way or construction of highways, provided the State has submitted, and the Administrator finds acceptable, information as to the regulations, procedures and manner in which right-of-way matters are handled by or for the State. Where the right-of-way for a highway project is acquired by the Corps of Engineers, the Bureau will not require the State to furnish information as to the regulations, procedures and manner in which right-of-way matters are handled.

Attention is called to the fact that under the Federal highway legislation and regulations, Federal-aid highway funds may not be expended for reimbursement for the cost of certain items, payment of which is authorized by the land acquisition policy of the Corps of

Engineers. Payment by the State to the Corps of Engineers for the costs incurred in providing rights-of-way for the betterment may be computed on a percentage basis as agreed upon by the Corps of Engineers and the State. The eligibility of costs reimbursable to the State under the Federal-aid highway program will be governed by paragraph 5 of enclosed Policy and Procedure Memorandum 21-4.1, under which such costs, to be eligible for Federal-aid reimbursement, must be supported by appraisal data for each parcel of land including severance damage, if any. Copies of this Policy and Procedure Memorandum may be obtained by your field offices from any regional or division office of the Bureau of Public Roads.

Rights-of-way acquired by the Corps of Engineers for a highway project will be transferred to the State subsequent to completion of the highway project.

2. Preliminary engineering. In view of the complex division of responsibility between the Corps of Engineers and the highway agencies in necessary road relocations and betterments, it is desirable that the plans, specifications, and estimates for both replacements in kind and betterments be prepared by one agency.

Where a State requests that the replacement and betterment work be done by the Corps of Engineers, reimbursement from Federal-aid funds in the appropriate pro rata amount can be made to the State for such services as the State is thereby obligated for, provided the amount can be substantiated as a fair and reasonable charge. The Bureau cannot reimburse the State for any items on which an obligation was incurred prior to Bureau authorization and it is essential that preliminary engineering be programmed and authorized prior to such obligation.

It has been agreed in conference with representatives of your office that State-Corps of Engineers agreements on future relocations will be prepared and worded to indicate clearly the effective date on which the State would assume obligation for any work, including preliminary engineering to be performed by the Corps of Engineers. It was further agreed that the sum of engineering charges, for both preliminary and construction engineering, will not exceed 10 percent of the estimated construction cost and such charges may be on a lump-sum basis by agreement between the Corps of Engineers and the State, provided a showing is made that the charge is fair and reasonable.

3. Public hearings. The Federal Statute (23 U.S.C. 128) provides as follows respecting public hearings:

(a) Any State highway department which submits plans for a Federal-aid highway project involving the bypassing of, or going through, any city, town, or



village, either incorporated or unincorporated, shall certify to the Secretary that it has had public hearings, or has afforded the opportunity for such hearings, and has considered the economic effects of such a location. Any State highway department which submits plans for an Interstate System project shall certify to the Secretary that it has had public hearings at a convenient location, or has afforded the opportunity for such hearings, for the purpose of enabling persons in rural areas through or contiguous to whose property the highway will pass to express any objections they may have to the proposed location of such highway.

(b) When hearings have been held under subsection (a), the State highway department shall submit a copy of the transcript of said hearings to the Secretary, together with the certification.

The responsibility for the holding of public hearings pursuant to such statute rests upon the State. The State must furnish the transcript of the hearing with its certification to the division engineer of Public Roads before the latter may approve the plans, specifications, and estimates, and authorize the advertisement for bids, as indicated below. It is necessary that these public hearing requirements be observed in connection with any highway improvements financed with participation of Federal-aid funds.

4. Type of estimate required. The estimate required is developed from the estimated quantities of the approved plans and estimated unit costs prevailing in the particular area of the project for the various categories of work. It will be necessary to provide a breakdown of cost as between relocation costs borne entirely by the Corps of Engineers and betterments respecting which Federal aid is to be provided.

5. Approval of plans, specifications, and estimates. Under section 106 of title 23 U.S.C., the State highway department is required to submit to the Secretary of Commerce (i.e., Public Roads) for his approval such surveys, plans, specifications, and estimates for each proposed project as the Secretary may require. The regulations and procedures require that plans, specifications, and estimates for every project be submitted to our division engineer for review and approval.

6. Advertisement for bids and award of contracts. The advertisement for bids and the award of contracts for construction shall be subject to the concurrence of the State highway department and the Bureau's division engineer.

7. Construction supervision. The construction work on any Federal-aid highway project (excepting certain secondary system projects) shall be subject to the inspection and approval of the Bureau's division engineer and shall be performed under the direct supervision of the State highway department and in accordance with State and applicable Federal laws. Such direct State supervision will be exercised through the contracting officer of the Corps of Engineers in those cases where it is so provided in an agreement between the State and the Corps of Engineers.

8. Amount of work contractor is required to perform. To comply with Federal-aid requirements, the Corps of Engineers will include a provision in its advertised specifications that the prime contractor shall perform with his own organization work amounting to not less than 50 percent of the combined value of all items of work covered by the contract, and that work which will require highly specialized knowledge, craftsmanship, or equipment not ordinarily available in contracting organizations qualified to bid on the project will be designated in the advertised specifications as "Specialty Items" and may be sublet without regard to such 50-percent limitation.

The Bureau is making an effort to revise the regulations to permit exceptions to this requirement in specific cases where a conflicting policy of another Government agency poses a problem.

9. Certificate of materials. Under Federal-aid procedures, the State is required to certify that all of the materials used on the project meet pertinent specification requirements of the contract. The requirements of Public Roads will be met if the State's certificate is based on a corresponding certificate from the Corps of Engineers. All test reports covering materials used in the project should be available for examination by Public Roads if desired.

10. Contract provisions. It is recognized that the Corps of Engineers will use Standard Form 23-A, General Provisions, in its construction contract documents.

The State is required to furnish to Public Roads a sworn statement by the successful bidder certifying that the bidder has not taken any action in restraint of free competitive bidding in connection with a Federal-aid highway contract. It is understood that the Corps of Engineers will incorporate this requirement in its construction contract documents.

Except for projects involving financing with Federal-aid Interstate funds, it is essential that the minimum wage rates predetermined by the State highway department be not less than those

determined by the Secretary of Labor pursuant to the Davis-Bacon Act. Approval by the State of the Corps of Engineers construction contract documents, in which the rates determined by the Secretary of Labor are incorporated, will be sufficient evidence of conformity with the above requirement. On Interstate projects, wage rate determinations are required to be made by the Secretary of Labor after consultation with the State highway department pursuant to 23 U. S. C. 113. Accordingly, it is understood that the Corps of Engineers in applying for wage rate determinations for such projects in accordance with established Corps of Engineers procedures will include reference to 23 U. S. C. 113.

In addition, it is understood that the Corps of Engineers will include in its contract documents for highway construction projects a requirement that the contractor will: (a) submit to the Bureau of Public Roads each calendar quarter a statement, on Form PR 110, showing employment data separately with respect to each of four prescribed labor classifications, and (b) maintain a record of the total man-hours and costs of labor and the total cost and quantities of certain specified materials and supplies and, upon completion of the contract, submit such record to Public Roads on Form PR 47. The required forms will be supplied by the Bureau of Public Roads.

11. Changes during construction. The Corps of Engineers will notify the State of proposed change orders as soon as the need for the change becomes apparent. It may be expected that the State and the Bureau's division engineer will promptly notify the Corps of Engineers of their approval or disapproval.

12. Length of time required to obtain Public Roads approval. The decentralized operations of Public Roads, under which division engineers are vested with broad powers to review and approve plans, specifications, estimates, and proposed contract awards and to exercise other powers, assure prompt consideration of all matters subject to Public Roads action.

Responsibility for prompt preparation and transmission of the necessary Federal-aid documents rests in the State Highway Department.

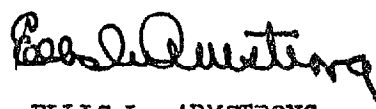
Conclusions. It is believed that the various requirements as outlined above, with the noted changes in procedure as agreed to in conference will permit the construction of the highways to proceed in an economical and efficient manner without jeopardizing the availability of Federal aid to the State therefor.

There may be instances on future construction where the Federal-aid work can be separately delineated and covered by separate specifications and contracts that include the usual Federal-aid requirements. This would greatly simplify procedures and we suggest that it be done whenever practicable.

Upon your concurrence in this letter, copies thereof will be distributed to our field offices and the States. It is understood that your office will likewise so inform your field offices.

The details with reference to the foregoing may be worked out in the field by our division engineer and your representative.

Sincerely yours,



ELLIS L. ARMSTRONG  
Commissioner of Public Roads

Enclosure



HEADQUARTERS  
DEPARTMENT OF THE ARMY  
OFFICE OF THE CHIEF OF ENGINEERS  
WASHINGTON 25, D. C.

IN REPLY REFER TO  
ENGWO

JUN 15 1959

Honorable Ellis L. Armstrong  
Commissioner of Public Roads  
Department of Commerce  
Washington 25, D. C.


Dear Mr. Armstrong:

Reference is made to your letter of 9 June 1959, file 26-01, in which you request my concurrence in the understandings and conclusions reached in conference between your and my representatives in problems concerning participation of Federal-aid highway funds in the cost of betterments included in the construction of roads being replaced due to reservoir development by the Corps of Engineers.

I concur in the understandings and conclusions set forth in your letter and propose to forward copies of the letter, with implementing instructions, to the various District and Division Engineers in order that they will be informed of the problems involved. I will also furnish you a copy of these instructions when they are issued.

I have been informed of the high degree of cooperation extended by you and the other members of your organization to my representatives and wish to express my personal thanks for your consideration. I am sure that should other problems arise, the recent conferences have formed a basis for their resolution by providing a mutual understanding of the policies and the magnitude of the programs of the Bureau of Public Roads and Corps of Engineers.

Sincerely yours,

  
E. C. ITSCHNER  
Major General, USA  
Chief of Engineers

## DEPARTMENT OF COMMERCE OFFICIALS

## RESPONSIBLE FOR

## ADMINISTRATION OF ACTIVITIES

## DISCUSSED IN THIS REPORT

	<u>Tenure of office</u>	
	<u>From</u>	<u>To</u>
SECRETARY OF COMMERCE:		
John T. Connor	Jan. 1965	Present
Luther H. Hodges	Jan. 1961	Jan. 1965
Frederick H. Mueller	Aug. 1959	Jan. 1961
Lewis Strauss	Nov. 1958	June 1959
FEDERAL HIGHWAY ADMINISTRATOR:		
Rex M. Whitton	Feb. 1961	Present
Bertram D. Tallamy	Feb. 1957	Jan. 1961
DEPUTY FEDERAL HIGHWAY ADMINISTRATOR:		
(Position vacant)	Oct. 1966	Present
T. Lawrence Jones	Sept. 1964	Oct. 1966
Lowell K. Bridwell (acting)	Jan. 1964	July 1964
D. Grant Mickle	Nov. 1961	Dec. 1963
COMMISSIONER OF PUBLIC ROADS (note a):		
Ellis L. Armstrong	Oct. 1958	Jan. 1961

<sup>a</sup>Position abolished in 1961.

DEPARTMENT OF DEFENSE OFFICIALS  
RESPONSIBLE FOR  
ADMINISTRATION OF ACTIVITIES  
DISCUSSED IN THIS REPORT

	<u>Tenure of office</u>	
	<u>From</u>	<u>To</u>
SECRETARY OF DEFENSE:		
Robert S. McNamara	Jan. 1961	Present
Thomas S. Gates, Jr.	Dec. 1959	Jan. 1961
Neil H. McElroy	Oct. 1957	Dec. 1959
SECRETARY OF THE ARMY:		
Stanley R. Resor	July 1965	Present
Stephen Ailes	Jan. 1964	July 1965
Cyrus R. Vance	July 1962	Jan. 1964
Elvis J. Stahr, Jr.	Jan. 1961	June 1962
Wilber M. Brucker	July 1955	Jan. 1961
CHIEF OF ENGINEERS:		
Lt. Gen. William F. Cassidy	July 1965	Present
Lt. Gen. W. K. Wilson, Jr.	May 1961	June 1965
Lt. Gen. E. C. Itschner	Oct. 1956	May 1961



DEPARTMENT OF THE ARMY  
WASHINGTON, D.C. 20310

APPENDIX IV

SEP 2 1966

Mr. J. T. Hall, Jr.  
Assistant Director  
Civil Accounting and Auditing Division  
United States General Accounting Office  
Washington, D. C. 20548

Dear Mr. Hall:

Representatives of the Corps of Engineers in the Office of the Chief of Engineers have carefully reviewed the draft of the report to the Congress of the United States on the collapse of the John Day River Bridge. The information is factual and agrees with information furnished the Chief of Engineers immediately following the collapse of the bridge.

I concur with the recommendation to the Federal Highway Administrator and Chief of Engineers contained on pages 19 and 20 of the draft report. Upon receipt of the official report, I will implement the necessary action to follow out the recommendation.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Alfred B. Fitt", with a horizontal line extending to the right.

Alfred B. Fitt  
Special Assistant (Civil Functions)





U.S. DEPARTMENT OF COMMERCE  
BUREAU OF PUBLIC ROADS  
WASHINGTON, D.C. 20235

SEP 2 1966

IN REPLY REFER TO:  
31-10

Mr. E. W. Stepnick  
Assistant Director  
Civil Accounting and Auditing  
Division  
U. S. General Accounting Office  
Washington, D. C.

Dear Mr. Stepnick:

I am transmitting herewith our comments on your draft report titled, "Review of Circumstances Relating to the Collapse of the John Day River Bridge on Interstate Route 80N in the State of Oregon."

I appreciate the opportunity afforded the Bureau to review the report.

Sincerely yours,

A handwritten signature in cursive script, appearing to read "Rex M. Whitton".

Rex M. Whitton  
Federal Highway Administrator

Enclosure

GENERAL ACCOUNTING OFFICE DRAFT REPORT TO THE CONGRESS

TITLED, "REVIEW OF CIRCUMSTANCES RELATING TO

THE COLLAPSE OF THE JOHN DAY

RIVER BRIDGE ON INTERSTATE ROUTE 80N IN

THE STATE OF OREGON"

U. S. DEPARTMENT OF COMMERCE  
BUREAU OF PUBLIC ROADS  
OFFICE OF AUDITS AND INVESTIGATIONS

AUGUST 1966

BACKGROUND, OBSERVATIONS, AND RECOMMENDATION (pp. 4-20)

Pages 19 and 20 contain the following recommendation to the Federal Highway Administrator and the Chief of Engineers:

"To avoid future misunderstandings concerning agency responsibilities in reservoir highway relocation projects in which Federal-aid highway funds are involved, we recommend that the Federal Highway Administrator and the Chief of Engineers revise their memorandum of understanding to more clearly define the respective responsibilities, and limitations therein, of each agency, and that the memorandum be brought to the attention of responsible field officials of both agencies along with such interpretive instructions as are necessary to highlight the significance of the changes."

We concur with this recommendation but it should be recognized that these actions will not necessarily preclude breakdowns in communications of the type discussed in this draft report. As acknowledged on report page 10, the relocation contract between the Corps of Engineers and the State provided that the changes and alterations in approved plans and specifications were to be made by written agreement between the Corps and the State subject to approval by the Bureau of Public Roads.

\* \* \* \* \*

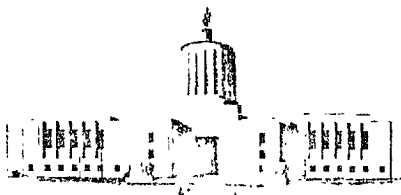
[See GAO note.]

In transmitting this draft report to us for review and comment, GAO requested that we obtain comments from the Oregon State Highway Department. We are furnishing their comments separately to GAO and are requesting that appropriate recognition be given to them in the GAO final report.

GAO note: Comments pertaining to draft report material have been omitted as they are no longer applicable to the final report.

FORM E-123

COMMISSIONERS  
GLENN L. JACKSON, CHAIRMAN  
MEDFORD  
KENNETH N. FRIDLEY, MEMBER  
WASCO  
DAVID B. SIMPSON, MEMBER  
PORTLAND



STATE OF OREGON  
STATE HIGHWAY DEPARTMENT  
SALEM 97310

August 9, 1966

Mr. A. W. Parsons, Division Engineer  
Bureau of Public Roads  
477 Cottage Street, N. E.  
Salem, Oregon

Dear Mr. Parsons:

Reference is made to your letter of August 5 containing a draft report entitled "Review of Circumstances Relating to the Collapse of the John Day River Bridge on Interstate 80N in the State of Oregon", and your request for comments on this draft. We have not been advised as to the purpose of this review and without this knowledge, it is somewhat difficult to objectively comment on the contents thereof.

To the extent that the purpose of this report is to determine engineering responsibility in connection with the construction of this bridge between two federal agencies, this office has no comment. Also, to the extent of any inference that may be created by the report that officials of the State Highway Department did not keep fully advised both the Corps of Engineers and the Bureau of Public Roads as to all details of adjustments in plans or that the State did not comply with the provisions of its agreements as to the design and construction of the bridge, we would certainly object. Otherwise, I believe the report to be factual as far as it goes but is deficient in some aspects if the complete story or situation is intended to be conveyed. This would be particularly true if the seeker of the information does not have intimate knowledge of the situation or does not have general knowledge of bridge construction procedures.

It was not pointed out that after being constructed this pier withstood the high water of 1962-63 and 1963-64. It was during the unprecedented flood of December 1964, that sufficient scour developed around the

Mr. A. W. Parsons  
August 9, 1966

footing of Pier 3 to cause the washout. So that an uninformed person may have a better understanding of the intensity of this storm, the following is an extract from a description published by the Portland District, Corps of Engineers, entitled "Flood of December 1964 - Projects and Project Effects":

"Meteorological conditions prior to 20 December 1964 created the potential for a major flood. Saturated, frozen ground was covered by a wet, heavy snowpack, even across the valley floors and down to ocean beach level. Then, on 20 and 21 December, a rapid weather change released that potential. Torrential rains, plus melting temperatures up to the 10,000-foot level, swept the snowpack from the valleys, hills, and mountains. Medford, Oregon, in a 9-day period, received about 9 inches of rainfall, which is equal to one-third of its average annual precipitation. Other representative areas received amounts ranging up to more than 25 inches at Crater Lake. Each of those amounts equalled one-fourth to one-third of the normal annual total.

"Little if any of the resulting runoff could be absorbed by the still-frozen ground. As a result, streams in northern California, along the Coast and Cascade Ranges in western Oregon, and even in normally arid eastern Oregon, experienced runoff rates which cannot be expected to be equalled more often than once in 50 to once in much more than 100 years, on an average. These were floods which apparently equalled or exceeded those of 1861, the previous maximum winter floods of historical record."

It was not pointed out in the draft report that this flood caused destruction and serious damage to many miles of highway and literally dozens of bridges, not only in Oregon but also in adjacent jurisdictions. The damage to the Oregon State Highway system was in excess of \$25 million and there was approximately \$6½ million additional damage to the county road systems.


Mr. A. W. Parsons  
August 9, 1966

No mention was made, although considerable information is available, on the difficulty of the subsequent contractor (who was engaged in repairing this structure) in removing the sand and gravel material. It was necessary to drill and shoot (blast with powder) every foot of this material to construct the footing to the predetermined elevation. While it was not possible to accurately measure the amount of scour that took place during the December 22 washout because of the water depth at the site of Pier 3, the depth of scour at this location was exceedingly small, probably a few inches.

It is, of course, easy to say after the washout occurred that had the footing been extended deeper, it would have withstood the flood. By the same token, we are convinced that had the flood of this intensity not occurred or if it had been delayed until the completion of the John Day Dam project, the bridge would likewise not have suffered this damage. It is very difficult to say at this time after observing the problems the second contractor had in removing this material that the personnel engaged in making the decision in 1962 did not use prudent judgment.

The draft also makes mention of the fatalities that resulted from this situation. The draft is correct in that there was one person on the bridge who lost his life. However, the two that were killed about 12 hours later drove through a well-barricaded section and these fatalities must be charged to improper vehicle operation.

Very truly yours,

  
Forrest Cooper  
State Highway Engineer