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July 14, 1995

TO: MTA BOARD MEMBERS AND ALTERNATES
FROM: FRANKLIN E. WHITE *FW*
SUBJECT: ATTACHED LETTERS

The attached letters raise troublesome issues relating to the sinkhole which occurred beneath Hollywood Boulevard last month. As you know, we have selected a forensic engineering firm, Wiss, Janney, Elstner Associates, Inc. to determine the cause of the sinkhole and whether the actions of anyone under contract, including the construction contractor, the construction manager and/or the design team, contributed to the cause of the incident.

As noted in the attached press release, the letters will be forwarded to Wiss, Janney for analysis, and until the firm has had time to review them and conduct its own analyses, it would be premature to comment on the issues raised. A thorough review must be concluded to assure us that we have the most stringent procedures in place to reduce the chances of a reoccurrence of such an incident and to sustain the trust of the citizens of Los Angeles in our construction program.



July 14, 1995

CONTACT: BILL HEARD/JIM SMART
MTA PRESS RELATIONS
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FOR IMMEDIATE RELEASE

MTA GETS LETTERS FROM RAIL DESIGNER AND
CONSTRUCTION MANAGER REGARDING HOLLYWOOD SINKHOLE

The MTA has received letters from the firms responsible for overall design and construction management of the twin tunnels under construction in Hollywood relating to the sinkhole which occurred June 22, 1995 in Hollywood.

"We announced earlier this week that we had hired the firm of Wiss, Janney, and Elstner, Associates, Inc. to determine the cause or causes of the sinkhole," said Franklin E. White, MTA CEO. "We are, therefore, turning over both of these letters to the firm. At this time, we plan to await their analysis of the statements in the two letters, as well as their independent evaluation, before taking any actions."

Parsons-Dillingham, the firm responsible for construction management, said in a letter to the MTA that the design submitted for re-mining beneath the boulevard was based on incorrect calculations, and that Engineering Management Consultant (EMC), the firm responsible for the overall design of the subway project, approved those designs.

more...

Letters

A letter from EMC stated that the procedures approved had been used successfully elsewhere in the re-mining process and that no concerns had been expressed by either the contractor or Parsons Dillingham staff, and that no modifications had been requested to the design.

The MTA on July 13 terminated Shea/Kiewit/Kenny, the Vermont/Hollywood tunneling contractor, noting that the Authority had lost confidence in the contractor's ability to complete the tunneling process within specifications. Parsons-Dillingham is the firm responsible for inspecting the work done by all contractors involved in the construction of the tunnels, and the EMC is responsible for development of all engineering plans and specifications for the construction program.

"At this time we cannot determine whether the issues raised in either letter can be substantiated," White said.

"We are, however, dismayed at the finger pointing, when what we need most from our consultants is for them to take responsibility and be accountable for their own actions," he added. "And, we intend to make them accountable."

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PARSONS-DILLINGHAM

METRO RAIL CONSTRUCTION MANAGER

REF: Contract No. 3369
R81/R82-CM-RC-3460
SQ020.2, CM300

July 13, 1995

Mr. John J. Adams
Acting Executive Officer
MTA Construction
Los Angeles County Metropolitan Transportation Authority
818 West Seventh Street, 5th Floor
Los Angeles, CA 90017-4606

Subject: **Hollywood Boulevard Water Main Break and Sinkhole**

Dear Mr. Adams:

In addition to the chronology of events surrounding the water main break and sinkhole at Hollywood Boulevard, provided to you in separate correspondence, we have further reviewed the activities of the Contractor, Engineer, and our inspection staff to provide a greater insight into this matter. The remaining work was being performed by the B251 Contractor (SKK) in accordance with procedures it had developed and which were reviewed and approved by the Engineer (EMC). The remaining work was to correct alignment in a 80 L.F. portion of the south (AL) tunnel. The inspectors verified that the work was being performed in accordance with the Engineer-approved submittal modified during construction by the Contractor as needed to suit field conditions. Contract and specification procedural requirements were satisfied by the Contractor's submittal of its procedures, approvals by the Engineer and performance of work verified by inspections.

Although the technical review of the Contractor's submittal to the Engineer is outside our scope of work, as part of our investigation of the sinkhole we have taken it upon ourselves to review the Contractor's design and calculations which were submitted to the Engineer. This review has raised certain concerns regarding the adequacy of the Contractor's submittal and the Engineer's approval. These concerns include the following:

The Contractor and its outside engineer provided a plan for remaining, which included calculations of the anticipated structural loads, and submitted it for the Engineer's approval. Review of the documents indicate that the Contractor's calculations for temporary support required a minimum of 4878 psi bearing capacity for the Puente material or concrete on which the temporary tunnel support was founded. The value of 5000 psi bearing capacity (360 tons/sf) which the Contractor used in its calculation is usually reserved for competent, intact, non-fractured, and



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confined bedrock and did not allow for a normal factor of safety. Although we have not performed any soils engineering analysis of the earth at the remaining site, we believe the ground would not be able to support the calculated or actual loads required of it.

Further, the Contractor's calculations do not appear to adequately address the stress release that occurred in the temporary precast lining caused by (1) its cutting and removal and (2) the transfer of load across the remaining expansion joint and into the temporary steel rib and wood lagging system for the enlarged tunnel.

These issues may not have been significant in previous areas of remined tunnel where water laden ground was not encountered, but they may have contributed to the structural failure when wet ground was encountered during remining, which resulted in loads on the structural support system greater than the ground was able to support. While we still believe that water-saturated earth was the primary cause of the sinkhole, these additional issues should be considered in your review of this matter.

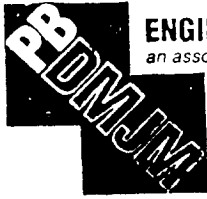
Sincerely,



George B. Morschauser
Construction Manager

GBM:sr

cc: J. Drew - MTA
R. Judson - The Parsons Corporation
C. Stark - MTA
Doc Control



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July 13, 1995

Mr. John J. Adams
Executive Officer, Construction
Metro Red Line
Metropolitan Transportation Authority
818 W. 7th Street
Los Angeles, CA 90014

Re: Water Main Break - Hollywood Blvd.

File No: R81/B251/DE461

Dear Mr. Adams:

In a meeting on July 7, 1995 with the Construction Manager (Parsons-Dillingham) and with the members of the MTA staff, issues concerning the acceptance of Contractor's submittals for re-mining operations were raised. The following is the response to answer the issues discussed:

EMC recommended acceptance of the Contractor's submittal on the basis of project experience, existing geotechnical conditions, and engineering and construction standards. The accepted submittal consisted of fabrication drawings; details for the selected steel rib, foot plate, and dutchman sections; the geometry of section of tunnel that was to be re-mined; calculation of ground loads; design of the concrete wall beam; schematic representation of the three major steps in the construction sequence; design of the timber lagging; and a narrative of the construction sequence.

Re-mining was taking place in the Puente Formation which is characterized as excellent ground conditions for mining as it possesses relatively high strength and good stand up time (days to weeks). After calculating the full overburden condition, the Contractor's engineer wrote that "therefore soil or concrete must have allowable bearing of approximately 5000 psi." Obviously, no soil or the Puente Formation could support this pressure; concrete can of course develop this strength and would have to be utilized to spread the load over a greater area of Puente to accommodate the strength. This calculated loading was not experienced in the previous 20,000 ft of tunneling in this formation under this contract.



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The re-mining operation was planned to benefit from the known good stand up time and arching of the Puente. Thus each ring could be cut (therefore unloaded), re-mined, and rebuilt with that ring subjected only to its own weight. The combination of good stand up time and arching could be counted upon to carry, for the duration of the re-mining, whatever ground load that ring had been carrying. Therefore, the calculated bearing capacity of 5000 psi was never required. When the rings are fully rebuilt, the loads would build back up but the load would once again be carried by the full, completed ring action. The net effect of this sequential construction is that stand up and arching combine to permit unloading of a the rings during re-mining; reloading of the rings occurs only after the reconstructed rings are ready to take the load. This concept of re-mining, taking advantage of the stand-up and arching characteristics of the soil, is the only practical means to accomplish reconstruction.

The experience of mining and re-mining in this formation along Vermont Avenue and portions of Hollywood Blvd. has confirmed the strength and behavioral characteristics of this formation and the applicability of these re-mining procedures. The Contractor's engineer, registered in California, considered such characteristics in his design of the temporary support for the re-mining. According to the contractor and the construction manager's inspectors, the Puente stood without any movement for days to weeks during the re-mining in other areas by the same contractor, and segments 82-100.

The sequential procedure was used to install anchors, cut segments, excavate ground and place intermediate supports and posts. This provided the Contractor and inspectors ample opportunity to observe ground conditions and take immediate measures to address changing conditions. No observations or any field modifications have been submitted for review or information to EMC. This indicates that the re-mining effort was routine in nature in all the areas except in the location where the contractor encountered saturated soil (a condition for which there was no approved design for re-mining).

It is the EMC's opinion that these procedures, calculations, and assumptions, prepared by the contractor for re-mining in dry Puente Formation are appropriate, especially considering that the ground was well mapped (and dry) during initial tunneling. The issue of re-mining was discussed in the field meetings because of the critical nature of the

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schedule but never was a concern expressed about difficult conditions or about unfavorable movements or large short term loading. The apparent condition that lead to the failure was the sudden, unexpected, massive inflow of soil and water creating voids behind the successfully remined area of the tunnel. This unanticipated flowing ground condition affected the stability of the partially erected rings and contributed to the collapse.

If we can be of further assistance, in this regard, please advise.

Sincerely,

PB/DMJM - EMC Team



K.N. Murthy
Director of Engineering and Projects

KNM:hs

cc: Charles Stark
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Martin Rubin
Milan Kadlec
DCC(2)
Chron