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An Evaluation of Highway Flood Damage Statistics

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Abstract

Hydraulic events result in thousands of incidents of property damage each year. The U.S. Army Corps of Engineers estimates that annual damage averages over \$2 billion (COE, 1991). Federal, state, and local agencies have set up emergency assistance programs to help pay these unusually heavy expenses. Despite the detail of the policies regulating such programs, a comprehensive database describing the causes and consequences of flood losses does not exist. In an effort to obtain clear and consistent statistics on highway related damage, the disaster files of the Federal Highway Administration's (FHWA) Emergency Relief (ER) Fund and the Federal Emergency Management Agency's (FEMA) Disaster Assistance Program (DAP) have been studied.

Introduction

The applicability of ER or DAP funds for hydraulic disasters is based on the extent and intensity of the event. Disasters warranting FHWA or FEMA assistance are sudden and unusually large, occurring over a very wide area. For example, in 1989 after May floods hit Texas, FEMA declared 87 of its 254 counties disaster areas and over \$11.5 million in ER and DAP funds was spent on the restoration of the highway system.

When a large disaster occurs, a formal proclamation asking for FHWA funds will be issued by the governor of the affected state. If the event is extremely severe,

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the governor may request a Presidential declaration. If the President authorizes the use of federal funds, both organizations will aid in the disaster clean-up. The DAP assists with temporary housing, food and water provisions, medical care, debris removal, and emergency repairs to keep essential off system facilities operating. ER funds are only allocated for the repair and reconstruction of roads and bridges on the Federal-Aid system. If a Presidential declaration is not made, the FHWA conducts a field investigation and eligibility for funding is determined by the FHWA Administrator upon review of the field report. The FEMA has no role in such cases.

Emergency Relief Fund Data

The ER records researched (DOT, 1991) contained files on over 300 disasters amounting to \$1.8 billion in repair and reconstruction costs. All FHWA funded natural disasters and catastrophic failures occurring between 1973 and 1990 were included in the study. After a careful analysis to determine the cause of each disaster, the records were placed into one of five disaster categories. Table 1 gives a brief explanation of each.

TABLE 1. DISASTER CATEGORIES

CATEGORY	EXPLANATION
COLLISIONS	BARGE AND VEHICLE COLLISION, PLANE CRASHES, TRAIN DERAILMENTS
HYDRAULICS	FLOOD AND HURRICANE EVENTS
STRUCTURAL	DAM AND STRUCTURAL FAILURES
OTHER EVENTS	EARTHQUAKES, FIRES, LANDSLIDES, TORNADOES, VOLCANOES
UNKNOWN	NO EXPLANATION IS STATED IN FILES

Disaster distributions are shown in figure 1. Hydraulic events account for over 75 percent of the disasters studied. Approximately \$1.1 billion has been obligated by the ER fund for these events. This makes up 63 percent of the total amount allocated by the ER program since 1973.

Figures 2 shows event cost. Approximately 14 hydraulic events of sufficient size to qualify for ER eligibility occur every year costing the FHWA an average of \$62 million in highway repair costs. Nearly 35 bridge

projects are initiated annually due to these events, and over \$17 million in FHWA funds is spent on the repair and reconstruction of bridges.

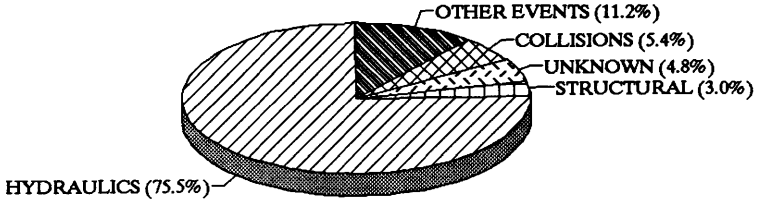


FIGURE 1. ER DISASTERS (1973-1990)

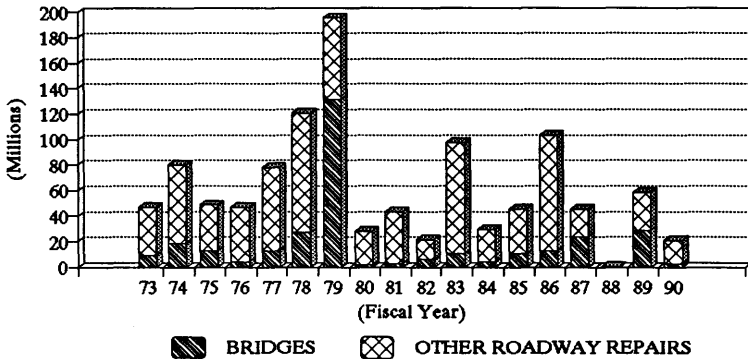


FIGURE 2. ER ANNUAL DISASTER COSTS

Figure 3 shows the relationship between the number of disasters funded by the ER program each year and the number of bridge projects initiated in those years. While the number of disasters has remained mostly

consistent, fluctuating between 10 and 30 events per year, the number of bridge projects has steadily decreased.

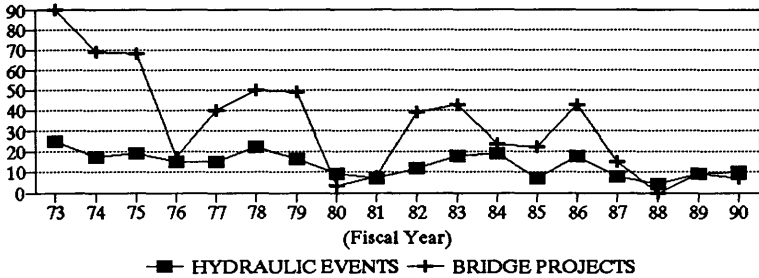


FIGURE 3. ER ANNUAL EVENTS AND PROJECTS

Disaster Assistance Program

The DAP files studied (FEMA, 1991) contained 201 Presidentially declared severe storm, flood, and hurricane disasters occurring between 1980 and 1990. During this time FEMA allocated nearly \$1.6 billion in emergency assistance. Disaster cost is shown in figure 4.

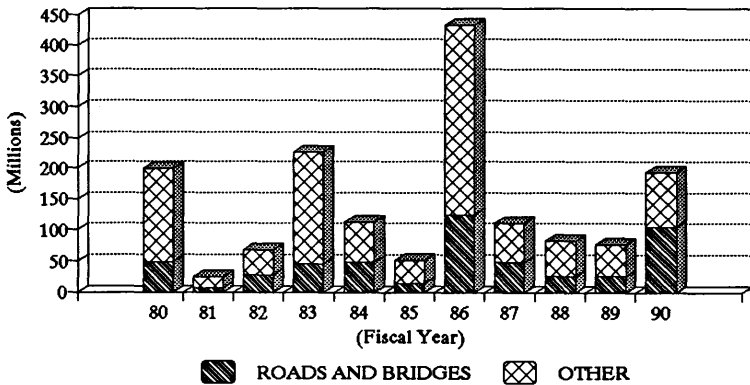


FIGURE 4. DAP ANNUAL DISASTER COSTS

Over 30 percent of the money funded through the DAP is spent on roads and bridges. This amounts to \$29 million annually. A representative sample of small, medium, and large disasters shows that about 16 percent of this is allocated for bridges.

The relationship between the number of events funded by the two programs is shown in figure 5. The DAP funds an average of 6 more disasters each year. Many disasters do not receive funds from the ER program because the FHWA only allocates money for the restoration of highway facilities on the Federal-Aid system and many times it is the off system facilities that suffer the most damage.

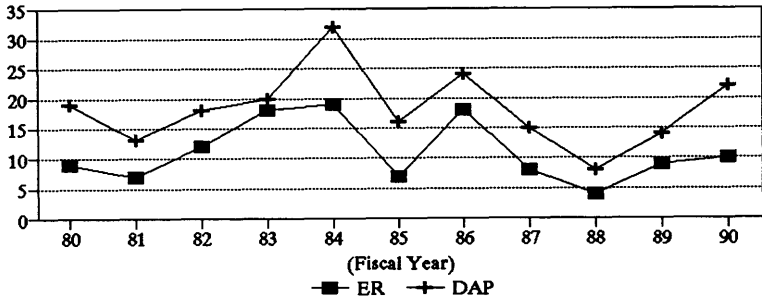


FIGURE 5. ANNUAL HYDRAULIC EVENTS

Conclusions

There is no uniform way of accounting for the total losses suffered because of damages sustained by highways and bridges during hydraulic disasters. The Emergency Relief Fund and Disaster Assistance Program make up a very small portion of the total costs being spent. Other forms of financial aid are available. Funds are administered through the National Flood Insurance Program as well as a multitude of private insurance companies. The cost to small businesses and industry as well as individuals due to downed bridges and closed roads is phenomenal, and many of the damages suffered from the hundreds of small events occurring every year go unrecorded.

There are also differences in reporting flood losses. Different agencies have different definitions

for floods and flood losses and have different eligibility requirements for receiving aid. Therefore, in many cases, estimates are not necessarily comparable.

The National Weather Service (NWS) accumulates rough cost estimates for flood events based on information taken from a variety of sources including other government agencies, field surveys, and the media. The Corps of Engineers uses this data in its annual report to Congress. In order to submit the report in January of each year, the Corps begins summarizing the data in October, immediately after the end of the fiscal year. Data from events occurring during the summer months, especially August and September, are rough estimates because there is no time to finalize or reevaluate costs.

Summary

A unified database containing information on highway losses due to flood related damage does not currently exist. Most agencies assisting in emergency repair keep records on file, but data classification systems vary, making it difficult to organize a consistent record of road and bridge losses. There is need for a more comprehensive record of flood related damages to highways so that specific failure mechanisms can be evaluated and engineering adjustments made in design procedures and practices.

Appendix

Federal Emergency Management Agency. "DMIS Report 2.4" and "DMIS Report 2.5." Disaster Assistance, May 1991.

U.S. Army Corps of Engineers. "Annual Flood Damage Report to Congress for Fiscal Year 1990." Engineering Division, January 1991.

U.S. Department of Transportation, Federal Highway Administration. "Emergency Relief by Flood Years." Federal Aide Branch, January 1991.