Emergency Vehicle Access During Flooding

An Inventory of Major Roadways in Eastern Pima County and the Relative Risk to Motorists Driving During Relatively, Small Frequent Floods

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I. INTRODUCTION

1.1 Purpose

As part of Pima County's Emergency Preparedness Program, a map has been drawn by the Pima County Technical Services Department, dated August 7, 2000, showing those principal arterial streets in eastern Pima County where motor vehicles may drive during or immediately following a major flood. Streets have been identified or color coded Red, Yellow, and Green, representing "Roads Questionable During Storms," "Roads Passable During Moderate Storms," and "Roads Passable During Major Floods," respectively. This existing map can be seen on Pima County's web page (http://www.dot.co.pima. az.us/gis/maps/mapguide/ pimamap.cfm), and it shows approximately 400 miles of major roadways located in eastern Pima County.

This report was prepared at the request from staff of the Flood Control Planning Section of the Pima County Department of Transportation and Flood Control District, for the purposes of reviewing this existing map, and to updating it based on a standardized definition of each roadway-hazard classification. The primary work product is a set of three arcview shape files suitable for inserting into Pima County's geographical information system network. This report briefly describes how these GIS files were produced.

1.2 Project Location

In general, the study area encompasses the greater Tucson metropolitan area, and is generally bounded on the north by the Pima/Pinal County line, on the west by the Pima/Cochise County line, on the south by the Pima/Santa Cruz County line, and on the west by the Tohono O'odham Nation. Only major public roadways in eastern Pima County were examined and visually categorized. The alignment and location of these major arterial roadways were provided by Pima County from their geographical information data base (files emroad.shp, pagstreets.shp, dated November 22, 2002).

II. HAZARD ASSESSMENT

2.1 Analytical Approach

The following approach was used to evaluate each major roadway segment and to assign it a relative hazard classification. These steps included:

1. Definitions were developed for three roadway-hazard classifications. These definitions are given in the next section of this report.
2. Recent aerial photographs of eastern Pima County and GIS data layers were obtained and plotted to scale for use as field maps.
3. A preliminary hazard classification was assigned to each roadway segment based on an initial visual assessment of the plotted aerial photographs.
4. Visual inspections of the selected roadway segments were then made (totaling about 350-road-miles) and each road segment and wash crossing was categorized as either "Passable During Major Storms," "Passable During Moderate Storms," and "Questionable During Storms.
5. Approximately 5 percent of these roadway segments were visited a second time to verify the field-inspection-based classification.
6. Final summary maps were drafted for inclusion in this report.
7. The AutoCAD R2002 drawings were converted to Archview Shape Files (*.shp) for submittal and use by County staff.

2.2 Roadway-Hazard Definitions

Three roadway-hazard classifications were defined for use in field identification. These classifications are as follows.

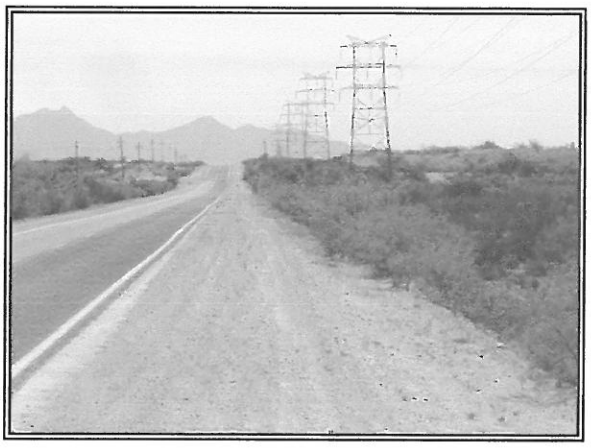
Definitions:

1. Roads that are **Passable During Major Storms** are all-weather roads that are generally elevated above the surrounding terrain and have culverts at most wash crossings. In addition, these roads generally have curbs and gutters, and may be flanked by grader ditches, canals, or other stormwater conveyance facilities.

2. Roads that are **Passable During Moderate Storms** are moderate-weather roads that are generally not elevated above the surrounding terrain, and have culverts or engineered at-grade wash crossings. Furthermore, roads within this classification are all paved.

3. Roads where travel is **Questionable During Storms** are fair-weather roadways that my not be passable even during small, frequent thunderstorms. Furthermore, these roadways generally appear to intercept and convey sheetflow .

Examples of these general roadway classifications are given below in the following photographs. Photograph #1 was taken of Houghton, south of Drexel Road, and it shows an elevated roadway that freely drains away from the roadway.



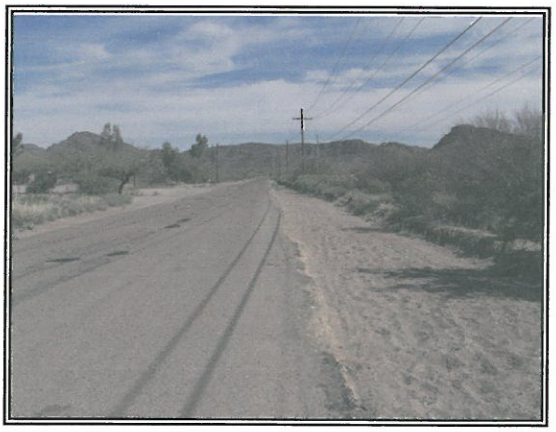
Photograph 1. Passable During Major Storms

(Houghton Road, near Drexel Road)

Photograph #2 was taken of Sierrita Mountain Road, south of Ajo Way, and it shows a roadway that is has occasional at-grade wash crossings, but is otherwise free from cross drainage. Photograph #3 was taken of Camino Verde, near Bopp Road, and it shows a roadway that intercepts and convey sheetflow along the roadway shoulder.

Photograph 2. Passable During Moderate Storms

(Sierrita Mountain Road, south of Ajo Way)



Photograph 3. Questionable During All Storms

(Camino Verde, near Bopp Road)

2.3 Analytical Subjectivity

All of the roadways studied exhibited one or more of the general roadway-hazard characteristics defined above. Furthermore, and not at all surprisingly, many of the roadways segments had characteristics typical of two hazard types within a relatively short distance, such as roadways with culverts as well as at-grade dip crossings. In these situations where hazards varied within a relatively short distance, the most conservative classification was assigned to the one-mile-long roadway segment. Because of this, many times, some subjectivity by the field inspector was necessary when evaluating a roadway segment and determining classification. Consequently, some of the roadway segments were visited a second time in order to help verify the designation and to help unify the analytical approach.

2.4 Flood Frequency

In this study, the terms *major storms*, *moderate storms*, and *all storms* were not assigned any relative flood frequency or return period. However, in order to help the field inspectors visualize flow rates, a bank-full discharge was assumed and used during the drive-by assessments. Therefore, a reasonable upper bound on the size of *major storms* would be a 10-year event.

2.5 Results

The relative degree of hazard to motorists was categorized into three groups representing: (1) all-weather roadways that may be passable during most major storms, (2) moderate-weather roadways that may be passable during moderately-sized thunderstorms, and (3) fair-weather roadways that my not be passable even during small, frequent thunderstorms. A roadway map was prepared and marked either Green, Yellow, or Red, for each of the above hazard classifications, respectively.

Figure 1 of this report is a map of eastern Pima County, and it summarizes the roadway-hazard designations for each of the roadways visited. In addition, accompanying this report, under separate cover, is a set of index maps used to identify, in greater detail, those major roadways that were visited, and for which a classification was assigned. In addition, a compact disk on which these index maps have been recorded, along with the aerial photographs for the northern half of the study area located north of Township 14 South (approximately Grant Road). Aerial photographs for the portion of the study area located south of Township 14 South were not plotted as Adobe PDF files because it had been determined during this study that the amount of time necessary to plot these individual files was unacceptably long, and was not an economical benefit to Pima County when digital copies of the aerial photographs were readily available on their own geographical information system.

2.6 Recommendations

It is recommended that the major arterial roadways identified in this project be used to as part of Pima County's Emergency Preparedness Program to help emergency personnel identify those principal arterial streets in eastern Pima County where motor vehicles may drive during or immediately following a major flood.