

INTRODUCTION

The Pan American Highway is of great economic, political and social importance on both the regional and hemispheric levels. In the case of Central America, the Pan American Highway's geographic, atmospheric and meteorological context, as well as its design parameters and its maintenance make it more vulnerable to natural hazards. As a consequence of this vulnerability, there are substantial damages to the transportation infrastructure in the region, therefore producing serious effects on the production and social sectors and the populated areas both near and far.

The transportation infrastructure in the Central America region includes not only the following corridors: Natural Highway Corridor (Pacific), Alternative A (Central) and Alternative B (Atlantic), but also some connections that are the main entrances to important ports. The Alternative A corridor is also called the Pan American Highway and has its own nomenclature in each country (see Figure 1).

Figure 1. Nomenclature of the Pan American Highway and its Complementary Corridors of the Highway Network in Central America

Corridor	Costa Rica	El Salvador	Guatemala	Honduras	Nicaragua	Panamá
Pan American Highway, Alternative A Corridor or Central Corridor	Pan American Highway CRN1 and CRN2	CA-1	CA-01	Alternate A Corridor	Pan American Highway	Pan American Highway
Alternative B Corridor or Atlantic Corridor	Alternative B Corridor or Atlantic Corridor	Alternative B Corridor or Atlantic Corridor	Alternative B corridor or Atlantic Corridor	Alternative B Corridor or Atlantic Corridor	Alternative B Corridor or Atlantic Corridor	Alternative B Corridor or Atlantic Corridor
Natural Highway Corridor or Pacific Corridor	Natural Highway Corridor or Pacific Corridor	Natural Highway Corridor or Pacific Corridor	Natural Highway Corridor or Pacific Corridor	Natural Highway Corridor or Pacific Corridor	Natural Highway Corridor or Pacific Corridor	Natural Highway Corridor or Pacific Corridor
Corridors mentioned in this document in addition to the Pan American Highway	Coastal Highway	Littoral Highway or CA-2 Coastal Highway (Pan American Highway Alternate Corridor)	<ul style="list-style-type: none"> • Western Intertronal Corridor (CITO) • CA-09 South • National Route 16 (RN 16) • CA-02 (Alternate Corridor of the Pan American Highway) 	<ul style="list-style-type: none"> • Natural Highway Corridor • Alternate B Corridor or Atlantic Corridor • Several connections 	Non existent	Non existent

Source: OAS/USDE based on national reports

The objective of this document is to present information on the vulnerability of road segments on the Pan American Highway and when available, information on its alternate or complementary corridors in Central America. The document also contains information about the vulnerability of each section of the Pan American Highway, the natural hazards to which it is prone, the length of each vulnerable road segment, the lists of vulnerability reduction measures taken, and the history of disasters it has suffered (where information was available). This information is based on Central American vulnerability profile studies carried out by technical teams from the Central American countries and with international coordination by the USDE. The USDE has coordinated these efforts and has been working on the development of vulnerability studies since March 2000.

The vulnerability profiles cover the geographic area known as the Central American Framework, which consists of Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama. The national institutions that served as focal points for each study are the following:

Costa Rica: Dirección de Planificación, Ministerio de Obras Públicas y Transporte (MOP)

El Salvador: Unidad de Planificación Vial, Ministerio de Obras Públicas (MOP)

Guatemala: División Planificación y Estudios, Dirección General de Caminos (DGC)

Honduras: Unidad de Planeamiento y Evaluación de Gestión, Sistema de Obras Públicas, Transporte y Vivienda (SOPTRAVI)

Nicaragua: Administración Vial y Dirección de Vialidad, Ministerio de Transporte e Infraestructura (MTI)

Panama: Dirección Nacional, Instituto Geográfico Nacional "Tommy Guardia" (IGNTG), Ministerio de Obras Públicas

The following points should be kept in mind as a general summary of this document:

- The vulnerability studies of the road segments of the Pan American Highway and its complementary corridors that each of the countries prepared correspond to a first approach and therefore are presented as the beginning of a process that should be continually updated and broadened.
- This document is presented keeping in mind that the institutions that coordinated the vulnerability studies in each of the countries are responsible for its publication and discussion.

- The national technical teams were the principal actors at the initiation of the vulnerability studies. The contents of these studies reflect the availability of information, the actual conceptual focus and the conditions in which the public sector operates with support from consultants.
- The purpose of requiring the type and quantity of the mitigation work on the most vulnerable road segments of the corridors is to support the vulnerability evaluation process of the highway transportation corridors for vulnerability investment and its incorporation into the planning of the transportation sector.
- The lack of sufficient and complete information about natural hazards, the quantity and value of priority mitigation projects to reduce vulnerability indicates the necessity to reinforce activities of the sector in order to produce the missing information.
- The results of the national studies are directly linked to the mutual assistance theme in the case of damages to the infrastructure of highway transportation in the region and implicate a need for additional training of specialists on the subject in both the private and public sectors.

Before describing the structure of this document, it is necessary to explain certain basic concepts that will aid in its comprehension:

- Natural hazards are those geological, atmospheric or meteorological processes that threaten human life and that are caused by forces beyond their control (OAS/DRDE, 1991 and 1993). In this document the natural hazards described are those that most affect the Central American region are earthquakes, hurricanes, floods, landslides and volcanic eruptions.
- Natural hazard evaluation is an evaluation of the location, severity, and the possibility that a natural event may occur within a specific period of time (OAS/DRDE, 1991).
- Vulnerability evaluation is the damage/loss estimate that can be the consequence of a natural hazard event of a specific severity, including construction damages, personal damages, and the interruption of economic services and everyday community activities (OAS/DRDE, 1991).
- In the context of this document, the term “natural hazard” refers to all atmospheric, hydrological and geological phenomena that due to the location, severity and frequency may adversely affect the infrastructure of the highway transportation sector.
- In some nations, the term “natural threat” is used instead of natural hazard.
- When the term “vulnerability profile” is used in this document, it refers to a general study about the transportation road segments that are vulnerable to natural hazards in a specific geographical area.

Based on these definitions, this document contains three chapters, which are briefly described below:

Chapter One, General Study on the Vulnerability to Natural Hazards of the Pan American Highway and its Complementary Corridors, describes vulnerability

studies carried out by the technical teams. It includes the vulnerability road segments of the Pan American Highway and their lengths and the methodology and concepts that were used to determine each vulnerability profile. Such information was gathered from the national profiles sent to the USDE by each focal point, and will be a helpful reference and orientation tool for successful regional highway planning and subsequently the reduction of the effects of natural hazards.

Chapter Two, Relationships of the Activities Regarding Vulnerability Reduction to Natural Hazards of the Central American Transportation Sector presents information relating products and activities generated by this document to the regional studies on vulnerability reduction that are programmed or actually being carried out in the region.

Chapter Three, Conclusions and Recommendations, presents broader comments regarding the reach and usefulness of this information in helping to determine future courses of action in the transportation sector.

In addition, this document has a series of appendices with associated tools that refer to the road segment vulnerability studies carried out in each of the countries and provide a better understanding of the work itself. One of the annexes contains the general format that each country used as a guideline to carry out its study. A similar format was created for bridges related to the road segments previously mentioned (where information was available) in order to study their vulnerability to natural hazards.

Almost all of the information provided in this document comes from national studies carried out by the respective technical groups. In some cases it includes information that comes from other sources, which are duly cited.