



CARL T.C. GUTIERREZ  
GOVERNOR OF GUAM

APR 29 1996


The Honorable Speaker  
Twenty-Third Guam Legislature  
Guam Legislature Temporary Building  
155 Hesler Street  
Agana, Guam 96910

OFFICE OF THE LEGISLATIVE SECRETARY	
ACKNOWLEDGMENT RECEIPT	
Received By	<u>Alfred</u>
Time	<u>4:41</u>
Date	<u>4/29/96</u>

Dear Speaker:

Enclosed please find a copy of Substitute Bill No. 417 (LS), "AN ACT TO AMEND 21 GCA §67101, RELATIVE TO CHANGING GUAM'S UNIFORM BUILDING CODE EARTHQUAKE SEISMIC ZONE THREE (3) TO SEISMIC ZONE FOUR (4)", which I have numbered as **Public Law No. 23-88**.

Very truly yours,

  
Carl T. C. Gutierrez  
Governor of Guam

Attachment

**231101**

Office of VICE-SPEAKER TED G. NELSON	
<u>labb</u>	<u>ke</u>
Print Name	Initial
Date: <u>4-29-96</u>	Time: <u>4:20pm</u>

TWENTY-THIRD GUAM LEGISLATURE  
1996 (SECOND) Regular Session

This is to certify that Substitute Bill No. 417 (LS), "AN ACT TO AMEND 21 GCA §67101, RELATIVE TO CHANGING GUAM'S UNIFORM BUILDING CODE EARTHQUAKE SEISMIC ZONE THREE (3) TO SEISMIC ZONE FOUR (4)," returned to the Legislature without approval of the Governor, was reconsidered by the Legislature and after such reconsideration, the Legislature did, on the 19th day of April, 1996, agree to pass said bill notwithstanding the objection of the Governor by a vote of twenty-one (21) members.



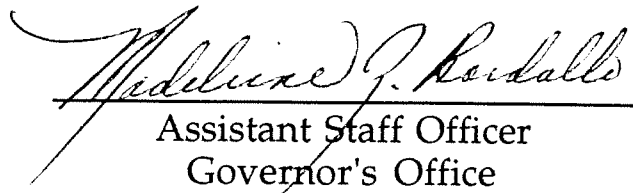
TED S. NELSON  
Acting Speaker

Attested:



JUDITH WON PAT-BORJA  
Senator and Legislative Secretary

-----  
This Act was received by the Governor this 26 day of April,  
1996, at 6:00 o'clock P.M.



Assistant Staff Officer  
Governor's Office

TWENTY-THIRD GUAM LEGISLATURE  
1995 (FIRST) Regular Session

Bill No. 417 (LS)  
As substituted by the author

Introduced by:

F. P. Camacho  
T. S. Nelson  
A. C. Blaz  
A. C. Lamorena V  
T. C. Ada  
J. P. Aguon  
E. Barrett-Anderson  
J. M. S. Brown  
M. C. Charfauros  
M. Forbes  
C. Leon Guerrero  
L. Leon Guerrero  
S. L. Orsini  
V. C. Pangelinan  
D. Parkinson  
J. T. San Agustin  
A. L. G. Santos  
F. E. Santos  
A. R. Unpingco  
J. Won Pat-Borja

AN ACT TO AMEND 21 GCA §67101, RELATIVE TO  
CHANGING GUAM'S UNIFORM BUILDING CODE  
EARTHQUAKE SEISMIC ZONE THREE (3) TO  
SEISMIC ZONE FOUR (4).

1        **BE IT ENACTED BY THE PEOPLE OF THE TERRITORY OF GUAM:**  
2        **Section 1.** The Legislature finds that the Uniform Building Code (UBC)  
3 was adopted by the Fourteenth Guam Legislature into Guam law, and is now  
4 recognized as the standard to secure and promote the safety, health, and

1 general welfare of the people of Guam by providing guidelines for the  
2 location, design, material, construction, alteration, repair, building service  
3 equipment, maintenance, use, occupancy, moving, removal, and demolition  
4 of buildings and structures throughout our island.

5 The legislature also finds that as a result of the earthquake on Guam on  
6 August 8, 1993, of magnitude 8.1 on the Richter scale, utmost attention should  
7 be given to the quality of design and construction of all future buildings on  
8 Guam. The Earthquake Engineering Research Institute (EERI) team that  
9 visited Guam immediately after the 8.1 earthquake gave a Governor's  
10 briefing on August 17, 1993. The EERI stated that they "...believe the people  
11 of Guam should be aware that future earthquake could produce significantly  
12 greater damage than the recent quake."

13 The 1991 Uniform Building Code currently places Guam in seismic Zone  
14 3. However, designing buildings and structures for UBC seismic zone 4 in lieu  
15 of UBC seismic Zone 3 would increase a building's base shear by 33 percent;  
16 hence, buildings on Guam designed and built accordingly in the future would  
17 be capable of resisting a 33 percent increase in inertial forces in the elastic  
18 range. Considering the severity of the 1993 earthquake and the failure of  
19 some of the buildings on Guam as a result of that earthquake, the advice of  
20 the EERI should be taken very seriously. This legislature should take the  
21 necessary steps to improve both building design and building construction  
22 practices here on our island.

23 A change in seismic Zone 3 to Zone 4 for Guam, and the resulting change  
24 in design and construction practices to adhere to a seismic Zone 4, would be a  
25 step in assuring the safety and well-being of the people of Guam.

26 **Section 2.** The existing §67101 in Chapter 67 of Title 21, Guam Code  
27 Annotated, is hereby recodified as §67101(a).

1           **Section 3.** A new Subsection (b) is hereby added to 21 GCA §67101 to  
2 read:

3           "(b) All seismic Zone 3 references to Guam in the Uniform Building  
4 Code and any updated version thereof shall be changed to seismic Zone 4 as it  
5 pertains to any standard on Guam for the furtherance of the intent of  
6 Chapter 66 of this Title."

7           **Section 4.** The provisions of this Act shall not apply to building projects  
8 currently under construction, but shall apply to all construction projects that  
9 have not applied for a building permit by the effective date of this Act. This  
10 Act shall take effect 180 days after enactment into law.

VOTING SHEET

✓ Bill No. VB 417  
 Resolution No. \_\_\_\_\_  
 Question: \_\_\_\_\_

NAME	YEAS	NAYS	NOT VOTING/ ABSTAINED	ABSENT/ OUT DURING ROLL CALL
ADA, Thomas C.	✓			
AGUON, John P.	✓			
BARRETT-ANDERSON, Elizabeth	✓			
BLAZ, Anthony C.	✓			
BROWN, Joanne S.	✓			
CAMACHO, Felix P.	✓			
CHARFAUROS, Mark C	✓			
CRISTOBAL, Hope A.	✓			
FORBES, -MARK	✓			
LAMORENA, Alberto C., V	✓			
LEON GUERRERO, Carlotta	✓			
LEON GUERRERO, Lou	✓			
NELSON, Ted S.	✓			
ORSINI, Sonny L.	✓			
PANGELINAN, Vicente C	✓			
PARKINSON, Don	✓			
SAN AGUSTIN, Joe T.	✓			
SANTOS, Angel L. G.	✓			
SANTOS, Francis E.	✓			
UNPINGCO, Antonio R.	✓			
WONPAT-BORJA, Judith	✓			

TOTAL

21    0    0    0

CERTIFIED TRUE AND CORRECT:

\_\_\_\_\_  
 Recording Secretary



OFFICE OF THE GOVERNOR  
TERRITORY OF GUAM

OFFICE OF THE LEGISLATIVE SECRETARY

MAR 06 1996

The Honorable Don Parkinson  
Speaker  
Twenty-Third Guam Legislature  
424 West O'Brien Drive  
Julale Center - Suite 222  
Agana, Guam 96910

Date:	3/6/96
Time:	10:30A
Received By:	GW
Print Name:	HANS ENRIQUE

REFER TO  
LEGISLATIVE SECRETARY

Dear Speaker Parkinson:

Enclosed please find Substitute Bill No. 417 (LS), "AN ACT TO AMEND 21 GCA §67101, RELATIVE TO CHANGING GUAM'S UNIFORM BUILDING CODE EARTHQUAKE SEISMIC ZONE THREE (3) TO SEISMIC ZONE FOUR (4)", which I have vetoed.

The provisions of Substitute Bill No. 417 increase the standard for construction in the Uniform Building Code as applied to Guam by formally changing Guam from an earthquake seismic zone three (3) to an earthquake seismic zone four (4).

This increase in design criteria for buildings would increase the cost of construction, especially for large buildings such as hotels. On the one hand, Guam is providing incentives for new investors to our island, and on the other hand, legislation such as this would increase the cost of construction for investors. Preliminary estimates show that a 2% to 10% increase in construction costs, perhaps higher in some cases, would result from the passage of this legislation.

Although some experts may now recommend that Guam change to earthquake seismic zone four (4), the issue should be studied more within the construction related professions before making this change in Guam's building code at this time. Guam experienced a severe earthquake several years ago, yet only a few buildings suffered substantial damage and there were no fatalities.

Very truly yours,

*Madeleine Z. Bordallo*  
Madeleine Z. Bordallo  
Acting Governor of Guam

Attachment

231023

OFFICE OF THE LEGISLATIVE SECRETARY	
ACKNOWLEDGMENT RECEIPT	
Received By:	<i>Jellifer</i>
Time:	11:34
Date:	3/6/96

**TWENTY-THIRD GUAM LEGISLATURE**

1996 (SECOND) Regular Session

Date: 2/22/96

**VOTING SHEET**

Bill No. 417

Resolution No. \_\_\_\_\_

Question: \_\_\_\_\_

NAME	YEAS	NAYS	NOT VOTING/ ABSTAINED	ABSENT/ OUT DURING ROLL CALL
ADA, Thomas C.	✓			
AGUON, John P.	✓			
BARRETT-ANDERSON, Elizabeth	✓			
BLAZ, Anthony C.	✓			
BROWN, Joanne S.	✓			
CAMACHO, Felix P.	✓			
CHARFAUROS, Mark C 11	✓			
CRISTOBAL, Hope A.		✓		
FORBES, MARK	✓			
LAMORENA, Alberto C., V	✓			
LEON GUERRERO, Carlotta	✓			
LEON GUERRERO, Lou	✓			
NELSON, Ted S.	✓			
ORSINI, Sonny L.	✓			
PANGELINAN, Vicente C	✓			
PARKINSON, Don 1	✓			
SAN AGUSTIN, Joe T.	✓			
SANTOS, Angel L. G. 1	✓			
SANTOS, Francis E.	✓			
UNPINGCO, Antonio R.	✓			
WONPAT-BORJA, Judith	✓			

TOTAL

20   1   0   0

CERTIFIED TRUE AND CORRECT:

\_\_\_\_\_  
Recording Secretary





Ofisinan i Setbienten i Taotao Guahan  
**Office of the Vice-Speaker**  
Twenty-Third Guam Legislature

**TED S. NELSON**  
Vice-Speaker

February 12, 1996

**Chairman,**  
Committee on General  
Governmental  
Operations &  
Micronesian Affairs

**Member,**  
Committee on  
Community, Housing  
and Cultural Affairs

**Member,**  
Committee on Education

**Member,**  
Committee on Health,  
Welfare & Senior  
Citizens

**Member,**  
Committee on Judiciary,  
Criminal Justice &  
Environmental Affairs

**Member,**  
Committee on Rules

**Member,**  
Committee on Water  
Utilities & Electronic  
Communications

**Member,**  
Committee on Youth,  
Labor, and Parks &  
Recreation

**Director & Vice-President**  
(*Ranking Member*),  
Association of Pacific  
Island Legislatures (APIL)

Honorable Don Parkinson  
Speaker  
23rd Guam Legislature  
155 Hessler Street  
Agana, Guam 96910

Dear Mr. Speaker:

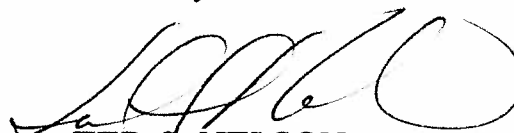
The Committee on General Governmental Operations and Micronesian Affairs, to which was referred **Bill No. 417, "An Act to change Guam's Uniform Building Code Earthquake Seismic Zone Three (3) to Seismic Zone Four (4),"** has had the same consideration and now wishes to report back the same with the recommendation **to do pass.**

The Committee votes are as follows:

To do pass	<u>12</u>
Not to pass	<u>0</u>
To report out only	<u>0</u>
Abstain	<u>0</u>
To place in inactive file	<u>0</u>

A copy of the Committee Report and other pertinent documents are enclosed for your reference and information.

Sincerely,

  
TED S. NELSON


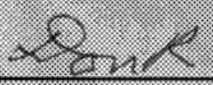
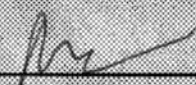
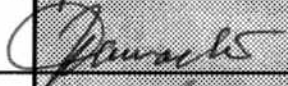
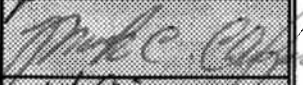

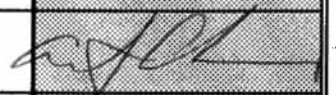
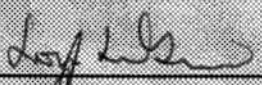

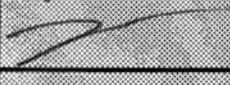
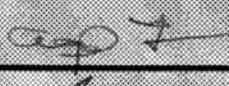
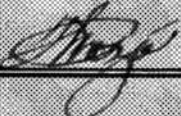
Enclosures

**COMMITTEE GENERAL GOVERNMENT OPERATION  
AND MICRONESIAN AFFAIRS**  
Twenty-Third Guam Legislature

**VOTE SHEET**  
on Bill No. 417

*An Act to change Guam's Uniform Building Code Earthquake Seismic Zone  
Three (3) to Seismic Zone Four (4)*

**Recommendation: To Do Pass**

Committee Members	To Do Pass	Not To Pass	To Report Out Only	Abstain	To Place in the Inactive File	Signature
Vice-Speaker Ted S. Nelson Chairman	✓					
Speaker Don Parkinson Ex-Officio Member	✓					
Senator Thomas C. Ada						
Senator Anthony C. Blaz	✓					
Senator Felix P. Camacho	✓					
Senator Mark C. Charfauros	✓					
Senator Hope A. Cristobal	✓					
Senator Alberto C. Lamorena V	✓					
Senator Carlotta Leon Guerrero						
Senator Lou Leon Guerrero	✓					
Senator Sonny L. Orsini	✓					
Senator Ben C. Pangellinan	✓					
Senator Angel L.G. Santos	✓					
Senator Judith WonPat-Borja	✓					
<b>Total Votes:</b>	12	0	0	0	0	

**TWENTY-THIRD GUAM LEGISLATURE NOV 13 1995  
1995 (FIRST) Regular Session**

Bill No. 417(LS)  
Introduced by:

F.P. Camacho  
*[Handwritten signatures]*

**AN ACT TO CHANGE GUAM'S UNIFORM BUILDING CODE  
EARTHQUAKE SEISMIC ZONE THREE (3) TO SEISMIC  
ZONE FOUR (4).**

1 BE IT ENACTED ON BY THE PEOPLE OF THE TERRITORY OF GUAM

2  
3 **Section 1.** The legislature finds that the Uniform Building Code (UBC) was adopted by the  
4 Fourteenth Guam Legislature into Guam law, and is now recognized as the standard to secure and  
5 promote the safety, health, and general welfare of the people of Guam by providing guidelines for  
6 the location, design, material, construction, alteration, repair, building service equipment,  
7 maintenance, use, occupancy, moving, removal and demolition of buildings and structures  
8 throughout our island.

9 The legislature also finds that as a result of the earthquake on Guam on August 8, 1993 of  
10 magnitude 8.1 on the Richter scale, utmost attention should be given to the quality of design and  
11 construction of all future buildings on Guam. The Earthquake Engineering Research Institute  
12 (EERI) team that visited Guam immediately after the 8.1 earthquake gave a Governor's Briefing  
13 on August 17, 1993. The EERI stated that they "...believe the people of Guam should be aware  
14 that future earthquakes could produce significantly greater damage than the recent quake."

15 The 1991 Uniform Building Code currently places Guam in seismic Zone 3. However,  
16 designing buildings and structures for UBC seismic Zone 4 in lieu of UBC seismic Zone 3 would

1 increase a building's base shear by 33 percent; hence, buildings on Guam designed and built  
2 accordingly in the future would be capable of resisting a 33 percent increase in inertial forces in  
3 the elastic range. Considering the severity of the 1993 earthquake and the failure of some of the  
4 buildings on Guam as a result of that earthquake, the advise of the EERI should be taken very  
5 seriously. This legislature should take the necessary steps to improve both building design and  
6 building construction practices here on our island.

7 A change in seismic Zone 3 to Zone 4 for Guam, and the resulting change in design and  
8 construction practices to adhere to a seismic Zone 4, would be a step in assuring the safety and  
9 well-being of the people of Guam.

10  
11 **Section 2.** Section 67101 in Chapter 67 of Title 21, GCA, is hereby lettered as Section 67101(a).

12  
13 **Section 3.** There is hereby created a new section 67101(b) which shall state.

14 All seismic Zone 3 references to Guam in any updated version of the Uniform Building Code shall  
15 be changed to seismic Zone 4 as it pertains to any standard on Guam for the furtherance of the  
16 intent of Chapter 66 of this Title.

**COMMITTEE ON GENERAL GOVERNMENTAL OPERATIONS  
AND MICRONESIAN AFFAIRS  
TWENTY-THIRD GUAM LEGISLATURE  
155 Hesler Street, Agana, Guam 96910**

**COMMITTEE REPORT**

**ON**

**BILL NO. 417**

**"An Act to Change Guam's Uniform Building Code Earthquake Seismic  
Zone Three (3) to Seismic Zone Four (4)"**

**COMMITTEE MEMBERS**

Chairman: Ted S. Nelson

Ex-Officio Member: Speaker Don Parkinson

Thomas C. Ada  
Anthony C. Blaz  
Felix P. Camacho  
Mark C. Charfauros  
Hope A. Cristobal  
Alberto C Lamorena V

Carlotta A. Leon Guerrero  
Lourdes A. Leon Guerrero  
Sonny L. Orsini  
Vicente C. Pangelinan  
Angel L.G. Santos  
Judith Won Pat-Borja

## COMMITTEE REPORT

### **BILL NO. 417**

“An Act to Change Guam’s Uniform Building Code Earthquake Seismic Zone Three (3) to Seismic Zone Four (4)”

#### I. BACKGROUND

As a result of the August 8, 1993 earthquake on Guam measuring at a magnitude of 8.1 on the Richter scale, the Legislature urges that the utmost attention should be given to the quality of design and construction of all future buildings on Guam. The public hearing was conducted by the Committee on Economic-Agricultural Development and Insurance, chaired by Senator Joe T. San Agustin.

#### II. TESTIMONY

**Mr. Frank P. Camacho**, Executive Assistant for the Territorial Planning Council provided the committee with written testimony in support of the bill. Mr. Camacho and the TPC staff believe that by raising the Guam’s Seismic Designation to Zone Four is a good conservation approach, and an economic step in terms of reduction in property damage, and more importantly a good conservative approach in reducing the possible loss of lives from a major earthquake event in the future. From the TPC staff perspective, Mr. Camacho recommended that in addition to the upgrading of Seismic Designation Zone Four, that Bill 417 be amended to make it a full disclosure policy. This policy will ensure that all permit applicants are made aware of the fault lines that might affect their development. This process could be accomplished during the permitting process of both private and public projects or developments.

**Mr. Juan B. Rosario**, Director of Civil Defense/Guam Emergency Services Office provided the committee with written testimony in support of the bill. Mr. Rosario informed the committee that Civil Defense has been advised by the Earthquake Engineering Research Institute to upgrade

Guam's Seismic Zone from Three to Four. Mr. Rosario continued that the change from Seismic Zone Three to Seismic zone Four would be a step forward in assuring the safety and well-being of the people of Guam in the event of a catastrophic earthquake.

**Mr. Carl Gumataotao**, member of the Guam Seismic Advisory Council and creator of the "Quake Up Guam program", provided the committee with written testimony in support of the bill. While serving as the Guam Earthquake Program Manager with Civil Defense/Guam Emergency Services Office, Mr. Gumataotao shared his knowledge with the committee regarding the Public Education programs to inform the public about Guam's vulnerability to earthquakes. Mr. Gumataotao strongly supports the upgrade of Guam's Seismic Zone to Seismic Zone Four, and urged the Legislature to give Bill No. 417 favorable consideration because of the mere fact that we have experienced an earthquake with a magnitude of 8.1 in August of 1993.

**Mr. Jesus T. Salas**, Acting Administrator for the Guam Environmental Protection Agency provided the committee with written testimony in support of the bill. In his testimony, Mr. Salas pointed out that due to the fact that Guam sits on the "Rim of Fire" and on top of several fault lines, it is necessary to look at the possibility of large magnitude earthquakes very closely. Mr. Salas continued that updating the Uniform Building Code to change from Seismic Zone Three to Seismic Zone Four is in line with this protection. Mr. Salas also commented that this change could increase the cost of building somewhat, however, it is a cost beneficial trade-off. GEPA also recommends that all fault hazard areas which cut across the island be identified and delineated. Following this surveyed delineation, minimum setbacks or buffer zones should be established along the fault lines varying in width as appropriate for the type of development. Mr. Salas further recommended that subsurface utility lines especially water and sewer lines be constructed with flexible joints.

**Mr. Michael W. Makio**, AIA, Chairman, Guam Seismic Advisory Council and Sr. Project Architect for Taniguchi-Ruth-Smith & Associates provided the committee with written testimony in support of Bill No. 417. Mr. Makio stated that we must realize that the extent of Guam's seismic vulnerability may be higher than what previous data has indicated. Mr.

Makio further commented that by changing Guam's Seismic Zone from Three to Four is a good and conservative approach to affording Guam's residents an added level of security. This change is an economical step in terms of the reduction in property damage and more importantly in reducing the loss of lives from a major earthquake event in the future.

**Mr. Thomas P. Camacho, S.E.** Co-Chairman, Guam Seismic Advisory Council provided the committee with written testimony in support of Bill No. 417. Mr. Camacho informed the committee that in the 1975 Recommended Lateral Force Requirements and Commentary (by the Seismology Committee of SEAOC, dated 1990 commonly referred to as the "Bluebook"), *the boundary (between Zones 3 and 4) was set at 25 miles from a fault capable of generating an earthquake of magnitude 7.0 or greater.* Therefore, by definition, Guam should have been in Zone 4 since the 1975 earthquake, with an epicenter located 25 miles from Agana which had a magnitude of 7.1. Mr. Camacho continued that in view of the effects of the August 8 earthquake, coupled with the ominous warnings from the EERI, the Government of Guam and the A/E community should re-evaluate the design parameters for buildings on Guam.

**Mr. Paul M. Hattori,** Geophysicist with the U.S. geological Survey and Chief of the Guam Observatory, provided the committee with written testimony in support of Bill No. 417. Mr. Hattori commented that the August 8 earthquake was a surprise, and that an earthquake of that magnitude was not possible. Mr. Hattori went on to make references to the earthquakes in Northridge and Kobe whose time came prematurely. In conclusion, Mr. Hattori strongly urges that an upgrade to Seismic Zone Four (4) based on seismic history and to mitigate future economic loss is warranted and supported.

**Mr. Terangue E.R. Gillham, P.E.,** a registered engineer employed by GK2 Inc., provided the committee with written testimony in support of Bill No. 417. Mr. Gillham stated that structural designers are charged with the task of constantly updating information bases and techniques in order to ensure the greatest safety margin possible for the public. The knowledge of Guam's earthquake risk is based on experience, and the experience provided on August 8, 1993, shows that Guam is indeed vulnerable to large earthquakes which have high damage potential. Upgrading Guam to



Zone 4 will increase the seismic design forces which are used to design future buildings. Mr. Gillham concluded that Bill No. 417 is neither a first nor last step, it is a continuation of the process of providing the highest level of safety possible to the residents and visitors of Guam.

### III. FINDINGS

The committee finds that as a result of the 8.1 magnitude earthquake experienced by the people of Guam on August 8, 1993, it is of the utmost importance to change Guam's Seismic Zone from Three (3) to Seismic Zone Four (4) for the purpose of redirecting the quality of design and construction of all future buildings on Guam.

### IV. RECOMMENDATIONS

The Committee on General Governmental Operations and Micronesian Affairs hereby reports out Bill No. 417 to the Twenty-Third Guam Legislature with the recommendation **TO DO PASS**.

# TERRITORIAL PLANNING COUNCIL

GUAM COMPREHENSIVE  
DEVELOPMENT PLAN



Land Use Plan  
Community Design Plan  
Transportation Plan  
Regulations Plan  
Public Facilities Plan  
Public Lands Plan  
Public Buildings Plan  
Housing Plan  
Redevelopment Plan  
Conservation Plan  
Recreation Plan  
Safety Plan  
Tourism Plan  
Development Policy Plan  
Capital Improvements Plan  
Policy Statements Plan  
Other Elements

December 19, 1995

The Honorable Joe T. San Agustin  
Senator and Chairman  
Committee on Economic-Agricultural  
Development and Insurance  
Twenty-Third Guam Legislature  
424 W. O'Brien Drive  
Julale Shopping Center, Suite 218  
Agana, Guam 96910

Re: Bill No. 417: Testimony before the Committee on Economic-  
Agricultural Development and Insurance

*Hafa Adai* Mr. Chairman and Members of the Committee:

My name is Frank P. Camacho, Executive Assistant, Territorial Planning Council. I am here to testify in support of Bill No. 417 to change Guam's uniform Building Code Earthquake Seismic Zone Three (3) to Seismic Zone Four (4).

Our Territorial Planning Council (TPC) Staff was informed that some buildings suffered different types damages from the various earthquakes on our island by Mr. Paul M. Hattori, geophysicists with the U.S. Geological Survey and Chief of the Guam Observatory. Additionally, We reviewed the Guam Seismic Advisory Council study of Guam's earthquake vulnerability. After reviewing the data from the August 8 earthquake, the earthquake in Kobe, Japan and the recent seismic activity in the Marianas Islands, The TPC Staff believe that raising Guam's Seismic Designation to Zone Four is a good conservative approach, an economical step in terms of reduction in property damage, and more importantly a good conservative approach in reducing the possible loss of lives from a major earthquake event in the future.

From the TPC Staff perspective, I recommend that in addition to the upgrading of Seismic Designation to Zone Four that we also amend Bill 417 to make it a full disclosure policy. This policy will ensure that all permit applicants are made aware of the fault lines that might affect their development. This procedure could be accomplished during the permitting process of both private and public project/development.

TERRITORIAL PLANNING COUNCIL  
Suite #103 - Reflection Center  
222 Chalan Santo Papa  
Agana, Guam 96910  
Telephone (671)472-9770  
Fax (671)472-9772

In summary, I strongly urge this committee and the Legislature to support Bill 417 and our other efforts to study and mitigate the effects of earthquakes. We further asked that we inform all developers of fault lines that might affect their project. If you will for just a moment, close your eyes and remember how it felt on August 8, 1993, I think you will find it easy to support this Bill.

*Si Yu'os Ma'ase*

A handwritten signature in black ink, appearing to read "Camacho", written in a cursive style.

FRANK P. CAMACHO

CC: Acting Director, Bureau of Planning

TESTIMONY ON BILL NO. 417

GOOD MORNING MR. CHAIRMAN AND MEMBERS OF THIS COMMITTEE. MY NAME IS JUAN B. ROSARIO AND I AM CURRENTLY THE DIRECTOR OF CIVIL DEFENSE /GUAM EMERGENCY SERVICES OFFICE.

WITH ME THIS MORNING IS THE CHAIRMAN OF THE GUAM SEISMIC ADVISORY COUNCIL, MR. MICHAEL B. MAKIO, AND MEMBERS OF MY STAFF.

WE ARE HERE THIS MORNING TO TESTIFY IN SUPPORT OF BILL NO. 417. AS YOU MAY RECALL, THE GREAT GUAM EARTHQUAKE OF 1993 SEVERELY DAMAGED MANY CONCRETE STRUCTURES AROUND THE ISLAND. WE HAVE BEEN ADVISED BY THE EARTHQUAKE ENGINEERING RESEARCH INSTITUTE TO UPGRADE OUR SEISMIC ZONATION FROM THREE (3) TO SEISMIC ZONE FOUR (4).

UTMOST ATTENTION SHOULD BE GIVEN TO THE QUALITY OF DESIGN AND CONSTRUCTION OF ALL FUTURE BUILDINGS ON GUAM. IN LINE WITH GOVERNOR GUTIERREZ'S VISION 2001 PLAN, WE AS OFFICIALS OF THIS TERRITORY, HAVE THE ULTIMATE RESPONSIBILITY TO BUILD PARTNERSHIPS FOR A SAFER GUAM COMMUNITY.

A CHANGE IN SEISMIC ZONE THREE (3) TO SEISMIC ZONE FOUR (4) WOULD BE A STEP FORWARD IN ASSURING THE SAFETY AND WELL-BEING OF THE PEOPLE OF GUAM IN THE EVENT OF A CATASTROPHIC EARTHQUAKE.

Good morning and merry Christmas!

My name is Carl Gumataotao a member of the Guam Seismic Advisory Council and the creator of the Quake Up Guam Program.

I sit here before you in support of Bill 417 introduced by the good Senator Camacho. I served as the Guam Earthquake Program Manager for two years while I was at the Guam Emergency Services Office/Civil Defense.

I remember as one of my Public Education programs at Civil Defense was to get the word out to the public Guam's vulnerability to earthquakes. As we all know as we sit that Guam is constantly beraged with Earthquakes every single day. According to the local experts these EQ's occur and we don't feel them but the instrumentation at the Guam EQ Observatory reads about an average of three or maybe even more occurrences in an twenty four hour period.

Six months before the Great EQ of August 8, I sat with crossed fingers during a television interview explaining how Guam should be prepared for a Earthquake of major magnitude and low and behold the great quake of August 8 occurred. You could not believe the response I got from my counterparts at FEMA Region IX they were in total awe when they got the news. Little did I know that this was the start of national and worldwide recognition for Guam.

As part of my duties I was tasked to entertain the many scientist and engineers who came to Guam to do site surveys and gather up data as a result of the Great Aug. 8 EQ. They were amazed at the magnitude of the earthquake and what little damage we experienced as a result of the

earthquake. One of the focal points of controversy was the famous "Royal Palm Hotel" here was a building that had its grand opening a month earlier and suffered the most significant damage. I remember going through the rubble and the thing that disturbed me the most was how the occupants survived. Fortunately enough the guests in the hotel were from Japan. Japan is best known for its efforts in public education relating to Earthquakes. I remember seeing makeshift shelters inside the rooms. Majority of injuries incurred as a result of an EQ usually stem from debris falling on peoples heads but these people made makeshift barriers and stayed still until rescuers were able to get to them. The building looked like something from a science fiction set where there was debris and places where what used to be two stories were now compressed to one, it was very eerie. However, the experts concluded that the damaged sustained to the building was a result of poor construction-we know to day there was improprieties associated with the construction of the building.

Apparently the building was not build according to code but yet received approval for its construction. A number of other different buildings suffered significant damage like the alcove at the Guam Reef Hotel, the Guam Plaza Hotel which had to be totally demolished. Piti Power plants which had been built in the 1950's and 60's suffered significantly because of building codes set in that time frame. Now with Cabras #3 and 4 regardless of the UBC are build to seismic zone four based on our vulnerability.

The experts to this day are still amazed at the way we got through this travesty the way we did. One of the interesting points they observed was how the number of structures reported no damages. They attributed the construction practices of our local engineers and architects and the careful detail they take in our building practices. In

conclusion the mere fact that we went through the 8.0 earthquake constitutes we upgrade our UBC.

Thank You.



# GUAM ENVIRONMENTAL PROTECTION AGENCY

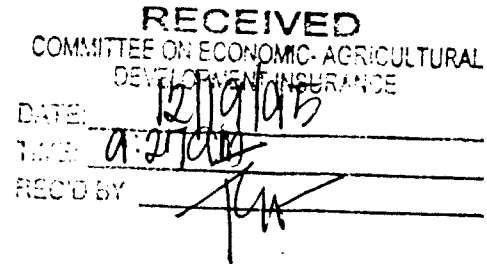


## AHENSIAN PRUTEKSION LINA'LA GUAHAN

P.O. BOX 22439 GMF • BARRIGADA, GUAM 96921 • TEL: 472-8863 • FAX: 477-9402

DEC 18 1995

Senator Joe T. San Agustin  
Chairman  
Committee on Economic-Agricultural  
Development and Insurance  
Twenty-Third Guam Legislature  
155 Hessler Place  
Agana, Guam 96910



Dear Chairman:

Thank you for this opportunity to testify on Bill No. 417, an Act to change Guam's Uniform Building Code Earthquake Seismic Zone Three (3) to Seismic Zone Four (4).

Due to the fact that Guam sits on the "Rim of Fire" and on top of several fault lines, it is necessary to look at the possibility of large magnitude earthquakes very closely. We must take all precautions to protect the people and property of our Territory.

Updating the Uniform Building Code (UBC) to change from Seismic Zone Three to Seismic Zone Four, is in line with this protection. It must be pointed out that this could increase the costs of building somewhat, but we feel that it is a cost beneficial trade-off.

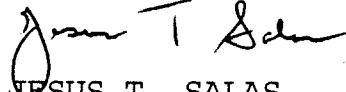
Planning for and allowing design criteria to be stepped up to UBC Seismic Zone Four design standards should decrease the probability of structural failure during seismic activities, and negate the even higher commensurate costs associated with rehabilitating or rebuilding. In addition, we would like to recommend that all fault hazard areas, which cut across the island, be identified and delineated. Following this surveyed delineation, minimum setbacks or buffer zones should be established along the fault lines varying in width as appropriate for the type of development. Furthermore, to preclude catastrophic failures, subsurface utility lines, especially water and sewer lines, should be constructed with flexible joints. Through such planning efforts we can help decrease the impact on the environment in the event of an earthquake. We were indeed fortunate with the last major earthquake; let's plan ahead so we don't have to rely solely on our good fortune.



Senator Joe T. San Agustin  
Page 2

Thank you.

Sincerely,

A handwritten signature in cursive script that reads "Jesus T. Salas". The signature is written in dark ink and is positioned above the typed name.

JESUS T. SALAS  
Acting Administrator

December 18, 1995

**Taniguchi-Ruth-Smith  Associates**  
Members of the American Institute of Architects

The Honorable Joe T. San Agustin  
Chairman, Committee on Economic-Agricultural  
Development and Insurance  
Twenty Third Guam Legislature  
424 W. O'Brien Drive  
Julale Shopping Center, Suite 218  
Agana, Guam 96910

Subj: Testimony in support of Bill 417, an act to raise Guam's UBC  
seismic zone designation from three to four.

From: Michael W. Makio, AIA  
Chairman, Guam Seismic Advisory Council  
Sr. Project Architect, Taniguchi-Ruth-Smith +Associates

I would like to thank Senator San Agustin and this committee for allowing me an opportunity to testify in support of Bill No. 417.

I am currently serving as the Chairman of the Guam Seismic Advisory Council and a Sr. Project Architect with the firm Taniguchi-Ruth-Smith +Associates.

As such, I was directly involved with the group of emergency planners, architects, engineers and geologists who advocated the creation of Bill 417.

As you have heard from the preceding testimony, emergency planners and private sector professionals have done a lot of research to evaluate the benefits of raising our Seismic Zone designation. We understand this is just *one step* in a larger and more comprehensive effort to provide safer buildings and keep the public aware of earthquake facts, mitigation efforts and preparedness.

In reviewing all the research about our regions seismic conditions, the most significant point we have come to realize is this; **the extent of Guam's seismic vulnerability may be higher than previous data indicated.** To put this another way, there may be even more damaging earthquakes in Guam's future. The Guam Seismic Advisory Council is continuing correspondence with National and International Research and Building Code organizations to further our understanding of Guam's earthquake vulnerability and use that information in our island's emergency recovery plans, disaster mitigation plans and building design. The Seismic Council also has long term plans to commission studies and make use of more state-of-the-art earthquake monitoring equipment, but, this is a very long process. Based on the data that we have right now, and considering the August 8 earthquake, the Earthquake in Kobe Japan and the recent volcanic activity in the Marianas Islands we feel that raising Guam's Seismic Designation to zone four is a good, conservative approach to affording Guam's residents an added level of security right now.

It is an economical step in terms of the reduction in property damage and more importantly in reducing

the loss of lives from a major earthquake event in the future.

I will ask this committee to please keep in mind the following three points as you consider this legislation.

1. This change in Guam's Seismic Zone will primarily affect only multi-story Commercial and Hotel/Resort structures.

The majority of Guam's local, single family and multi family residential buildings will not be affected by the design criteria changes in UBC seismic zone four.

For single family residences and smaller structures, seismic zone three and four design criteria are very similar from a design engineering standpoint.

2. The cost increases in terms of design and construction are minimal, (with our current estimates between 2% and 7%), and this cost is more than off- set by the additional building safety that will be afforded to Guam residents and tourists alike.

The insurance industry should look favorably on this bill since it is a mechanism for minimizing earthquake damage and loss of lives. Guam may even see some reduction in insurance coverage costs resulting from passage of this legislation, similar to the Property Loss Reduction Programs being undertaken by Insurance Organizations in the States.

3. Earthquake science deals with probabilities and earthquakes are very unpredictable so there is no way to keep our residents completely safe during an earthquake but mitigation and education are the keys to minimizing loss. We must ensure that the design and construction codes are the best and most conservative available.

In summary , I strongly urge this committee and the legislature to look positively on Bill 417 and our other efforts to study and mitigate the effects of Earthquakes. If you will for just a moment, close your eyes and remember how you felt on August 8,1993 I think you will find it easy to support this bill.

Regards,



Michael W. Makio, AIA

**TRSA**  
Members of the American Institute of Architects

December 18, 1995

**The Honorable Joe T. San Agustin**  
Chairman, Committee on Economic-Agricultural  
Development and Insurance  
Twenty Third Guam Legislature  
424 W. O'Brien Drive  
Julale Shopping Center, Suite 218  
Agana, Guam 96910

**Subject: Testimony in support of Bill No. 417, an act to raise Guam's UBC Seismic Zone designation from Zone 3 to Zone 4**

**From: Thomas P. Camacho, S.E.**  
Co-Chairman, Guam Seismic Advisory Council  
President, GK<sup>2</sup>, Inc.

Senator Joe T. San Agustin, Chairman and Members of the Committee on Economic -Agricultural Development and Insurance:

I would like to thank you for the opportunity to testify in support of Bill No. 417.

My name is Thomas P. Camacho and I am a Registered Structural Engineer on Guam, the President of GK<sup>2</sup>, a local Structural Engineering Firm which has provided engineering services on Guam for 25 years, and current holder of the co-chairmanship for the Guam Seismic Advisory Council. I would like to express my support for Bill No. 417 which proposes to upgrade the current Uniform Building Code (UBC) Seismic Zone from Zone 3 to Zone 4.

A common question asked among building and design professionals after experiencing the August 8, 1993 earthquake of 8.1 magnitude is "Are we designing for the right seismic zone?", which is a legitimate question. The 1994 Uniform Building Code designates Guam as Seismic Zone 3.

The UBC incorporates a majority of the recommendations of the Seismology Committee of the Structural Engineers Association of California (SEAOC). Attached is an excerpt from "RECOMMENDED LATERAL FORCE REQUIREMENTS AND COMMENTARY" by the Seismology Committee of SEAOC, dated 1990 commonly referred to as the "Bluebook".

*In the 1975 Commentary the boundary (between Zones 3 and 4) was set at 25 miles from a fault capable of generating an earthquake of magnitude 7.0 or greater....* By definition, Guam should have been in Zone 4, since the 1975 earthquake, with an epicenter located 25 miles from Agana which had a magnitude of 7.1. More recently, zoning has been predicated on the estimated peak acceleration with a value of 0.3g being the boundary between seismic Zones 3 and 4.

The Earthquake Engineering Research Institute (EERI) team that visited Guam immediately after

the August 8 earthquake estimated effective ground accelerations in the maximum range of 0.25g which is less than the value of 0.3g (which the Bluebook now uses to differentiate between Zones 3 and 4). However, in the EERI summary of their August 17, 1993 Governor's Briefing, EERI states *The EERI Team believes the People of Guam should be aware that future earthquakes could produce significantly greater damage than the recent event.* In the final draft of the Guam Earthquake Reconnaissance Report dated April 1995, EERI states *The August 8 earthquake, though large, took place relatively far away. Reconnaissance of the island identified evidence for late-Quaternary activity of on-island faults. An earthquake smaller than the August 8 event on one of these on-island faults could produce ground motions much larger than those observed during this earthquake.*

In the same report, EERI compares the similarity of the effect of the ground motion of the 1993 Guam earthquake to those observed in the 1964 Alaska earthquake and the 1985 Mexico City Earthquake. The UBC currently lists Alaska and Mexico City in seismic Zone 4.

In view of the effects of the August 8 earthquake, coupled with the ominous warnings from the EERI, I submit that the Government of Guam and the A/E community should re-evaluate the design parameters for buildings on Guam.

It would appear that available scientific data are inadequate to "prove" that Guam should be in Zone 3 or that Guam should be in Zone 4 which indicates a specific area where we should concentrate our efforts. The engineering Community and the building codes normally investigate a variety of different loading conditions for structures and use the "worst case" for design purposes. In the absence of adequate scientific data, I believe it prudent to assume, unless there is strong evidence to the contrary, that Guam should be in Zone 4, and to design accordingly.

Economics are another factor influencing the choice of design intensity. A valid economic assessment of the cost of providing increased seismic resistance in building design depends on several factors. Messrs. Paulay and Priestly in their book: "Seismic Design of Reinforced Concrete and Masonry Buildings" state that *The extent to which economics becomes the overriding consideration depends on a number of factors: some quantifiable, others apparently not.... The key unquantifiable factor is the value of human life, which is subjective and controversial.* The factors to consider for making a valid economic assessment follow:

*Initial cost of providing increased seismic resistance*

*Reduced cost of repair and replacement, both structural and non-structural, as a result of damage or collapse*

*Reduced loss of revenue resulting from loss of serviceability*

*Reduced costs caused by third-party consequences of collapse*

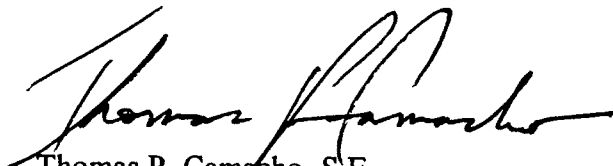
*Possible reduced insurance costs*

*Reduced costs arising from injury or loss of life*

*The cost of providing increased seismic resistance is generally significantly less than believed by uninformed critics, particularly when the increased resistance is provided by improved detailing rather than increased strength. Typical studies comparing the cost of doubling strength of frame buildings from resisting a total lateral force corresponding to 0.05g to 0.1g indicate increased structural costs of about 6 to 10 %. Since the structural system is approximately one third of the total cost of the building, the increased building costs would be about 2 to 3 % if we apply the above factor.*

I submit that everyone on Guam would benefit from the proposed legislation. Considering the severity of the Guam Earthquake and the failure of some of the buildings on Guam, it is miraculous that no one was killed. The advice of EERI should be heeded.

Thank You,



Thomas P. Camacho, S.E.

## APPENDIX 1E2a—Z

The Z coefficient in Formula (1-1) for the design base shear is included to take account of geographical variations in the expected levels of earthquake ground shaking. Evidence for such variations can be found both in the historical record of earthquake effects and also in the distribution of the major fault systems considered likely to produce significant earthquakes. The Z coefficient was deliberately omitted from the formula for design base shear until the 1974 edition of the Recommended Lateral Force Requirements because, until that time, it was believed that the available data were inadequate for the delineation of zones corresponding to different levels of ground shaking within California, and the Requirements were primarily intended for use within that state.

The 1975 Seismology Committee recommended adoption of a four-zone system with the coefficients  $\frac{3}{16}$ ,  $\frac{3}{8}$ ,  $\frac{3}{4}$ , and 1 to be used for Zones 1, 2, 3, and 4, respectively, of the 1976 Uniform Building Code. In the Commentary published in 1975, California was divided between Zones 3 and 4, with the boundary determined by proximity to major fault systems. The boundary was set at 25 miles from a fault considered capable of generating an earthquake of magnitude 7.0 or greater and 15 miles from a fault that could generate an earthquake of magnitude between 6.0 and 7.0. The distances were based on the Schnabel-Seed attenuation curve (Ref. Z14) and a value of 0.3g for the peak acceleration at the boundary on a rock site.

In 1978 the Applied Technology Council (ATC) prepared seismic zoning maps of the United States (Ref. Z4), based, with modifications, on a map by Algermissen and Perkins (Ref. Z1) showing the value of peak horizontal acceleration on rock with a 10 percent probability of being exceeded in a 50 year period. The Algermissen-Perkins map was based on historical seismicity. There were two ATC maps, one showing Effective Peak Acceleration, which was intended to control the short-period portion of the design-base shear curve and one showing an Effective-Peak-Velocity-Related Acceleration Coefficient, which was intended to control the long-period portion. The ATC maps show values equivalent to Zone 2 over an area of significant size in northern and central California.

The 1987 Seismology Committee collaborated with a number of other organizations and individuals to produce a zone map of the United States for use in the 1988 Uniform Building Code. The zone map for California is shown in Figure 1-A. There is only one zone map, but the philosophy embodied in the two ATC maps was followed. In drawing the zone boundaries both acceleration- and velocity-related maps were consulted, and, if they disagreed, the one indicating the higher zone prevailed. The Z values for Zones 2, 3, and 4, respectively, are 0.2, 0.3, and 0.4 for use in the design base shear formula, which was modified so that values of Z would correspond to the estimated values of effective peak acceleration. It was intended that the boundary between

The Honorable Joe T. San Agustin  
Senator and Chairman  
Committee on Economic-Agricultural  
Development and Insurance  
Twenty-Third Guam Legislature  
424 W. O'Brien Drive  
Julale Shopping Center, Ste. 218  
Agana, Guam 96910

Testimony before the Committee on  
Economic-Agricultural Development and Insurance  
December 19, 1995

Mr. Chairman and Members of the Committee:

My name is Paul M. Hattori. I am a geophysicist with the U.S. Geological Survey and Chief of the Guam Observatory. I am here to testify in support of Bill no. 417 to change Guam's Uniform Building Code Earthquake Seismic Zone three (3) to Seismic Zone four (4) and to provide information on the seismic history of Guam.

The August 1993 earthquake was a surprise--an earthquake of that magnitude was not possible. Northridge and Kobe were recognized high risks whose time came prematurely. Such is the state of our seismic knowledge and thus seismic hazard assessment. The advantage of Northridge and Kobe is you can walk on parts of the fault systems thus giving you a measurable potential magnitude. In contrast, parts of Guam's faults are in both the Pacific Ocean and Philippine Sea.

As you are aware we are situated on the southeast lobe of the 'pear-shaped' Philippine Sea Plate in the vicinity of the point where the Mariana Trench arcs to the wsw to join the Yap Trench (fig. 1). The on-going subduction process of the Pacific Plate moving under the Philippine Sea Plate is the primary cause of earthquakes in our region.

Figure 2 shows the structural subdivisions in our area and principal faults through and around the island. Following the August 1993 earthquake, a number of earthquakes ON, UNDER and ADJACENT to the island have been recorded. It has not been established by direct measurement the extent to which these faults are active.

Most will recall the November 1975 earthquake and if we use that as a bench mark, ground motion of similar or greater intensity has been experienced ten times since 1779. Ground shaking similar or greater than the 1993 earthquake occurred in 1849 and 1902.



December 19, 1995  
Page 2

The 1993 earthquake series was located south and east of the island, the 1902 event was north of Guam and the 1849 quake appears to have originated west of the island so the big earthquakes do not have fixed generation region nor a determinable recurrence cycle.

The earthquake in 1975 was of higher frequency and affected more short structures than the 1993 event which was of intermediate frequency of ground shaking. As damaging as the 1993 quake was we face the possibility of even longer periods of ground motion as may have occurred in 1902.

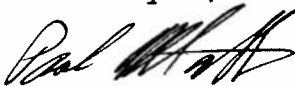
In 1994 two earthquakes 75 and 211 miles distance were recorded on the strong-motion accelerograph at my office. The event 211 miles away was northeast of Saipan, magnitude 5.5, was felt more strongly in Merizo than in Saipan. The April 1990 magnitude 7.5 quake east of Saipan and 224 miles from my office resulted in \$20,000 damage to a condominium under construction in Tumon. This longer period motion from an earthquake of magnitude comparable to the 1993 quake will affect high-rise structures more drastically than the 1993 event.

In my contacts with people relative to earthquake damage a few interesting observations have been noticed after the 1993 event.

- 1) the scope of the damage is occurring at lower magnitudes than in the past.
- 2) Some buildings suffered particular damage in 1975. The same buildings suffered different damage in August 1993. Small, magnitudes less than 5.3, earthquakes in 1994 and 1995 exacerbated the 1975 damages.

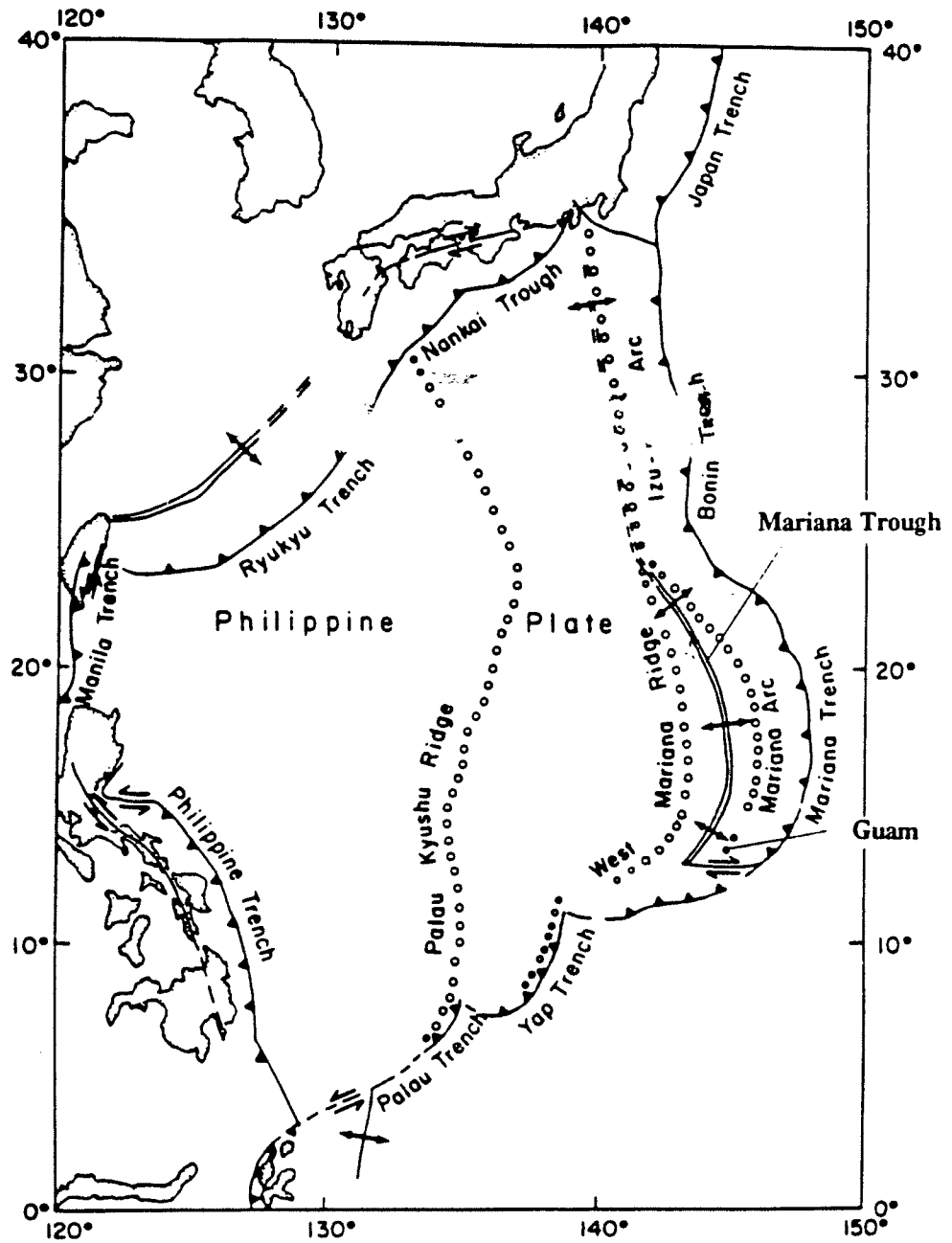
The August 1993 earthquake was a surprise--an earthquake of that magnitude was not possible. Northridge and Kobe were recognized high risks whose time came prematurely. I feel an upgrade to Seismic Zone four (4) based on seismic history and to mitigate future economic loss is warranted and support passage of Bill No. 417.

Thank you,

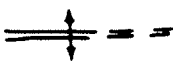


Attachments



FIGURE 1



LEGEND

  
 Spreading Center  
  
 Transform Fault

SOURCE: Karig and Ranken, 1983

  
 Subduction Zone  
 (Triangles = overriding plate)  
  
 Island Arc

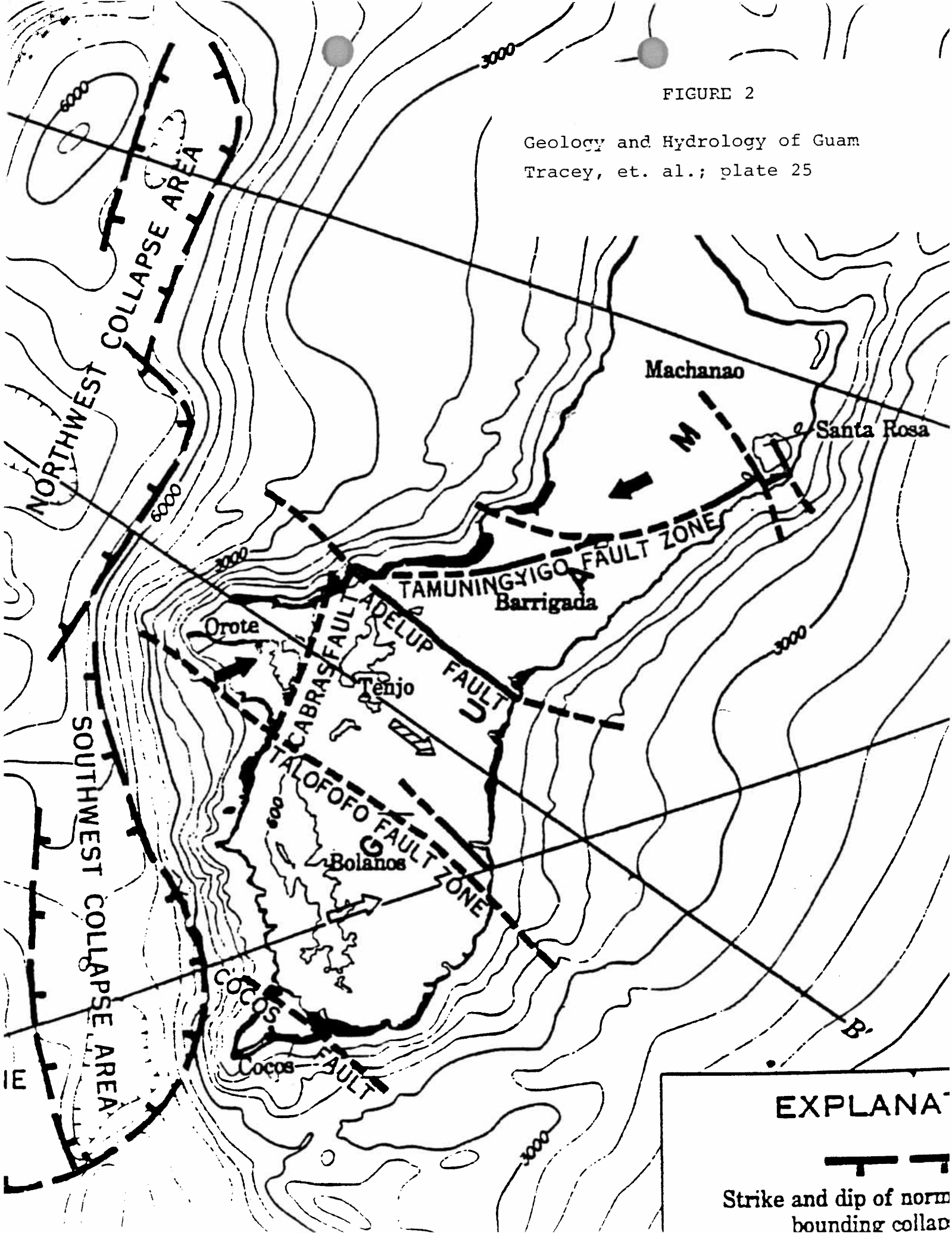
**SCHMATIC PLATE TECTONIC SETTING OF THE WESTERN PACIFIC OCEAN AND PHILIPPINE SEA**

October 1994  
03074-060-038

Government of Guam  
Earthquake Hazard Vulnerability Study  
Guam, Mariana Islands

FIGURE 2

Geology and Hydrology of Guam  
Tracey, et. al.; plate 25



December 18, 1995

**The Honorable Joe T. San Agustin**  
Chairman, Committee on Economic-Agricultural  
Development and Insurance  
Twenty Third Guam Legislature  
424 W. O'Brien Drive  
Julale Shopping Center, Suite 218  
Agana, Guam 96910

**Subject: Testimony in support of Bill No. 417, an act to raise Guam's UBC Seismic Zone designation from Zone 3 to Zone 4**

**From: Terangue E. R. Gillham P.E.**

Mr. Chairman and Committee Members:

My name is Terangue Gillham, and I am here to voice my support for Bill 417 which would change Guam's seismic rating from zone three to zone four. I am a registered civil engineer employed by GK2 Inc. My main area of work is in building structural design, and much of that work pertains to seismic design.

Guam's history is filled with records of the powerful typhoons and super-typhoons that pass over or near our island, causing the damage and problems that we as residents are all too familiar with. However, the same amount of attention, and respect, has not been accorded to the earthquakes which occur on our island. All of this changed dramatically on August 8, 1993, when an 8.1 Richter magnitude earthquake struck, causing widespread damage.

The experts sent to Guam after the earthquake by EERI, the Earthquake Engineering Research Institute, stated in their reports that Guam has the potential to experience more damaging earthquakes centered even closer to Guam. We were fortunate to have escaped the great quake with the amount of damage that we did. Many other areas have fared far worse under much smaller magnitude earthquakes. However, this is not justification for stating that Guam will necessarily be so fortunate in the future.

Structural designers are charged with the task of constantly updating information bases and techniques in order to ensure the greatest safety margin possible for the public. Our knowledge of Guam's earthquake risks is based on experience, and the experience provided on August 8, 1993, shows us that Guam is indeed vulnerable to large earthquakes which have high damage potential.

Upgrading Guam to zone 4 will increase the seismic design forces which are used to design future buildings. Given the magnitude of the August 8 earthquake, and considering the implications of the EERI reports, this increase is warranted. If used in conjunction with sound and rational

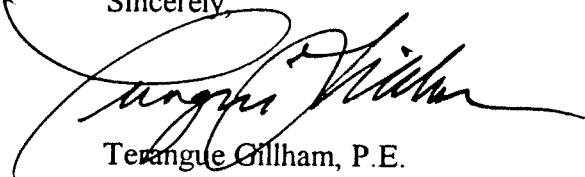
design techniques, and with proper construction practices, this change will heighten the level of safety provided to the community. This increased safety level will help to protect our island's structures, and the occupants of those structures, from damage wrought by future earthquakes.

Upgrading Guam to zone 4 will serve another purpose as well. A rating of zone 4 means that an area is classified as having the highest level of earthquake risk. This will act as a red flag to a structural designer, telling him or her that the structure they are designing has a high probability of being subjected to a large earthquake at some point during its lifetime. Consequently, that designer should recognize that the appropriate amount of attention and respect is to be paid to the seismic design process.

While this Bill is a step in the right direction, it is not a cure all that will provide 100% protection against damage in the future. The design community, lawmakers, and even the public must understand that effort on all their parts is needed to minimize the risk to our island. The design of structures resisting seismic loading is still a relatively new field, when compared to the long history of civil and structural engineering in general. As more research is done on seismic design, and more information is collected on earthquakes around the world, we must all be willing to help translate that information into increased safety for our island. This Bill is neither a first nor last step, it is a continuation of the process of providing the highest level of safety possible to the residents and visitors of Guam.

I thank you for the opportunity to speak on this matter.

Sincerely,

A handwritten signature in black ink, appearing to read "Terangue Gillham", written in a cursive style. The signature is positioned above the printed name.

Terangue Gillham, P.E.

NOV 13 1995

**TWENTY-THIRD GUAM LEGISLATURE**  
**1995 (FIRST) Regular Session**

Bill No. 417 (LS)  
Introduced by:

F.P. Camacho *Camacho*

**AN ACT TO CHANGE GUAM'S UNIFORM BUILDING CODE  
EARTHQUAKE SEISMIC ZONE THREE (3) TO SEISMIC  
ZONE FOUR (4).**

1 BE IT ENACTED ON BY THE PEOPLE OF THE TERRITORY OF GUAM:

2  
3 **Section 1.** The legislature finds that the Uniform Building Code (UBC) was adopted by the  
4 Fourteenth Guam Legislature into Guam law, and is now recognized as the standard to secure and  
5 promote the safety, health, and general welfare of the people of Guam by providing guidelines for  
6 the location, design, material, construction, alteration, repair, building service equipment,  
7 maintenance, use, occupancy, moving, removal and demolition of buildings and structures  
8 throughout our island.

9 The legislature also finds that as a result of the earthquake on Guam on August 8, 1993 of  
10 magnitude 8.1 on the Richter scale, utmost attention should be given to the quality of design and  
11 construction of all future buildings on Guam. The Earthquake Engineering Research Institute  
12 (EERI) team that visited Guam immediately after the 8.1 earthquake gave a Governor's Briefing  
13 on August 17, 1993. The EERI stated that they "...believe the people of Guam should be aware  
14 that future earthquakes could produce significantly greater damage than the recent quake."

15 The 1991 Uniform Building Code currently places Guam in seismic Zone 3. However,  
16 designing buildings and structures for UBC seismic Zone 4 in lieu of UBC seismic Zone 3 would

1 increase a building's base shear by 33 percent; hence, buildings on Guam designed and built  
2 accordingly in the future would be capable of resisting a 33 percent increase in inertial forces in  
3 the elastic range. Considering the severity of the 1993 earthquake and the failure of some of the  
4 buildings on Guam as a result of that earthquake, the advise of the EERI should be taken very  
5 seriously. This legislature should take the necessary steps to improve both building design and  
6 building construction practices here on our island.

7 A change in seismic Zone 3 to Zone 4 for Guam, and the resulting change in design and  
8 construction practices to adhere to a seismic Zone 4, would be a step in assuring the safety and  
9 well-being of the people of Guam.

10  
11 **Section 2.** Section 67101 in Chapter 67 of Title 21, GCA, is hereby lettered as Section 67101(a).

12  
13 **Section 3.** There is hereby created a new section 67101(b) which shall state:

14 All seismic Zone 3 references to Guam in any updated version of the Uniform Building Code shall  
15 be changed to seismic Zone 4 as it pertains to any standard on Guam for the furtherance of the  
16 intent of Chapter 66 of this Title.