

# **INSULAR ABC'S INITIATIVE**

## **Phase III Task 1 Findings and Recommendations**

### **Guam**

October 2015



**US Army Corps  
of Engineers**  
Honolulu District



**Office of Insular Affairs**  
**US Department of Interior**



**HHF PLANNERS**  
*places for people*



## Background

The US Office of Insular Affairs' (OIA) Insular ABCs Initiative is a multi-phase effort being managed by the US Army Corps of Engineers, Honolulu District via its contractor, HHF Planners. It is a collaborative effort with Insular Governors focused on improving the physical conditions of Insular Area public schools (Commonwealth of Northern Marianas, Guam, American Samoa and the US Virgin Islands).

The project is now in its third and final phase focused on removing the Deferred Maintenance (DM) backlog identified in Phase II. Assessments and recommendations for school sites and buildings were divided amongst four disciplines:

- Architectural
- Structural
- Mechanical, Electrical, Plumbing, and Fire Alarm (MEPFA)
- Civil

The purpose of the Phase III investigation was to:

- Receive updated input from cognizant local agencies and other stakeholders related to school conditions and priorities
- Confirm and review DM work completed since the Phase II condition assessment (2013)
- Update condition assessments for elements of concern
- Evaluate new Health/Safety issues
- Discuss and review issues of particular concern with cognizant local agencies
- Gather information on issues/elements of concern to develop and refine project recommendations to be included in the Work Plan.

This report includes Phase III findings and recommendations for Architectural, Structural, and MEPFA building system conditions. Civil engineer findings and recommendations are addressed in a separate report.

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# ARCHITECTURAL SUMMARY REPORT

## GUAM

October 2015

Prepared by:

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## I. PRIORITIZATION PRIOR TO PHASE 3 SITE VISIT

The Phase 2 survey produced ratings for various Architectural elements, as well as identification of Health and Safety issue. Prioritization of Architectural projects for Phase 3 was compiled from the results of the Phase 2 surveys, based on building element conditions and the potential hazards to building users. The order of priority for projects based on the Phase 2 observations were: conditions that pose an immediate hazard to the health and safety of the building occupants, conditions that if left unrepaired may cause damage to other building components or its contents, and other maintenance and repair projects. The table below shows the architectural elements found in the Phase 2 survey with Health and Safety concerns.

SCHOOL	BUILDING	HEALTH/SAFETY ELEMENT
Astumbo Elementary	01 – Admin/Library	Damaged & rusted doors
Astumbo Elementary	02-09 - Classrooms	Door Hardware
Captain Price Elementary	15 - Classroom	Deteriorated stair & handrail
Captain Price Elementary	16 - Classroom	Loose handrail
Captain Price Elementary	21 - Classroom	Heavily rusted roofing
F.B. Leon Guerrero Middle School	13 - Gym	Unsafe stairway
Carbullido Elementary School	13 - classroom	Unsecured roof panels
Merizo Martyrs Memorial Elementary School	05 - classroom	Wood stair is missing step
Vicente S.A. Benavente Middle School	04 - classroom	Railing end needs repair
Wettengel Elementary School	17 - Stage	Rail connection needs repair

## II. SUMMARY OF PHASE 3 MEETINGS AND SCHOOL VISITS

The purpose of the Phase 3 territory visits was to:

- Get input from DOE, DPW and other stakeholders
- Confirm and review DM work completed since the Phase 2 visits
- Update condition assessments of elements of concern
- Evaluate any new Health/Safety issues
- Discuss and review issues of particular concern to DPW
- Gather information on issues/elements of concern to develop project recommendations

Based on concerns developed during our Phase 2 survey, as well as additional concerns expressed by the DOE and stakeholders to the project team prior to or during the Phase 3 visit, the following schools were re-visited during the March 2015 visit:

- LP Untalan Middle School
- Captain Price Elementary School
- George Washington High School

- Jose Rios Middle School
- JQ San Miguel Elementary School
- Carbullido Elementary School
- MU Lujan Elementary School
- Agana Heights Elementary School
- Vincente Sa Benevente Middle School
- FB Leon Guerrero Middle School
- Southern High School
- MA Sablan Elementary School
- Inarajan Middle School
- Truman Elementary School
- Agueda Johnston Middle School

### III. OBSERVATIONS AND ADDITIONAL INFORMATION FROM PHASE 3 VISIT

It was observed that some repair work had been completed since the Phase 2 visits. This consisted of reroofing, some concrete spall repairs, some new gutters and downspouts, and other various repairs. Some schools have received extensive renovation work, such as LP Untalan Middle School. Most health and safety issues were repaired. Prominent work remaining is door and window replacement, exterior painting, and a need for new covered walkways at many schools.

Other observations are that often storm shutters or metal louvers are kept closed - either being used as sun shade, to prevent students from being distracted by something outside, or for security purposes during non-school hours - but they are not opened during the day to allow in natural light. Availability of natural light has been shown to increase productivity. Schools should consider using interior shade devices that teachers can more easily operate and encourage them to allow natural lighting. Also, many schools have louvers, which were installed when natural ventilation was utilized. These windows leaks cooled air, so they are often covered with non-openable plexiglass or with boards, which makes the room unusable if A/C breaks down. Adding fans will circulate cooled air and make room feel cooler.

Following is a summary of the schools visited and the issues noted at each school.

#### A. LP Untalan Middle School

This school has received extensive renovations including doors, windows, interior finishes, etc. Three new classroom buildings were constructed; two were constructed inside existing courtyards, which has reduced the natural ventilation and natural light available to the adjacent buildings as well as the new buildings. Temporary buildings 1-4 were moved to new locations on the property, and a new building was constructed in their original location.



After renovation, many buildings now have windows on only one side, and the temporary buildings have no windows; this could pose a problem if the A/C fails and there is lack of natural ventilation, making rooms uncomfortable. At nearly every window, the storm shutters are kept closed to help prevent vandalism. As a result, limited natural light is available.



Some roofs did not receive new roofing.

#### B. Captain Price Elementary School

New roofing was installed on most buildings. There is typically deteriorated roofing and sheathing at the covered walkways.

Buildings 16 and 17 are not in use, and the flooring and most wall finishes have been removed. At Building 16 (T7) the metal structure is quite rusted and is in poor condition. At Building 17 (T8) the wood structure is in fair condition, and the building could be refurbished and reused if space is needed.



Building 21 has been demolished.

### C. George Washington High School

Building 19 (A) was determined to have asbestos floor tiles, so the tiles were encapsulated in an epoxy coating. The epoxy is now cracking and bubbling in some areas; likely either the tiles below are detaching from the slab, or the epoxy is detaching from the tile. In some areas concrete was used to patch places where the tile detached and peeled off.





New handrails and some new doors and interior finishes were installed in Building 19. Buildings 11, 27 and 28 (Building B) also received new doors, lights, flooring and lab tables.

Gutters are in poor condition in several locations. There are some roof leaks in need of repair (Library, C-wing, A-wing), new exterior paint needed, and some railings need repair and repainting.



#### D. Jose Rios Middle School

The Gym (Building 15) has received extensive renovation, but new flooring is needed at the basketball court.





New gutters and roofing are needed at the covered walkways. A new covered walkway is needed between buildings 8 and 10, as students often get rained on when walking to these classrooms. Building 1 (built from metal containers) is still in poor condition.



#### E. JQ San Miguel Elementary School

Concrete repairs has been done as well as roofing work at the Cafeteria, which has for now stopped water leaks. At several locations, but predominantly at Building 14, condensation is forming on the outside of the building due to low room temperature inside and no insulation; moisture is damaging steel door and window frames, light fixtures, paint, and causing mold to form.



Buildings 9 and 12 have moisture/water issues inside due to earth outside of wall. Installation of a moisture barrier is needed at the walls and floor. Most concrete roofs have received new roofing except at buildings 6 and 7. Some metal railing repairs are needed.



#### F. Carbullido Elementary School

The roofing is generally in good condition, except in some areas where ponding occurs, and the roofing is starting to peel up. At the Cafeteria and adjacent offices it leaks when it rains; this appears to be from needed waterproofing at the joint between the building roof and the exterior walkway roof.



The previous moisture issues at Building 13 seem to have been solved with weep holes and painting. Building 6 needs repairs, including windows, doors, and flooring. The accessible ramp near Building 3 needs a roof to protect the ramp and its users from rain.





#### G. MU Lujan Elementary School

Concrete spalls were repaired last year at several buildings, including 11-16 and the covered walkways. Several of the fast track buildings (5-10) had leak issues that were resolved, but they need constant repairs at the building joints. Building 3 is not in use, and is planned for demolition. All buildings need exterior painting.



Some ponding areas were noted at the roof, but roofing at the concrete roofs is in good condition. New metal roofing is needed at the Stage (Building 17). The covered walkways on the southeast side of the campus are dilapidated and need new gutters.



#### H. Agana Heights Elementary School

Buildings 2, 12 and 5 are not in use and are planned for demolition. Some new gutters and downspouts were installed at Building 1. Tree debris is causing clogging of gutters, and debris on roof will hold moisture and cause damage to the roofing. The covered walkways with concrete roofs need new roofing.



#### I. Vincente SA Benavente Middle School

Buildings 1, 2, 3 are planned for demolition, but are still used by staff. Trash has accumulated around these buildings and near the adjacent classroom building (4).



There are some roof leaks at cafeteria despite new roofing. Termites are in the wall boards and furniture at Building 8, and should be treated by an exterminator. Broken windows often patched with plywood, which blocks natural light and invites more termites. New glazing or plexiglass should be installed instead. Many louvers are broken and need to be replaced.



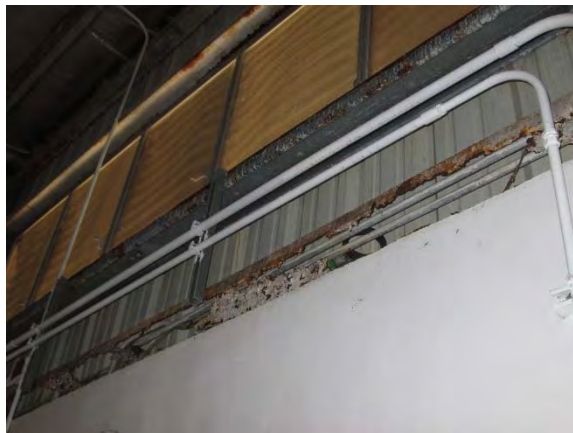
The constant use of gym and cafeteria by the school and by other groups using the facilities leads to trash around campus. The poor slope of window shade (now used to support A/C equipment) and no waterproofing is causing leaks in classrooms.

Burned out book room still filled with trash and unused. Remaining ducts of defunct A/C units on the roofs causing leaks inside the buildings. Restroom and covered walkways are needed near fast track buildings (20-22).

J. FB Leon Guerrero Middle School

New fluid applied roofing has been installed on all buildings. The roof is leaking at Building 6, possibly due to a clogged roof drain or A/C duct from the roof.

The hazardous stair issues at the Gym have been repaired. The Gym has rusted girders and leaks at the roof above the 2<sup>nd</sup> floor mezzanine; new edge flashing may help to resolve the leak issues. The gym flooring needs to be replaced. The rusted girders are a safety hazard due to falling pieces of rusty metal.





The spalling concrete was repaired at several locations, but there are other locations of spalling concrete, including the exterior stair at Buildings 1, 4 and 6, and at a beam at Building 5.



All buildings need new exterior paint.

#### K. Southern High School

The Auditorium (Building 12) and Gym (Building 11) have been renovated. The roofs are leaking at the Gym, Nurse's Office, and Building 6 (5000); mold is forming in the wet ceiling of the restroom at the Nurse's office. In several locations the gutters are rusting; it appears that they are not properly sloped and so water sits in the gutter for an extended time.



The recreation buildings at the baseball field, pool and track not used and are not maintained; the pool full of water, which is unsafe and also a breeding ground for insects.



L. Truman Elementary School

Buildings 11 and 13 were demolished.

The roof is leaking at library; also it appears the bottom of the wall at the addition is not properly flashed/sealed and is leaking inside during rains. New gutters are needed in several locations. Some trees were removed, but several of the remaining trees put debris on roofs and clog up the gutters and downspouts. The trees should at least be trimmed to reduce debris on the buildings.



M. MA Sablan Elementary School

Most buildings have received new fluid-applied or metal roofing. The covered walkways need new gutters and roofing, and Building 3 needs new metal roofing, gutters and flashing.



The floor sheathing is soft from previous roof leaks at Buildings 11, 12, 17, but the floor structure appears to still be in good condition.

N. Inarajan Middle School

At the joint between Buildings 1 and 5, the steel beam is rusted and the concrete is spalling. The Gym has rusted girders, broken bleachers, and the gym needs a new floor.



There are leaks between the Gym and the adjacent building. The building exteriors need new paint.

L. Agueda Johnson Middle School

The Stage, considered a safety hazard in the Phase 2 assessment, has been repaired. The Covered walkways need new corrugated metal roofing. The plywood sheathing should be eliminated, as it traps moisture and attracts termites. The plywood was reportedly installed to meet a FEMA detail/requirement for a walkway structure.





#### IV. ADJUSTMENTS TO PRIORITIZATION

Some of the health and safety issues identified in the Phase 2 assessment have been addressed and repaired. Only a few new health and safety issues identified were in the Phase 3 assessment.

The table below provides a summary of Health and Safety issues identified in the Phase II and Phase III assessments. Where Phase II Health and Safety items were repaired/addressed, they were removed from the list. The Phase III assessments entailed rapid observations, and not all schools were visited nor were all buildings at each school re-surveyed. Some other safety issues not listed below may still exist.

SCHOOL	BUILDING	HEALTH/SAFETY ELEMENT
REMAING FROM PHASE II		
Astumbo Elementary	01 – Admin/Library	Damaged & rusted doors
Astumbo Elementary	02-09 - Classrooms	Door Hardware
Merizo Martyrs Memorial Elementary School	05 - classroom	Wood stair is missing step
Vicente S.A. Benavente Middle School	04 - classroom	Railing end needs repair
Wettengel Elementary School	17 - Stage	Rail connection needs repair
NEW FROM PHASE III		
FB Leon Guerrero Middle School	13- Gym	Rusted metal from girder

## V. RECOMMENDATIONS

Following are descriptions of Architectural Health and Safety Issues of prominent concern, as well as some other repair issues, along with recommended repair solutions.

These recommended projects are provided as a means to assist in accelerating the time to complete these projects by providing identification of prominent issues as well as suggested solutions.

### 1. Damaged concrete at railing attachment

Location: Wettengel Elementary School, Building 17

The concrete wall is cracking and spalling at several locations where the railing connects to the wall. It is likely some of the damage is due to students pulling or pushing against the railing from either side, but if the railing ends had been adequately imbedded in the concrete wall it would not likely be damaged.

In addition, the connection of the rail to the concrete step on one side is also spalled and has lost integrity to support the railing. This should also be repaired to ensure overall strength of the railing.



#### Recommended Scope of Work:

- Cut railing off at each rail end and remove railing
- Cut out the metal end bases in concrete at both wall and steps and remove all loose concrete
- Install new metal railing end bases in concrete wall, deeper than previous end base. Patch with hydraulic concrete.

- Install new metal railing base in concrete step. The railing base is too close to the side of the step, so install further from side of step, or the step will need to be extended out so that there is minimum 2" concrete cover.
- Weld new rail bases to existing railing to reinstall

2. Rusted metal railing

Location: JQ San Miguel Elementary School, various locations



Recommended Scope of Work:

Where railings are rusted at the base, the railing must be removed and a new metal railing base installed in the concrete.

- Cut railing off at each base and remove railing
- Cut out the metal bases in concrete and remove all loose concrete
- Install new metal railing bases in concrete with hydraulic concrete. Weld bases to railing, ensuring that the railing is the height required by building code.

3. Rusted metal handrail

Location: JQ San Miguel Elementary School, various locations; FB Leon Guerrero Middle School, Building 13

Several of the handrails are heavily rusted on the top surface, in some areas to the point that the pocked rusted areas may cut people's hands, and are therefore a safety hazard. The railings should be repaired, or replaced with aluminum railings.



**Recommended Scope of Work:**

To repair the existing railing:

- Grind/sand the railing surface until there are no sharp edges
- Treat with a rust inhibitor
- Paint with an appropriate primer for final coat to be used
- Paint with a heavy catalyzed coating such as Amerlock Sealer
- Repaint as needed to keep an integral coating and help prolong life of railing

**4. Rusted metal door and window frames**

Location: JQ San Miguel Elementary School, Building 14

The extreme temperature difference between the outside air and the heavily cooled classrooms in this building causing moisture to condense on the outside of the walls, doors and windows. The moisture is causing the metal doors and metal frames to rust.



**Recommended Scope of Work:**

In order to prolong the life of these metal frames and doors:

- Remove paint from frames and doors
- Remove as much rust as possible
- Treat with a rust inhibitor



- Prime and paint all metal surfaces of the frame and doors
- Repaint as needed to keep an integral coating

5. Isolated areas of deterioration of Fluid-applied roofing

Location: Carbullido Elementary School, various locations

The roofing is generally in good condition, except in some areas where ponding occurs, and the roofing is starting to peel up.



Recommended Scope of Work:

To patch deteriorated area:

- Remove areas of peeling or bubbled roofing
- Thoroughly clean exposed roof surface and roofing around area to be patched
- Install new roofing patches according to manufacturer's directions

6. Spalling concrete (non structural)

Location: FB Leon Guerrero Middle School, Buildings 1, 4, 5 and 6; Inarajan Middle School, Building 1

The concrete is spalling at several locations on this campus, including at several stairs. The spalling should be repaired before it becomes worse and further compromises the integrity of the concrete element.



Recommended Scope of Work:

To repair non-structural concrete spalling, the following steps should be taken:

- Remove all loose concrete
- Remove as much rust as possible from steel reinforcing elements
- Replace reinforcing as necessary. Consider using fiberglass reinforcing bars
- Treat steel with a rust inhibitor compound
- Fill all cracks and patch spalls with new concrete

MECHANICAL, ELECTRICAL, PLUMBING, AND FIRE PROTECTION  
SUMMARY REPORT  
GUAM  
October 2015

Prepared by:  
InSynergy Engineering, Inc.

# I. PRIORITIZATION PRIOR TO PHASE 3 SITE VISIT

The initial physical assessment of all of the Guam schools was conducted in 2013 under Phase II of the ABC's Initiative. Based on these surveys, physical condition assessment ratings were developed for the various MEP elements for each of the Guam public school buildings (except for leased schools). The locations of particular types of concerns based on condition assessment data are summarized in the following table:

School	HVAC – Outside Air Provision	HVAC - Maintenance	HVAC - Equipment	Plumbing System	Plumbing Fixtures	Water Tank & Booster Pump	Electrical System	Electrical Hazard	Interior Lighting	Exterior Lighting	Telecommunications/Data	Fire Sprinkler system	Fire Pump System	Fire Alarm	Public Announcement (PA) System & Bell System	Has FEMA generator building	Has Booster pump system	Total Deficiencies
Agueda Johnston MS	X	X	X	X	X		X		X	X					X	N	N	9
Astumbo ES	X	X	X		X	X				X		X			X	Y	N	8
Taitano ES	X	X	X	X	X			X		X					X	N	N	8
Captain Price ES	X	X	X	X	X		X	X	X	X	X				X	N	N	11
Carbullido ES	X	X	X	X	X	X	X			X					X	Y	Y	9
Chief Brodie Memorial ES	X	X	X		X					X					X	N	N	6
Daniel L. Perez ES	X	X	X		X					X					X	N	N	6
F.B. Leon Guerrero MS	X	X	X	X	X	X				X	X	X			X	Y	N	10
Finegayan ES	X	X	X	X	X		X		X	X					X	N	N	9
George Washington HS	X	X	X		X	X			X	X					X	Y	N	8
Hagatna Heights ES	X	X	X		X		X		X	X					X	N	N	8
Inarajan ES	X	X	X	X	X	X				X	X				X	N	Y	9
Inarajan MS	X	X	X	X	X	X	X		X	X	X				X	Y	Y	11
J.P. Torres ES	X	X	X		X	X	X		X	X					X	N	Y	9
J.Q. San Miguel ES	X	X	X		X	X	X		X	X					X	N	Y	9
Jose Rios MS	X	X	X		X			X	X	X		X			X	N	N	9
Juan M. Guerrero ES	X	X	X		X	X	X		X	X					X	Y	N	9
L.P. Untanlan MS	X	X	X	X	X		X		X	X	X				X	N	N	10
LBJ ES	X	X	X		X			X		X	X				X	N	N	8
M.A. Sablan ES	X	X	X	X	X	X	X	X	X	X					X	N	Y	11
M.U. Lujan ES	X	X	X	X	X	X	X	X	X	X	X				X	Y	N	12
Machananao ES	X	X	X		X	X	X			X		X			X	Y	N	9
Maria A. Ulloa ES	X	X	X		X	X	X		X	X					X	Y	N	9
Merizo Martyrs Memorial ES	X	X	X		X	X	X		X	X					X	Y	N	9
Oceanview MS	X	X	X	X	X	X	X	X	X	X	X				X	N	Y	12
Ordot/ Chalan Pago ES	X	X	X		X	X		X		X					X	Y	N	8
P.C. Lujan ES	X	X	X		X					X					X	N	N	6
Simon Sanchez HS	X	X	X		X		X		X	X	X				X	N	N	9
Southern HS	X	X	X		X	X		X		X		X	X		X	N	Y	10
Talofofo ES	X	X	X	X	X	X	X		X	X					X	Y	Y	10
Tamuning ES	X	X	X		X				X	X		X			X	N	N	8
Truman ES	X	X	X		X	X	X		X	X					X	Y	Y	9
Upi ES	X	X	X		X	X	X			X					X	Y	Y	8
Vicente Benevente MS	X	X	X		X		X	X	X	X	X				X	N	N	10
Wettengel ES	X	X	X		X	X	X			X					X	Y	N	8
<b>Total Deficiencies</b>	<b>35</b>	<b>35</b>	<b>35</b>	<b>13</b>	<b>35</b>	<b>21</b>	<b>22</b>	<b>10</b>	<b>21</b>	<b>35</b>	<b>10</b>	<b>6</b>	<b>1</b>	<b>0</b>	<b>35</b>	<b>15</b>	<b>11</b>	<b>314</b>
LEGEND =																		
X has deficiency																		
O satisfactory																		
N/A not available																		



The phase 2 assessment also identified the high priority Health and Safety (H/S) items which pose an immediate hazard to the health and safety of the building occupants. H/S items are summarized in the table below:

System	Electrical								Plumbing & Sanitation						Mechanical						Fire Protection			
Hazard	Fire, Injury	Shock	Falling	Shock	Shock	Shock, Fire	Shock	Safety	Fire, Injury	Injury	Fire	Sanitation	Health	Sanitation	IAQ, Health	IAQ, Fire	Injury	Injury	IAQ	Injury	Life safety	Life Safety	Fire	
Causes	Unlocked electrical rooms, used as storage, lack of clearance around equipment, water heater in same room	Corroded main service equipment, service drop conductors exposed	Handholes are missing covers on school grounds or not secured	Panelboard is in poor condition, not rated for outdoor use, corroded, missing breakers, cover, exposing wiring	Outdoor receptacles and receptacles near plumbing fixtures not GFCI type	Exposed or open receptacles, junction boxes, wall switches, wireways, corroded wiring and conduits, exposed conductors	Interior Lighting fixtures missing covers, corroded and worn	Exterior lighting not rated or appropriate for external use, not weatherproof, missing cover	LP Gas container has not been enclosed	Hot water heater relief valve is not piped, has improper termination	Inappropriate piping material used, e.g. PVC piping at kitchen hood	Floor drain backup, nonexistent, flooded rooms	Rusted pipes contaminating potable water	Inoperable water pumps, lift station	Mildew and poor indoor air quality	No ventilation air due to lack of inoperable windows or fans, toilet ventilation discharges to hallways	Mechanical equipment missing cover/guard for moving parts	Condensate drain discharge at walkway	Corroded large package units, ductwork	Abandoned AC units, solar hot water panels, heaters, and other equipment	Fire alarm/sprinkler/fire pump system not operational, corroded or damaged	Fire suppression system at cooking hood need service & maintenance	Generator room code violations*	Total
Guam School																								
Agueda Johnston MS			X		X						X													3
Astumbo ES										X											X		X	3
Taitano ES										X							X							2
Captain Price ES				X		X																		2
Carbullido ES						X				X												X		3
Chief Brodie Memorial ES					X	X		X																3
Daniel L. Perez ES																								0
F.B. Leon Guerrero MS					X										X						X		X	4
Finegayan ES			X	X	X												X							4
George Washington HS					X	X										X	X					X	X	6
Hagatna Heights ES				X	X																			2
Inarajan ES																			X					1
Inarajan MS				X		X										X						X		4
J.P. Torres ES								X						X										2
J.Q. San Miguel ES																					X			1
Jose Rios MS	X	X							X	X											X			5
Juan M. Guerrero ES																						X		1
L.P. Untalan MS										X				X										2
LBJ ES					X																			1
M.A. Sablan ES							X	X					X											3
M.U. Lujan ES		X			X	X							X									X		5
Machananao ES																					X		X	2
Maria A. Ulloa ES						X				X												X		3
Merizo Martyrs Memorial ES					X	X				X									X			X		5
Oceanview MS				X	X	X																		3
Ordot/ Chalan Pago ES																			X				X	2
P.C. Lujan ES				X		X				X														3
Simon Sanchez HS						X												X	X					3
Southern HS		X				X				X		X				X			X	X				7
Talofofo ES		X		X				X															X	4
Tamuning ES																					X		X	2
Truman ES					X	X																X		3
Upti ES						X													X			X		3
Vicente Benevente MS		X																						1
Wettengel ES				X		X																X		3
<b>Total</b>	<b>1</b>	<b>5</b>	<b>1</b>	<b>8</b>	<b>11</b>	<b>16</b>	<b>1</b>	<b>4</b>	<b>1</b>	<b>9</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>6</b>	<b>6</b>	<b>2</b>	<b>16</b>	<b>101</b>

## II. PHASE III SCOPE OF WORK AND FOLLOW-UP MEETINGS AND SCHOOL VISITS

The Phase III scope included refining and confirming the high priority mechanical, electrical, and plumbing (MEP) concerns from the Phase II assessments, coordinating these MEP priorities with needs from other disciplines at a building level and developing conceptual multidisciplinary projects that would allow some of the repair or replacement work to be grouped for more efficient implementation.

As part of Phase III, additional field survey work was conducted from May 4 to May 8, 2015. The purpose of the Phase III territory visits was to:

- Get input from Guam Department of Education (GDOE) and other stakeholders, including the Guam Power Authority (GPA), and Guam Fire Department (GFD)
- Confirm and review DM work completed since the Phase II visits
- Update condition assessments of elements of concern
- Evaluate any new Health/Safety issues
- Discuss and review issues of particular concern to the GDOE
- Gather information on issues/elements of concern to develop project recommendations
- Review and update the energy audit assessment

Based on concerns developed during our Phase II survey, as well as additional concerns expressed by the GDOE and stakeholders to the project team prior to or during the Phase III visit, the following schools were re-visited during the May 2015 visit:

- LP Untalan Middle School
- Captain Price Elementary School
- George Washington High School
- Jose Rios Middle School
- CL Taitano Elementary School
- Oceanview Middle School
- Talofofo Elementary School
- Vicente S.A. Benevente Middle School
- Wettengel Elementary School
- Finegayan Elementary School
- Southern High School
- Truman Elementary School
- MA Sablan Elementary School
- Inarajan Middle School

## III. OBSERVATIONS AND ADDITIONAL INFORMATION FROM PHASE III VISIT

Some of the MEP DM work items identified in Phase II have been completed, but most of the high priority MEP H/S items have yet to be addressed.

The primary concern raised during the survey work was that some of the fire alarm systems at the schools were inoperable due to numerous troubles and silenced fire alarms. The fire alarm systems were installed during the Phase II survey, but lacked service maintenance support from qualified fire alarm service providers. Based on these findings, and additional concerns raised by the fire department

on this issue, the repair and replacement of the fire alarm systems has been elevated to a high priority MEP H/S item.

Some of the electrical service upgrades have been completed, while other service upgrades still need to be accomplished. The electrical service upgrade work in our physical condition rating assessment has been updated accordingly.

A majority of the DX ductless split air conditioning systems have also been recently replaced under ARRA funding. Temperatures of conditioned spaces were controlled by standalone local thermostats. These thermostats were neither non-programmable nor interconnected for centralized controls. Some space temperature settings were at 22.2 °C (72 °F) or lower. Air conditioners run continuously 24/7, year round. Low space temperatures did not only consume more energy, but also caused condensation to the hallways and adjacent unconditioned spaces. Condensation could cause damage to building elements, indoor environmental issues, and safety issues such as slippery floors. Furthermore, some of the split air conditioners are equipped with temperature control that requires manual reset after brown out. Energy Conservation Measures (ECM) for Heating, Ventilation and Air Conditioning (HVAC) control or Energy Savings Performance Contracting (ESPC) for HVAC systems and controls could be considered to reduce the energy costs, reduce building repair costs, improve indoor air quality, and reduce slipping hazards.

The generators and water storage tank systems for the schools that have been designated as emergency shelters by FEMA were also reviewed. These generators have been maintained by FEMA regularly.

Additional ECM improvements were also completed as noted in the section covering the Energy Audit Assessment Update. Following is a summary of the schools visited and the issues noted at each school.

#### **A. LP Untalan Middle School**

##### **1. Fire Alarm System**

OIA Phase III survey found the fire alarm panel had trouble signals. The fire alarm system requires services and repairs to ensure its functions and performance meet the fire safety requirements.



2. Plumbing

The school had major renovations to the buildings. Nevertheless, old plumbing pipes inside the pipe chases and underground were not repaired or replaced during the renovation. Restrooms have experienced clogged sewage lines since the renovation.

OIA phase II survey found the emergency power generator and sewage pumps at the sewage lifting station building needed repairs and restoration. These equipment were restored and operational during the Phase III survey.



3. Air conditioning system

Air conditioning equipment was replaced during the renovation. Ductless DX split systems were installed at the classrooms with provision for outside air.



4. Electrical/Lighting

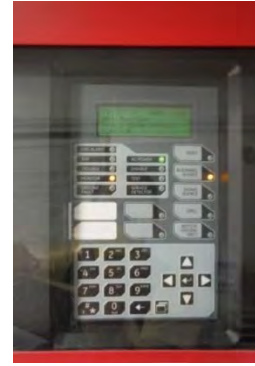
A new main switchboard was installed in the electrical room. All lighting fixtures are slowly being replaced with higher efficiency lighting.



## **B. Captain Price Elementary School**

### **1. Fire Alarm System**

OIA Phase III survey found the fire alarm panel had trouble signals. The fire alarm system requires services and repairs to ensure its functions and performance meet fire safety requirements.



### **2. Electrical/lighting**

All lighting fixtures are slowly being replaced with higher efficiency lighting.



## **C. George Washington High School**

### **1. Fire Alarm System**

OIA Phase III survey found the fire alarm panel had trouble signals. The fire alarm system requires services and repairs to ensure its functions and performance meet the fire safety requirements.



2. Electrical/lighting

All lighting fixtures are slowly being replaced with higher efficiency lighting.



**D. Jose Rios Middle School**

1. Fire Alarm System

OIA Phase III survey found the fire alarm panel had trouble signals and silenced alarms. The fire alarm system requires services and repairs to ensure its functions and performance meet fire safety requirements.



2. Mechanical System

OIA Phase II survey found the air conditioning system at Building 15, Gymnasium required repair and balancing. OIA phase III survey found new air conditioner had been installed.





3. Electrical/lighting

All lighting fixtures are slowly being replaced with higher efficiency lighting.



**E. CL Taitano Elementary School**

1. Fire Alarm System

OIA Phase III survey found the fire alarm panel was at normal operation. Some smoke detectors were less than 36" from supply air diffusers which were noncompliant installation to NFPA 72.



2. Plumbing System

Occasional low municipal water supply pressure affected normal operation of plumbing fixture flush valves. Booster pump system or low operation pressure flush valves can be considered to rectify the issues.

3. Electrical/lighting

All lighting fixtures are slowly being replaced with higher efficiency lighting.



**F. Oceanview Middle School**

1. Fire Alarm System

OIA Phase III survey found the fire alarm panel had trouble signals and silenced alarms. The fire alarm system requires services and repairs to ensure its functions and performance meet fire safety requirements.

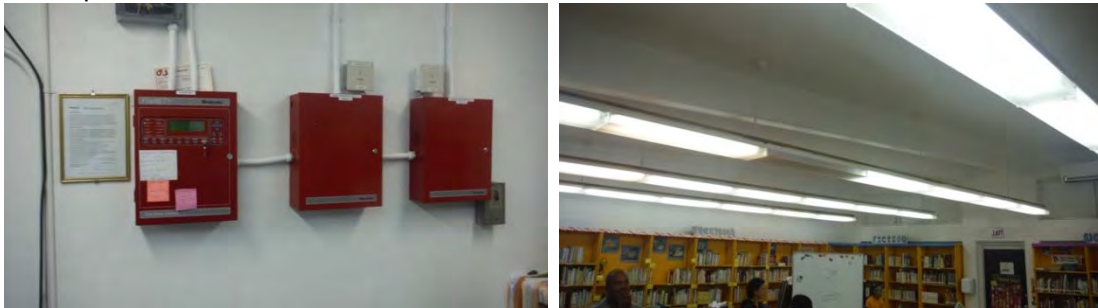
2. Electrical/lighting

All lighting fixtures are slowly being replaced with higher efficiency lighting.

**G. Talofofo Elementary School**

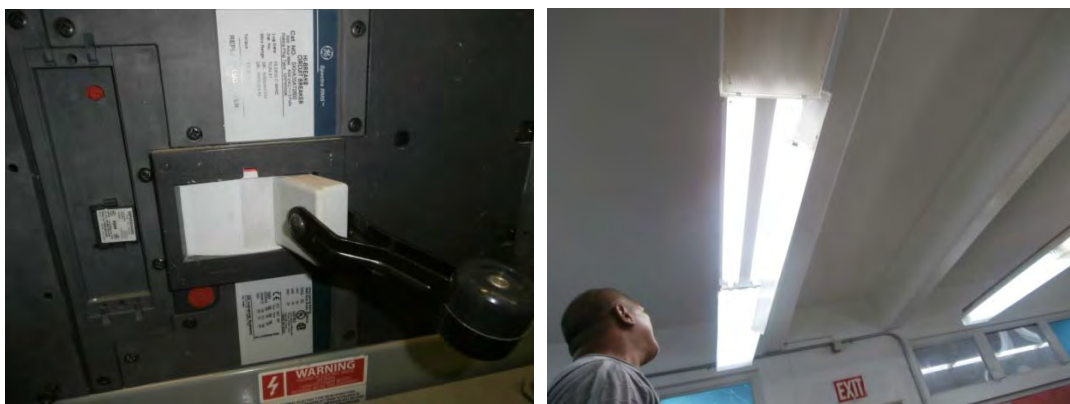
1. Fire Alarm System

OIA Phase III survey found the fire alarm panel was at normal operation. Building 12, Library, had no pull stations or automatic fire detectors.



2. Electrical/lighting

A new main switchboard was installed in the electrical room. All lighting fixtures are slowly being replaced with higher efficiency lighting.





## H. Vicente S.A. Benevente Middle School

### 1. Fire Alarm System

OIA Phase III survey found the fire alarm panel had trouble signals. The fire alarm system requires services and repairs to ensure its functions and performance meet fire safety requirements.



Fire alarm extender panel at Building 22 was below a ductless split indoor fan coil unit. Ductless fan coil unit will have condensation occasionally and potentially damage the fire alarm extender panel or cause trouble signal.



### 4. Fire hazard

OIA Phase III survey found Building 11 had pile of damaged books and papers left from a previous fire. These substances pose a fire hazard and should be cleared.



5. Air conditioning System

OIA Phase III survey found the space temperatures were low. Cafeteria ceiling was damaged due to air conditioning system condensation. Condensation drain did not pipe and discharge to proper location. Condensation at hallways occurred due to low space temperatures at the classrooms above.

Space temperature at Building 13, Cafeteria, was set at 61° F. It was too low and caused condensation, mildew growth (indoor air quality concerns), excess power consumption, and compressor operation.



Condensate drain pipes at Building 10 discharged at the overhang. Condensate drain should be piped and discharged to a proper location.



Condensation occurred at hallway ceiling at Building 8 and Building 11. Condensation and subsequent mildew growth were because of low room temperatures in air conditioned rooms above the hallway. The hallways were damp, with slippery floors, due to the condensation.



6. Electrical/lighting

A new main switchboard was installed in the electrical room. All lighting fixtures are slowly being replaced with higher efficiency lighting.



I. Wettengel Elementary School

1. Fire Alarm System

OIA Phase III survey found the fire alarm panel had trouble signals. Some protective cover for manual pull stations had condensation. The fire alarm system requires services and repairs to ensure its functions and performance meet fire safety requirements.



2. Plumbing System

OIA Phase III survey found the domestic water piping and water filters at Building 16, Cafeteria, leaked and should be repaired.



3. Electrical/lighting

A new main switchboard was installed in the electrical room. All lighting fixtures are slowly being replaced with higher efficiency lighting.



**J. Fineganyan Elementary School**

1. Fire Alarm System

OIA Phase III survey found the fire alarm system was damaged by lightning. The fire alarm system power was off. Some manual pull stations were missing at Building 2 and Building 3. The fire alarm system requires services and repairs to ensure its functions and performance meet fire safety requirements.





2. Electrical/lighting

A new main switchboard was installed in the electrical room. All lighting fixtures are slowly being replaced with higher efficiency lighting.



**K. Southern High School**

1. Fire Alarm Systems

OIA Phase III survey found the school had three fire alarm systems not interconnected. Fire alarm system at Building 11, Gymnasium, was at normal condition but the transient surge protector was not powered and needed repair. Fire alarm system at Building 12, Auditorium, was at normal condition. Fire alarm system at Building 15, Main office, power was off. This system protected all school buildings except Building 11 and Building 12. GDOE explained that a project for the replacement of the fire alarm system at Building 15 was being bid.



Fire alarm panels at Building 11, Gymnasium



Fire alarm panels at Building 12, Auditorium



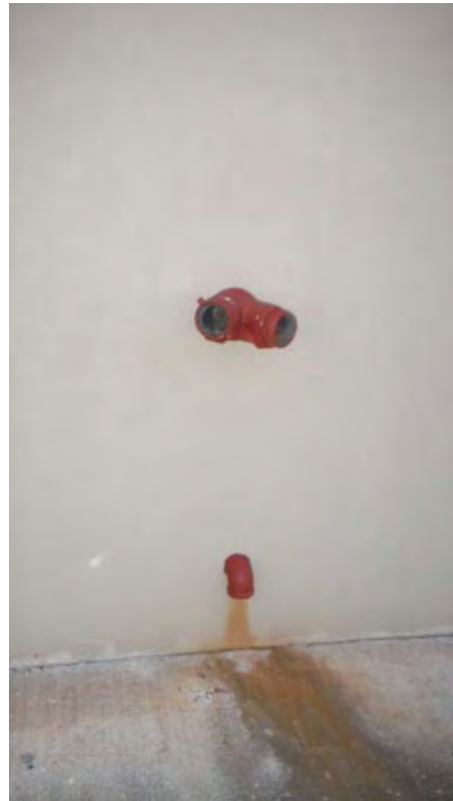
Fire alarm panel at Building 15

## 2. Fire Sprinkler Systems

OIA Phase III survey found the fire sprinkler systems were not serviced per NFPA 25. Control valve at Building 11, Gymnasium, was not supervised per NFPA 13 and Internal Fire Code (IFC). Fire department connection at Building 12, Auditorium, had no cover protection. The fire sprinkler systems require regular servicing and tests to ensure functions and performance meet fire safety requirements.



Sprinkler riser at Building 11, Gymnasium



FDC at Building 12, Auditorium

## 3. Mechanical Systems

OIA Phase III survey found the air conditioning system at Building 7, Cafeteria, was down and required repairs. This system was installed after OIA phase II survey.

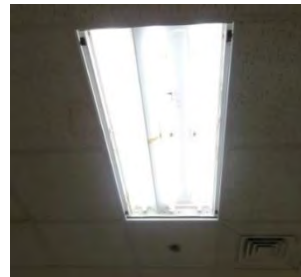


4. Plumbing Systems

Occasional low municipal water supply pressure affected normal operation of plumbing fixture flush valves. A booster pump system or low operation pressure flush valves can be considered to rectify the issues.

5. Electrical/lighting

All lighting fixtures are slowly being replaced with higher efficiency lighting.



**L. Truman Elementary School**

1. Fire Alarm System

OIA Phase III survey found the fire alarm panel had trouble signals and silenced alarms. Fire alarm notification devices at Building 5, Library, were covered by decorations. The fire alarm system requires services and repairs to ensure its functions and performance meet fire safety requirements.

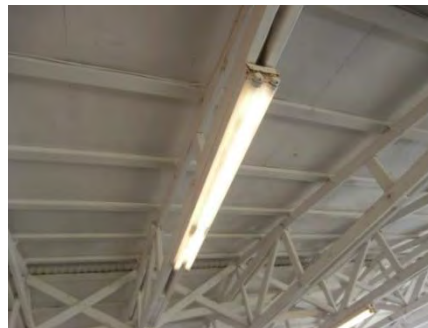


2. Plumbing Systems

Occasional low municipal water supply pressure affected normal operation of plumbing fixture flush valves. Booster pump system or low operation pressure flush valves can be considered to rectify the issues.

3. Electrical/lighting

All lighting fixtures are slowly being replaced with higher efficiency lighting.





### **M. MA Sablan Elementary School**

#### **1. Fire Alarm System**

OIA Phase III survey found the fire alarm panel was at normal operation. The fire alarm system required services and repairs to ensure its functions and performance meeting the fire safety requirements.



#### **2. Electrical/lighting**

All lighting fixtures are slowly being replaced with higher efficiency lighting.

### **N. Inarajan Middle School**

#### **1. Fire Alarm System**

OIA Phase III survey found the fire alarm panels had trouble signals and silenced alarms. The fire alarm system requires services and repairs to ensure its functions and performance meet fire safety requirements.



#### **2. Mechanical Systems**

OIA Phase III survey found some new installed air conditioning units dripped at the walkway. Ventilation fans at Building 2, Gymnasium were not operational and needed repair.



3. Electrical/Lighting

A new main switchboard was installed in the electrical room. All lighting fixtures are slowly being replaced with higher efficiency lighting.



IV. ADJUSTMENTS TO PRIORITIZATION

Some of the MEP Health and Safety issues noted in Phase II were seen to have been repaired, the site visits in Phase III added some additional items to the list of MEP Health and Safety issues. Revisions to the MEP DM physical condition assessment scoring, and to the H/S list based on our Phase III follow-up work were made to the database and include:

1. DM items for the electrical service upgrades already completed removed from the work plan list
2. DM items for air conditioning dx system replacement removed from the DM list where complete
3. DM items for fire alarm systems, upgraded after OIA phase II survey from the ARRA grants that now have trouble signals or silenced alarms, were marked as complete but with additional problems so these items, and respective costs, remain on the DM work list. These are identified as H/S category level 1 or level 2.

## V. ENERGY AUDIT ASSESSMENT UPDATE FOR PHASE III

### 1. Recap of Phase II Energy Audit Findings

The chart below (p. 20 in the Phase II report) provides an overview of the energy conservation measures (ECMs) that were initially recommended for Guam. At that time, the total annual savings was estimated at \$1.7 M (2013 dollars) at a total investment cost of \$13.6 M for the Primary ECMs that were recommended.

Energy Audit ECM Recommendations	Guam
<b>ECMs - Electric</b>	
New Solar Hot Water or Heat Recovery System	
Replace T12 Fixtures with T8 LED	
Replace T8 Fluorescent Lamps with T8 LED	
Programmable Thermostats for AC	
Roofmount 30-200 KW PV system	
Fix Supply Air Discharge Duct Leaks	
New Lighting Controls	
New VFDs/High Efficiency Booster Pump Motors	
<b>Total Investment (\$M) - Primary ECMs</b>	\$13.6
<b>Simple Payback (years) - Primary ECMs</b>	8
<b>Investment Capitalization (years) - Primary ECMs</b>	10
<b>Dollar Savings (millions per year) - Primary ECMs</b>	\$1.7
<b>Percent Reduction in Utility Costs - Primary ECMs</b>	20%
	ECM Recommended – Primary Recommendation
	ECM Recommended– Other, feasible if funding permits

### 2. Updated Phase II Energy Audit Analysis

Based on our follow-up survey, several ECM's have been implemented, primarily for replacing T-12 with T-8 lighting and replacement of plumbing fixtures with low flow fixtures in the schools in Guam. Our updated analysis, which has been revised to reflect the implementation of T-8 lighting retrofits is summarized in the table below:

Energy Audit ECM Recommendations	Guam
<b>ECMs - Electric</b>	
New Solar Hot Water or Heat Recovery System	
Replace T12 Fixtures with T8 LED	NA
Replace T8 Fluorescent Lamps with T8 LED	
Programmable Thermostats for AC	
Roofmount 30-200 KW PV system	
Fix Supply Air Discharge Duct Leaks	
New Lighting Controls	
New VFDs/High Efficiency Booster Pump Motors	
<b>Total Investment (\$M) - Primary ECMs</b>	\$15.5
<b>Simple Payback (years) - Primary ECMs</b>	9
<b>Investment Capitalization (years) - Primary ECMs</b>	10
<b>Dollar Savings (millions per year) - Primary ECMs</b>	\$1.7
<b>Percent Reduction in Utility Costs - Primary ECMs</b>	21%
<b>Total Investment (\$M) – All Feasible ECMs</b>	\$65.5
<b>Simple Payback (years) – All Feasible ECMs</b>	15
<b>Investment Capitalization (years) – All Feasible ECMs</b>	15
<b>Dollar Savings (millions per year) - All Feasible ECMs</b>	\$4.3
<b>Percent Reduction in Utility Costs - All Feasible ECMs</b>	50%
	ECM Recommended – Primary Recommendation
	ECM Recommended– Other, feasible if funding permits

The updated analysis, which includes the retrofit of the recently installed T-8 fluorescents with LED linear lamps for an additional 30% improvement in energy efficiency for lighting, suggests that the implementation of the Primary ECM's will still be cost effective, with the total annual savings for all Primary ECM's totaling \$1.7 Million at a total investment cost of \$15.5 Million. The total annual savings including all additional feasible ECM's, including replacement of all of the air conditioning equipment with high efficiency units, and the replacement of all remaining plumbing fixtures with low flow plumbing fixtures, would increase to \$4.3 Million at a total investment cost of \$65.5 Million. The implementation of these additional feasible ECM's would also have a significant positive impact on addressing the Deferred Maintenance (DM) for the replacement and maintenance on these items.

Retrocommissioning to the AC systems:

Existing AC systems are mostly ductless split systems, 24/7 year round operations with local standalone temperature controls. Space temperatures are set at 22 °C (72 °F) and lower by occupants. GDOE indicated the total monthly electric power of schools exceeded one million dollars. Few schools have central air conditioning systems, including the central chilled water plant at Tamuning Elementary School, and Southern High School with DX ducted systems and chiller plant in the Auditorium. Retrocommissioning AC systems may include high efficiency AC units, programmable temperature controls or direct digital controls central temperature controls and DDC, web-based interfacing DDC control, testing/ adjusting/ balancing, and indoor air quality to optimize the system efficiency, indoor air quality and occupant comfort.

## VI. PROJECT RECOMMENDATIONS

Following are descriptions of Mechanical/ Plumbing/ Electrical Health and Safety Issues of prominent concern, as well as some other common repair issues, along with recommended repair solutions. These are provided to assist in scoping these types of projects.

### 1) HVAC System

#### a) Air conditioning equipment:

Most of Guam schools use unitary air conditioning systems including ductless split, ducted split and packaged air conditioners except Tamuning ES and Southern HS have central chillers plant and chilled water air handlers serving part of the school. Most of the air conditioning equipment have been replaced recently under the ARRA funded projects and are in good conditions. When air conditioners are installed, the following recommendations should be considered.

Recommendations:

- EPA approved refrigerant, high efficiency system and corrosion protective coating air conditioning equipment should be used.
- Placement of condensing units should consider maintenance accessibility, required operation clearance, acoustical impact to classrooms; minimize penetrations to building envelopes and typhoon protection.
- Metal supports with corrosion protective coating for AC equipment should be used.
- Remove old air conditioning equipment and seal all unused penetrations.

Location: Southern HS, Building 7 Cafeteria – the air conditioning system was down during OIA III survey and need repair.



b) Air conditioning temperature and operation controls:

Air conditioners run 24/7 continuously including weekends and holidays. Some spaces have low space setting temperature. Because air conditioning system continuously operates at low temperature setting, condensation occurs at the adjacent space or floor below where is humid and reaches dew point. The condensation creates health and safety issues. Section 715.12(f) of Guam Code Title 1 requires classroom temperature not greater than 78 °F. However, the lowest classroom temperature setting has not been established for Guam schools yet. Some space temperature controllers require manually reset after power outage.

Location: Vicente Benavente MS, Building 13, Cafeteria — the space temperature controller is set at 61 °F



Location: Vicente Benavente MS, Building 11 – Classroom condensation occurs at 1/F hallway ceiling due to low temperature of room above. It creates mildew and slippery floor which becomes health and safety issues.



Recommendations:

- Maintain space conditions per ASHRAE Standard 55, Thermal Environmental Conditions for Human Occupancy, and Guam codes.  
Reference to ASHRAE Handbook 2015, the following space conditions may be used  
Classroom 75.4 °F ~ 78 °F (24.1 °C ~ 25.6 °C), 50% RH; Gymnasium 73.9 °F ~ 78 °F (23.3 °C ~ 25.6 °C), 50% RH; Cafeteria 78.5 °F (25.8 °C), 50% RH
- Provide programmable thermostat setting for un-occupied temperatures set back controls.
- Turn off air conditioning equipment when they are not needed.
- Establish energy conversation awareness program.
- Direct digital controls should be considered when replacing new temperature controls system.

c) Indoor air quality:

Ventilation should conform to ASHRAE 62.1. Space comfort level should conform to ASHRAE 55.1. HVAC system deficiencies will cause poor indoor air quality, health hazards and damage to building elements and contents.

Location: Vicente Benavente MS, Building 13 – Cafeteria  
ceiling is damaged due to air conditioner condensation.  
Repairs to ceiling and air conditioner are needed.

Recommendations:

- Repair air conditioning deficiencies, water leak and condensation as soon as possible.
- Maintain inadequate outside air and space comfort levels to the occupied spaces per ASHRAE standards. Provide treated outside air using dedicated outdoor air system wherever is possible.



Exhaust system should be installed per codes and ASHRAE standards.

Location: George Washington HS Building 21, Restroom  
– Toilet exhausts discharge to walkway.

Recommendations:

- Provide new toilet ventilation system per ASHRAE 62.1 and International Mechanical code.
- Provide dehumidifier and turn off air conditioner at classroom when it is unoccupied during holidays.



d) Condensate drain:

Condensate drains should be terminated to proper locations to avoid damage to building elements and slipping hazard.

Location: Vicente Benavente MS Building 10 – Classroom  
condensate drain discharges at the building overhang  
creating corrosion and vegetation problems at the  
overhang.



Location: Inarajan MS  
Building 5, Classroom  
Condensate of condensing unit drips on walkway

Recommendations:

- Provide proper sized and sloped condensate drain lines to collect and convey the condensate drain. Minimum 1" (25 mm) diameter pipe and 2% slope are preferred. Provide clean out not more than 180 degree change in direction and 50 ft apart.
- Condensate drain should be discharged to dry well or indirect drain with P-trap to waste line.
- Provide condensate drain pan for air conditioning equipment





2) Plumbing fixture and piping

Plumbing fixtures and piping should be maintained including leaky pipes and valves, defected and loosen fixtures and clogged waste line.

Location: LP Untalan MS Building 29 restrooms have experienced clogged sewage line at the existing underground piping since renovation.

Recommendations:

- Inspect internal condition of existing sewage line at LP Untalan MS. Repair and upgrade the sewage line accordingly.

Location: Wettengel ES Building 16 has leaks at domestic water piping and filters.

Recommendations:

- Repair water leak and plumbing fixture as soon as possible.





3) Unsteady water supply pressure

Some schools have experienced unsteady water supply pressure affecting flush valve operation causing improper flushing to plumbing fixture.

Location: CL Taitano ES, Truman ES and Southern HS

Recommendations:

- Coordinate with Guam Waterworks and make improvement plan. Improvement considerations include installation of booster pump, installation of pressure regulator and installation of low operating pressure flush valves and plumbing fixtures.

4) Fire sprinkler system

Where fire sprinkler system is installed, the system should be serviced and tested per NFPA 25, Standard for the inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.

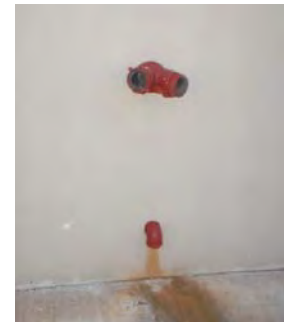
Location: Southern HS, Building 11 – Gymnasium fire sprinkler riser control valve is not supervised by fire alarm system.



Location: Southern HS, Building 12, Auditorium.  
Fire department connections have no cap protection.

Recommendations:

- Maintain and test automatic fire sprinkler system in accordance with NFPA standards and manufacturer's requirement.



5) Fire Hazard

Vicente Benevente MS Building 11 has pile of damaged books and paper left from previous fire. These combustible contents pose a fire hazard to the school and occupants.

Recommendation:

- Remove the damaged books and papers.

## 6) Fire Alarm Systems

Except Southern HS Building 15 and main campus, all Guam schools upgraded fire alarm systems in recent years under ARRA funded projects. Warranty of these fire alarm systems has been expired. Some systems have been trouble and silence alarms. Some devices have deficiency should be rectified.

Location: CL Taitano ES Building 03 – Office. Smoke detector is installed less than 36” from supply air diffuser.



Location: Talofofo ES Building 12, Library.  
Library does not have manual pull station or automatic fire detection device.



Location: Truman ES Building 5 – Library. Notification device is covered by decoration.



Location: Wettengel ES Building 18 – Office. Manual pull station and enclosure has condensation.



Location: Southern HS  
School has three fire alarm panels located at Building 15 Main Office, Building 12 Auditorium and Building 11 Gymnasium.

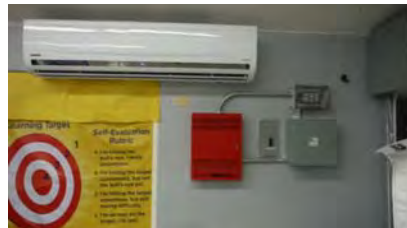
- 1) Three systems are not interconnected.
- 2) Fire alarm panel at Building 15 is OFF. This system covers the whole school except Building 12 and Building 11.
- 3) Transient surge protector at Building 11 is not powered and need repair.



Location: Vicente Benvente ES

Building 22, Classroom

Fire alarm extender panel is installed under ductless split indoor DX fan coil unit. Fan coil unit will have condensation occasionally and potentially damage the fire alarm extender panel or cause trouble signal to fire alarm system.



Location: Finegayan ES Building 1, Office

Fire alarm system was damaged by lightning.

Upi ES fire alarm system was damaged by lightning as well.



Fire alarm panels have trouble and silence alarms, and need repair.

Location: Captain Price ES, George Washington HS, Inarajan MS, Jose Rios MS, LP Untalan MS, Ocean MS, Truman ES, Vicente Benavente MS and Wettengel ES

#### Recommendations:

- Perform routine maintenance and testing to fire alarm systems per NFPA 72 by qualified technicians. If possible, establish fire alarm technical team within GDOE to perform troubleshooting, repair, maintenance and routine testing and certification.
- Upgrade fire alarm system at Southern HS Building 15 and main campus. Interconnect fire alarm systems at Building 15, Building 12 and Building 11.
- Repair lightning damaged fire alarm systems at Finegayan ES and Upi ES.
- Rectify and repair fire alarm system deficiency.
- Maintain fire alarm system information, manuals, maintenance and testing records on site.
- Provide regular operation training of fire alarm system to school staffs. Establish fire safety awareness program to promote fire safety awareness to the staffs and occupants.
- Conduct regular test and fire drill. Coordinate and invite fire department to participate fire test and fire drill.

#### 7) Electrical Lighting Systems

Lighting fixtures should be maintained. Defective light bulbs and broken casings should be repaired timely.

Location: All Schools

Location: Vicente Benavente Middle School

Lighting fixtures are missing their casing. Hallway fixtures need repair and bulb replacement.



Recommendations:

- Replace inoperable light bulbs with a more efficient bulb such as T8 fluorescents or CFLs.
- Provide highly durable light casings.
- LED lamps can be used to improved performance and cost efficiency.

8) Electrical Power System

Power systems which include electrical conduits, wiring, panel boards, and receptacle outlets should be installed and maintained in accordance with the National Electrical Code.

Location: Finegayan Elementary School  
NEC space clearance in front of switchboard has not been met.



Location: Captain Price Elementary School  
Junction box, containing exposed wires, is covered by a wooden box.



Location: Wettengel Elementary School  
Degraded panel boards with rusted enclosures are still in use.

Recommendations:

- Replace all degraded/rusted electrical enclosures.
- Remove unused exposed wiring.



# STRUCTURAL SUMMARY REPORT

**GUAM**

October 2015

Prepared by:

Martin & Chock, Inc.



## I. Prioritization of Structural Repairs Prior to the Phase III Site Visits

A initial list for prioritization of repair projects was compiled based on the ratings of the Phase II building assessments. The Phase II Assessments entailed rapid observations of damage to non-concealed structural elements. At the top of the list are all buildings with structural damage identified as a life safety issue. Table 1 below provides a summary of all building damage identified to present a life safety concern prior to the Phase III site visits. Table 2 considers the next priority items with Conditions 1 and 2 ratings prior to the Phase III. Table 3 considers the next level of priority items with Condition 3 ratings. There were no Condition 0 structural ratings for Guam from the Phase II surveys.

**Table 1 – Summary of Buildings with Structural Life Safety Concerns Prior to the Phase III Site Visits**

SCHOOL	BUILDING ID / DESCRIPTION	ELEMENT
Capt Price Elementary School	21-Condemedned Metal Shed	Wood roof framing, missing bearing wall
	22-Covered Walkways	Wood roof framing in select areas
Carbullido Elementary School	16-Covered Walkways	Wood roof framing in select areas
F.B. Leon Guerrero Middle School	01-Main Office/Library	Reinforced Masonry Bearing Walls
J.Q. San Miguel Elementary School	05-Library, Classroom 32	CIP Beam and Slab
M.U. Lujan Elementary School	01-Cafeteria, Multi-purpose	CIP Column – Floor
Simon Sanchez High School	18-Main Building	CIP Beam & Slab – Roof
Southern High School	22-Covered Walkways	Steel Joists, Beams & Deck

**Table 2 – Summary of Condition 1 and 2 Items Prior to the Phase III Site Visits**

SCHOOL	BUILDING ID / DESCRIPTION	LIFE SAFETY ELEMENT
Agana Heights Elementary School	08-Covered Walkways	Wood Roof Decking
Agueda Johnston Middle School	06-Stage	Wood bearing walls
Capt Price Elementary School	16-T-8	Spread Footing
	22-Covered Walkways	Wood Roof Decking
F.B. Leon Guerrero Middle School	04-J	CIP Beam & Slab - Roof
	22-Covered Walkways	CIP Beam & Slab - Roof
		Wood Roof Decking
Jose Rios Middle School	01-T-1, T-2	Beams and Lightweight Decking System
		Steel frame or braced frames
L.P. Untalan Middle School	16-T-3	Spread footings
		Beams and Lightweight Decking
M.A. Sablan Elementary School	04-Stage	Wood Roof Decking
	18-16 – 19, Book room	Wood Roof Framing
Southern High School	14-GH	Slab on Grade
		Steel Joists and Composite Slab
Truman Elementary School	11-Bldg 21	Crawl space
	13-24 - 25	Crawl space

**Table 3 – Summary of Condition 3 Items Prior to the Phase III Site Visits**

SCHOOL	BUILDING ID / DESCRIPTION	LIFE SAFETY ELEMENT
<b>Agana Heights Elementary School</b>	01-Cafeteria, Lounge, Library	CIP Beam & Slab - Roof
		Reinforced Masonry bearing walls
	09-Main Office, 1 - 5	CIP Beam & Slab - Roof
	03- 08 - 14	CIP Beam & Slab - Roof
	12-T3	Wood Beams
		Wood bearing walls
<b>Astumbo Elementary School</b>	13-Covered Walkways	CIP Beam & Slab - Roof
	10-J, Cafeteria	Steel Joists, Beams & Deck on Columns & Walls
	01-A, Admin/Library	Steel Joists, Beams & Deck on Columns & Walls
<b>C.I. Taitano Elementary School</b>	09-17, 4th	Beams and Lightweight Decking System
<b>Capt Price Elementary School</b>	09-4th C1 - C6A	CIP Beam & Slab - Roof
	06-1st F1 - F5	CIP Beam & Slab - Roof
	04-Kinder E-1 - E-4	CIP Beam & Slab - Roof
	11-Library, Office, Lounge, Lab	CIP Beam & Slab - Roof
	10-Cafeteria, A-10 Supply room	CIP Beam & Slab - Roof
	19-Admin Building	CIP Beam & Slab - Roof
	08-2nd D1, D2, D7, D8	Slab on Grade
	07-2nd D3 - D6	Slab on Grade
	16-T-8	Beams and Lightweight Decking System
	15-T-15	Crawl Space
	12-Space	Slab on Grade
	21-Condemned Metal Shed	Wood Roof Decking
<b>Carbullido Elementary School</b>	13-Bldg. 5, 15 - 20	CIP Beam & Slab - Roof
		Steel Columns

<b>Daniel L Perez Elementary School</b>	07-Classroom	CIP Beam & Slab - Roof
	04-Classroom	CIP Beam & Slab - Roof
	06-Classroom	CIP Beam & Slab - Roof
	05-Classroom	CIP Beam & Slab - Roof
	03-Cafeteria	CIP Beam & Slab - Roof
	13-Covered Walkways	Wood Roof Decking
		Wood/Flat or Pitched
<b>F.B. Leon Guerrero Middle School</b>	03-H	CIP Beam & Slab - Roof
		CIP Column - Floor
		Concrete Non-Bearing Walls
	01-Main Office/Library	CIP Beam & Slab - Roof
		CIP Column - Floor
	04-J	CIP Beam & Slab
		CIP Column - Floor
	25-F2, Band Room	CIP Beam & Slab - Roof
	06-A	CIP Beam & Slab - Roof
	05-B	CIP Beam & Slab - Roof
	09-D1, D2	CIP Beam & Slab - Roof
	22-Covered Walkways	Wood/Flat or Pitched
	23-F1, Music Room	Wood bearing walls
		Wood/Flat or Pitched
<b>George Washington High School</b>	20-C, 104-107	CIP Beam & Slab - Roof
	15-Covered Walkways	Wood Roof Decking
	23-C, 108	Steel Columns
	17-C, 109-112	Steel Columns
<b>Inarajan Middle School</b>	15-45, 46	CIP Beam & Slab - Roof
<b>J.P. Torres Elementary School</b>	02-Bldg. 2, 1 - 7	Steel or Concrete Frames without Decking

<b>J.Q. San Miguel Elementary School</b>	06-13, 14, Bookrm, 25, 26, 26A	CIP Beam & Slab
	12-Classrms 11, 12, 23, 24, 36 & 37	CIP Beam & Slab
	09-Rms 21, 22, 34 & 35	CIP Beam & Slab
	04-Classrm 31, Lounge and restroom	CIP Beam & Slab
	07-Classrms 15, 27, Restrms	CIP Beam & Slab
<b>Jose Rios Middle School</b>	01-T-1, T-2	Crawl Space
		Steel Joists, Beams & Deck on Columns & Walls
	05-T3	Crawl Space
<b>L.P. Untalan Middle School</b>	17-42 - 45	CIP Beam & Slab - Roof
	19-37-39	CIP Beam & Slab - Roof
	23-Covered Walkways	Wood/Flat or Pitched
	08-T-9	Spread Footing
		Wood bearing walls
		Wood/Flat or Pitched
	14-T-1, T-2	Spread Footing
		Wood Beams
	01-T4	Spread Footing
		Wood/Flat or Pitched
	03-T6	Spread Footing
		Wood/Flat or Pitched
	10-T-8	Spread Footing
		Wood/Flat or Pitched
	02-T5	Spread Footing
		Wood/Flat or Pitched
	12 - 23 - 28	Steel Columns



<b>M.A. Sablan Elementary School</b>	25-Covered Walkways	Cellular Steel Deck, Triple Span
	11-T-3, T-4	Crawl Space
	17-Locker Room	Crawl Space
	5- 5 - 8	Steel Joists, Beams & Deck on Columns & Walls
	16-12 - 15	Wood Roof Decking
	04-Stage	Wood/Flat or Pitched
<b>M.U. Lujan Elementary School</b>	01-Cafeteria, Multi-purpose	Reinforced Masonry bearing walls
	10-126	CIP Beam & Slab - Roof
<b>Maria A Ulloa Elementary School</b>	21-T12	Beams and Lightweight Decking System
<b>Merizo Martyrs Memorial Elementary School</b>	05-D14 A, D14 B	Crawl Space
<b>P.C. Lujan Elementary School</b>	02-E, 25-33	CIP Beam & Slab - Roof
	12-A, 1-5	CIP Beam & Slab - Roof
	03-D, 102-104, 201-204	Reinforced Masonry bearing walls
	01-B, 18-20	CIP Beam & Slab - Roof
<b>Simon Sanchez High School</b>	18-Main Building	Reinforced Masonry bearing walls
	16-Gym	CIP Beam & Slab - Roof
	17-Covered Walkways	CIP Beam & Slab - Roof
	07-304, 309	Light metal framed structural walls
	12-317, 318	Crawl Space
	11-319, 320	Crawl Space
	02-315	Beams and Lightweight Decking System
		Crawl Space
	03-313	Beams and Lightweight Decking System
		Crawl Space
	01-314	Beams and Lightweight Decking System
		Crawl Space
<b>Southern High School</b>	13-AQ	Concrete Structural Bearing walls

## **II. Phase III Site Visits**

The purpose of the Phase III site visits was to:

- Get input from the stakeholders in the Guam
- Evaluate new life safety issues that were not previously identified or conditions that were identified but need to be elevated to a higher priority.
- Determine if the high priority conditions identified during Phase II have changed appreciably.
- Outline a scope of work for high priority structural items.

Based on the prioritization exercise performed by our office and input from stakeholders in the Territory, the following school buildings were re-visited during our May 2015 visit to Guam:

Monday, May 4, 2015

1. L.P. Untalan Middle School
2. Capt. Price Elementary School
3. George Washington High School
4. Jose Rios Middle School

Tuesday, May 5, 2015

1. J.Q. San Miguel Elementary School
2. Carbullido Elementary School
3. M.U. Lujan Elementary School
4. Agana Heights Elementary School

Wednesday, May 6, 2015

1. Vincente S.A. Benevente Middle School
2. F.B. Leon Guerrero Middle School

Thursday, May 7, 2015

1. Southern High School
2. M.A. Sablan Elementary School
3. Inarajan Middle School
4. Truman Elementary School
5. Agueda Johnston Middle School

### **III. General Observations and Additional Findings during the Phase III Site Visits**

Most of the structural health and safety items from the Phase II site visit had been addressed by the time of the Phase III site visit. The only preexisting item identified in Phase II was isolated deteriorated purlins at the covered walkways at Southern High School. There was also a soffit of another covered walkway that was observed during the Phase III site visit that may be an event greater risk, as the sag in soffit indicates some likely deterioration of the soffit framing and potential collapse. It is recommended that this is investigated and repaired and that that soffit supports for other similar conditions at the school also be investigated to determine any other potential deficiencies. This should be treated seriously, particularly given the collapse of a similar condition at another territory where a teacher was seriously injured.

There was one new structural safety concern associated with the wall girts that were severely corroded and partly collapsed in places at F.B. Leon Guerrero Middle School. Renovation of this was indicated by DOE staff to be one of the next projects to be programmed.

All deferred maintenance priorities at Simon Sanchez High School have been removed from the priority lists as there are plans to demolish or completely renovate the school in the near future, therefore other maintenance projects at the school are not considered a priority.

The following narrative provides a detailed discussion of the findings at each of the buildings that were visited during the Phase III site visits:

**1A. L.P. Untalan Middle School – 01-04 Buildings T4-T7**

This entire school was renovated and most of the previously observed maintenance issues at the school have been addressed. There are no remaining significant structural maintenance or safety issues.

These four buildings were relocated to make way for a new classroom building. They were founded on new concrete blocks with ties to the wood beams above and are now in good condition.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)



**1B. L.P. Untalan Middle School – 8 and 10 - Rooms T9, T8**

The buildings were renovated with new paint coatings for protection of the structures. There were no other significant structural changes.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)



**1C. L.P. Untalan Middle School – 12 - Rooms 21-28**

The building was being renovated during the Phase II site visit. The renovation is now complete.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)



**1D. L.P. Untalan Middle School – 16 – Rooms T-3**

The building has been renovated with fresh exterior paint. New entry ramps have been constructed. The corroded beams observed previously were cleaned and painted. The close proximity of the beams to the ground and exposed flanges that collect water will require regular maintenance of these conditions. The foundation conditions remain the same.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)



**1E. L.P. Untalan Middle School – 17 – Rooms 42-45**

The building has been renovated, including soffit spall repairs. No water penetration or stains from the roof were observed. The patch repairs were reportedly made by mixing Thoro Acryl 60 with cement and fine aggregate. The admixture is specified to improve adhesion and the condition of the repairs appears to be good, although as they were completed very recently, it is not possible to gage their durability.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)



**1F. L.P. Untalan Middle School – 19 – Rooms 37-39**

This building has been extensively renovated with spall repairs and new paint. Its condition is significantly improved since the Phase II site visits.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)



**2A. Capt. Price Elementary School – 16 – Room T8.**

This building was in a partial stage of demolition with the floor decking having been removed and steel joists exposed. Corrosion of the steel joists was more apparent. The foundations were still in the same condition as observed in Phase II. The entry ramp and rail was observed to be damaged. There is little salvageable about the building and it may be best to completely demolish it.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)





**2B. Capt. Price Elementary School – 17– Room T8.**

This building was also in a partial stage of demolition with the wood floor decking having been removed. The wood joists appear to be in good condition, therefore the building can reasonably be renovated with new interior sheathing and finishes.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)



**2C. Capt. Price Elementary School – 21– Condemned Metal Shed**

The building, which was observed to be abandoned during the Phase II site visit, has now been demolished down to the slab.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)



## **2D. Capt. Price Elementary School – 22 - Covered Walkways**

One area of covered walkway was reported to be unstable during the Phase II site visit and reportedly subsequently collapsed. This section has been repaired. Generally the covered walkways are still in poor condition in places and in need of repairs and replacement, although there are no longer any immediate safety concerns.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)





### **3A. George Washington High School – 15 – Covered Walkways**

The roof has been replaced over almost all of the covered walkways except one small section between Buildings 11 and 15 that is in need of some repair.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)

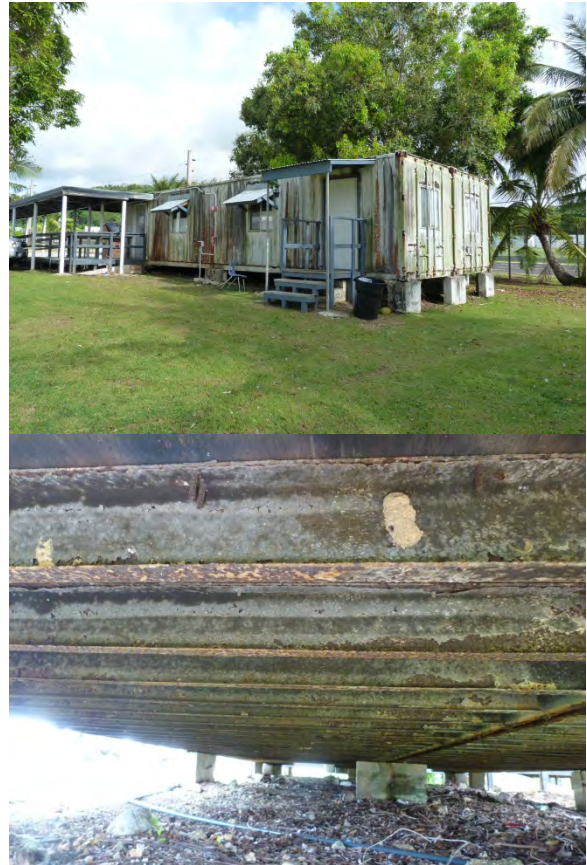


#### **4A. Jose Rios Middle School – 01 – Rooms T1, T2**

This temporary building is constructed from two shipping containers. The floor framing is quite corroded and susceptible if heavily loading. It should be repaired or retired from use.

Phase II Site Visit (November 2012)

Phase III Site Visit (May 2015)



**4B. Jose Rios Middle School – 05, 06 - T3, T4-T7**

The floor decking was replaced in these two buildings. The framing still has some corrosion but is in sound condition. There is a hole in one of the exterior walls of Building 05 where an air conditioning unit appears to have been removed. This should be sealed up to prevent water infiltration from deteriorating the framing.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)



**5A. J.Q. San Miguel Elementary School – 05 – Library**

The cracks and spalls observed for this building have been repaired. There was one crack that was observed along the window sill in the library. It is not significant structurally but may allow water to seep into the building and should be sealed.

Phase II Site Visit (November 2012)

Phase III Site Visit (May 2015)





**6A. Carbullido Elementary School -13 - Rooms 5, 15, 20**

The base of the steel columns has been recoated to protect them from corrosion. Localized spalls at the top of the columns were repaired.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)



**6B. Carbullido Elementary School -16 - Covered Walkways**

Localised areas of rotted covered walkway framing, observed during the Phase II assessments, have been repaired.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)





#### **7A. M.U. Lujan Elementary School – 01 – Cafeteria**

The spalls around the top of a number of columns in this building have been repaired. The patches were not well consolidated in some locations, although these appear to be earlier repairs. Poorly consolidated patches are likely to result in further spalling sooner than would be expected after a repair. For future repairs like these, it is recommended to undercut a section of the column to sound concrete to result in clean edges between the new concrete patches and existing concrete.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)



**8A. Agana Heights Elementary School – 01, 03, 09**

These buildings were being reroofed during the Phase II site visit. There were previously spalls observed at the soffit of the roofs, particularly at the exterior eaves. These generally appear to have been patched.

Phase II Site Visit (November 2012)



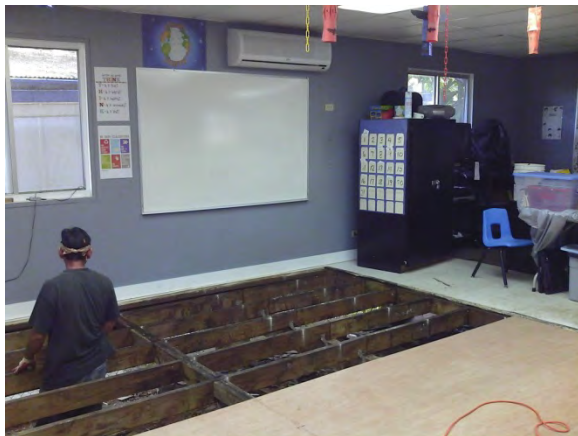
Phase III Site Visit (May 2015)



**8B. Agana Heights Elementary School – 05 and 12 – Rooms T3 - T6**

These rooms were reported to have severe moisture damage. The floor decking of one area had been removed during the Phase II site visit. They are now scheduled to be demolished and were not reassessed.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)

**8C. Agana Heights Elementary School – 08 - Covered Walkways**

The covered walkway adjacent to Room 04 – 06 (Building 05) was also in poor condition. It is presumed that this too will be demolished along with the buildings.

Phase II Site Visit (November 2012)

Phase III Site Visit (May 2015)



**9A. Vincente S.A. Benevente Middle School – 01, 02, 03 – Rooms A1 – A12**

These three buildings are to be demolished. Structurally they are in fair condition, therefore a complete renovation is feasible. However, it is understood there are a number of leaks and indoor environmental quality issues.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)



**9B. Vincente S.A. Benevente Middle School – 11 - Classrooms**

The west side of this building has a room that had a fire in the distant past and has been abandoned since then. The room was not closely inspected due to lack of access but there does not appear to be structural damage. It needs to be cleaned out and renovating it so that it does not become an environment health hazard.

Phase II Site Visit (November 2012)

Phase III Site Visit (May 2015)





### **10A. F.B. Leon Guerrero Middle School – 01 – 06**

These buildings are of similar construction type and conditions. The buildings have been reroofed, which appears to have addressed the leaks that had caused a number of soffit spalls observed during the Phase II assessments. Spall repairs were completed throughout the buildings.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)





**10B. F.B. Leon Guerrero Middle School – 22 – Covered Walkways**

The spalls at the concrete walkway roof to the cafeteria have been repaired. For the covered walkways with steel roof decking, the decking has been replaced in most of the areas. The one area where the existing decking remained was in a relatively sheltered area between buildings and the decking was in fair condition.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)



### **10C. F.B. Leon Guerrero Middle School – 13 - Gymnasium**

Some of the gymnasium framing was observed to have severe corrosion and has deteriorated since the Phase II site visit. The wall girts, particularly on one side of the building, are completely corroded, with the shards making for a potential falling hazard. This damage is attributed to wind driven and salt laden precipitation coming through the louver openings. Due to Z – configuration of the girts, water is able to get trapped on them, which accelerates corrosion.

Some of the roof purlins are also corroded due to past or current roof leaks. Portions the columns at the east end of the gym are also damaged. The siding and roofing the gymnasium appears to be in good condition, although it would be difficult to repair the girts without replacing the siding.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)







### **11A. Southern High School – 06 – CR**

This building was undergoing a renovation during the phase III site visit. A number of wall cracks were observed in this building during both site visits. While the building is being renovated, it would be best to seal any cracks over around 0.020 inches in width to prevent structural deterioration of the reinforcing in the walls. Finer cracks generally will not be able to absorb significant moisture.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)



### **11B. Southern High School – 13 – AQ**

This building is abandoned but is in fair condition. Initially, due to the abandonment, it was proposed to demolish the building. However, after the Phase III site visit this is not considered to be warranted. Some non-structural maintenance, particularly to the trench drains, is required.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)



### **11C. Southern High School – 14 – Building G & H**

Like Building 13, this building is abandoned, but demolition is not necessary. It just requires some maintenance.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)





### **11D. Southern High School – 22 – Covered Walkways**

The only pre-existing structural health and safety item remaining from Phase II was the deteriorated purlins at few locations of the covered walkways. These conditions appear to remain since the Phase II site visit as this school has not yet been renovated, except isolated buildings. As the steel in the covered walkways is generally exposed, it deteriorates quite rapidly compared to the steel inside the air conditioned buildings. Diagonal bracing and bridging straps are missing in many places, which affect the stability of the purlins for high wind uplift loading.

There is a soffit at one covered walkway that was also observed during the Phase III site visit to have notable sag. This might indicate that the framing of the soffit is deteriorated, probably due to a leak in the roofing resulting in ponding of water and corrosion of the soffit framing. This could lead to future collapse of the soffit if it is not repaired. It is recommended that this be investigated and repaired and that the soffit supports for other similar conditions at the school also be investigated to determine any other potential deficiencies. This should be treated seriously, given the collapse of a similar condition at another territory where a teacher was seriously injured.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)



**12A. M.A. Sablan Elementary School – 04 (Stage), 09, 10, 11, 12, 13 16 17, 18**

These buildings were all reroofed with aluminum roofing and stainless steel trim. This stainless steel trim is a good feature as this has been observed to be the first part of the roof to deteriorate with these types of roofs in other locations. The floor decking in Buildings 11, 12 and 17 is understood to need replacing due to the moisture damage from past roof leaks. The beams and joists at these floors were generally observed to be in good condition, although this does not preclude the possibility of localized damage, which will be uncovered during decking replacement.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)



**12B. M.A. Sablan Elementary School – Covered Walkways**

These covered walkways were not reroofing with the rest of the metal roof buildings. The walkways generally have low slopes on the roofs, collecting debris, ponding water and accelerating deterioration. In some cases the corrugations are perpendicular to the direction of the roof slope. Reroofing with a larger slope on the roofs and correctly oriented corrugations would be beneficial. Some trees have been removed from the site to lessen the debris on the roofs.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)





### **13A. Inarajan Middle School – 02 – Gymnasium**

This gymnasium was enclosed in the 1990s. There is corrosion to the wall girts resulting from moisture coming through the shuttered wall openings and settling on the web of these girts. The bleachers no longer operate as rolling bleachers.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)



### **13B. Inarajan Middle School – 05 – Rooms 7-10, 25-28**

Connection plates for precast concrete column and archway components are consistently corroded. There were leaks observed in the joints between this building and the adjacent Building 01.

Phase II Site Visit (November 2012)

Phase III Site Visit (May 2015)



**13C. Inarajan Middle School – 15 – Rooms 45 - 46**

Crack and spalls repairs to the roof slab of this building were being completed during the Phase II assessment. These repairs have been completed and no problems were observed during the follow-up visit.

Phase II Site Visit (November 2012)

Phase III Site Visit (May 2015)



#### **14A. Truman Elementary School – 05 – Library**

In the past the exterior sidewalk adjacent to this building was enclosed to add internal space to the library. The resulting slab is lower than the adjacent original interior slab and is prone to flooding. The bottom of the exterior siding is also corroded where water tends to pond. It is recommended to raise the level of the slab at the lower area to match the adjacent slab and raise the base of the siding accordingly.

Phase II Site Visit (November 2012)

Phase III Site Visit (May 2015)





**14B. Truman Elementary School – 11 and 13 – Rooms 21 and 24, 25**

These buildings were demolished since the Phase II assessments.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)



### **15A. Agueda Johnston Middle School – 06 – Stage**

The stage has been reroofed and roof framing replaced where necessary.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)



### **15B. Agueda Johnston Middle School – 15– Covered Walkways**

The covered walkways have areas of the roof that are corroded and subsequent localized decay to wood framing. The condition appears to have worsened since the Phase II assessment. It needs reroofing with isolated framing repair.

Phase II Site Visit (November 2012)



Phase III Site Visit (May 2015)



#### IV. Prioritization of Structural Repairs After the Phase III Site Visits

The original priority tables are reproduced with changes between the Phase II and Phase III condition assessments provided. Table 4 below provides a summary of all building damage identified as a life safety concern following the Phase III site visits. As stated earlier, conditions from Simon Sanchez High School have been removed from the priority list. Most of the structure life safety issues have been addressed. The one new item is the gymnasium girts at F.B. Leon Guerrero Middle School, indicated in italics.

Table 5 provides an updated summary of remaining or new Condition 1 & 2 structural maintenance issues. Again most items have been addressed by either repair or demolition of the building. The exception is the one building, which was intended as temporary building, at Jose Rios Middle School.

Table 6 provides an updated summary of remaining or new Condition 3 items. Not all of these schools were surveyed in Phase III, therefore it is expected that many of the items have been addressed with the work already completed. Completed work may be removed from the priority list as appropriate. Where surveyed in the Phase III site visit, the update to the priority list is reflected.

**Table 4 – Updated Summary of Life Safety Items After Phase III Site Visits**

SCHOOL	BUILDING ID / DESCRIPTION	LIFE SAFETY ELEMENT
<del>Capt Price Elementary School</del>	<del>21-Condemned Metal Shed</del>	<del>Wood roof framing, missing bearing wall</del>
	<del>22-Covered Walkways</del>	<del>Wood roof framing in select areas</del>
<del>Carbullido Elementary School</del>	<del>16-Covered Walkways</del>	<del>Wood roof framing in select areas</del>
F.B. Leon Guerrero Middle School	<del>01-Main Office/Library</del>	<del>Reinforced Masonry Bearing Walls</del>
	<b>13-Gym</b>	<b><i>Girt and purlin framing</i></b>
<del>J.Q. San Miguel Elementary School</del>	<del>05-Library, Classroom 32</del>	<del>CIP Beam and Slab</del>
<del>M.U. Lujan Elementary School</del>	<del>01-Cafeteria, Multi-purpose</del>	<del>CIP Column-Floor</del>
<del>Simon Sanchez High School</del>	<del>18-Main Building</del>	<del>CIP Beam &amp; Slab-Roof</del>
Southern High School	22-Covered Walkways	Steel Joists, Beams & Deck

**Table 5 – Updated Summary of Condition 1 and 2 Items after Phase III Site Visits**

SCHOOL	BUILDING ID / DESCRIPTION	LIFE SAFETY ELEMENT
Agana Heights Elementary School	08-Covered Walkways	Wood Roof Decking
<del>Agueda Johnston Middle School</del>	<del>06 Stage</del>	<del>Wood bearing walls</del>
Capt Price Elementary School	16-T-8	Spread Footing
	<del>22 Covered Walkways</del>	<del>Wood Roof Decking</del>
<del>F.B. Leon Guerrero Middle School</del>	<del>04 J</del>	<del>CIP Beam &amp; Slab Roof</del>
	<del>22 Covered Walkways</del>	<del>CIP Beam &amp; Slab Roof</del>
		<del>Wood Roof Decking</del>
Jose Rios Middle School	01-T-1, T-2	Beams and Lightweight Decking System
		Steel frame or braced frames
<del>L.P. Untalan Middle School</del>	<del>16 T-3</del>	<del>Spread footings</del>
		<del>Beams and Lightweight Decking</del>
<del>M.A. Sablan Elementary School</del>	<del>04 Stage</del>	<del>Wood Roof Decking</del>
	<del>18-16-19, Book room</del>	<del>Wood Roof Framing</del>
Southern High School	<del>14 GH</del>	Slab on Grade
		Steel Joists and Composite Slab
<del>Truman Elementary School</del>	<del>11 Bldg 21</del>	<del>Crawl space</del>
	<del>13-24-25</del>	<del>Crawl space</del>

**Table 6 – Updated Summary of Condition 3 Items After Phase III Site Visits**

SCHOOL	BUILDING ID / DESCRIPTION	LIFE SAFETY ELEMENT
<b>Agana Heights Elementary School</b>	01-Cafeteria, Lounge, Library	CIP Beam & Slab - Roof
		Reinforced Masonry bearing walls
	09-Main Office, 1 - 5	CIP Beam & Slab - Roof
	03- 08 - 14	CIP Beam & Slab - Roof
	12-T3	Wood Beams
		Wood bearing walls
<b>Agueda Johnston Middle School</b>	<b>15-Covered Walkways</b>	<b>Wood Roof Framing</b>
<b>Astumbo Elementary School</b>	13-Covered Walkways	CIP Beam & Slab - Roof
	10-J, Cafeteria	Steel Joists, Beams & Deck on Columns & Walls
	01-A, Admin/Library	Steel Joists, Beams & Deck on Columns & Walls
<b>C.I. Taitano Elementary School</b>	09-17, 4th	Beams and Lightweight Decking System
<b>Capt Price Elementary School</b>	09-4th C1 - C6A	CIP Beam & Slab - Roof
	06-1st F1 - F5	CIP Beam & Slab - Roof
	04-Kinder E-1 - E-4	CIP Beam & Slab - Roof
	11-Library, Office, Lounge, Lab	CIP Beam & Slab - Roof
	10-Cafeteria, A-10 Supply room	CIP Beam & Slab - Roof
	19-Admin Building	CIP Beam & Slab - Roof
	08-2nd D1, D2, D7, D8	Slab on Grade
	07-2nd D3 - D6	Slab on Grade
	16-T-8	Beams and Lightweight Decking System
	15-T-15	Crawl Space
	12-Space	Slab on Grade
	<del>21-Condemned Metal Shed</del>	<del>Wood Roof Decking</del>
	<b>22-Covered Walkways</b>	<b>Wood Roof Decking</b>



<del>Carbullido Elementary School</del>	<del>13-Bldg. 5, 15-20</del>	<del>CIP Beam &amp; Slab - Roof</del>
		<del>Steel Columns</del>
Daniel L Perez Elementary School	07-Classroom	CIP Beam & Slab - Roof
	04-Classroom	CIP Beam & Slab - Roof
	06-Classroom	CIP Beam & Slab - Roof
	05-Classroom	CIP Beam & Slab - Roof
	03-Cafeteria	CIP Beam & Slab - Roof
	13-Covered Walkways	Wood Roof Decking
		Wood/Flat or Pitched
F.B. Leon Guerrero Middle School	<del>03-H</del>	<del>CIP Beam &amp; Slab - Roof</del>
		<del>CIP Column - Floor</del>
		<del>Concrete Non-Bearing Walls</del>
	<del>01 Main Office/Library</del>	<del>CIP Beam &amp; Slab - Roof</del>
		<del>CIP Column - Floor</del>
	<del>04-J</del>	<del>CIP Beam &amp; Slab</del>
		<del>CIP Column - Floor</del>
	25-F2, Band Room	CIP Beam & Slab - Roof
	<del>06-A</del>	<del>CIP Beam &amp; Slab - Roof</del>
	<del>05-B</del>	<del>CIP Beam &amp; Slab - Roof</del>
	09-D1, D2	CIP Beam & Slab - Roof
	<del>22-Covered Walkways</del>	<del>Wood/Flat or Pitched</del>
	23-F1, Music Room	Wood bearing walls
		Wood/Flat or Pitched
George Washington High School	20-C, 104-107	CIP Beam & Slab - Roof
	<del>15-Covered Walkways</del>	<del>Wood Roof Decking</del>
	23-C, 108	Steel Columns
	17-C, 109-112	Steel Columns

<b>Inarajan Middle School</b>	<b>02-Gym</b>	<b>Exterior Wall Construction</b>
	<b>05-7 - 10, 25-28</b>	<b>Concrete Beams &amp; Slabs</b>
	<del>15-45, 46</del>	<del>CIP Beam &amp; Slab - Roof</del>
<b>J.P. Torres Elementary School</b>	02-Bldg. 2, 1 - 7	Steel or Concrete Frames without Decking
<b>J.Q. San Miguel Elementary School</b>	06-13, 14, Bookrm, 25, 26, 26A	CIP Beam & Slab
	12-Classrms 11, 12, 23, 24, 36 & 37	CIP Beam & Slab
	09-Rms 21, 22, 34 & 35	CIP Beam & Slab
	04-Classrm 31, Lounge and restroom	CIP Beam & Slab
	07-Classrms 15, 27, Restrms	CIP Beam & Slab
<b>Jose Rios Middle School</b>	01-T-1, T-2	Crawl Space
		Steel Joists, Beams & Deck on Columns & Walls
	<del>05-T3</del>	<del>Crawl Space</del>
<del><b>L.P. Untalan Middle School</b></del>	<del>17-42-45</del>	<del>CIP Beam &amp; Slab - Roof</del>
	<del>19-37-39</del>	<del>CIP Beam &amp; Slab - Roof</del>
	<del>23-Covered Walkways</del>	<del>Wood/Flat or Pitched</del>
	<del>08-T-9</del>	<del>Spread Footing</del>
		<del>Wood bearing walls</del>
		<del>Wood/Flat or Pitched</del>
	<del>14-T-1, T-2</del>	<del>Spread Footing</del>
		<del>Wood Beams</del>
	<del>01-T4</del>	<del>Spread Footing</del>
		<del>Wood/Flat or Pitched</del>
	<del>03-T6</del>	<del>Spread Footing</del>
		<del>Wood/Flat or Pitched</del>
	<del>10-T-8</del>	<del>Spread Footing</del>
		<del>Wood/Flat or Pitched</del>

	<del>02-T5</del>	<del>Spread Footing</del>
		<del>Wood/Flat or Pitched</del>
	<del>12-23-28</del>	<del>Steel Columns</del>
<b>M.A. Sablan Elementary School</b>	25-Covered Walkways	Cellular Steel Deck, Triple Span
	11-T-3, T-4	Crawl Space
	17-Locker Room	Crawl Space
	5- 5 - 8	Steel Joists, Beams & Deck on Columns & Walls
	<del>16-12-15</del>	<del>Wood Roof Decking</del>
	04-Stage	Wood/Flat or Pitched
<b>M.U. Lujan Elementary School</b>	<del>01 Cafeteria, Multi-purpose</del>	<del>Reinforced Masonry bearing walls</del>
	10-126	CIP Beam & Slab - Roof
<b>Maria A Ulloa Elementary School</b>	21-T12	Beams and Lightweight Decking System
<b>Merizo Martyrs Memorial Elementary School</b>	05-D14 A, D14 B	Crawl Space
<b>P.C. Lujan Elementary School</b>	02-E, 25-33	CIP Beam & Slab - Roof
	12-A, 1-5	CIP Beam & Slab - Roof
	03-D, 102-104, 201-204	Reinforced Masonry bearing walls
	01-B, 18-20	CIP Beam & Slab - Roof
<b><del>Simon Sanchez High School</del></b>	<del>18 Main Building</del>	<del>Reinforced Masonry bearing walls</del>
	<del>16 Gym</del>	<del>CIP Beam &amp; Slab - Roof</del>
	<del>17 Covered Walkways</del>	<del>CIP Beam &amp; Slab - Roof</del>
	<del>07-304, 309</del>	<del>Light metal framed structural walls</del>
	<del>12-317, 318</del>	<del>Crawl Space</del>
	<del>11-319, 320</del>	<del>Crawl Space</del>
	<del>02-315</del>	<del>Beams and Lightweight Decking System</del>
		<del>Crawl Space</del>
	<del>03-313</del>	<del>Beams and Lightweight Decking</del>

		<del>System</del>
		<del>Crawl Space</del>
	<del>01-314</del>	<del>Beams and Lightweight Decking System</del>
		<del>Crawl Space</del>
<b>Southern High School</b>	<b>06-CR</b>	<b>Concrete Structural Bearing walls</b>
	13-AQ	Concrete Structural Bearing walls
<b><i>Truman Elementary School</i></b>	<b><i>05-Library</i></b>	<b><i>Concrete Non-Bearing Walls</i></b>
		<b><i>Slab on Grade</i></b>

## **V. Recommended Scope of Work for the High Priority Structural Items**

A description of recommended repair procedures and outline of structural scope of work is provided for each of the remaining high priority structural repair projects with healthy and safety concerns or Conditions 1 and 2 items. For a description of existing conditions and photographic exhibits, refer to Section III of this report.

Recommended general repair procedures, for repetitive structural repairs of cracks, spalls and light framed covered walkways, are provided see Appendices A-C respectively. For the crack repairs a flexible sealant is recommended on the basis that the cracks are not as a result of a structural overstress situation. A structural engineer shall be consulted if there is a potential that such a condition exists. The area around a crack should be sounded with a hammer to determine if there is a delamination, that may not be immediately obvious. If this type of condition exists it should be treated as a spall repair. The spall repair recommendations show typical conditions in slab, columns, beams and walls. These repair procedures provide the proper preparation and undercut of the surface of the existing concrete, and material recommendations, to achieve a durable patch. Typical covered walkway repairs are also recommended.

Repair procedures are not listed for structural items associated with Condition 3 assessments. These may be completed using the general repair procedures provided in the appendices where applicable. Where a specific scope is needed, these will need to be developed if and when they get elevated to the priority repair items.

The summaries are provided as a tool to assist the Department of Education in determining scope, cost, and schedule when preparing requests for proposals for the design and execution of repair work. The summaries are not intended to be used directly as requests for proposals.

### **Structural Health and Safety Items**

#### **1. F.B. Leon Guerrero Middle School – 13 – Gymnasium**

Have an architect, structural and mechanical and fire protection engineer perform a complete survey of the gymnasium and provide a design and construction documentation for repair and replacement of the severely damaged components. The renovation should also include ventilation, fire suppression and alarm upgrades. Remove the siding. Repair the affected roof purlins, temporarily removing roof decking as required. Repair miscellaneous steel framing such as columns that exceeds a predefined level of damage. Replace all the girts. Preferably replace with new girts that will not trap moisture. Replace the siding. Install new louvers or other form of protection to prevent wind driven rain getting into the building. Perform mechanical ventilation and fire protection upgrades.



## **2. Southern High School – 22 – Covered Walkways**

Remove a portion of the soffit at the sagging area. Have a structural engineer determine the cause of the deformation. Shore and stabilize or remove the soffit to prevent future collapse if deemed necessary. Structurally survey the other similar conditions.

Have a structural engineer perform a survey of all the exposed steel in the covered walkways and identify all areas that have deterioration exceeding a threshold that is determined to be unacceptable, for example 10% of loss of the steel cross section. Design and prepare construction documentation for repairs where necessary. It is recommended to replace the bridging straps with more substantial members given the exposure and propensity for light gage straps to corrode and fail after a short time. Repair the framing shown in the construction documentation. Clean and recoat all the exposed steel framing of the covered walkways with a durable coating system, such as one with a zinc based primer and epoxy finish coating.

### **Condition 1 and 2 Items**

## **3. Agana Heights Elementary School – 18 – Covered Walkways**

Demolish the covered walkways where the buildings are to be demolished. Any remaining light framed covered walkways in poor condition shall be replaced in accordance with Appendix C.

## **4. Capt. Price Elementary School – 16 - T8**

Demolish the building.

## **5. Jose Rios Middle School – 01 – T1, T2**

If the building is to continue to remain in use, consult with a structural engineer to design new floor framing that will meet the current building code. Remove the floor decking and replace the steel joist framing with the new framing per the construction drawings. Install new floor decking.

## **APPENDIX A**

### **RECOMMENDED CONCRETE OR MASONRY CRACK REPAIR PROCEDURE**

### **Existing Conditions:**

Most cracks observed in a concrete or masonry structure are not the result of structural distress that could lead to a structural failure. If there is a potential that cracks are due to structural distress, or due to severe foundation movement (crack widths over 0.060 inches), then a structural engineer should be consulted for an assessment. Most cracks are due to shrinkage in the concrete or masonry or minor movement of foundation elements over time. These cracks are not structurally significant alone, but can lead to deterioration of a structural components and more significant structural consequences if left unchecked.

Concrete directly exposed to water is a porous material and will absorb the moisture. Therefore, roofs or the top of other concrete surfaces exposed to weather should not be relied upon for preventing moisture entering into a building. These surfaces should always have a well maintained waterproof membrane designed to bridge over any cracks in the concrete surface. For other concrete surfaces, such as vertical surfaces where incidental moisture can easily drain away, or the underside of roof eaves, a quality paint coating is generally sufficient to prevent moisture infiltration. The paint can bridge over small cracks in these surfaces and even if not sealed with paint, it has been found that moisture will generally not significantly penetrate through cracks under 0.020 inches in width. For larger cracks moisture can infiltrate through the crack and result in deterioration of the reinforcing and subsequent spalling or mold and other moisture related problems. To prevent these impacts it is recommended that cracks of 0.020 inches or larger be sealed with a non-sag polyurethane or other flexible crack sealant. Epoxy based products should not be used as they do not have the necessary flexibility to accommodate thermal or other movement of the cracks.

### **Recommended Products**

- Quikrete Polyurethane Concrete Crack Sealant
- Sika Sikaflex Concrete Fix or Sikaflex -15 LM
- BASF Sonolastic NP1

### **Recommended Scope of Work and Directions for Repair:**

- 01 Survey the building or buildings to adequately describe the scope of crack repair.
- 02 Prepare the crack to leave it clean, dry, free of oil and other contaminants.
- 03 Cut a V-shape groove along the crack that is around ¼ inch deep and ¼ inch wide.
- 04 Use the nozzle to install sealant into the crack.
- 05 Follow the manufacturer's instructions for other directions and curing.

## **APPENDIX B**

### **RECOMMENDED CONCRETE OR MASONRY CONCRETE OR MASONRY SPALL REPAIR PROCEDURE**

### **Existing Conditions:**

Spalls are pieces of concrete or masonry that have delaminated from the surface of the wall, slab, columns or other structural component. Generally the spall starts when a source of moisture gets into the concrete over a period of time and causes corrosion of the reinforcing. When reinforcing corrodes it expands and the expansive pressure pushes the surface of the concrete loose from the remaining concrete element in the vicinity of the spalls.

Spalls are generally repaired by placing a cementitious patch over the area where the concrete has been damaged. For a spall repair to be effective it must address the cause of the moisture infiltration and prevent further reinforcing corrosion as well as a patch to the concrete. The new concrete patch must be mechanically anchored to the remaining concrete or masonry substrate, by undercutting the existing concrete surface and also using screw anchors where not other reinforcing is present. Where spalls are not yet opened up but there is a crack around the perimeter of a piece of concrete, these areas shall be chipped off and treated like an open spall. If spalls are too widespread then it may be best to demolish the structural component and rebuild it.

Repair details for different conditions are provided in the attached sketches, S-1. These details show repairs for shallow and deep vertical and overhead repairs of columns, beams and walls. They are applicable to concrete or masonry walls.

### **Recommended Scope of Work for Repair:**

- 01 Survey the subject building or buildings to adequately describe the scope of spall repair. Tap on the concrete surfaces of the building with a hammer to identify loose concrete areas that may have started to delaminate due to reinforcing corrosion but may not have yet showed surface signs of deterioration. Remove this loose concrete.
- 02 Select the applicable repair method from Detail 1 or 2 on S-1, depending on the location and depth of each repair.
- 03 Excavate and repair the spall according to the applicable detail. Make sure to complete the undercuts as shown. These are critical to the physical anchorage of the new patch material.
- 04 Replace reinforcing if necessary per Detail 3 on S-1 and install the screw anchors as shown.
- 05 Select applicable products to complete the repair depending on whether the repair is on a horizontal, vertical surface or overhead and depending on the depth of the patch, therefore whether or not it will be formed or trowel applied.
- 06 Complete the repairs per the details and manufacturer's recommended procedures.



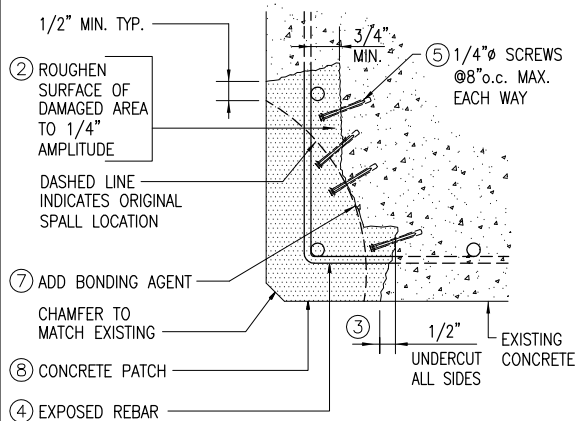
**NOTE: THESE NOTES AND DETAILS ARE A GENERAL RECOMMENDATION ONLY. A LICENSED STRUCTURAL ENGINEER SHALL VERIFY ALL EXISTING CONDITIONS TO DETERMINE THEIR APPLICABILITY.**

**CONCRETE REPAIR NOTES:**

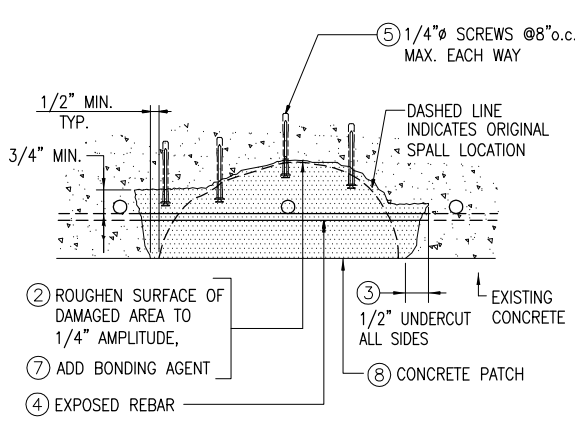
- EXCAVATE ALL LOOSE FRACTURED CONCRETE AROUND SPALL. IN GENERAL, EXTEND LIMITS OF EXCAVATION UNTIL SOUND CONCRETE IS ENCOUNTERED OR AS SHOWN ON THE DRAWINGS. LIMIT CHIPPING GUN TO 15 LB.
- CLEAN ALL EXISTING REBAR OF ALL LOOSE RUST BY SANDBLAST OR NEEDLE GUN.
- ROUGHEN SURFACE TO 1/4" AMPLITUDE AT ALL INTERFACE CONTACT WITH EXISTING CONCRETE SUBSTRATE. PROVIDE UNDERCUT AT PERIMETER OF CONCRETE PATCH AS SHOWN ON DETAILS.
- CLEAN ALL EXCAVATED CONCRETE SURFACES OF DEBRIS, DUST, GREASE, OIL, ETC.
- IN GENERAL, THE FOLLOWING APPLIES TO REPLACEMENT/SUPPLEMENT OF CORRODED REBAR:
  - IF CROSS-SECTIONAL LOSS OF BAR IS LESS THAN 20% AFTER REMOVING ALL CORROSION PRODUCT, THE BAR DOES NOT REQUIRE REPLACEMENT/SUPPLEMENT.
  - IF CROSS-SECTIONAL LOSS OF BAR IS GREATER THAN 20% AFTER REMOVING ALL CORROSION PRODUCT, REPLACE OR SUPPLEMENT WITH SPLICED BARS PER DETAIL 1 THIS SHEET.
- ALL REPLACEMENT REINFORCING STEEL SHALL CONFORM TO ASTM A706 GRADE 60 UNLESS OTHERWISE NOTED.
- WHERE REINFORCING STEEL IS TO BE ADDED, IT SHALL BE LAP SPLICED FOR A LENGTH OF 48 BAR DIAMETERS. IN LIEU OF LAPPED REBAR, NEW REINFORCING MAY BE WELDED TO EXISTING REINFORCING PER DETAIL 1 THIS SHEET.
- PRIOR TO PLACEMENT OF PATCH MATERIAL, THE EXPOSED CONCRETE SHALL BE SATURATED SURFACE DRY WITH NO WATER ACCUMULATION.
- REPAIR MATERIALS SHALL BE APPLIED TO FILL VOIDS. FOR PATCH DEPTHS IN EXCESS OF ONE INCH, CONCRETE PATCH SHALL CONTAIN 3/8" PEA GRAVEL AGGREGATE.
- FOR DEEP OVERHEAD AND VERTICAL PATCHES, CEMENTITIOUS MATERIAL (PER ITEM "B" IN THE TABLE OF ACCEPTABLE CONCRETE REPAIR PRODUCTS) MAY BE USED IF APPLIED IN LIFTS. THICKNESS OF LIFTS AND TOTAL THICKNESS OF PATCH SHALL NOT EXCEED THE MAXIMUM THICKNESS RECOMMENDED BY THE MANUFACTURER. A CLEAN, ROUGHED SURFACE SHALL BE MAINTAINED WITH AN APPROPRIATE SETTING TIME, PER MANUFACTURER'S INSTRUCTIONS, FOR PLACEMENT BETWEEN LIFTS. ALTERNATIVELY, THE PATCH SHALL BE FORMED AND CONCRETE PER ITEMS "C" AND "D" ON THE TABLE OF ACCEPTABLE CONCRETE REPAIR PRODUCTS SHALL BE USED. WHEN FORMED, THE CONCRETE SHALL BE EXTERNALLY AND/OR INTERNALLY VIBRATED AS IT IS PLACED IN THE FORMS TO ACHIEVE THE PROPER CONSOLIDATION TO FILL ALL CORNERS OF THE FORMS; ALLOWING SUFFICIENT SPACE AT THE TOP OF THE FORMED AREA TO PROPERLY PLACE AND CONSOLIDATE THE CONCRETE.
- FOLLOWING THE INITIAL SET OF THE CONCRETE AT FORMED AREAS, THE SPACE AT THE TOP OF THE PATCH AREA SHALL BE FILLED WITH PATCHING MORTAR.
- THE SURFACE FINISH SHALL MATCH ADJACENT CONDITIONS.
- FORMS SHALL BE REMOVED AFTER FIVE DAYS OF CURING. PATCHES SHALL BE INSPECTED FOR IMPROPER CONSOLIDATION OR CRACKING AROUND THE PERIMETER OR IN THE PATCH. IF THESE CONDITIONS EXIST, NOTIFY THE CONTRACTING OFFICER FOR POSSIBLE REMEDIAL ACTION.
- MINIMUM CONCRETE COVER TO REINFORCING STEEL FOR "PATCHES," REPAIRS, ETC., SHALL BE AT LEAST 2" FOR CONCRETE EXPOSED TO WEATHER AND 1 1/2" FOR CONCRETE NOT EXPOSED TO WEATHER.
- CONCRETE REPAIR AREAS SHALL BE ALLOWED TO CURE A MINIMUM OF 14 DAYS PRIOR TO SURFACE PRIMING AND PAINTING.

**ACCEPTABLE CONCRETE REPAIR PRODUCTS**

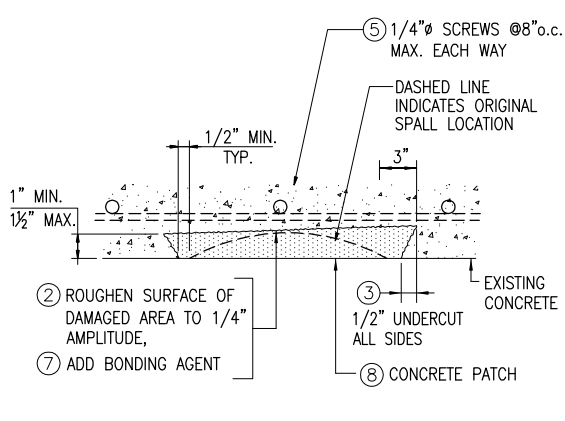
PRODUCT DESCRIPTION	ACCEPTABLE ALTERNATIVE PRODUCTS
A. CEMENTITIOUS MATERIAL FOR HORIZONTAL (TOP) SHALLOW PATCH REPAIRS	<ul style="list-style-type: none"><li>SIKAQUICK 1000</li><li>EMACO T430, BASF.</li><li>MASTERFLOW 713, BASF.</li><li>QUIKRETE FAST SET REPAIR MORTAR (NO. 1241)</li><li>THORITE GENERAL PURPOSE CONCRETE RESTORATION, BASF</li></ul>
B. CEMENTITIOUS MATERIAL FOR OVERHEAD & VERTICAL SHALLOW PATCH REPAIRS	<ul style="list-style-type: none"><li>SIKAREPAIR 223, SIKA CORPORATION</li><li>THORITE RAPID VERTICAL, THORO SYSTEMS</li><li>POWERCRETE POWERTOP GEL PATCH</li><li>SONNEBORN SONOPATCH 200</li><li>EUCO VERTICOAT, EUCLID CHEMICAL COMPANY</li></ul>
C. POLYMER MODIFIED CAST-IN-PLACE CONCRETE FOR ALL DEEP PATCH REPAIRS	<ul style="list-style-type: none"><li>CONCRETE PROPERTIES:<ul style="list-style-type: none"><li>28-DAY STRENGTH = 6000 PSI</li><li>MAX. WATER TO CEMENT RATIO = 0.50</li><li>3/8" DIAMETER PEA GRAVEL</li><li>CALCIUM NITRIDE ADMIXTURE</li><li>HIGH RANGE WATER REDUCER (MAX. 6-1/2" SLUMP)</li><li>SHRINKAGE COMPENSATING ADMIXTURE</li></ul></li><li>LATEX (POLYMER) ADMIXTURE MUST BE INCLUDED, SEE MANUFACTURER FOR PROPORTIONS OF EITHER DILUTED OR UNDILUTED MIX</li></ul> <p>NOTE: PRE-MIXED BAGGED CONCRETE SUCH AS QUIKRETE (6000 PSI) MIX OR SIKAGROUT 212 WITH PEA GRAVEL (25#/55# BAG OF DRY MIX BUT NOT EXCEEDING 25% BY VOLUME) MAY BE USED W/THE ABOVE ADMIXTURES.</p>
D. SHRINKAGE REDUCING ADMIXTURE	<ul style="list-style-type: none"><li>GRACE ECLIPSE, 2% BY WEIGHT OF CEMENT; 1.5 GALS. PER YD.</li><li>SIKA CONTROL 40, 30 FL. OZ. PER 100 LB. OF CEMENT.</li><li>BASF MASTERLIFE SRA 20, 1.5 GALS. PER YD.</li></ul>
E. STEEL ANCHORS	<ul style="list-style-type: none"><li>1/4" ZINC PLATED HILTI KWIK-CON II HEX HEAD SCREWS IN 1 1/4" DEEP HOLE DRILLED WITH MATCHING DRILL BIT</li><li>1/2" CLIMASEAL REDHEAD TAPCON IN 1 1/4" DEEP HOLE DRILLED WITH MATCHING DRILL BIT</li><li>1/2" SIMPSON TITEN HD MINI IN 1 1/4" DEEP HOLE DRILLED WITH MATCHING DRILL BIT</li></ul>
F. BONDING AGENT	<ul style="list-style-type: none"><li>SIKA ARMATEC 110</li><li>THORO ACRYL 60</li><li>QUIKRETE BONDING ADHESIVE</li></ul>
G. EPOXY TO SET ANY DOWELS	<ul style="list-style-type: none"><li>HILTI HIT-RE 500-SD EPOXY ADHESIVE (INTERIOR APPLICATIONS ONLY)</li><li>HILTI HIT-HY 150 ACRYLIC ADHESIVE</li><li>RED HEAD EPICON C6 EPOXY ADHESIVE (INTERIOR APPLICATIONS ONLY)</li><li>RED HEAD EPICON A7 ACRYLIC ADHESIVE</li><li>SIMPSON SET-XP EPOXY-TIE ADHESIVE (INTERIOR APPLICATIONS ONLY)</li><li>SIMPSON AT ACRYLIC-TIE ADHESIVE</li></ul>



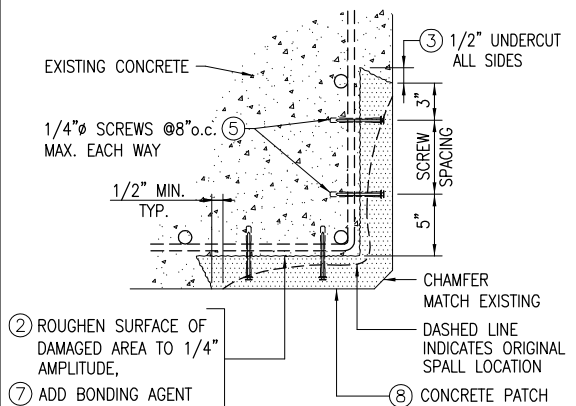
**1A DEEP PATCH REPAIR**  
CORNER SPALL  
MIN. PATCH DEPTH = 1 1/2"  
MAX. PATCH DEPTH = AS REQUIRED



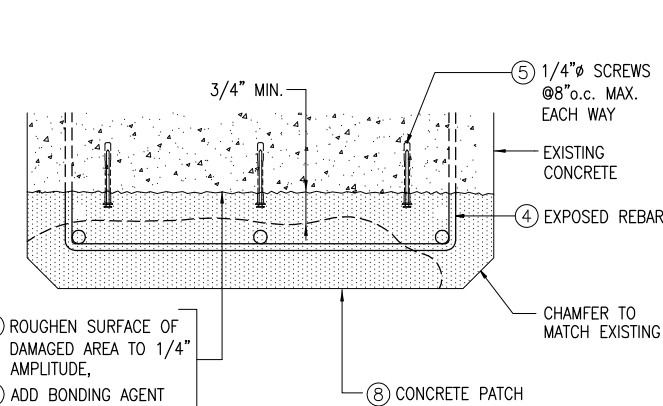
**1B DEEP PATCH REPAIR**  
VERTICAL OR HORIZONTAL SPALL  
MIN. PATCH DEPTH = 1 1/2"  
MAX. PATCH DEPTH = AS REQUIRED



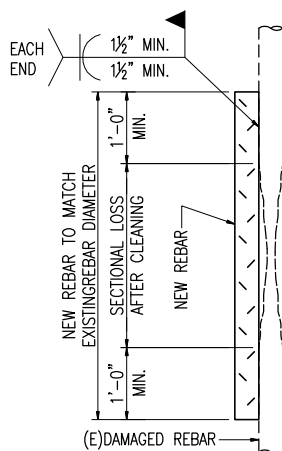
**1C SHALLOW PATCH REPAIR**  
VERTICAL OR HORIZONTAL SPALL  
MIN. PATCH DEPTH = 1"  
MAX. PATCH DEPTH = 1 1/2"



**1D SHALLOW PATCH REPAIR**  
CORNER SPALL  
MIN. PATCH DEPTH = 1"  
MAX. PATCH DEPTH = 1 1/2"



**1E DEEP PATCH REPAIR**  
SPALL FULL WIDTH OF MEMBER  
MIN. PATCH DEPTH = 1 1/2"  
MAX. PATCH DEPTH = AS REQUIRED



**1F REINFORCING REPLACEMENT**

**REPAIR PROCEDURE**

- CHIP OUT ALL LOOSE AND FRACTURED CONCRETE AROUND SPALL. EXTEND LIMITS OF EXCAVATION UNTIL SOUND CONCRETE IS ENCOUNTERED.
- ROUGHEN SURFACE TO 1/4" MINIMUM AMPLITUDE.
- CREATE 1/2" UNDERCUTS CUT AT PERIMETER.
- CLEAN ALL EXPOSED REBAR TO BRIGHT STEEL CONDITION. REPLACE CORRODED BARS WHICH HAVE LOST MORE THAN 20% OF CROSS-SECTION AND/OR AS DIRECTED BY THE ENGINEER (SEE DETAIL 1 THIS SHEET).
- INSTALL 1/4" SCREWS @8" O.C. MAX. EACH WAY. SEE ITEM "F" ON TABLE OF ACCEPTABLE CONCRETE REPAIR PRODUCTS ON THIS SHEET. PROVIDE 1 1/4" MIN. EMBEDMENT INTO SOUND CONCRETE. PROVIDE 3/4" MIN. CLEAR COVER TO HEAD OF SCREW AFTER PATCH INSTALLATION.
- PROVIDE SHADE ABOVE WORK AREA OF PATCHES IF CONCRETE MEMBER IS EXPOSED TO DIRECT SUNLIGHT DURING CURING.
- APPLY BONDING AGENT TO CONCRETE SURFACE. SEE ITEM "G" ON THE TABLE OF ACCEPTABLE CONCRETE REPAIR PRODUCTS ON THIS SHEET.
- INSTALL PATCH MATERIAL ACCORDING TO MANUFACTURER'S RECOMMENDATIONS. SEE ITEMS "A" THROUGH "D" ON THE TABLE OF ACCEPTABLE CONCRETE REPAIR PRODUCTS ON THIS SHEET.
- FINISH AND CURE AS REQUIRED.

**REINFORCING REPLACEMENT NOTES:**

- SEE CONCRETE REPAIR NOTES 2, 5, 6, & 7 FOR GENERAL REPLACEMENT/SUPPLEMENT OF (E) REINFORCING.
- WELDING OF REINFORCING STEEL SHALL BE IN ACCORDANCE WITH "STRUCTURAL WELDING CODE-REINFORCING STEEL" (AWS D1.4).
- REBAR FOR SPLICE SHALL BE ASTM A706, GRADE 60.
- PREHEAT BARS ACCORDING TO AWS D1.4 STANDARDS.

**1 TYPICAL CONCRETE REPAIR DETAIL AT SLABS, BEAMS AND COLUMNS**  
N.T.S.

October 2015

MARTIN & CHOCK

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U.S. DEPARTMENT OF THE INTERIOR  
OFFICE OF INSULAR AFFAIRS

**INSULAR ABCs PHASE III  
GUAM**

DRAWING TITLE

**TYPICAL  
CONCRETE AND  
MASONRY REPAIRS**

NO. DATE REVISION

DATE JULY 24, 2015

SHEET

**S-1**

1 OF 1



## **APPENDIX C**

### **RECOMMENDED COVERED WALKWAY WITH WOOD FRAMING AND METAL DECKING REPAIR PROCEDURE**

### **Existing Conditions:**

There are many instances of covered walkways consisting of metal corrugated decking over wood framing supported by wood, steel, masonry or concrete columns. Sometimes there is plywood decking under the corrugated metal decking.

Deterioration of these structures generally starts with corrosion of the roof framing leading to holes and moisture damage and decay of wood framing below. Where there is plywood decking under the metal decking it is common for moisture to get trapped between the metal decking and plywood, causing mold and decay of the plywood before the metal decking and wood framing deteriorates. It is recommended that when replacing these structures, the plywood be removed and not replaced. Presumably the purpose of the plywood was to add to the in-plane diaphragm strength of the covered walkway roof structure. However, the corrugated metal panels will generally have sufficient diaphragm strength alone. It is unlikely that the roof will fail due to an in-plane failure of the diaphragm during an extreme wind event. It is more susceptible to wind uplift and dependent on: the type of fasteners connecting the decking down to the framing; the strength of the framing, or; the lateral capacity of the columns. To provide adequate wind uplift capacity, appropriately sized wood framing is required and the decking shall be fastened with decking screws rather than nails as they have superior strength in resisting withdrawal from the wood framing. The steel columns must have adequate anchorage at the base of the columns.

The steel decking has a limited lifespan, particularly if not painted. Alternatives to the steel decking should be considered for replacement decking, including non-metallic or aluminum decking sheets with stainless steel fasteners. Selected decking must have appropriate impact and wind resistance.

Sometimes there is deterioration around the base of the steel or other columns. This can be prevented by improved site drainage to prevent ponding around the base of the columns and a good quality waterproof coating around the base of the posts.

### **Recommended Scope of Work for Repair or Replacement of Covered Walkways:**

- 01 Define the area of covered walkways to be replaced and the items to be replaced: decking; purlins; beams; columns.
- 02 For column replacement, columns shall be equal or greater size than the original. Steel posts shall be anchored at the base with a baseplate and four bolt minimum connection or embedded into a concrete footing to match the existing column conditions. Wood posts shall not be used unless the covered walkway is braced back to an adjacent building.
- 03 Replace wood framing as required with sizes equal to or greater than the original sizes. Provide galvanized steel ties to resist vertical uplift forces from the column to joists. Paint the framing with a specified paint system. Framing shall provide at least 1:12 slope in direction parallel to roof decking.



- 04 For decking replacement, remove any plywood decking and install the new specified decking directly to wood framing. Use stainless steel, screw type fasteners.
- 05 Where the geometry or framing needs to be strengthened or modified, contact a licensed structural engineer to design the required components.





## **APPENDIX D**

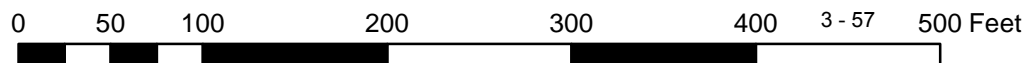
### **SCHOOL CAMPUS MAPS WITH BUILDING IDENTIFICATION NUMBERS**



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## Agueda Johnston Middle School

Date: 5/24/2013



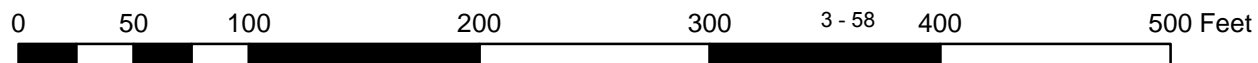




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## Astumbo Elementary School

Date: 5/24/2013



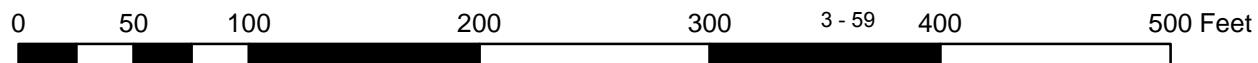




**Helber Hastert & Fee**

**C.L. Taitano Elementary School**

Date: 5/24/2013



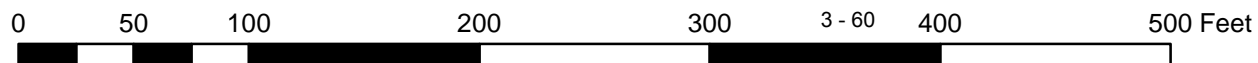




**Helber Hastert & Fee**

## Capt Price Elementary School

Date: 5/24/2013



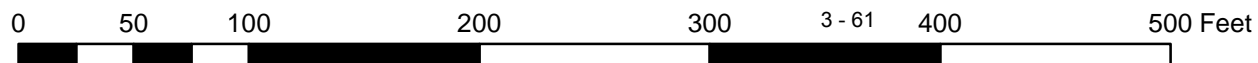




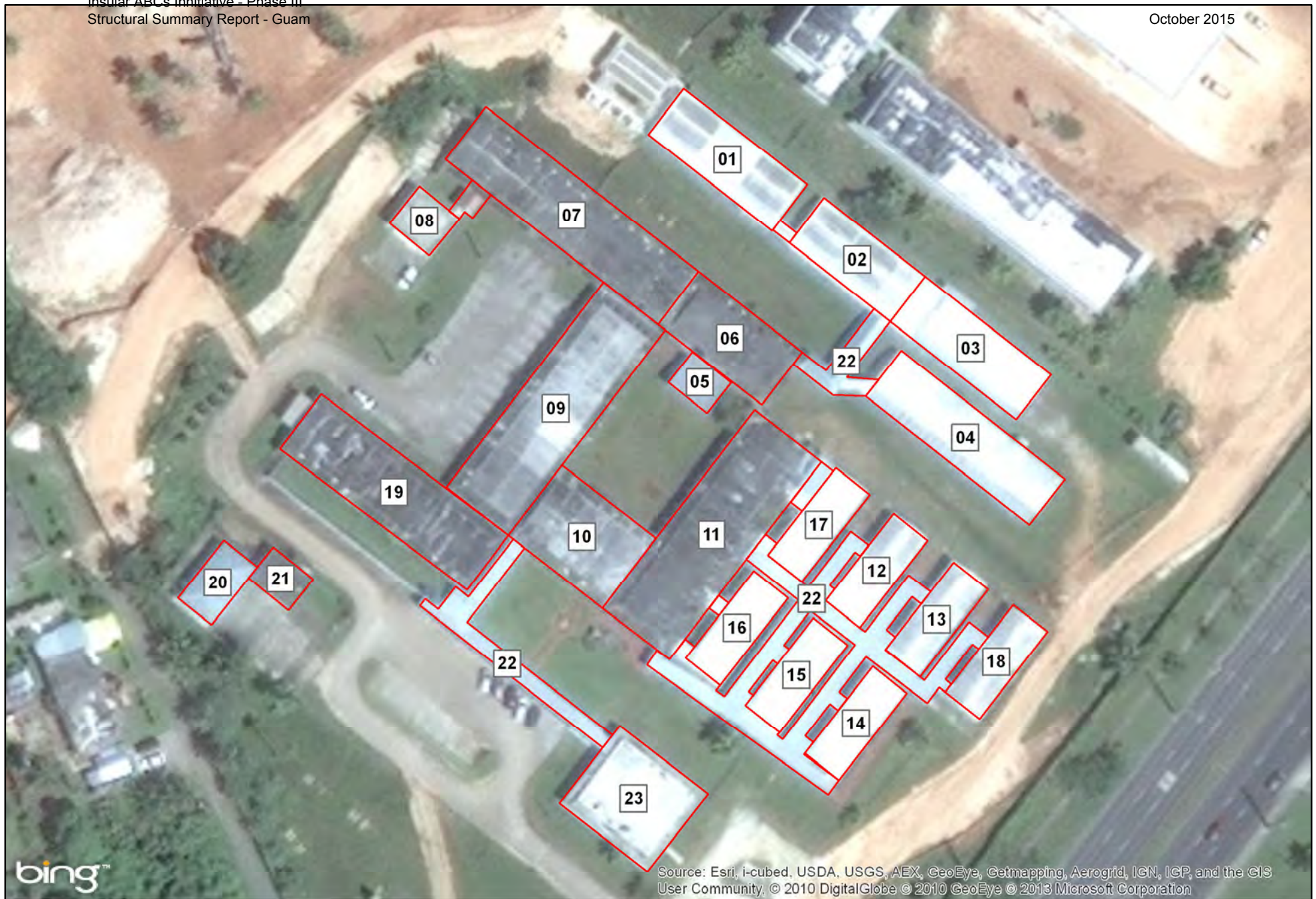
**Helber Hastert & Fee**

## Carbullido Elementary School

Date: 5/24/2013



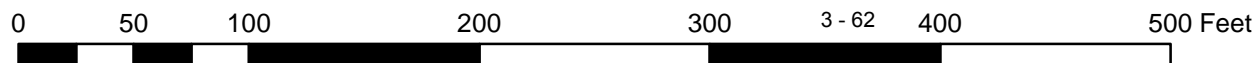




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## Chief Brodie Memorial Elementary School

Date: 5/24/2013







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**Daniel L. Perez Elementary School**

Date: 5/24/2013



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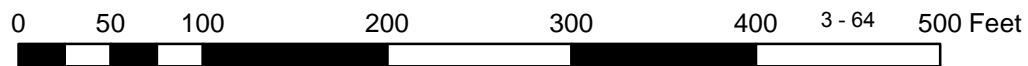




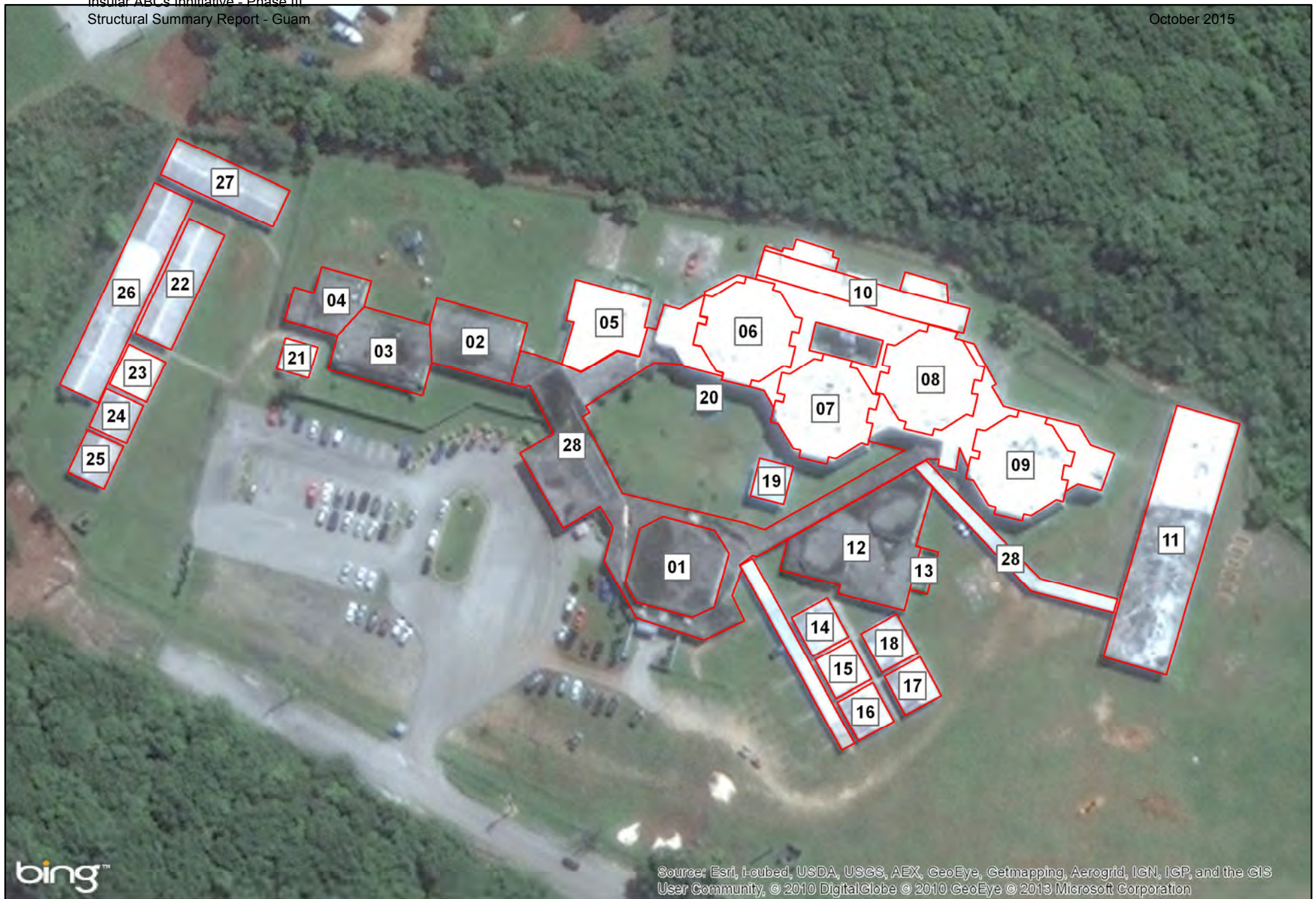
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**F.B. Leon Guerrero Middle School**

Date: 5/24/2013







**Helber Hastert & Fee**

## Finegayan Elementary School

Date: 5/24/2013

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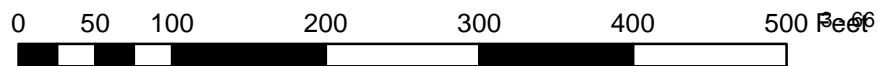




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**George Washington High School**

Date: 5/24/2013



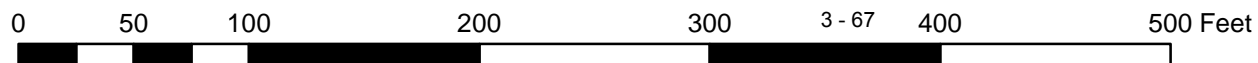




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Date: 5/24/2013



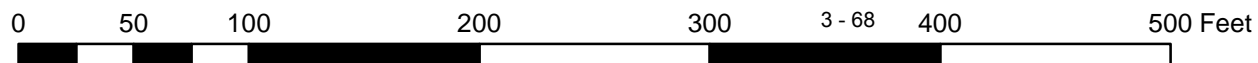




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## Inarajan Elementary School

Date: 5/24/2013







**Helber Hastert & Fee**

## Inarajan Middle School

Date: 5/24/2013



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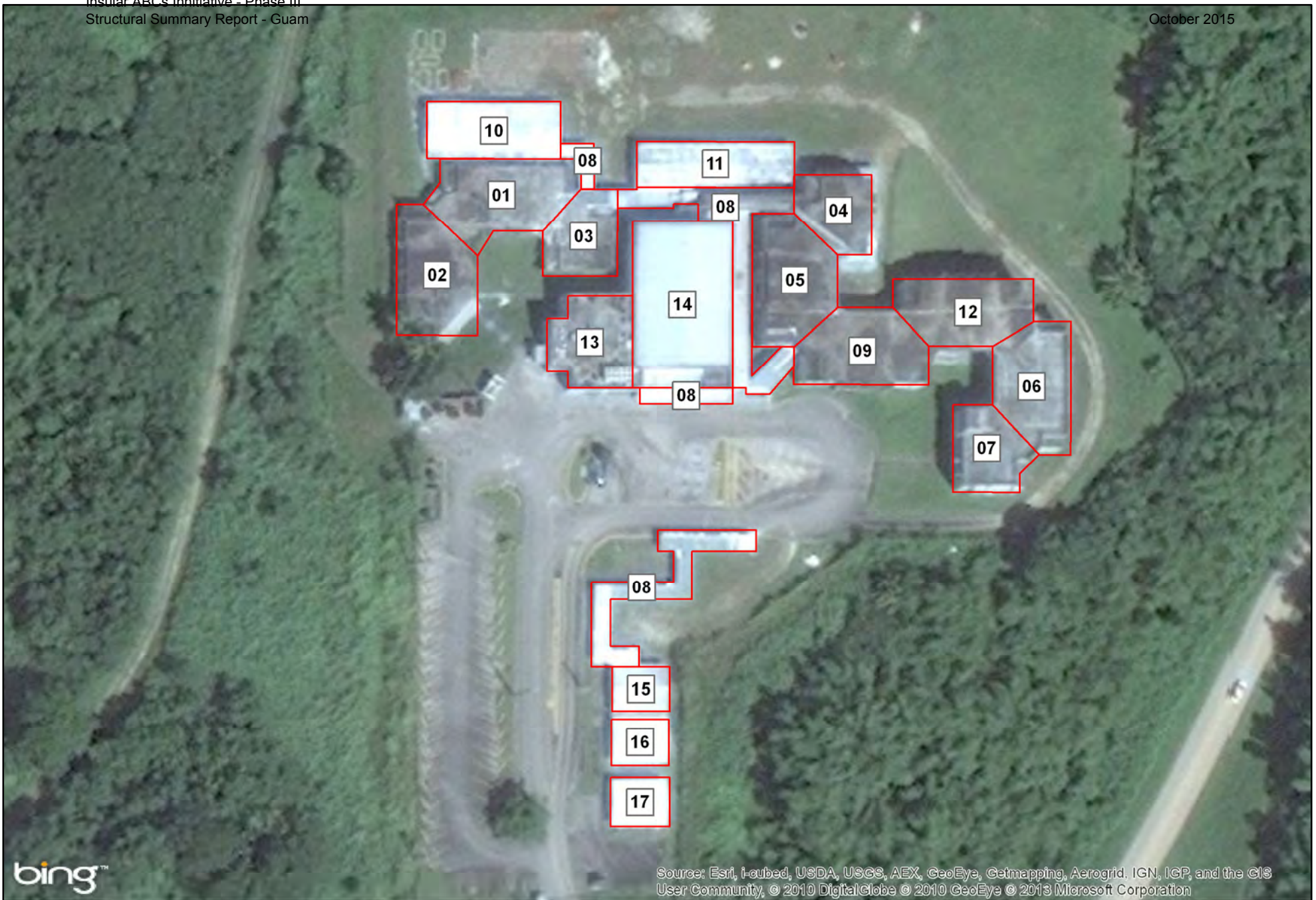
**J.P. Torres Elementary School**

Date: 5/24/2013



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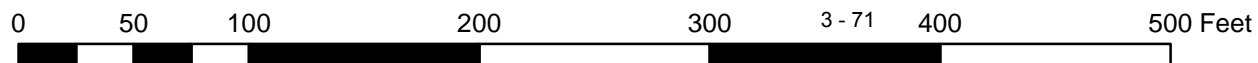




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## J.Q. San Miguel Elementary School

Date: 5/24/2013



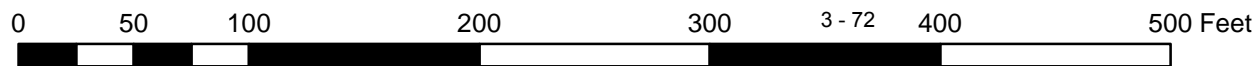




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**Jose Rios Middle School**

Date: 5/24/2013



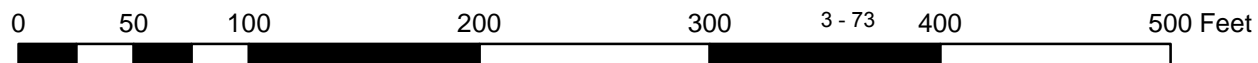




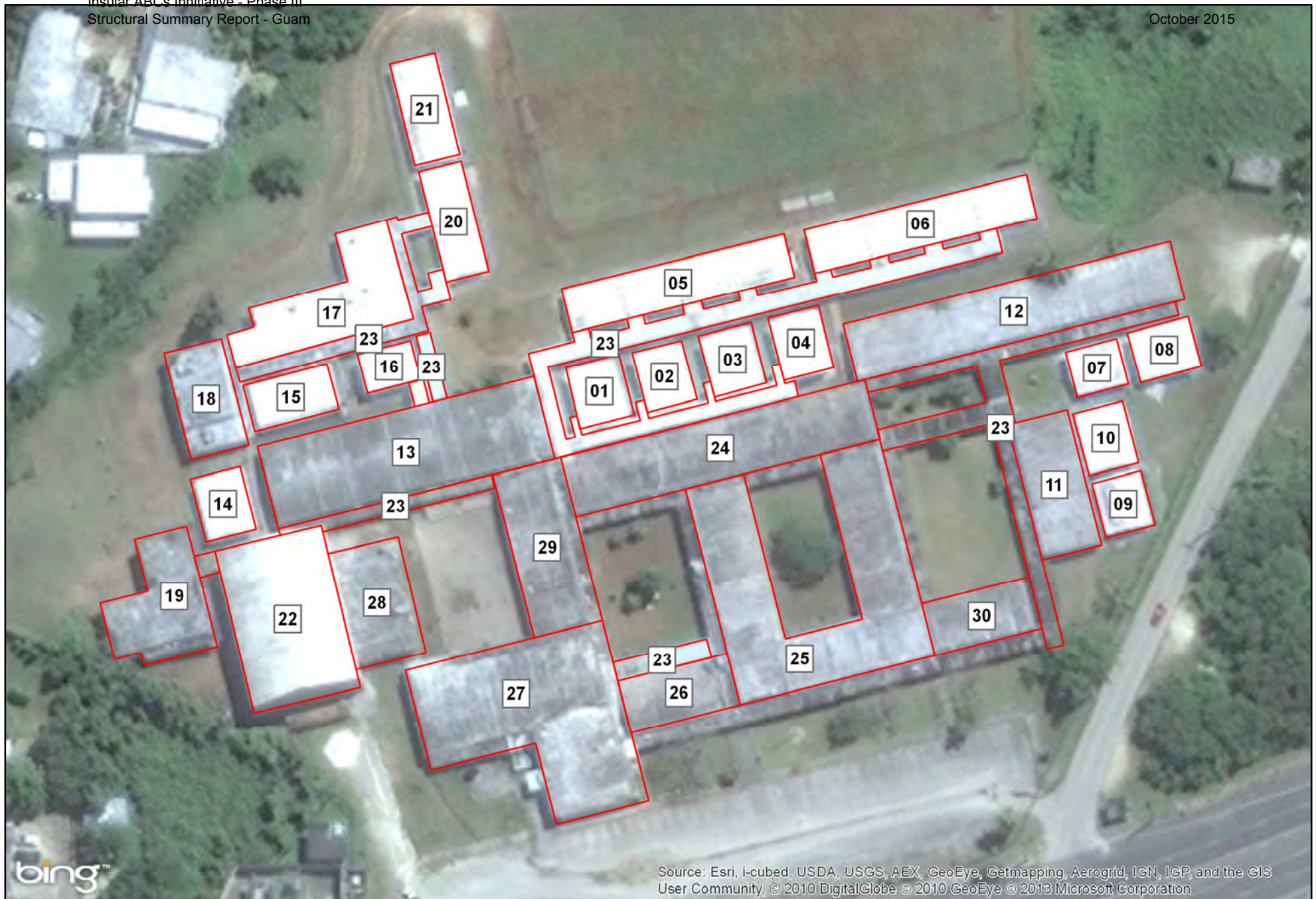
**Helber Hastert & Fee**

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Date: 5/24/2013



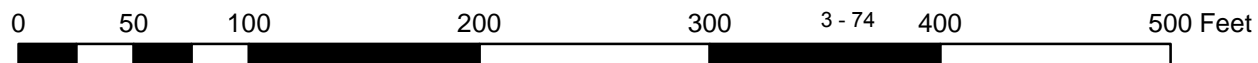




**Helber Hastert & Fee**

**L.P. Untalan Middle School**

Date: 5/24/2013



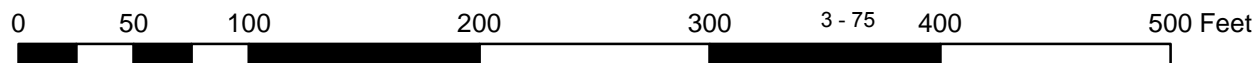




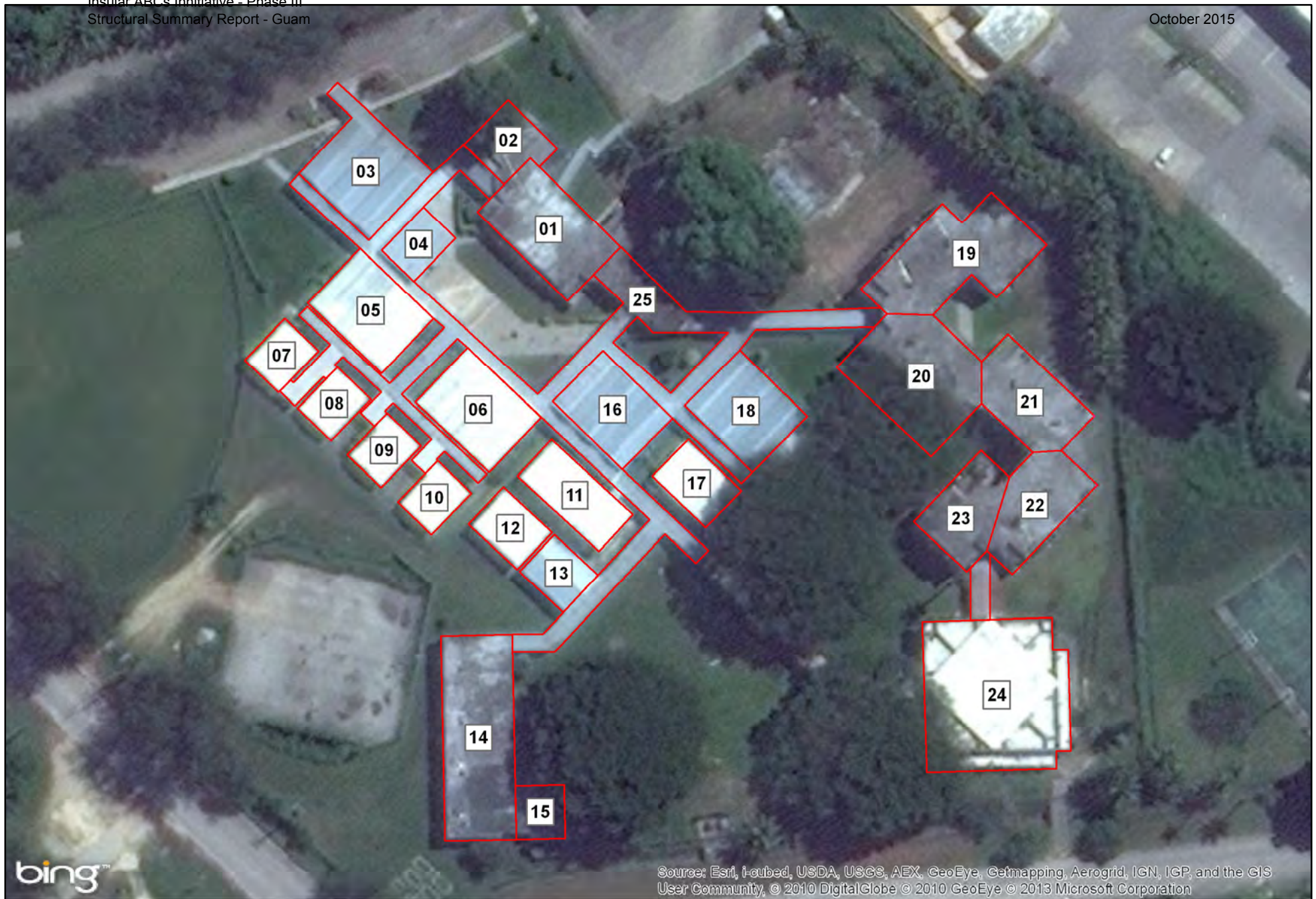
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## LBJ Elementary School

Date: 5/24/2013







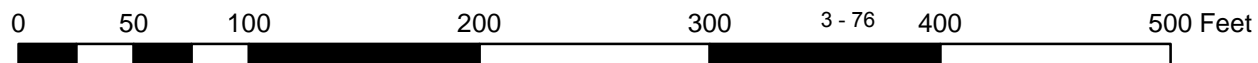
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**M.A. Sablan Elementary School**

Date: 5/24/2013



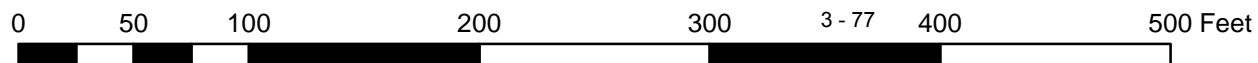




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**M.U. Lujan Elementary School**

Date: 5/24/2013







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**Machananao Elementary School**

Date: 5/24/2013



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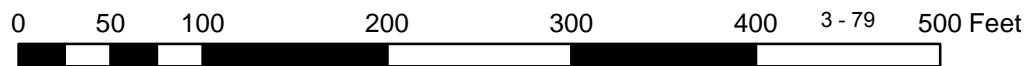




**Helber Hastert & Fee**

**Maria A. Ulloa Elementary School**

Date: 5/24/2013



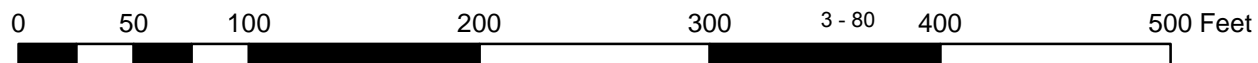




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## Merizo Martyrs Memorial Elementary School

Date: 5/28/2013



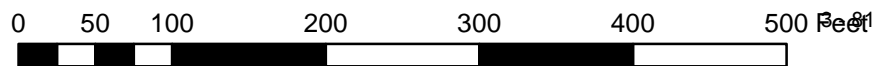




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Date: 5/24/2013



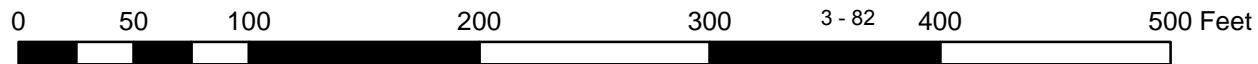




**Helber Hastert & Fee**

**Ordot/Chalan Pago Elementary School**

Date: 5/24/2013



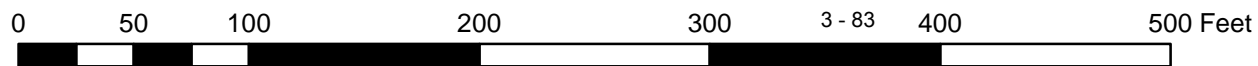




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**P.C. Lujan Elementary School**

Date: 5/24/2013



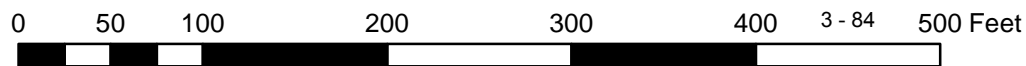




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**Simon Sanchez High School**

Date: 5/24/2013







**Helber Hastert & Fee**

## Southern High School

Date: 5/24/2013

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A horizontal scale bar with alternating black and white segments, representing distances from 0 to 500 feet.







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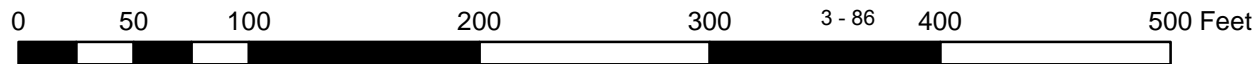
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**Talofoto Elementary School**

Date: 5/24/2013







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## Tamuning Elementary School

Date: 5/24/2013



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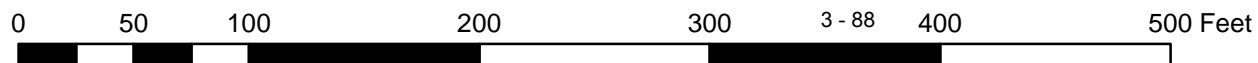




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## Truman Elementary School

Date: 5/24/2013







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**Upi Elementary School**

Date: 5/24/2013

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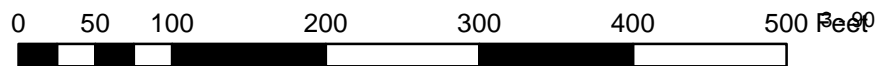




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**Vicente S.A. Benavente Middle School**

Date: 5/24/2013







**Helber Hastert & Fee**

**Wettengel Elementary School**

Date: 5/24/2013

