



**ReidMiddleton**

## RESPONSE & RECOVERY SERVICES

Earthquake Preparedness



# Civil & Structural Engineering Services

*Post-Disaster Response & Recovery  
Engineering Services*

*Seismic Screening & Evaluations  
(FEMA 154, ASCE 31)*

*America's Water Infrastructure Act (AWIA)  
Seismic Risk Assessments for Water Districts*

*Building & Bridge Shoring & Stabilization*

*Seismic Rehabilitation & Upgrades (ASCE 41)*

*Roadway & Infrastructure Repair,  
Shoring & Stabilization*

*Slope Stabilization*

*Post-Disaster Safety Evaluation of Buildings  
& Structures (ATC-20/45, CAL EMA)*

*Building Permitting Technical Review*

*Post-Earthquake Recovery Services  
for Building Departments*

*Post-Disaster Recovery Planning*



*City-Wide Seismic Screening of URM  
Buildings Study, City of Seattle, WA*



*Naval Hospital  
Twentynine Palms*



*Whatcom Middle School Post-Fire, Bellingham, WA*



*Tacoma Fire Facilities Seismic  
Evaluations, City of Tacoma, WA*



*Naval Hospital Bremerton*



*Naval Medical Center San Diego*



*Sammamish Plateau Water Tanks 297 & 7MG*

# Post-Earthquake Response & Recovery Services Experience

The startling frequency of large devastating earthquakes that have recently occurred around the world are a potent reminder about the importance of disaster preparedness of our communities. After such large-scale disasters involving buildings, bridges and critical urban infrastructure, assessing the damage and safety of our infrastructure is one of the most important first steps to disaster recovery. People are scared to return to their damaged homes, offices and public spaces. The displaced public places an even greater demand on disaster response and recovery resources. Post-Earthquake, Windstorm and Flood Safety Evaluation of Buildings (ATC-20 and ATC-45) are the de facto standards for post-disaster safety evaluations of buildings in the United States and around the Pacific Rim. ATC-20/45 training is critical for our nation's disaster preparedness to quickly assess building safety in the aftermath of a major disaster. Reid Middleton is regularly asked to lead such training events for clients including the U.S. Navy, Port of Seattle, ASCE in Costa Rica, Washington State General Administration, University of Washington, Bellevue College, and Vulcan Northwest.

Structural engineering at Reid Middleton has focused on renovation, preservation, and expansion projects. Over the past seven years, we have designed more than 90 seismic upgrade and renovation projects and more than six million square feet of new buildings. We have performed FEMA 154 seismic screening for over 500 buildings leading to innovative seismic risk reduction programs for our clients such as the U.S. Navy, Seattle Tacoma International Airport, Anchorage International Airport, Alaska Airlines, City of Seattle, City of Tukwila, among others. A sampling of our post-earthquake evaluation experience includes:

## **Anchorage School District - Post-Earthquake Response & Recovery**

91 seismic evaluations, 22 minor repair designs, 2 major conceptual designs, 1 renovation/mitigation design complete

## **Naval Air Weapons Station China Lake, Ridgecrest, CA - Post-Earthquake Response & Recovery**

63 ATC-20 Evaluations; 132 D-B RFPs

## **City of Seattle Post-Nisqually Earthquake Response & Recovery**

ATC-20 Evaluations of 1,500 buildings

## **U.S. Navy Post-Nisqually Earthquake Safety Evaluations**

ATC-20 Evaluations of 47 buildings at Naval Base Kitsap-Bremerton and Keyport, WA

## **City of Des Moines Post-Nisqually Earthquake Evaluations, WA**

ATC-20 Evaluations of City Hall, Senior Center, Field House, and bridges

## **City of Renton Post-Nisqually Earthquake Evaluations, WA**

ATC-20 Evaluations of several office and commercial buildings

## **Elevated Water Tanks Seismic Evaluation & Retrofit, Renton, WA**

2 elevated water tank seismic evaluation and upgrades using FEMA 346

## **Juvenile Detention Facility Evaluations Post-Satsop & Post-Nisqually Earthquake**

Grays Harbor County, Montesano, WA

## **Performance regarding Naval Air Weapons Station China Lake, CA**

"Reid Middleton is a very good firm to work with. Their personnel are very concerned with meeting and exceeding contract requirements and customer expectations. Reid Middleton is very flexible and is able to adjust their schedules and workforce to meet emergent customer needs."

*Gilbert Reyes, Senior Project Manager, NAVFAC SW*



*Renton Highland Water Tank Seismic Retrofit, Renton, WA*



*Post-Nisqually Earthquake Safety Evaluations & Engineering Coordination, City of Seattle, WA*



*Grays Harbor County Courthouse Seismic Evaluation & Upgrades, Montesano, WA*



# Rapid Evaluation & Assessment Program (REAP)

The Rapid Evaluation & Assessment Program (REAP) empowers facility management to quickly and accurately perform detailed building safety evaluations immediately after an earthquake. The system reduces delay in evaluating and posting essential facilities, gives the assessment team customized building specific information, "pre-engineered" guidance, and minimizes unnecessary delays. An innovative use of state-of-the-art technologies, REAP incorporates ATC-20 and Performance-Based Earthquake Engineering criteria into a system of seismic monitoring of the structure accessible via graphic user interface, post-earthquake evaluation field manuals, and training.

## Performance regarding Naval Medical Center San Diego REAP

"The Rapid Evaluation and Assessment Program (REAP) is a customized post-earthquake response tool that utilizes seismic sensors deployed at critical locations in our buildings to help us quickly and accurately assess the safety of the facility after a major earthquake. The NMCS D Seismic Improvements Program...has significantly improved our seismic safety and preparedness and is a model program for other hospitals and critical facilities in high seismic areas."

Napoleon Biagtan, PE - Project Manager Naval Medical Center San Diego



REAP includes building-specific field assessment manuals and record drawings.



Safety Assessment Plan to guide the assessment team and highlight important features.

Post-Earthquake Evaluation Safety Assessment Form			
Inspection		Rapid Posting	
Inspector ID:		<input type="checkbox"/> Inspected (green)	
Affiliation:		<input type="checkbox"/> Restricted Use (yellow)	
Inspection date & time:	<input type="checkbox"/> AM <input type="checkbox"/> PM	<input type="checkbox"/> Unusable (red)	
<b>Building Inspection</b>			
Building name: Hospital South		Lateral System	
Building ID: 1945		<input type="checkbox"/> Steel moment Frame	
Number of stories: 3		Primary Occupancy (By Floor)	
Seismic zone: Lower Floor		Upper - Inpatient ward	
Approx. "Seismic area" (sq. ft.): 25,420		Ground - Main entrance & adjacent area offices	
Approx. total floor area (sq. ft.): 64,260		Lower - Mechanical & electrical rooms, administrative offices, & storage	
<b>Evaluation</b>			
Evaluate the building for the following conditions and check the appropriate column. The checklist has been planning, so the evaluation should be performed in order. The page number after each item references the page in the ATC 20-1 Field Manual containing posting recommendations.			
	Minor/None	Major/Sev	Notes/Comments
<b>Overall hazards</b>			
Collapse or partial collapse (p. 70)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Building or item falling (p. 70)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Interior</b>			
Windows (p. 80)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nonstructural attachments (p. 70 & 71)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Concrete retaining walls (p. 82 & 83)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Life safety hazards (p. 85)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Exit doors (p. 86)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Roofs</b>			
Roofs & loadings (p. 90)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Connections	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Exit doors (p. 92)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

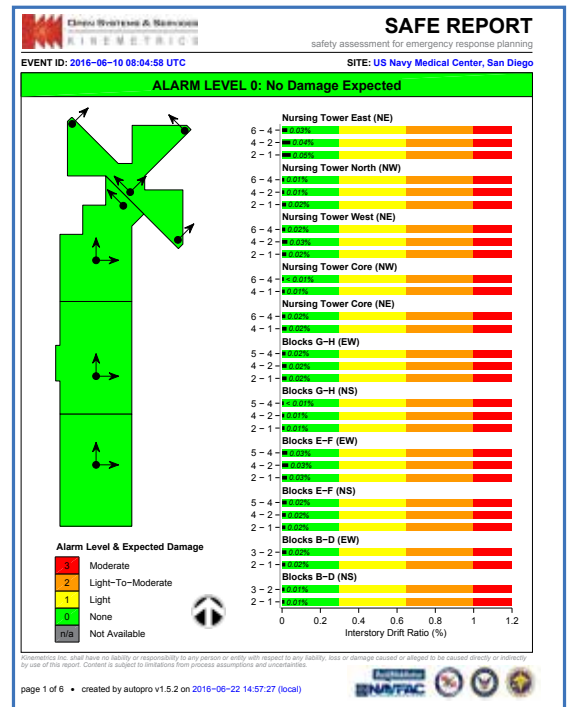
Post-Earthquake Evaluation Safety Assessment Form				
Building name: Hospital South		INSPECTOR ID:		
	Minor/None	Major/Sev	Notes/Comments	
<b>Upper Floor</b>				
Columns (p. 70)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Nonstructural attachments (p. 70 & 71)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Interior walls (p. 80)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Ceiling & lighting fixtures (p. 80)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Overhead piping & ducts (p. 80)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Equipment (p. 80)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Fire protection/detection equipment (p. 80)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>Second Floor</b>				
Columns (p. 70)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Nonstructural attachments (p. 70 & 71)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Interior walls (p. 80)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Ceiling & lighting fixtures (p. 80)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Overhead piping & ducts (p. 80)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Equipment (p. 80)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Fire protection/detection equipment (p. 80)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>Lower Floor</b>				
Columns (p. 70)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Nonstructural attachments between Hospital South & existing wall (refer to REAP Appendix B for location)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Roofs/overhangs (p. 71)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Floor/Horizontal attachments (p. 70 & 71)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Interior walls (p. 80)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Ceiling & lighting fixtures (p. 80)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	



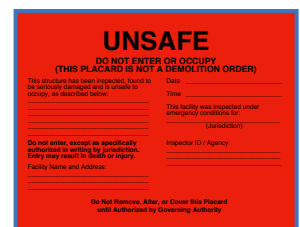
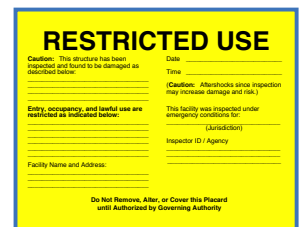
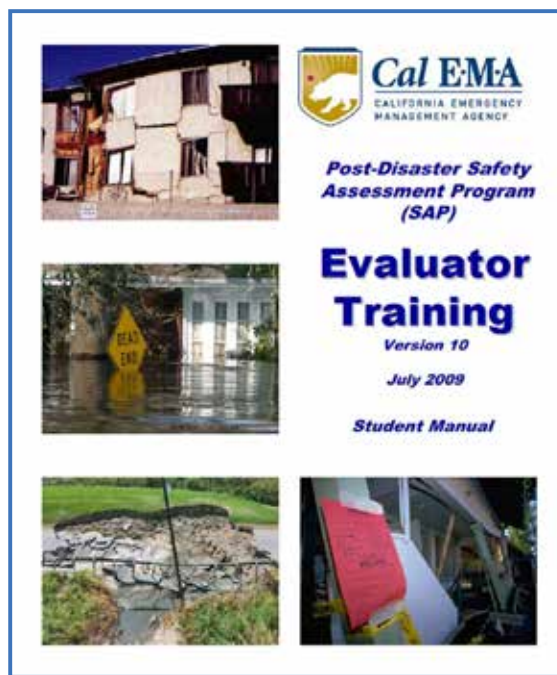
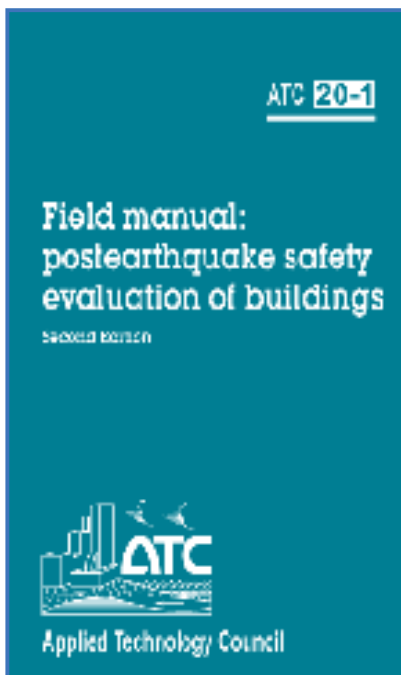
Inspection forms based on ATC-20/45 have been tailored to the specific construction and hazards in the building. Annotated photography documents pre-event conditions.



Seismic Monitoring System (SMS) provides real-time evaluation of the building response based on pre-engineered performance limits.



Auto-generated computer SAFE Report is e-mailed to users after an earthquake.





# Post-Disaster Investigation, Response & Recovery Expertise

Public safety is a defining passion of Reid Middleton engineers. Understanding the value to the engineering profession by investigating earthquakes worldwide, Reid Middleton regularly organizes and leads post-earthquake reconnaissance teams to learn how to better design buildings, bridges and infrastructure. Our engineers have first-hand experience with understanding how building and infrastructure behave under extreme events such as earthquakes, wind storms, heavy rains and snow, and floods. Our engineers have led or served on the following reconnaissance projects:

1999 Taiwan Earthquake, ASCE/SEAW Reconnaissance

1999 Satsop Earthquake, Response & Recovery, Aberdeen & Montesano, WA

2001 Nisqually Earthquake City of Seattle Response & Recovery Services, Seattle, WA

2001 Nisqually Earthquake Response & Recovery, Various Cities, WA

2002 City of Bellevue Post Disaster Recovery Plan, Bellevue, WA

2005 Hurricane Katrina, NCSEA Response Effort

2006 Hurricane Ernesto, US&R Deployment

2008 Wenchuan China Earthquake, UW/SEAW Reconnaissance

2009 Whatcom Middle School Fire, Response & Recovery, Bellingham, WA

2010 Chile Earthquake, ASCE/SEAW Reconnaissance

2010 Haiti Earthquake, UW/NSF Reconnaissance

2011 Christchurch New Zealand Earthquake Volunteer Safety Evaluations/Reconnaissances

2011 Great East Tohoku Japan Earthquake & Tsunami Reconnaissance

2014 Oso Landslide, WA US&R Deployment

2017 Central Mexico Earthquake Reconnaissance

2018 Anchorage, AK Earthquake Recovery

2019 Ridgecrest, CA Earthquake Recovery



Chile Earthquake - 2010



Taiwan Earthquake - 1999



Wenchuan China Earthquake - 2008



Mexico City Earthquake - 2017



Anchorage Earthquake - 2018



Christchurch Earthquake, NZ - 2010



Nisqually Earthquake, Seattle - 2001





Ridgecrest, CA Earthquake Reconnaissance Team



China Earthquake Reconnaissance



Engineers & Jojutla, Mexico emergency response team



Dubai Seismic Monitoring Presentation



Naval Medical Center San Diego, REAP Training



Anchorage Earthquake Recovery & Repair



Mexico Earthquake Reconnaissance



### China Lake Earthquake Response & Recovery, Ridgecrest, CA

On July 4th and 5th, 2019, a magnitude 6.4 and a magnitude 7.1 shallow strike slip earthquake occurred in Searles Valley, CA near Naval Air Weapons Station China Lake. Reid Middleton performed post-earthquake seismic safety inspections and 63 evaluations in accordance with Applied Technology Council (ATC-20) protocols. We designed emergency shoring for severely damaged structures, including ordnance handling and storage facilities, some with cranes. We also provided 166 repair scopes, Design/Build designs, and estimates, including some with seismic upgrade designs. Reid Middleton's multi-disciplinary team deployed quickly; we received contract on July 10 and performed on-site evaluations the day after. We visited 222 facilities, worked on 19 DD1391s and developed RFPs and cost estimates for 132 facilities.

# Firm Profile

Since 1953, Reid Middleton, Inc., has worked throughout the Pacific Northwest, Alaska, and California to provide civil and structural engineering, planning and permitting, and surveying services to public and private sector clients. Our multidisciplinary development capabilities expand to include work for cities, counties, private companies, state and federal agencies, and special-purpose districts. With 79 employees and offices in Everett, Washington; San Diego California; and Anchorage, Alaska, we look forward to continuing to create sustainable solutions for our clients.



*Darin Aveyard,  
PE, SE*



*Kenny O'Neill,  
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*David Stierwalt,  
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