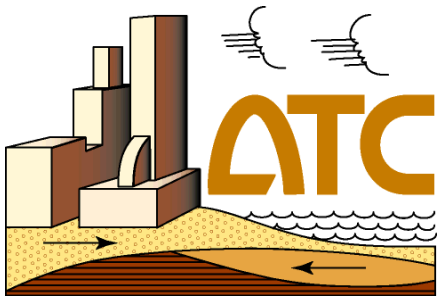
ATC-67 Project Overview and Rapid Observation of Vulnerability and Estimation of Risk (ROVER) Software

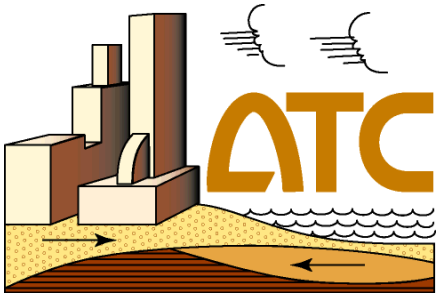


Thomas R. McLane, Director of Business Development
Applied Technology Council
Arlington, VA

Keith A. Porter, Associate Research Professor, University of Colorado at Boulder
Principal, SPA Risk LLC, Denver, CO; Berkeley, CA; & Kyoto, Japan

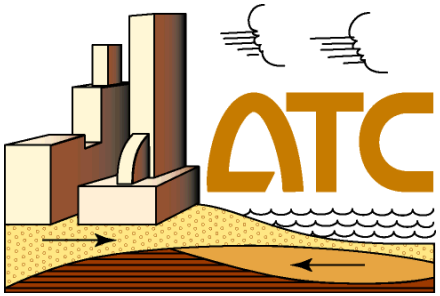
August 2, 2008

ATC-67 Project Overview



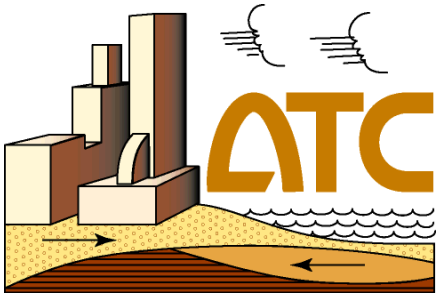
- ATC-67: Task Order 7 of FEMA Task Order Contract
- During Phases 1, 2 and 3:
  - evaluated potential enhancements to the existing paper-based RVS procedure
  - developed a conceptual overview of needed software functionality
  - conducted a User Needs Assessment and a User Needs Assessment Report (continually updated)
  - developed Alpha and Beta versions of Rapid Observation of Vulnerability and Estimation of Risk (ROVER) software
  - Beta tested the ROVER software in Salt Lake City, UT

ATC-67 Project Overview



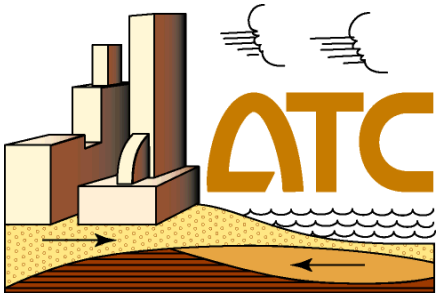
- Phase 4 objective
  - release Version 1.0 of the ROVER software
  - enhance the ROVER software to include extra data fields, making it capable of performing post earthquake safety evaluations (Beta version of the ATC-20-1, *Field Manual, Post-earthquake Safety Evaluation of Buildings*)
  - conduct a second field exercise, in Southern California in the fall of 2008
  - complete a ROVER Field Manual
  - develop a 50% Draft Open Source Business Plan

ATC-67 Project Overview

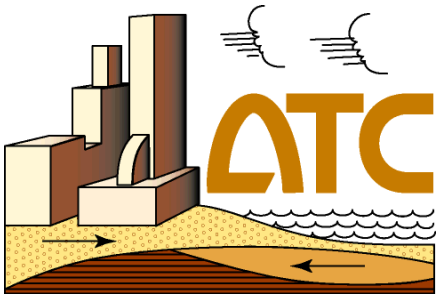


- Personnel
  - Keith Porter, Principal Investigator
  - Instrumental Software Technologies, Inc. , software developer

ATC-67 Project Overview



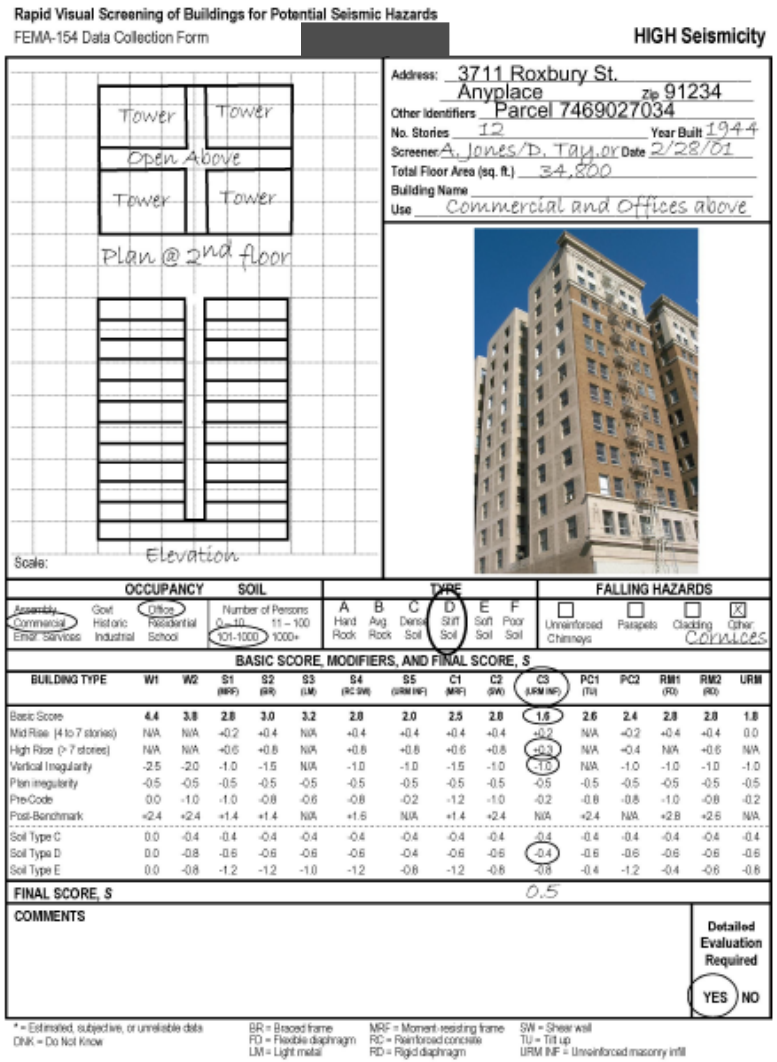
- Schedule
  - Complete ROVER version 1.0 by 8/1/08
  - develop the Beta version of ATC-20i by 9/15/08
  - conduct the 2nd field test of ROVER/ATC-20i by 11/08
  - complete a ROVER Field Manual by 2/10
  - develop a 50% Draft Open Source Business Plan by 11/09



ROVER Software

FEMA 154

- Screening tool: which buildings need detailed seismic evaluation
- Can we automate this?



Rapid Visual Screening of Buildings for Potential Seismic Hazards

FEMA-154 Data Collection Form [redacted] HIGH Seismicity

Tower Tower Open Above Tower Tower

Plan @ 2nd floor

Elevation

Scale:

Address: 3711 Roxbury St. Anyplace Zip 91234

Other Identifiers Parcel 7469027034

No. Stories 12 Year Built 1944

Screener A. Jones/D. Taylor Date 2/28/01

Total Floor Area (sq. ft.) 34,800

Building Name

Use Commercial and Offices above

OCCUPANCY: ~~Assembly~~ Commercial Emer. Services; Govt Historic Industrial; Office Residential School

SOIL: Number of Persons 0–10 11–100 101-1000 1000+

TYPE: A Hard Rock; B Avg. Rock; C Dense Soil; D Stiff Soil; E Soft Soil; F Poor Soil

FALLING HAZARDS: ☐ Unreinforced Chimneys; ☐ Parapets; ☐ Cladding; ☒ Other: Cornices

BASIC SCORE, MODIFIERS, AND FINAL SCORE, S

BUILDING TYPE	W1	W2	S1 (MRF)	S2 (BR)	S3 (LM)	S4 (RC SW)	S5 (URM INF)	C1 (MRF)	C2 (SW)	C3 (URM INF)	PC1 (TU)	PC2	RM1 (FD)	RM2 (RD)	URM
Basic Score	4.4	3.8	2.8	3.0	3.2	2.8	2.0	2.5	2.8	1.6	2.6	2.4	2.8	2.8	1.8
Mid Rise (4 to 7 stories)	N/A	N/A	+0.2	+0.4	N/A	+0.4	+0.4	+0.4	+0.4	+0.2	N/A	+0.2	+0.4	+0.4	0.0
High Rise (> 7 stories)	N/A	N/A	+0.6	+0.8	N/A	+0.8	+0.8	+0.6	+0.8	+0.3	N/A	+0.4	N/A	+0.6	N/A
Vertical Irregularity	-2.5	-2.0	-1.0	-1.5	N/A	-1.0	-1.0	-1.5	-1.0	-1.0	N/A	-1.0	-1.0	-1.0	-1.0
Plan Irregularity	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Pre-Code	0.0	-1.0	-1.0	-0.8	-0.6	-0.8	-0.2	-1.2	-1.0	-0.2	-0.8	-0.8	-1.0	-0.8	-0.2
Post-Benchmark	+2.4	+2.4	+1.4	+1.4	N/A	+1.6	N/A	+1.4	+2.4	N/A	+2.4	N/A	+2.8	+2.6	N/A
Soil Type C	0.0	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
Soil Type D	0.0	-0.8	-0.6	-0.6	-0.6	-0.6	-0.4	-0.6	-0.6	-0.4	-0.6	-0.6	-0.6	-0.6	-0.6
Soil Type E	0.0	-0.8	-1.2	-1.2	-1.0	-1.2	-0.8	-1.2	-0.8	-0.8	-0.4	-1.2	-0.4	-0.6	-0.8

FINAL SCORE, S 0.5

COMMENTS

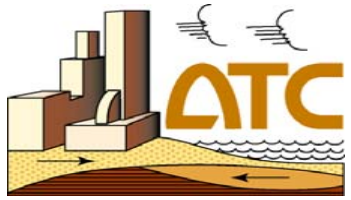
Detailed Evaluation Required: YES NO

* = Estimated, subjective, or unreliable data
DNK = Do Not Know

BR = Braced frame; FD = Flexible diaphragm; LM = Light metal; MRF = Moment-resisting frame; RC = Reinforced concrete; RD = Rigid diaphragm; SW = Shear wall; TU = Tilt up; URM INF = Unreinforced masonry infill

Figure 5-11 Completed Data Collection Form for Example 2, 3711 Roxbury Street.

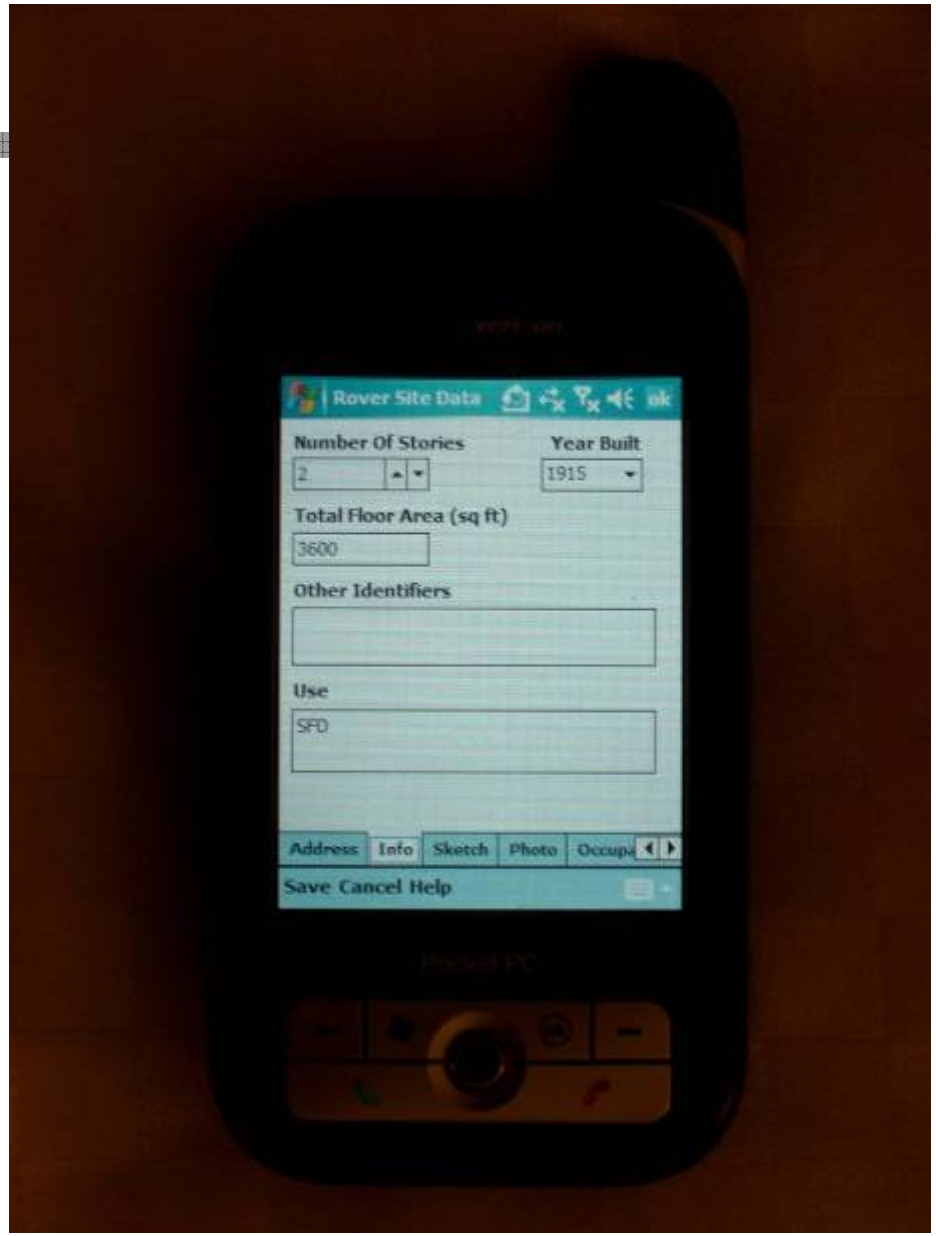
ROVER: Rapid Observation of Vulnerability and Estimation of Risk



- Implements FEMA 154 on smartphone and tablet PC
- Funded by FEMA (C. Carlisle, Program Officer)
- Objective: rapidly (10-20 min/building) create an inventory buildings exposed to risk; ID those warranting detailed examination
- Enhancements to FEMA 154 efficiency, accuracy & data handling:
  - Integral database, GPS, photos, sketches
  - Site-specific automated soil & hazard lookup
  - Enhanced risk scoring
  - Integrated with HAZUS & ShakeCast

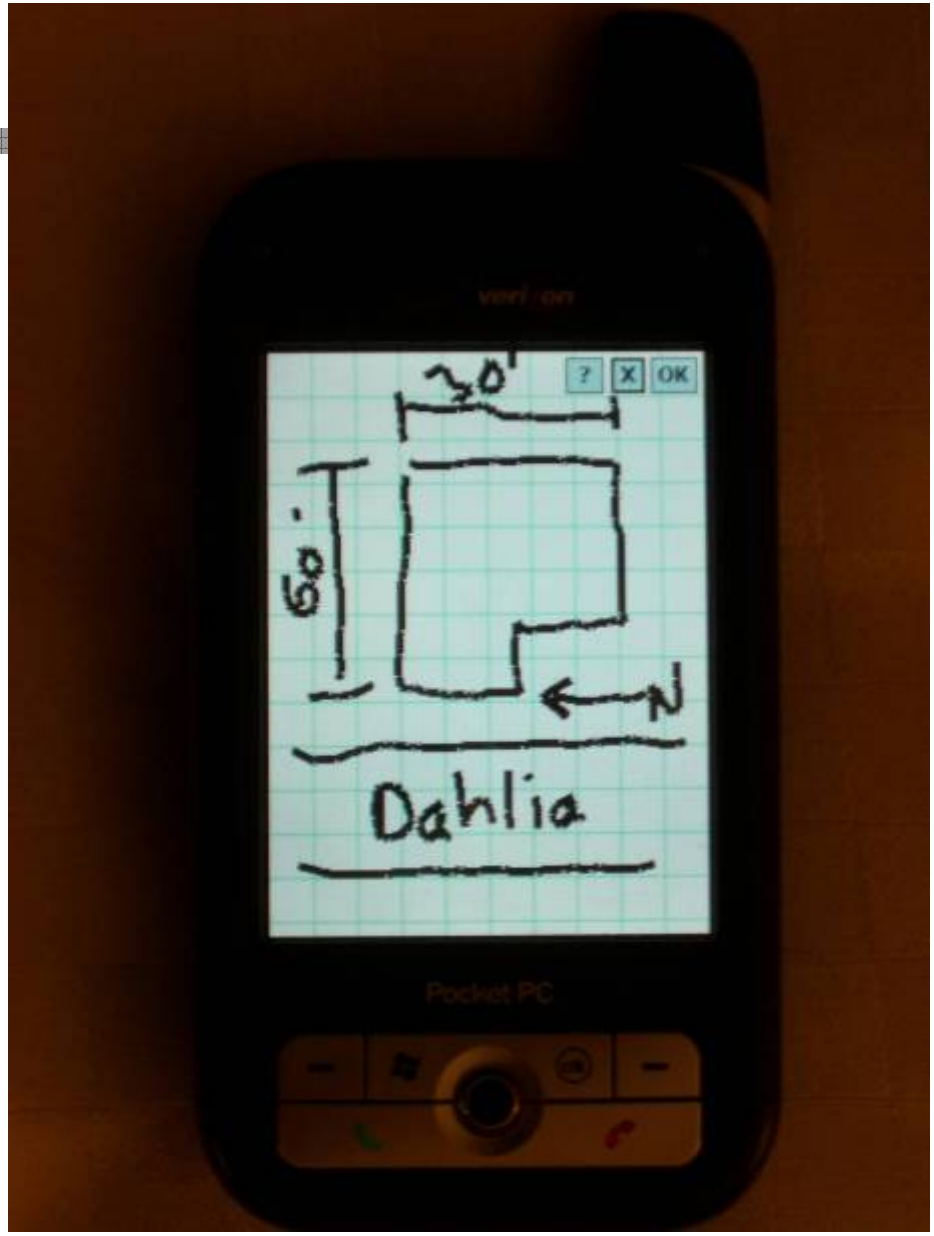
Assignment list

- Download from city records, etc.
- Field worker leaves office with list of buildings to examine already on forms
- Or record new sites on the fly



Info tab

- Stories
- Year built
- Square footage
- Other identifiers (e.g., parcel no)
- Use

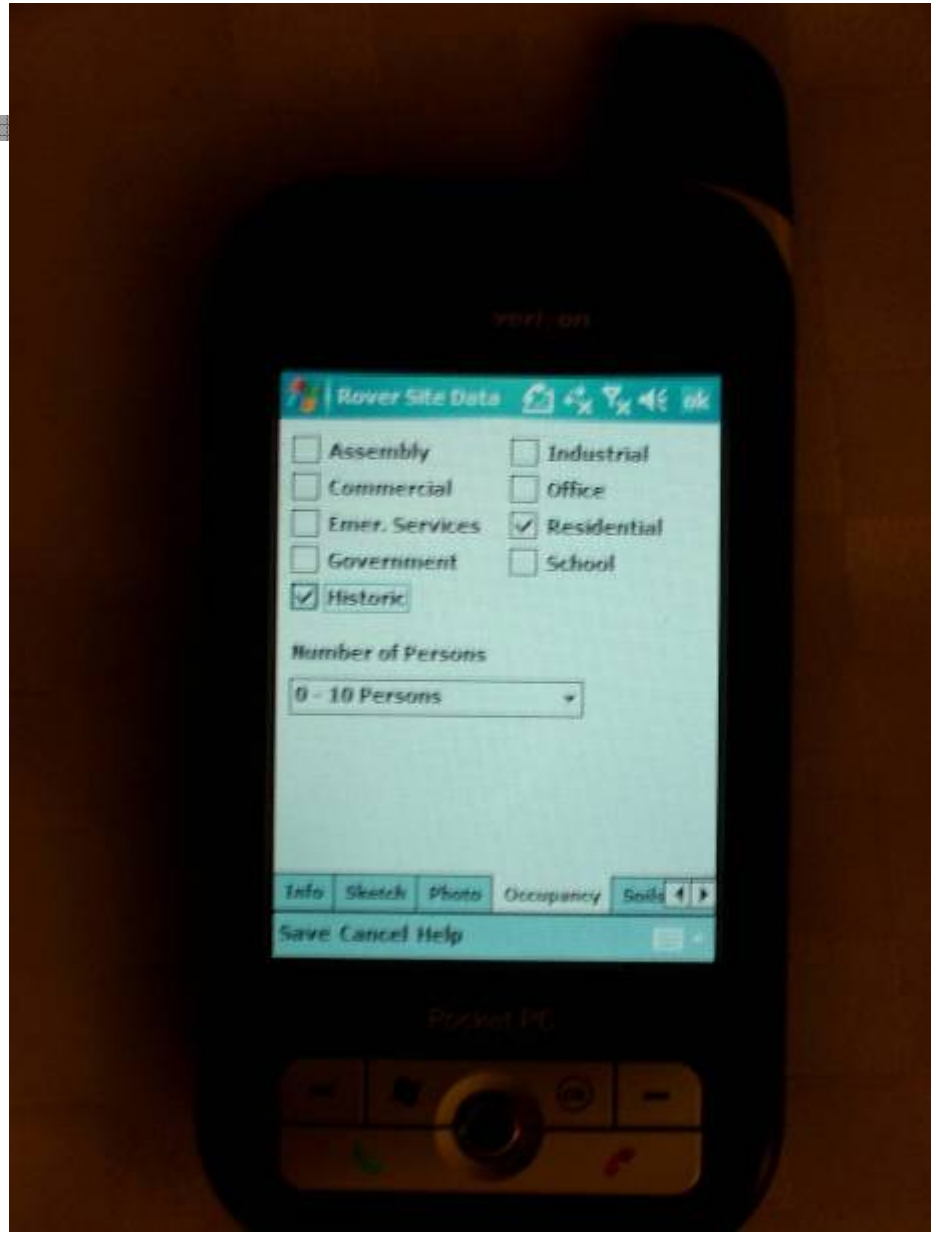


Sketch tab

- Freeform sketch
- Encourages field worker to walk around the building—see it from all sides
- Can note important features, e.g., “HAZMAT stored here”
- Sketch accompanies data in electronic database

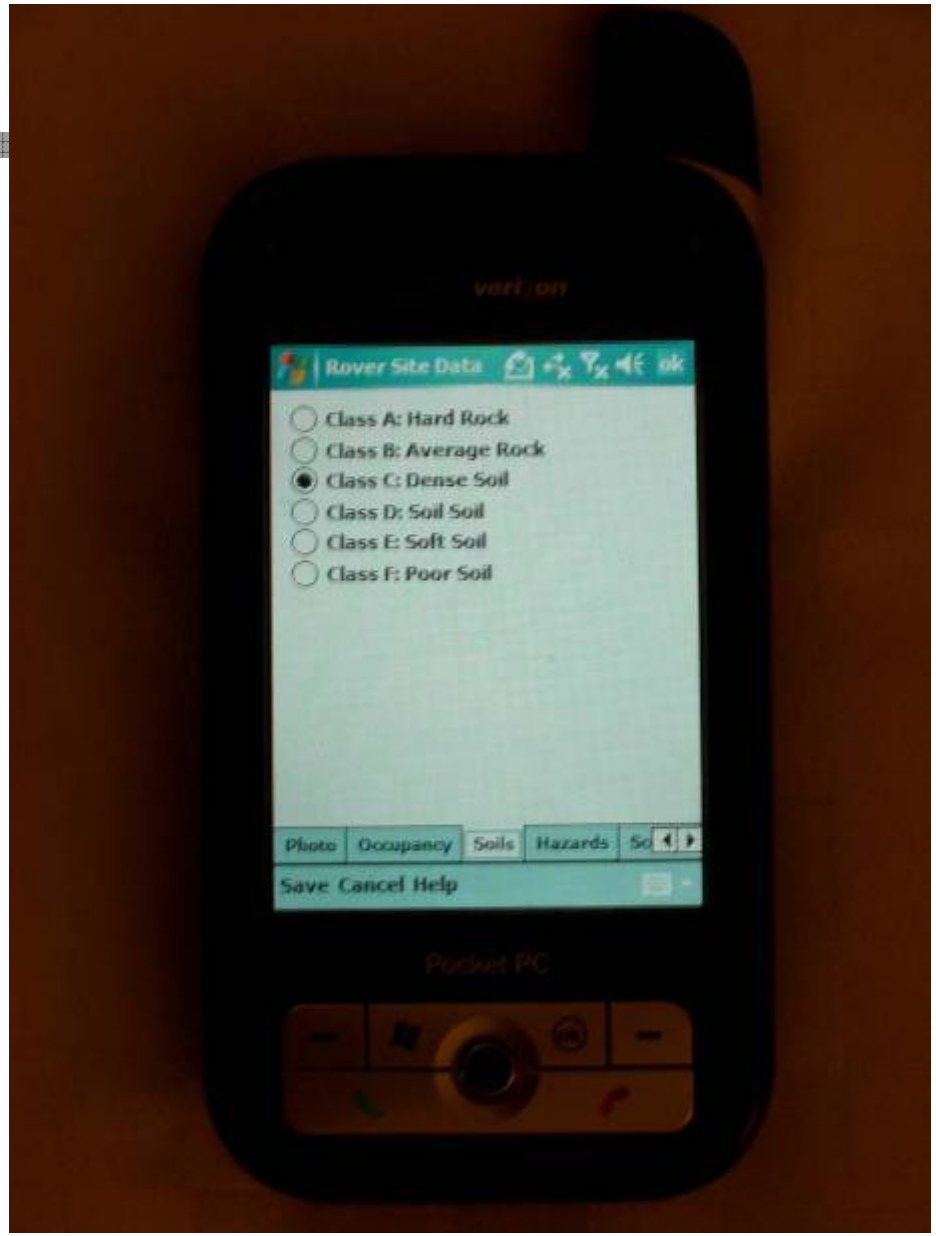
Photo tab

- **Use built-in smartphone camera 2 MPix+**
- **Server adds a watermark**



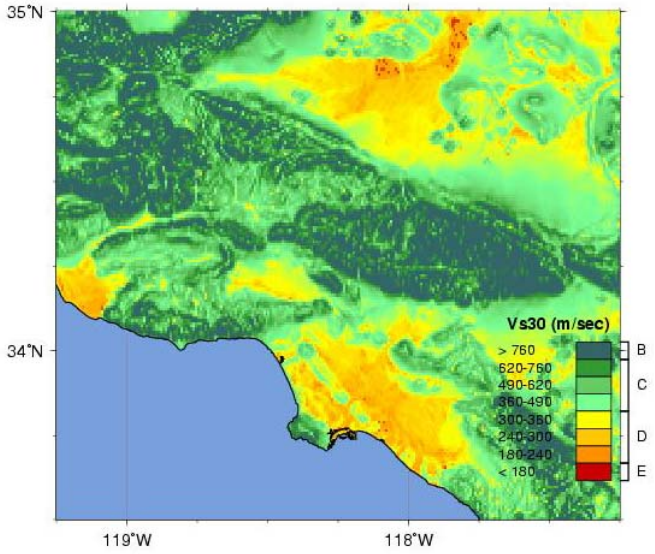
Occupancy tab

- Occupancy type
- Approx. number of occupants



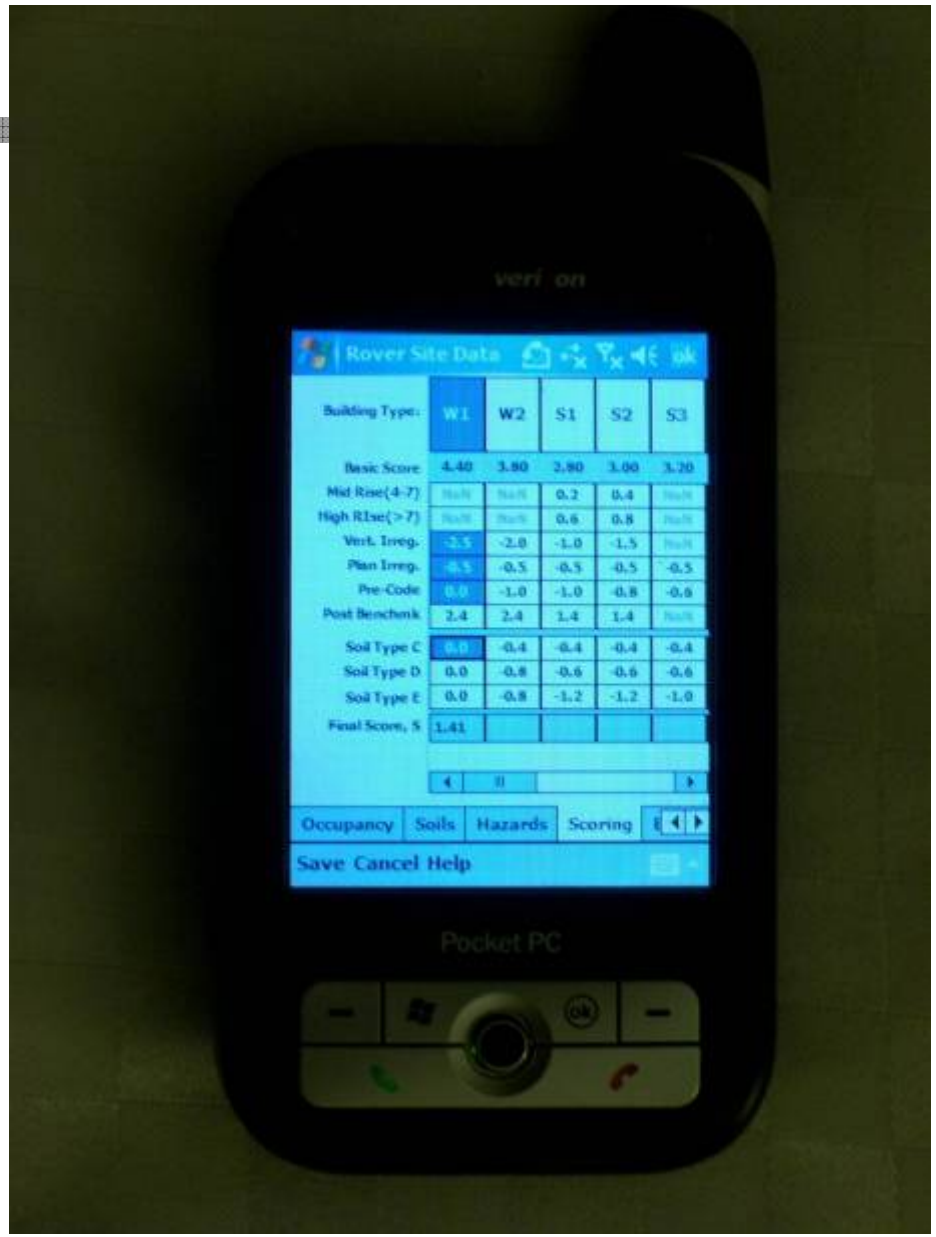
Soil tab

- A-F scale, like IBC
- Soft soil tends to amplify motion
- Server can add soil from built-in global USGS map



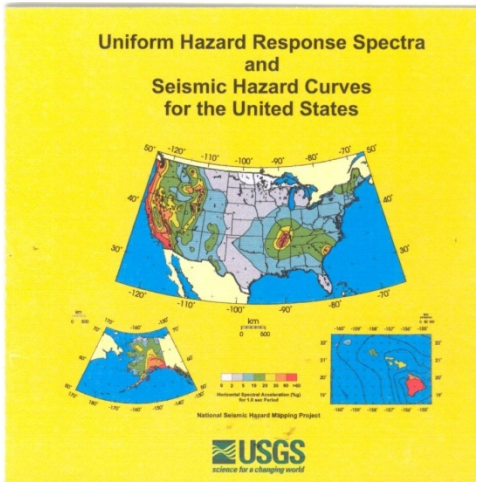
Hazards tab

- Falling hazards: chimneys, parapets, etc.
- Space for general observations

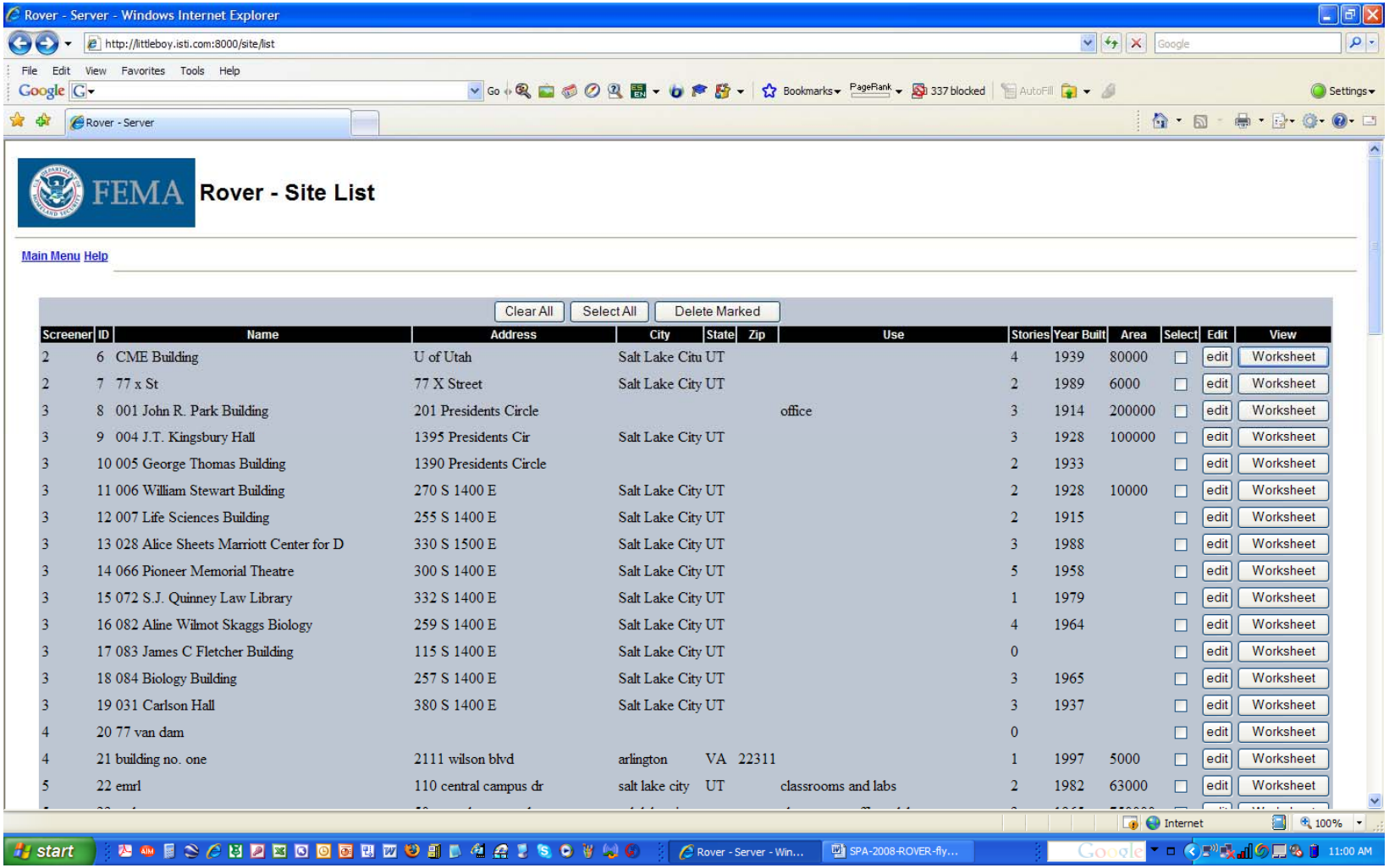


Scoring tab

- Choose possible building type
- Click building features
- “Risk score” calculated below; better math than paper form
- Server can update basic score with built-in USGS site hazard map



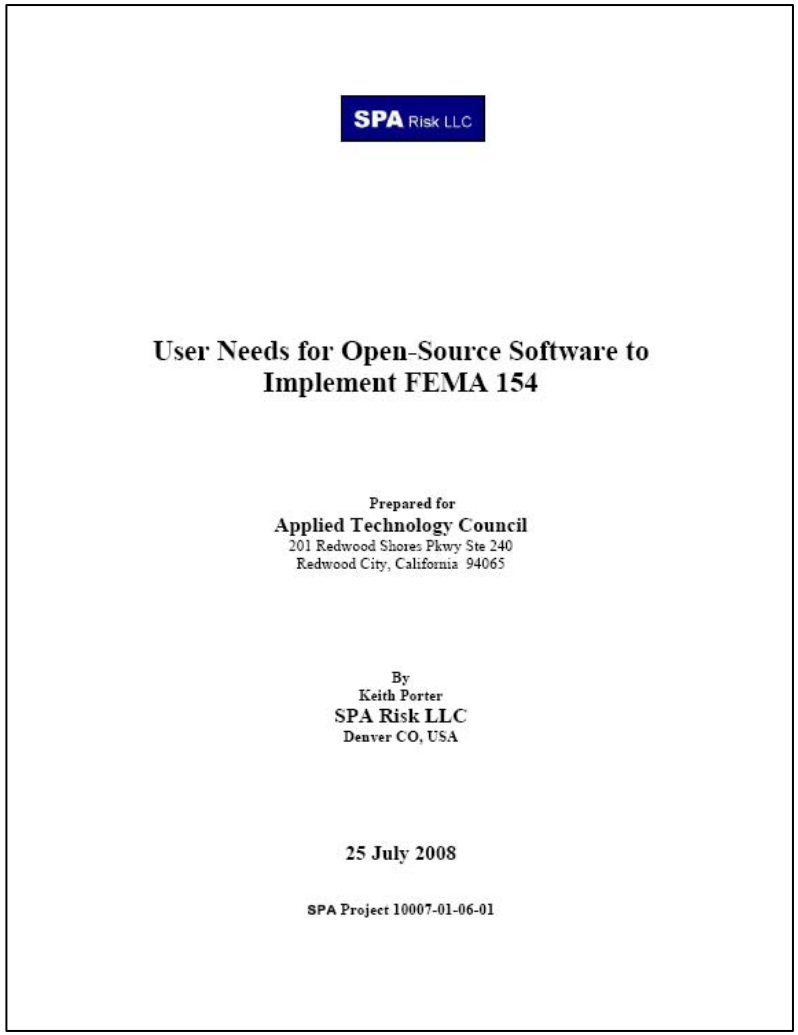
Wireless or wired synch to server



Screener	ID	Name	Address	City	State	Zip	Use	Stories	Year Built	Area	Select	Edit	View
2	6	CME Building	U of Utah	Salt Lake Citu	UT			4	1939	80000	☐	edit	Worksheet
2	7	77 x St	77 X Street	Salt Lake City	UT			2	1989	6000	☐	edit	Worksheet
3	8	001 John R. Park Building	201 Presidents Circle				office	3	1914	200000	☐	edit	Worksheet
3	9	004 J.T. Kingsbury Hall	1395 Presidents Cir	Salt Lake City	UT			3	1928	100000	☐	edit	Worksheet
3	10	005 George Thomas Building	1390 Presidents Circle					2	1933		☐	edit	Worksheet
3	11	006 William Stewart Building	270 S 1400 E	Salt Lake City	UT			2	1928	10000	☐	edit	Worksheet
3	12	007 Life Sciences Building	255 S 1400 E	Salt Lake City	UT			2	1915		☐	edit	Worksheet
3	13	028 Alice Sheets Marriott Center for D	330 S 1500 E	Salt Lake City	UT			3	1988		☐	edit	Worksheet
3	14	066 Pioneer Memorial Theatre	300 S 1400 E	Salt Lake City	UT			5	1958		☐	edit	Worksheet
3	15	072 S.J. Quinney Law Library	332 S 1400 E	Salt Lake City	UT			1	1979		☐	edit	Worksheet
3	16	082 Aline Wilmot Skaggs Biology	259 S 1400 E	Salt Lake City	UT			4	1964		☐	edit	Worksheet
3	17	083 James C Fletcher Building	115 S 1400 E	Salt Lake City	UT			0			☐	edit	Worksheet
3	18	084 Biology Building	257 S 1400 E	Salt Lake City	UT			3	1965		☐	edit	Worksheet
3	19	031 Carlson Hall	380 S 1400 E	Salt Lake City	UT			3	1937		☐	edit	Worksheet
4	20	77 van dam						0			☐	edit	Worksheet
4	21	building no. one	2111 wilson blvd	arlington	VA	22311		1	1997	5000	☐	edit	Worksheet
5	22	emrl	110 central campus dr	salt lake city	UT		classrooms and labs	2	1982	63000	☐	edit	Worksheet

Design document

- Intro; objectives
- Options considered & selections made
  - Hardware, OS, GPS, photos & sketches, open source license...
- Site-specific calcs:
  - Soil, hazard, score
- Enhanced math
- RedROVER specs...



SPA Risk LLC

User Needs for Open-Source Software to Implement FEMA 154

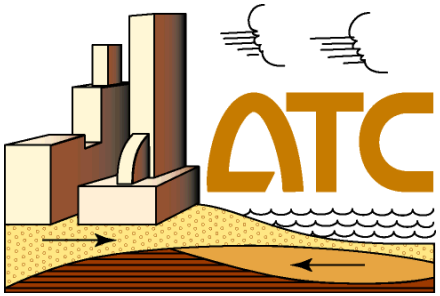
Prepared for
Applied Technology Council
201 Redwood Shores Pkwy Ste 240
Redwood City, California 94065

By
Keith Porter
SPA Risk LLC
Denver CO, USA

25 July 2008

SPA Project 10007-01-06-01

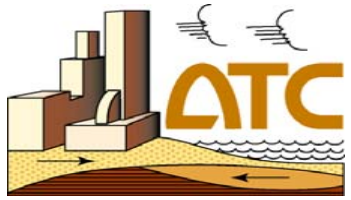
Enhancements to FEMA 154



Same basic methodology, plus:

- Site-specific hazard from USGS
- Site-specific soil from USGS
- Automated latitude & longitude location
- Integral photos & sketches
- Enhanced scoring (some fancy math)
  - Mods & basic score -> Poisson arrivals
    50-yr probability of “complete” damage -> S
- No transcription of paper data
- Integration with other risk software

ROVER's roll in seismic risk management data

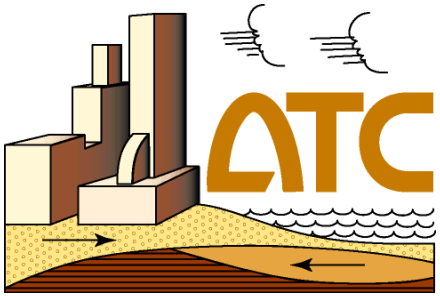


- Pre-earthquake
  - Inventory of buildings at risk
  - Screen for potential seismic risk — ROVER
  - Prioritize risk-mitigation efforts
  - Emergency planning — HAZUS
- Response
  - Prioritize inspections — ShakeCast
  - Safety inspection, cost estimates — ATC-20i
  - Learning from earthquakes (recon, etc.) — ?

Lear Reconnaissance in Earthquakes -- eXpress? (REX) SSIE)

  - Manage repairs—permitting, etc.

RedROVER, ShakeCast & HAZUS



- USGS's ShakeCast: free, easy software for post-event inspection prioritization and pre-event scenario analysis
- FEMA's HAZUS: pre-event risk analysis
- RedROVER: an import tool to port ROVER field data into either ShakeCast or HAZUS
  - University of Utah RedROVER InCAST edition: Summer 2008
  - USGS RedROVER ShakeCast edition: Summer 2008

Thanks

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