Be a surveyor in emergency conditions shipwreck Costa Concordia - Emilia Romagna earthquake

Enrico Davoli

Keywords: Engineering survey; gnss/gps; emergency conditions

Summary:

Climate change and human intervention have resulted unfortunately into unprecedented catastrophic events. During the aftermath of these events, what can a surveyor's main role be?

This paper aims to illustrate the different phases we undertook in these natural catastrophic events. It is essential to establish technical pathways concerning science, technical knowledge, and experience, especially during the first critical and emergency phases. It is also important to highlight the importance of our involvement as surveyors, the attitude to maintain, both in the personal and professional perspectives, whenever we work alongside rescue facilities. In this way, we play a crucial role in monitoring and data planning.

1. Introduction:

This paper concerns some of my professional experiences carried out in emergency phases with the aim of highlighting the need to establish smart and practical operating protocols aimed at improving the technical support of the emergency structures.

2. Subtitle:

In the last 30 years there have been 5 shipwrecks of large cruise ships or medium-sized boats and more than 632 earthquakes. Since our work is a crucial part of managing these emergencies, it is becoming increasingly necessary to analyze the events that are taking place in the world, also due to human errors and the role that the alerted technical figures have played.

In my short career I have had the opportunity to cooperate during the following catastrophic events:

2.1 Costa Concordia Survey:

Following the sinking of the Costa Concordia cruise ship on 13/01/2012 off the island of Giglio (Gr), some surveyors belonging to the National Council of surveyors and graduate surveyors of the province of Grosseto were alerted and summoned by the command of the fire brigade and civil protection of the province of Grosseto in order to install the first site for monitoring the position of the ship. This was accomplished by installing a total station and two prisms, one forward and one aft. This survey was aimed at monitoring the slipping and settling of the ship towards the underlying 70-meter abyss which would have inevitably dragged the rescuers intent on the rescue operations with them.

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Enrico Davoli (Italy)

FIG Working Week 2023
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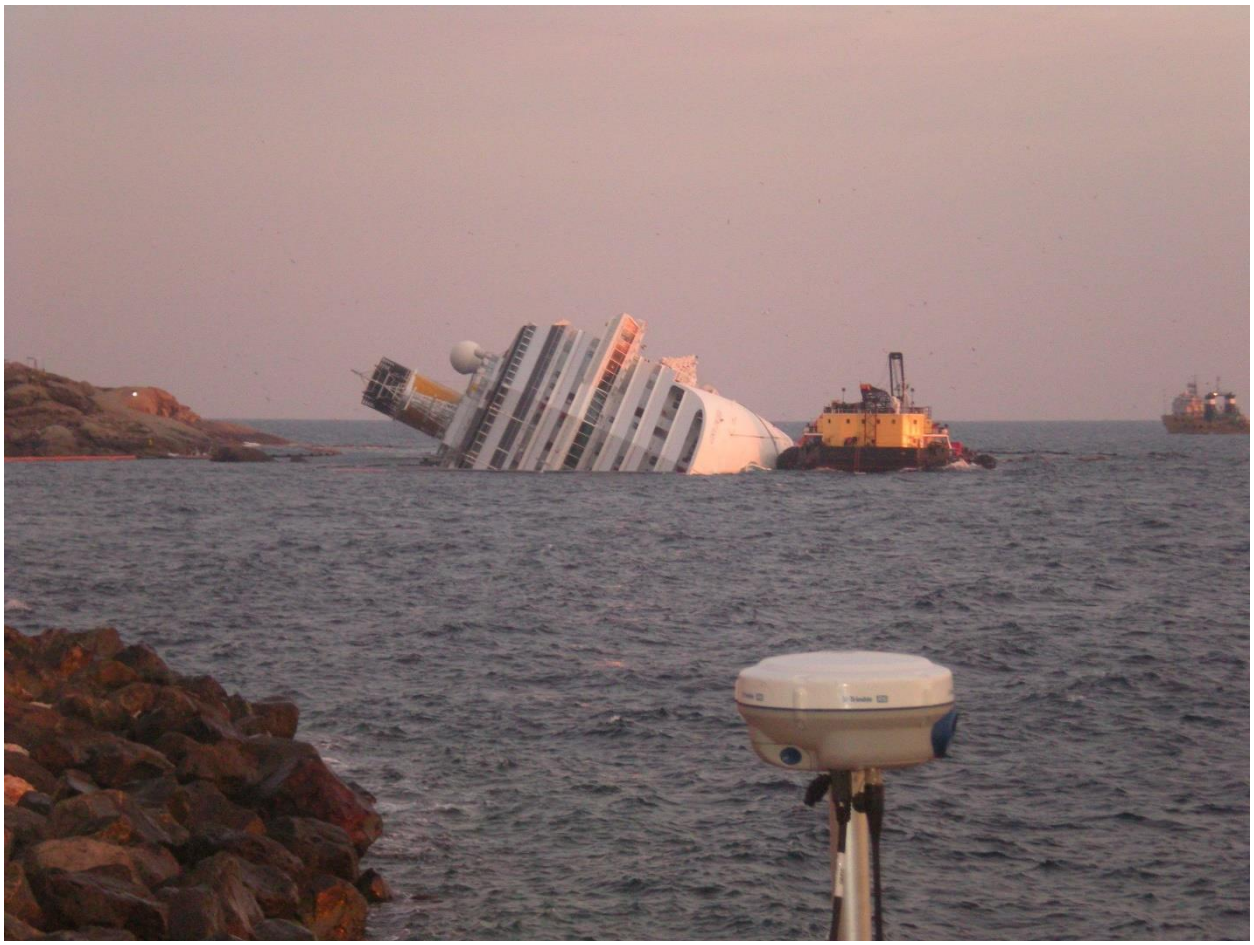
Following the operational difficulties in maintaining a constant monitoring with a total station also due to unfavorable weather conditions, I and another colleague, who are part of the board of surveyors and graduate surveyors of Modena, were activated and we reached the island del Giglio in order to provide for the installation of a second site for monitoring the ship using gps instrumentation in rover-gps methodology.



The monitoring lasted 3 weeks: the first week for 24 hours a day, while the other two only during the day since rescue activities were limited.

2.2 Emilia Romagna earthquake:

The 2012 Emilia earthquake was a seismic event (magnitude 5.9 and 5.8) consisting of a series of shocks located in the seismic district of the Emilian Po Valley, mainly in the provinces of Modena, Ferrara, Mantua, Reggio Emilia, Bologna and Rovigo, but also felt in a very large area including all of central-northern Italy, between 20 and 29 May 2012.

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Following this catastrophic event, the civil protection, in agreement with all the public safety commands (firefighters, police, etc.), proceeded to extraordinary request the intervention of numerous professionals including surveyors belonging to the board of surveyors and graduate surveyors from the province of Modena with 2 main purposes:

- the mapping and census of the first reception camps;

- the survey and census using specific forms of the static and structural conditions of the buildings located within the municipalities.

The first survey and census phase took place using GPS instrumentation in Rtk aimed at framing and census the positioning of the first reception camps and the related equipment.

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Afterwards, the survey was rendered graphically in 2D and delivered to the heads of the civil protection who would have implemented or modified the equipment present in the fields.

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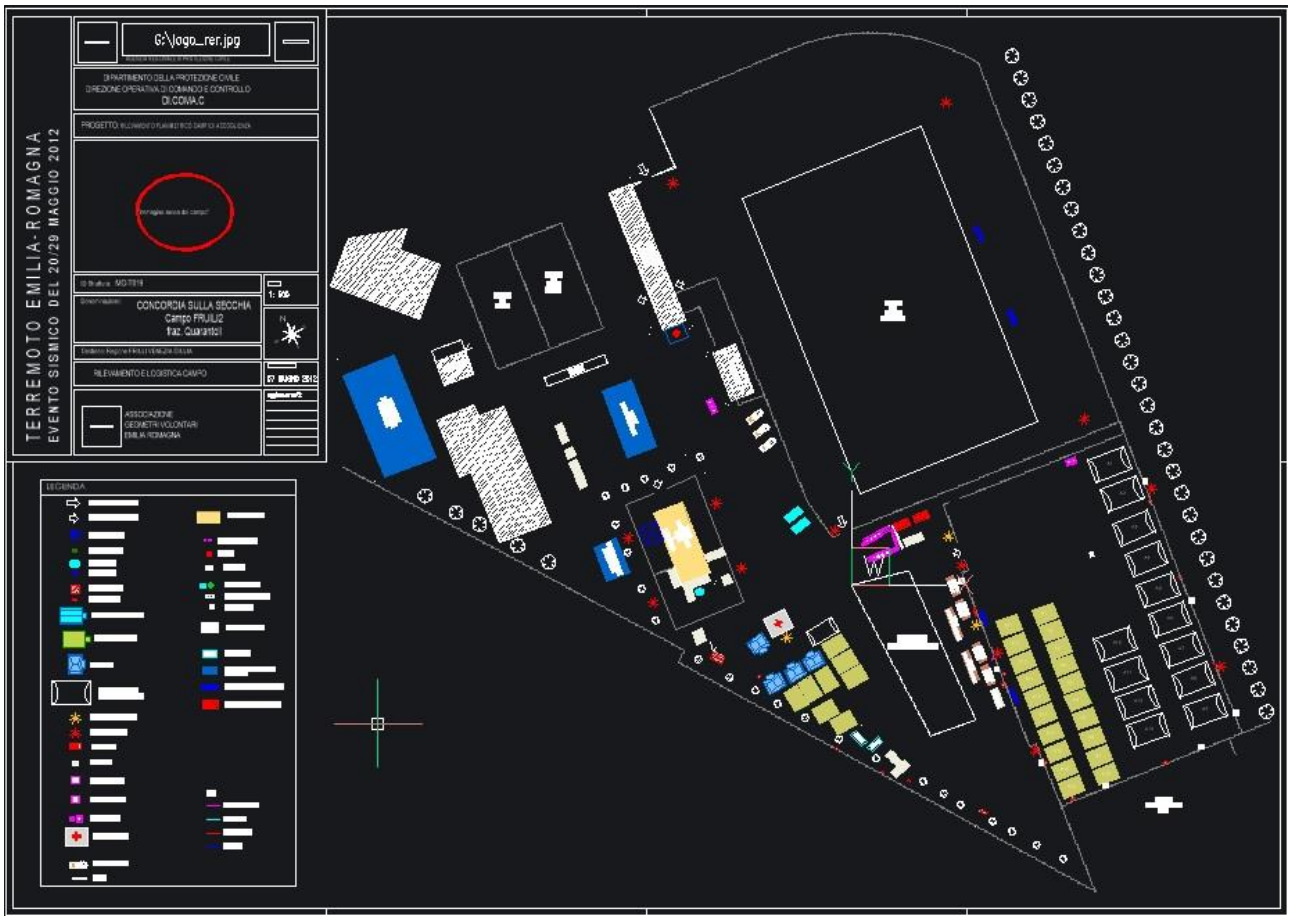

The second aim was drawn up directly by the civil protection together with the professional orders and concerned the census of the damaged buildings by means of a visual and technical inspection. Specifically, the buildings have been divided into 3 macro-categories:

- homes and small commercial buildings;

- listed or valuable assets, such as churches, sanctuaries or monasteries;

- large structures or complicated structures, such as large silos or vertical warehouses.

The classification of the damaged buildings was carried out with the aid of three types of technical sheets for expeditious compilation, called AEDES sheet.

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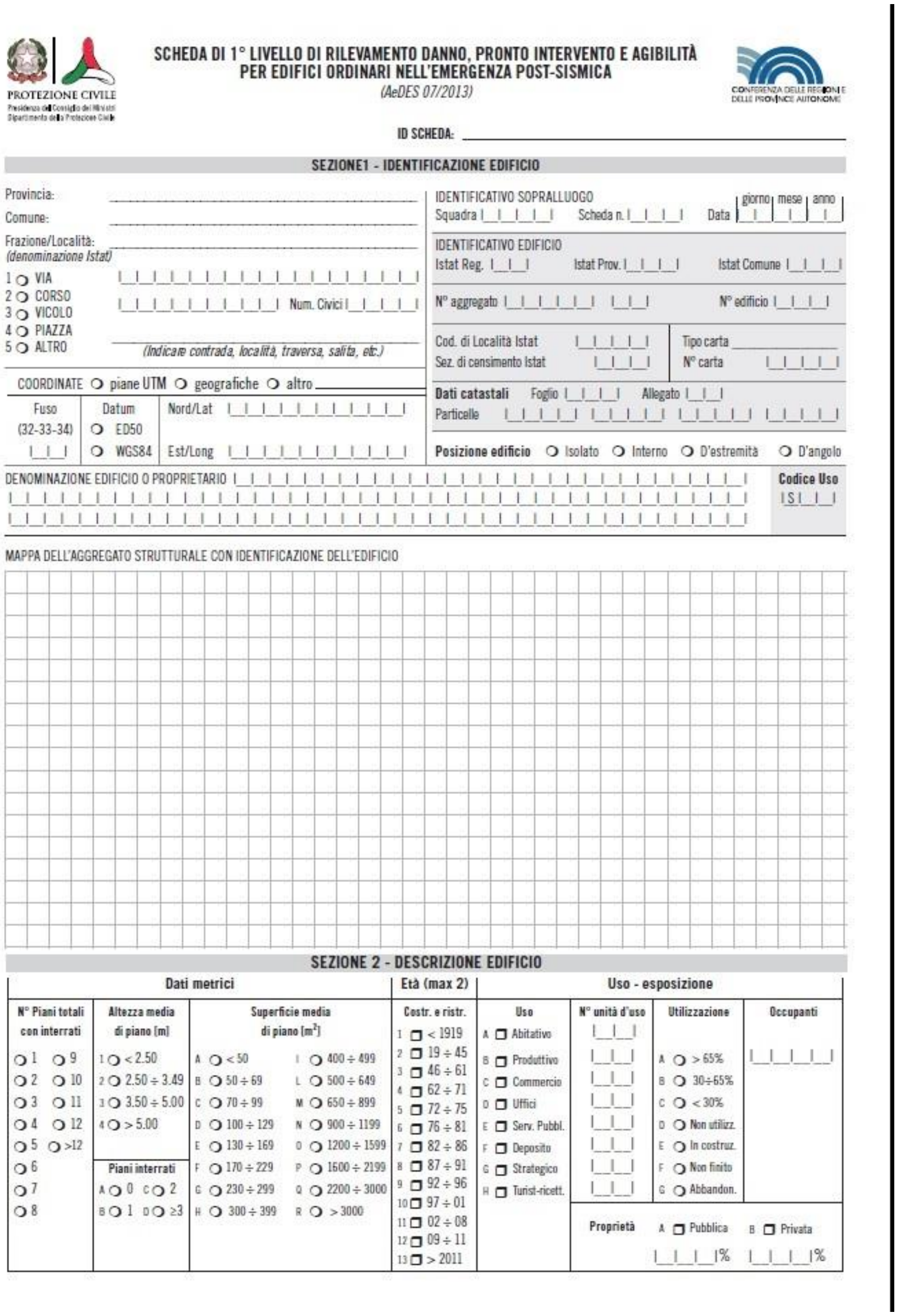
"Ordinary" buildings:



PROTEZIONE CIVILE
Presidenza del Consiglio dei Ministri
Dipartimento della Protezione Civile

SCHEDA DI 1° LIVELLO DI RILEVAMENTO DANNO, PRONTO INTERVENTO E AGIBILITÀ PER EDIFICI ORDINARI NELL'EMERGENZA POST-SISMICA
(AeDES 07/2013)

CONFERENZA DELLE REGIONI E DELLE PROVINCE AUTONOME

ID SCHEDA: ____

SEZIONE1 - IDENTIFICAZIONE EDIFICIO

Provincia: ____
Comune: ____
Frazione/Località: *(denominazione Istat)* ____
1 ○ VIA
2 ○ CORSO
3 ○ VICOLO
4 ○ PIAZZA
5 ○ ALTRO
Num. Civici
(Indicare contrada, località, traversa, salita, etc.)

COORDINATE ○ piane UTM ○ geografiche ○ altro ____

Fuso (32-33-34) | Datum ○ ED50 ○ WGS84 | Nord/Lat | Est/Long

IDENTIFICATIVO SOPRALLUOGO
Squadra | Scheda n. | Data giorno mese anno

IDENTIFICATIVO EDIFICIO
Istat Reg. | Istat Prov. | Istat Comune
N° aggregato | N° edificio
Cod. di Località Istat | Tipo carta
Sez. di censimento Istat | N° carta
Dati catastali Foglio | Allegato
Particelle
Posizione edificio ○ Isolato ○ Interno ○ D'estremità ○ D'angolo

DENOMINAZIONE EDIFICIO O PROPRIETARIO
Codice Uso S

MAPPA DELL'AGGREGATO STRUTTURALE CON IDENTIFICAZIONE DELL'EDIFICIO

SEZIONE 2 - DESCRIZIONE EDIFICIO

Dati metrici				Età (max 2)	Uso - esposizione			
N° Piani totali con interrati	Altezza media di piano [m]	Superficie media di piano [m²]		Costr. e ristr.	Uso	N° unità d'uso	Utilizzazione	Occupanti
○ 1 ○ 9	1 ○ < 2.50	A ○ < 50	I ○ 400 ÷ 499	1 □ < 1919	A □ Abitativo		A ○ > 65%	
○ 2 ○ 10	2 ○ 2.50 ÷ 3.49	B ○ 50 ÷ 69	L ○ 500 ÷ 649	2 □ 19 ÷ 45	B □ Produttivo		B ○ 30÷65%	
○ 3 ○ 11	3 ○ 3.50 ÷ 5.00	C ○ 70 ÷ 99	M ○ 650 ÷ 899	3 □ 46 ÷ 61	C □ Commercio		C ○ < 30%	
○ 4 ○ 12	4 ○ > 5.00	D ○ 100 ÷ 129	N ○ 900 ÷ 1199	4 □ 62 ÷ 71	D □ Uffici		D ○ Non utilizz.	
○ 5 ○ >12	Piani interrati	E ○ 130 ÷ 169	O ○ 1200 ÷ 1599	5 □ 72 ÷ 75	E □ Serv. Pubbl.		E ○ In costruz.	
○ 6	A ○ 0 C ○ 2	F ○ 170 ÷ 229	P ○ 1600 ÷ 2199	6 □ 76 ÷ 81	F □ Deposito		F ○ Non finito	
○ 7	B ○ 1 D ○ ≥3	G ○ 230 ÷ 299	Q ○ 2200 ÷ 3000	7 □ 82 ÷ 86	G □ Strategico		G ○ Abbandon.	
○ 8		H ○ 300 ÷ 399	R ○ > 3000	8 □ 87 ÷ 91	H □ Turist-ricett.			
				9 □ 92 ÷ 96		Proprietà	A □ Pubblica ___%	B □ Privata ___%
				10 □ 97 ÷ 01				
				11 □ 02 ÷ 08				
				12 □ 09 ÷ 11				
				13 □ > 2011				

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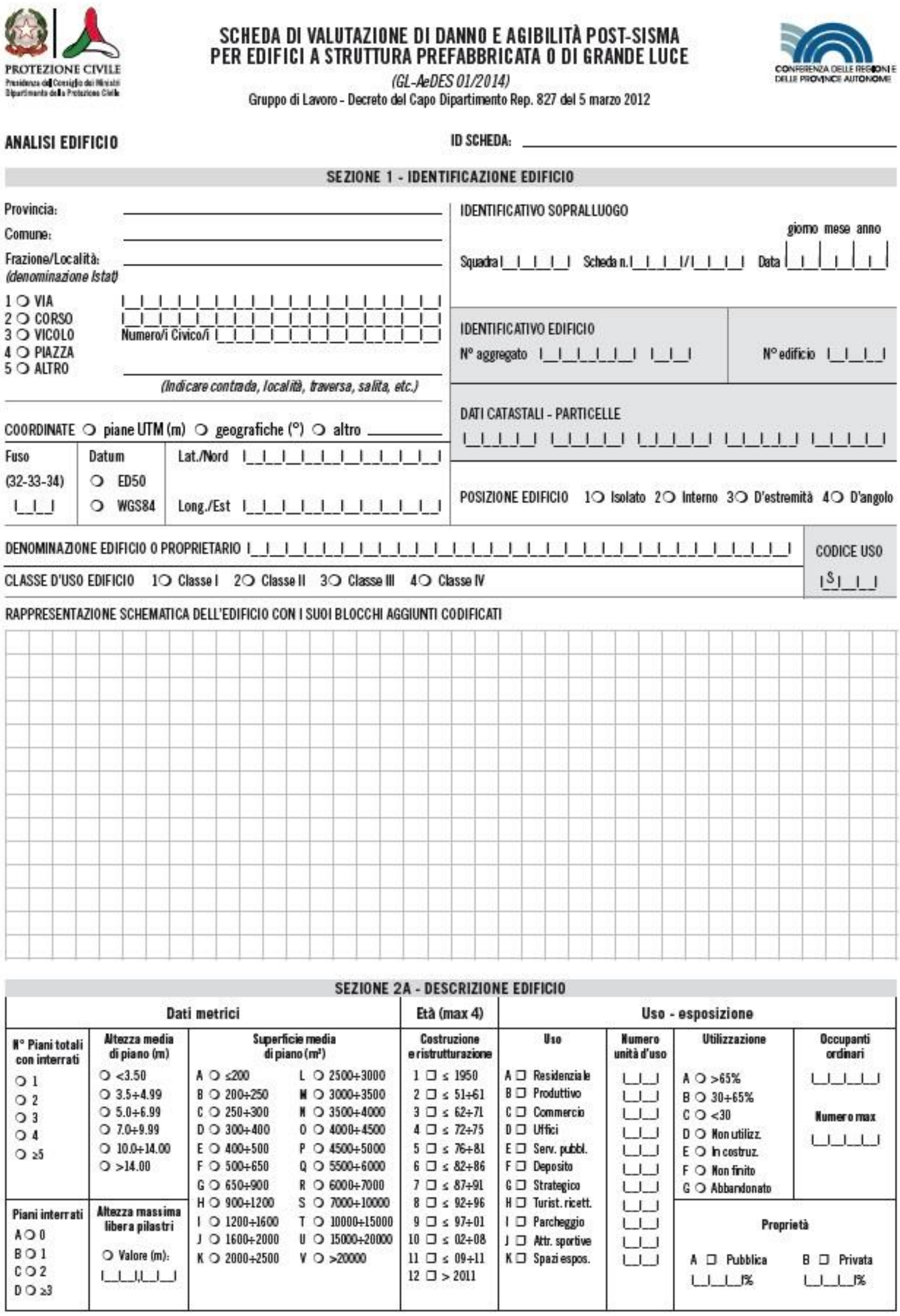
Buildings "large dimensions":



PROTEZIONE CIVILE
Presidenza del Consiglio dei Ministri
Dipartimento della Protezione Civile

SCHEDA DI VALUTAZIONE DI DANNO E AGIBILITÀ POST-SISMA PER EDIFICI A STRUTTURA PREFABBRICATA O DI GRANDE LUCE

(GL-AeDES 01/2014)

Gruppo di Lavoro - Decreto del Capo Dipartimento Rep. 827 del 5 marzo 2012

CONFERENZA DELLE REGIONI E DELLE PROVINCE AUTONOME

ANALISI EDIFICIO — **ID SCHEDA:** ______

SEZIONE 1 - IDENTIFICAZIONE EDIFICIO

Provincia: ______
Comune: ______
Frazione/Località: ______
(denominazione Istat)

1 ○ VIA
2 ○ CORSO
3 ○ VICOLO — Numero/i Civico/i
4 ○ PIAZZA
5 ○ ALTRO
(Indicare contrada, località, traversa, salita, etc.)

IDENTIFICATIVO SOPRALLUOGO
Squadra |_|_|_|_| Scheda n. |_|_|_|/|_|_|_| Data (giorno mese anno) |_|_|_|_|_|_|

IDENTIFICATIVO EDIFICIO
N° aggregato |_|_|_|_|_|_| |_|_| — N° edificio |_|_|_|

DATI CATASTALI - PARTICELLE
|_|_|_|_| |_|_|_|_| |_|_|_|_| |_|_|_|_| |_|_|_|_|

COORDINATE ○ piane UTM (m) ○ geografiche (°) ○ altro ______

Fuso (32-33-34) |_|_| — Datum ○ ED50 ○ WGS84 — Lat./Nord |_|_|_|_|_|_|_|_|_|_| — Long./Est |_|_|_|_|_|_|_|_|_|_|

POSIZIONE EDIFICIO 1○ Isolato 2○ Interno 3○ D'estremità 4○ D'angolo

DENOMINAZIONE EDIFICIO O PROPRIETARIO |_|_|_|...|_| — CODICE USO |S|_|_|

CLASSE D'USO EDIFICIO 1○ Classe I 2○ Classe II 3○ Classe III 4○ Classe IV

RAPPRESENTAZIONE SCHEMATICA DELL'EDIFICIO CON I SUOI BLOCCHI AGGIUNTI CODIFICATI

SEZIONE 2A - DESCRIZIONE EDIFICIO

Dati metrici				Età (max 4)	Uso - esposizione			
N° Piani totali con interrati	Altezza media di piano (m)	Superficie media di piano (m²)		Costruzione e ristrutturazione	Uso	Numero unità d'uso	Utilizzazione	Occupanti ordinari
○ 1	○ <3.50	A ○ ≤200	L ○ 2500÷3000	1 ☐ ≤ 1950	A ☐ Residenziale	|_|_|	A ○ >65%	|_|_|_|_|
○ 2	○ 3.5÷4.99	B ○ 200÷250	M ○ 3000÷3500	2 ☐ ≤ 51÷61	B ☐ Produttivo	|_|_|	B ○ 30÷65%	
○ 3	○ 5.0÷6.99	C ○ 250÷300	N ○ 3500÷4000	3 ☐ ≤ 62÷71	C ☐ Commercio	|_|_|	C ○ <30	Numero max
○ 4	○ 7.0÷9.99	D ○ 300÷400	O ○ 4000÷4500	4 ☐ ≤ 72÷75	D ☐ Uffici	|_|_|	D ○ Non utilizz.	|_|_|_|_|
○ ≥5	○ 10.0÷14.00	E ○ 400÷500	P ○ 4500÷5000	5 ☐ ≤ 76÷81	E ☐ Serv. pubbl.	|_|_|	E ○ In costruz.	
	○ >14.00	F ○ 500÷650	Q ○ 5500÷6000	6 ☐ ≤ 82÷86	F ☐ Deposito	|_|_|	F ○ Non finito	
		G ○ 650÷900	R ○ 6000÷7000	7 ☐ ≤ 87÷91	G ☐ Strategico	|_|_|	G ○ Abbandonato	
Piani interrati	Altezza massima libera pilastri	H ○ 900÷1200	S ○ 7000÷10000	8 ☐ ≤ 92÷96	H ☐ Turist. ricett.	|_|_|	Proprietà	
A ○ 0	○ Valore (m):	I ○ 1200÷1600	T ○ 10000÷15000	9 ☐ ≤ 97÷01	I ☐ Parcheggio	|_|_|	A ☐ Pubblica |_|_|_|%	B ☐ Privata |_|_|_|%
B ○ 1	|_|_|,|_|_|	J ○ 1600÷2000	U ○ 15000÷20000	10 ☐ ≤ 02÷08	J ☐ Attr. sportive	|_|_|		
C ○ 2		K ○ 2000÷2500	V ○ >20000	11 ☐ ≤ 09÷11	K ☐ Spazi espos.	|_|_|		
D ○ ≥3				12 ☐ > 2011				

All the activities carried out by the surveyors enrolled in the provincial College of Surveyors and Graduate Surveyors of the province of Modena were carried out on a voluntary basis and without receiving compensation in order to help the populations affected by the earthquake.

3. Discussion

Following the work carried out, I was able to ascertain how fundamental organization is in these catastrophic and emergency conditions and how essential it is to follow clear and standardized guidelines in order to optimize the information collected and deliver reliable data to the responsible authority who will then be able to define the most appropriate use.

4. Conclusion

Never as in these periods of climate and environmental change is it necessary to be ready, especially in an emergency, to provide one's professional contribution quickly and efficiently.

It is necessarily to create, in agreement with international corps, a database of working methods and approaches to emergency conditions also on the basis of the morphological characteristics of one's own territory, in order to be able to direct the professionals of the future, who will find themselves in our same situations of emergency, to proceed efficiently in supporting the rescue and civil protection teams.

It would be interesting to create a pool of surveyors who could locally support the Onu or the Unhcr in the early post-emergency phases through protocols shared with the civil protection company of the various states and with the best technologies that our profession offers (laser scanners, drones, thermal camera , etc.) in order to be able to direct other volunteer professionals of the emergency site to have a standardized protocol to follow.

REFERENCES

CONTACTS

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