Advanced investigation criteria for building encasements of working spaces

Advanced investigation criteria for building encasements of working spaces

Paolo Piantanida*

* Dipartimento di Ingegneria Strutturale, Edile e Geotecnica, DISEG, Politecnico di Torino

The role of working spaces in workers' safety is often neglected and reduced to the building final inspection report. Nevertheless plenty of dangers are originated by the building environment surrounding the working activity: wear and obsolescence of building elements, failure mends and vandalism make the original compliancy fade away. The investigation on the real condition of the rooms where work takes place is a keystone to manage workers' S&H properly. The wide compass of building heritage and construction systems is critical when considering any inquiry on their state. Advanced criteria driven from forensic canvassing are sketched to achieve a formalized and systemic full analysis on each room, revealing and recording any incompliance.
***Keywords**: OS&H management, working spaces, building encasement, canvassing.*

Criteri avanzati di indagine per la progettazione di postazioni e luoghi di lavoro. *Il ruolo degli spazi di lavoro nella sicurezza dei lavoratori viene spesso trascurato e ridotto al rapporto di ispezione finale dell'edificio. Tuttavia, molti sono i pericoli originati dall'ambiente edilizio che circonda l'attività lavorativa: l'usura e l'obsolescenza degli elementi costruttivi, i rammendi e gli atti di vandalismo fanno svanire la conformità originale. L'indagine sulla reale condizione delle stanze in cui si svolge il lavoro è una chiave di volta per gestire correttamente la S&H dei lavoratori. L'ampia gamma di patrimonio edilizio e sistemi di costruzione è fondamentale quando si considera qualsiasi indagine sul loro stato. I criteri avanzati guidati dal sondaggio forense sono disegnati per ottenere un'analisi completa e sistematica completa su ogni stanza, rivelando e registrando qualsiasi incompletezza.*
***Parole chiave**: gestione della sicurezza, ambienti di lavoro, analisi investigativa del contenitore edilizio.*

Les critères avancés issus de l'enquête judiciaire pour définir les espaces de travail. *Le rôle des espaces de travail dans la sécurité des travailleurs est souvent négligé et réduit au rapport de test final du bâtiment. Néanmoins, la part du bâtiment qui entoure l'activité de travail génère de nombreux dangers: l'usure et l'obsolescence des éléments de construction, les défaillances et le vandalisme font disparaître la conformité initiale. L'étude sur l'état réel des pièces où le travail a lieu est la clé pour bien gérer la santé et la sécurité des travailleurs. La vaste gamme de systèmes de construction et d'âge des bâtiments est un point critique pour toute étude sur leur état. Les critères avancés issus de l'enquête judiciaire sont tracés pour réaliser un examen complet formalisé et systémique de chaque pièce, révélant et enregistrant toute non-conformité.*
***Mots clé**: gestion de la sécurité, espaces de travail, critères pour l'investigation du batiment.*

1. Defining what a building encasement is

When considering a working place's safety, we must consider the space is defined by its borders, and in ordinary constructions these borders materially constitute the building. The envelope of the working space cannot be uninfluential to the activity inside, nor it can be forgotten when safety is considered. Risks and hazards don't come from the working activity only, but also from the performance context: before considering the work's safety, we must consider if the place deputed is safe by itself and with respect to the activity it will host.

In this frame, the investigation of safety issues due to building spaces is prodromal to the workers' health and safety management: no safe work can be performed in an unsafe environment.

We intend to define as building encasement the system of building elements confining and outlining a determined working place: first of all structure, floor, ceiling and walls, then doors, windows, facilities etc. (e.g. electric & data network, fittings, plumbing, lighting systems, false ceilings and so on). So we can assume the working place's envelope impacts on the workers' safety as if the activity's S&H analysis were depurated of the activity specific contribution in itself (e.g. equipment, stuff etc.). For example, we have to check a room for sharp edges, rambling floor, unsafe glazing, electric safety, fall from height issues and so on. If we have any machinery in that room, we should consider how that room is hosting that equipment (e.g. weight, possible interference with the safety evacuation routes, electric connections etc.), pointing out any issue rising from the machinery-building interloping.

2. Getting out the building knowledge

Italian building heritage is made of very different technologies (masonry, reinforced concrete frame, steel frame, wood etc.) covering a really long lapse of time. It spans from old monumental edifices with absolutely no data on the

starting performances of building components and on old and newer modifications, to quite recent constructions where the main part of datasheets and technical specifications has been lost through decades, to fresh buildings, where documentation may be confusing and difficult to identify due to its large quantity (sometimes the digital, paperless and liquid world could ever be worse than dusty files in a mouldy archive...).

Usually buildings' service life is managed to match the users' requirements and to fulfill mandatory standards, resulting in a series of maintenance duties, modifications, additions etc.: the knowledge goal is to focus technologically the history of the building up to the present and to manage the current decision makers' chain to avoid any unrecorded and/or unexpected behavior.

If after any accident the judicial core is to fix the responsibility chain (and a S&H law compliant conduct can quicken the process), during the building service life the S&H managing core is to be always aware of the decision chain without any loss of records (and this will enhance the prevention impact of the S&H management).

The shift is to observe, record and make accessible the building situation in a four dimension context (time to be added) so to log

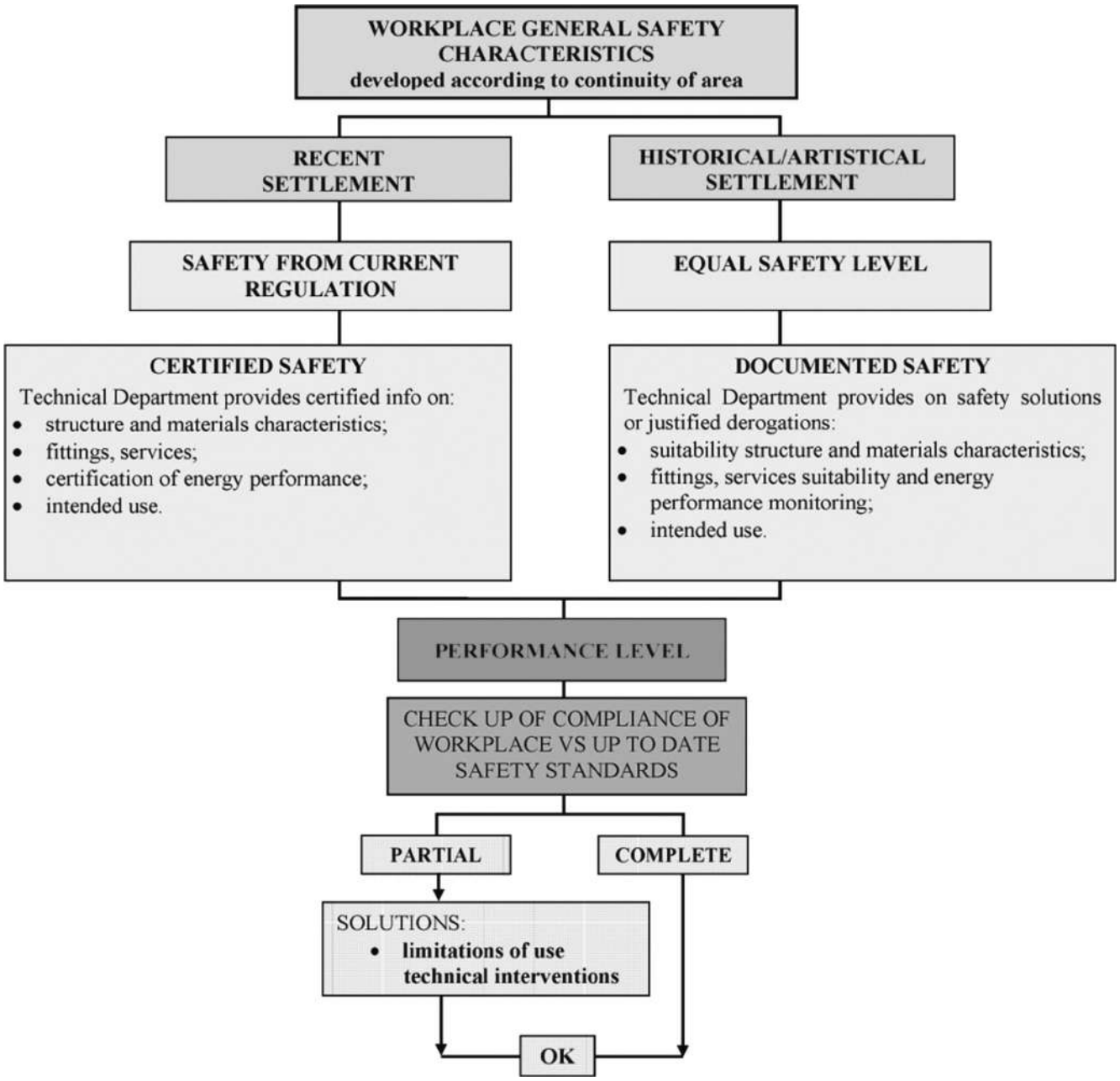

Fig. 1. Flow chart on the two proposed approaches on building encasement safety canvassing survey.
Diagramma di flusso sui due approcci proposti per la realizzazione di sondaggi sulla sicurezza del contenitore tramite il canvassing.

ITEM	HYCS	N.APPL	CERT	NOTE	IMAGE	LAW/REG. REF.
1.16.1 INTERNAL COMMON AREAS						
1.1. WINDOWS						
PERFORMANCE LIMIT		X				
1.1.1 DESCRIPTION: **fixed and mobile wooden frame with hinged opening with double doors.**				Condition: **good**		
1.1.2 They cannot be opened and / or adjusted safely or intact	X			**In an office of the mezzanine level there is a window that cannot be not opened in safety conditions.** **In a laboratory there is a window with a broken glass**	 	D.lgs. 9 aprile 2008, n. 81

Fig. 2. Example of check list entry about windows (university buildings survey in Torino, 2017).
Esempio di lista di controllo applicata alle finestre (indagine condotta sugli edifici universitari a Torino, 2017).

real life for ordinary continuous deeds (obsolescence, wear etc.) and for ordinary random affairs (failures, vandalism etc.). Moreover, this will greatly improve the S&H modelling quality on extraordinary events (fire, quake, flood etc.) and then the model output accuracy also on the timely based results (event return period, building evacuation lapse etc.).

3. Two approaches to the building encasement analysis

In large (public) edifices the issues concerning safety from the "encasement" point of view, reach a critical point when we consider buildings that can be classified as heritage with high cultural and historical value, and therefore subject to particular protection rules.

In addition, numerous and sometimes complex modifications (e.g. refurbishing, renewals, use changes etc.) and all those "traumatic" events (massive flooding, damages of various kind etc.) occurred over time. Besides we have to consider transformations to comply the legislative changes, both for buildings not considered "architectural assets" and for buildings of historical and artistic interest. However, for the latter, the respect of the current legislation, conceived for essentially different situations and uses, could sometimes entail distortions and alterations incompatible with the building characteristics: in these cases we have therefore to find alternatives leading us to a safety performance level substantially equivalent to the one stated by Law.

It is thus necessary to adopt two different approaches (Fig. 1) (Maida 2015).

The building safety approach "law compliant", whenever applicable, raises concerns about the retroactivity of the law, also for recent constructions that should be modified each time a regulation updates: retroactivity shall be prudently appraised case by case, considering the performance level to be achieved and the reason why an update was issued.

On the other side, whenever regulations cannot be identified or applicable, the building shall be carefully inspected through on site surveys. Methods and criteria to survey must be strictly defined in a forensic based canvassing policy leading to an extensive safety review (Borchiellini *et al.*, 2014). In this building safety approach "canvassing tactic", troubles depending on the present state and use of the

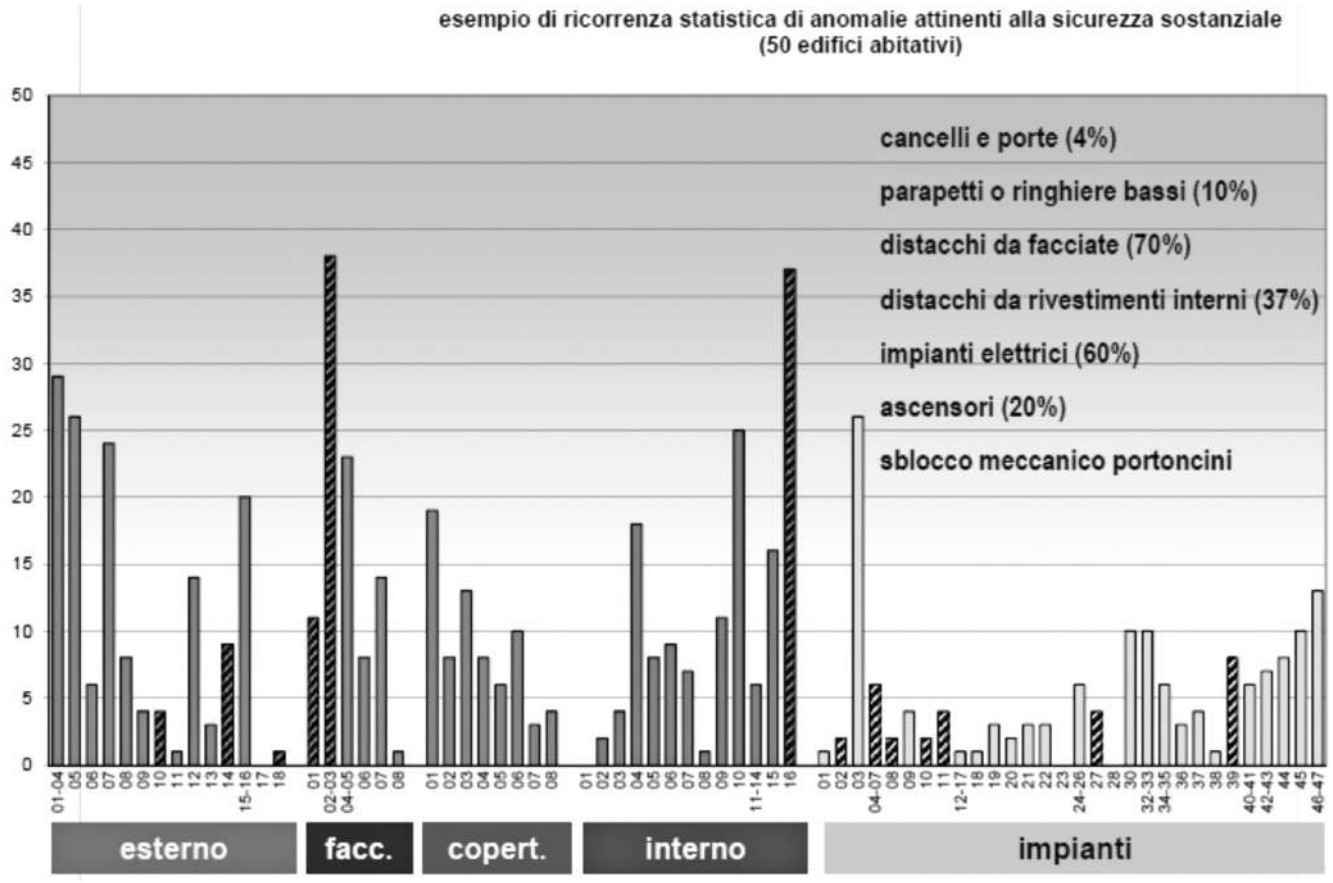

Fig. 3. Statistic occurrence of safety issues in 50 housing blocks (survey in Torino, 2004).
Ricorrenza statistica di problemi di sicurezza in 50 edifici abitativi (indagine svolta a Torino, 2004).

building should be pointed out (e.g. cracks, decay, fractures, detachments, plants and structure damage or overtime alteration).

4. Main steps for the investigation

The investigation first phase is based upon the documentation analysis. In the first step the whole updated regulatory frame shall be outlined; then all the documents concerning e.g. the designed activity allocation, the ceiling load, facilities and maintenance history, etc. shall be obtained and filed referring to each room. In these files we should find all the technical specifications and certificates about materials and components together with the testing outcomes of the building system. Structure (ceiling, walls, etc.), facilities (fittings, plumbing, plants etc.) and windowing (doors, windows, etc.) must find their specifications and their history. In the third step, all these data must be verified on site to check whether they cope or not with the present staff position and room condition, as inferable via the on-site inspection: personnel belonging to appointed companies should also be considered as both an issue in itself and an interference source regarding the resident staff.

The second phase is based on forensic canvassing technique to inspect working spaces. Check list is used to achieve a complete formalized and systemic analysis on each room, revealing and recording any incompliance (Fig. 2). Each room should have its own check list, properly tailored to the situation and dynamically expanded, depending on the overtime room and law modification. Anyway, the method must be always the same: each performance to be checked shall be described and determined, explicating besides all the legislative references.

The third phase is focused on handling the unforeseeable events in the everyday building life. Training of the rescue staff, running emergency communication, the emergency masterplan etc. should be verified and updated if necessary.

5. Conclusion

The systemic approach to S&H of the working spaces can greatly take advantage from the forensic technique of canvassing, especially when applied to the on-site in-

spection of the rooms. Past experiences about safety survey on over fifty housing blocks showed declarations and certificates of standard compliance are not enough: in the real service life, situations may vary a lot from the design, due to any use modification, accelerate wear, or even vandalism. In the housings mentioned, the great part of safety risks came from facades decay and electric fittings deterioration (Fig. 3). The former can be due to poor maintenance, but the latter should be ascribed to vandalism and manumission to which any certificate is vane.

The opportunity to apply again this method to large university buildings has enabled a further validation of check lists and of the method to tailor them on the working space considered. In the very near future, all the information will be managed through building information modelling, leading to a permanent multipoint access to updated data and enhancing the power of this method greatly.

References

Borchiellini, R., Maida, L., Patrucco, M., Pira, E., 2015. *Occupational S&H in the case of large public facilities: a specially designed and well-tested approach,* in International Conference on Chemical & Process Engineering, 19-22 Maggio, Milano, AIDIC, Chemical Engineering Transactions Vol. 43, pp.2155-2160.

Borchiellini, R., Fargione P., Maida L., Patrucco M., Piantanida P., Pira E., 2016. "*Forensic Investigation techniques contribution in the Occupational Safety & Health Risk Assessment and Management*" GEAM, Geoingegneria Ambientale e Mineraria, Anno LIII, vol. 1, Agosto 2016, pp. 33-42, ISSN 1121-9041

Maida, L., 2015. PhD Thesis, "*Strategic choices in safety systems of complex public institutions: from setting the risk analysis techniques to conservative and ameliorative quality management*" Chapter 6 "PoliTo – UniTo Guideline".