TOWARDS AN EXPERIENCE FEEDBACK SYSTEM FROM BUILDING INSPECTIONS THROUGH CLASSIFICATION OF CONSTRUCTION WORKS

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ABSTRACT

Different studies on the construction industry have shown that new buildings are produced with a large number of defects. The common practice in the industry to deal with defects is in a reactive way, i.e. to wait for the final inspection, rectify and then move on to the next project. There are competitive incentives for companies to learn from mistakes, i.e. through *Experience Feedback*, although the peculiarities of project-based organizations make these activities difficult. These difficulties might frighten companies from investing in new and complex feedback activities. We suggest that the information about defects from *Final Inspections* could be a way towards Experience Feedback, when the inspections are mandatory and therefore already entrenched in the industry. Taking this as a starting-point, this paper aims at evaluating the generation of defects information from final inspections of a large conference centre project and to present and discuss the results through the lens of Classification and System theory. The paper will show what kind of information that can be drawn from a current *de facto* 'best practice' of Final Inspection report in Sweden. It is suggested that the quality of defects information can be enhanced by classification of data with a suitable object classification system for construction work, such as the Swedish BSAB system. Eventually, the horizon of future research is discussed.

Keywords: Project Knowledge Management, Experience Feedback, Building Inspections, Classification system

1. INTRODUCTION

Several studies, (i.e. Josephson and Hammarlund 1999; Josephson et al. 2002; Sigfrid and Persson 2007) have shown that new buildings are produced with a large number of defects. In Swedish housing production, costs arising from defects, mistakes and deviations from client requirements are estimated to amount to 10-15% of total construction costs (SOU 2002; Josephson and Saukkoriipi 2007). Defects are discovered in every phase of the construction project.

Most defects in construction projects are due to human error (Atkinson 1999), and by regarding defects as a failure to accomplish intended objectives, they consist of both active and latent parts (Reason 2000). The common practice in the industry is to deal with defects in a reactive way, i.e. to wait for the final inspection, rectify and then move on to the next phase or project. We argue that rather than being reactive construction companies should make use of the identified defects proactively, to analyze and learn from mistakes, within the framework of their Experience Feedback (EF) activities and Quality System.

The term *feedback* can be explained as the interaction between a system and its surroundings. If the effect of the system is fed back to the system it becomes an input that can contribute to shape future outputs of the system (Nonaka *et al.* (1994) state that *experience* is the key to knowledge and that it needs to be shared in order to disseminate. Henry (1974) state that the constituents of EF are explained by the principles of knowledge management (KM). Such experiences comprise knowledge, either embodied in individuals or embedded in processes or practice (McAdam and McCreedy, 2000).

An exploratory survey conducted by Lundkvist et al. (2010) on medium to large sized main contractors in the Swedish construction industry's current attitude towards different EF activities showed a significant discrepancy between the practitioners' intentions and reality, regarding the actual use of data from Final Inspections. Seventy-six percent of the respondents agreed or fully agreed that their company regarded inspection defects as valuable information, and 71 % stated that their company had an expressed goal for reducing the number of defects in inspections. However, 63 % stated that their company did not have a system for compiling defect data from inspections, even though 80 % agreed or fully agreed to their company having an expressed goal to reduce the number of defects in inspections. Maybe even more strikingly, out of the 51 % of the respondents that disagreed or fully disagreed that their company made use of these defect data in their improvement work, 62 % stated that their company regarded the information from inspections as useful and 71 % that their company has an expressed goal to reduce the number of defects in inspections.

According to Lundkvist *et al.* (*ibid*) there is a strong feeling among the contractors in that inspection data provide valuable information. Some also try to use it for experience feedback and constant improvements, but most companies lack a system or process that supports the feedback of experience-based information provided by inspections. Obtaining relevant information from today's manually compiled, paper-based data sources is highly resource-demanding and may be seen as a big hill to climb. In this study, information on defects from Final Inspections is metaphorically regarded as the "low hanging fruits" of Experience Feedback, since there is already a system in place for collecting the information.

This work is an ongoing project should be regarded as a first step towards developing a future database solution. The objective of this paper is to evaluate the generation of defects information from Final Inspections and to present and discuss the results through the spectacles of Classification and System theory. We demonstrate what kind of information that can be drawn from a current *de facto* 'best practice' of Swedish Final Inspection reports for extracting knowledge for experience feedback.

For the purpose of improving data quality we propose the use of metadata, such as an object classification system as a systematic way to code and thereby improve data quality. The Swedish BSAB system, following the ISO 12006-2 standard is widely used in the Swedish construction industry and as such it is a suitable system for classification of construction works.

2. THEORETICAL FRAMEWORK

2.1 Human Error and Defects

Atkinson (1999) argues that most defects in construction projects are due to human error. An *error* is defined as an 'act involving an unintentional deviation from truth or accuracy' (Merriam-Webster, 2011). If an error is an act, this paper regards a *defect* as the result of such an act. The International Council for Research and Innovation in Building and Construction´s (CIB) group W86 (Building Pathology) define a 'defect' as 'a situation where one or more elements don't perform its intended function and an anomaly is referred to as an indication of a possible defect' (CIB 1993).

When performing a task, there are three stages of cognitive processing for tasks: *Planning*, (where a goal is identified and the sequence of actions for reaching the goal is selected), *Storage* (where the plan is stored in memory until execution), and *Execution* (where the plan is implemented by the individual or group, according to the original plan. The different stages have their own associated types of errors. The planning stage: *mistakes* (the plan does not work for the goal); the storage stage: *lapses* (omission of planned actions); and the execution stage: *slips* (planned actions not executed according to plan) (Reason 1990).

Reason (2000) also distinguishes between *active failures*, being failures with causes connected to the front-end people, such as the carpenter that works in the construction of a new building, and *latent failures*, being failures coming from errors that are related to activities removed in time and space from the control interface, such as designers, managers and maintenance.

Causes of failure are often actually quite complex, with different active and latent errors interacting (Atkinson 1999). High reliability organizations acknowledge the possibility of errors occurring and therefore train their workforce to recognize and report them. They also generalize errors instead of isolating them (Reason 2000). This idea is analogous to companies that have adopted the *Lean Production* strategy. Lean management acknowledges that defects are part of the system, hence individuals are not afraid to report them, because they aren't afraid of being blamed – ergo lessons are learned (Liker 2004).

Love and Josephson (2004) examined seven Swedish building projects and identified 2,879 defects. The most costly defects where examined in detail regarding the chain of events leading to the defect. They concluded that the most effective learning in relation to defects takes place in projects when an entire error-recovery process is in place, as defined by Sasou and Reason (1999) i.e. detection, indication and correction. A literature review conducted by Ilosor et al. (2004) suggests that defect studies can be divided according to their focus on: ways to systematically classify defects, causes of defects, and how defects are fixed or managed. Kim et al. (2007) concluded a ten-project study, consisting of 700 apartments in multi-storey buildings, and they suggested an Information Communication Technology (ICT) solution for managing defects in large construction projects. They tested and suggested real-time data collection and processing of defects, and the study reported significant efficiency improvements. Chong and Low (2005) investigated the possibility of feeding information obtained in operation and maintenance stages back to design so that future errors could be reduced. Information regarding badly working designs causing latent defects should be fed back to the design office (Scott and Harris 1998).

2.2 Project knowledge management and experience

The knowledge management (KM) of an organization consists of all the activities they carry out to create and transfer knowledge (Sverlinger 2000). Ackhof (1989) describes knowledge creation as an evolution of understanding, i.e. the process whereby data are transformed via interpretation into contextualized information, knowledge and eventually wisdom. Data, information, knowledge and wisdom can be regarded as forming a hierarchy – the DIKW model (Ackoff 1989) – of enhanced understanding. *Data* represent objective facts (if removed from their context they lack meaning), *information* is data that has meaning and thus relevant to a question, while *knowledge* emerges when information is placed in a particular context, in addition it involves understanding and has a longer lifespan than information. These distinctions are supported by Nonaka and Takeuchi (1995), who state that information is a flow of messages and that knowledge is essentially related to human action. According to Ackhoff (1989), knowledge can be obtained by transmission from others or from experience. Wisdom is argued to be of a permanent character. A simplistic linear model of the DIKW model is presented in *Figure 1*.

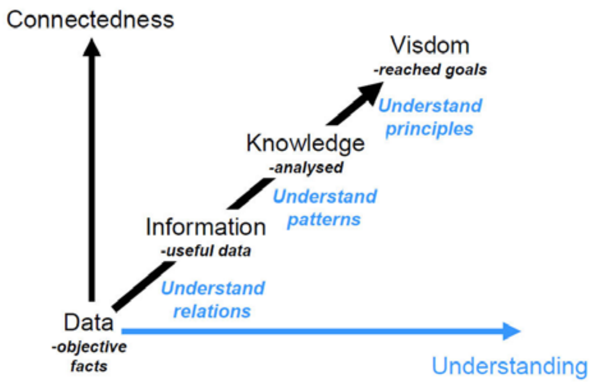

Figure 1. The DIKW model, a simplistic view of the relation between data, information, knowledge, wisdom and understanding, developed from Bellinger et al. (2004).

Experience feedback (EF) is limited to identifying scenarios where experience is available (and hence it does not provide useful knowledge in itself). Construction companies have found it difficult manage knowledge within the organization due to the peculiarities of the industry, characterized by, for instance, Vrijhoef and Koskela (2005). These are told to be: one-of-a kind production, temporary organizations, on-site production and project-unique technical solutions. However, this is not unique to construction, but a general problem within project-based industries (Prencipe and Tell 2001).

Project Knowledge Management is KM in a project environment (Hanisch et al. 2009). Feedback and learning loops are often broken (Gann and Salter, 2000) and companies lack the organizational mechanisms for knowledge from one project to be transferred and used within other projects (Prencipe and Tell, 2001; Dubois and Gadde, 2002). Construction companies seem to primarily rely on a personalization rather than codification strategy towards KM (Styhre et al. 2004) which makes knowledge sharing between geographically distant projects difficult, with teams reinventing the wheel over and over again almost inevitable (Wills et al. 2002). Recently projects has been started to be looked upon as a regular business creating value instead of as exceptional cases (Winch, 2000).

People in project-based firms often tend to ignore feedback processes (Sterman, 2000) and as the organization is decentralized (Lindkvist, 2004) and loosely coupled the challenge to share knowledge effectively becomes even bigger (Orton and Weick, 1990). The focus is on projects rather than processes (Riley and Clare-Brown 2001). To address the obstacles to knowledge diffusion, organizations may adhere to either a codification strategy (a technology-centered approach) or a personalization strategy (a people-centered approach) (Hansen et al. 1999; Sverlinger 2000). For the former, information technology (IT) based support has proven to be a necessary, but not sufficient tool for high-quality Project Knowledge Management (PKM) (Hanisch et al. 2009).

Chong and Low (2005) investigated the possibility of feeding information obtained in operation and maintenance stages back to design so that future errors could be reduced. The importance of feedback to design is also investigated and emphasized by Scott and Harris (1998), who call for more structured learning at an organizational level.

There is a strong rationale for handling experience within a company to promote problem-solving and continuous improvement, but it should be noted that EF requires an actual receiver in order to fulfill its intended use. Experience, as well as knowledge, has both tacit and explicit components, and both are important (Kamara et al., 2002). Nonaka et al. (1994) state that experience is the key to knowledge and that it needs to be shared in order to disseminate.

2.3 Classification of construction works

The purpose of a classification system is to bring standardization to the semantics of a particular field. Classification of construction works is widely used within the industry for writing up specifications, structuring documents, calculating costs, etc. (Ekholm and Fridqvist 1996). During the increase of IT in construction, a need top overbridge the gap between the different use of classification and product modeling was advocated by (Ekholm and Fridqvist 1996). With a common “language” from design till facility management we achieve a better transparency and traceability of work results, used materials and resources.

Objects in the real world are represented by concepts, which in languages may be interpreted by signs, associated concepts gives context to the concept and helps us understand the symbol, see example in Figure 1. This model serves as an ontological framework, as it represents the basic structure of reality (Bunge 1979).

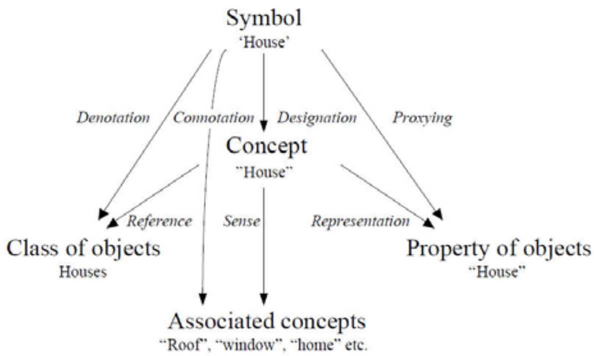

Figure 2. Basic semantic concepts (Ekholm 1996).

A system is a complex thing with bonding relations between it parts. One should consider its *composition* of parts, the *environment* interacting with the system, the *structure* of internal and external relations, the relational *laws* among its properties as well as the *history* of former incarnations of the system (Bunge 1979). An important feature of a classification system is that an object should only be put in one class on each hierarchical level. A system has a level order consisting of both super- and sub-systems. Hence the hierarchical structure of systems, where parts in lower levels are compiled into wholes on a higher level.

“Classifications summarize and order available knowledge” (Bunge 1983). A collection of objects are sorted into different classes. The purpose of a classification is to distinguish between the objects in a collection. “In order for the classification to be exhaustive, every object in the collection must be assigned to a class, and in order to be definite each object may only belong to one class. Without these criteria there would be unclassified objects and objects that belong to more than one class of the same rank” (Ekholm 1996). The members of a class share some specific characteristic properties. A *facet* is an exhaustive set of properties of similar kind. There are mainly three types of facets used in building classification systems, such as the Swedish BSAB system, namely *function*, *construction activity* and *material*. It is possible to classify the same collection of objects in different classification systems, for different purposes (Häggström 1994). The BSAB system, for instance, is actually several systems (tables) in one, to be used in different situations. This calls for caution when working with IT solutions, so that the abstract objects of the different tables are interconnected, otherwise the system will fail in transparency. However, this is also one important concept of building classification, namely to use the one table most suitable for that specific activity.

A *construction work* is an artificial system, built for a purpose. It has static ground construction, and relations to the environment like the surrounding nature and users (Ekholm 1987). In this context, a *space* is defined as “a three dimensional, material, constructions result contained within, or otherwise associated with, a building or other entity (Svensk Byggtjänst 2005). Appendix 1 shows the part of the BSAB 96 Spaces table used in this paper.

Spaces are further made up of several building elements if the design of the element isn’t known, or designed elements if their design is known. (Svensk Byggtjänst 2005). The lowest level of classification within BSAB is Work result, defined as “construction result achieved in the production stage or by subsequent alternation, maintenance, or demolition processes”. They are “identified by one or more of the following: the particular skill involved; the construction resources used; the part of the construction entity that results; the temporary work or other preparatory or completion work.

3. METHOD

This paper is based on a one construction project, both quantitative and qualitative, case study, namely a newly completed congress and conference center of 20.000 m^2 with room for ~3000 congress attendees and ~1000 conference attendees. The project was on a General Contract with seven sub-contractors. The inspection organization consisted of one main inspector and eight sub-inspectors with different expertise. The project was selected for this study on the terms that it: was inspected by a well renowned building inspector, implying a higher standard of inspection report; the project is considered both large and unique, implying a possibility to a large number of defects.

A single observation visit was conducted during the first Continuous Final Inspection, which had followed upon an earlier Final Inspection where the project had failed due to incomplete sections and a large number of non-negligible defects. The observation of the inspection activity was documented in an observation log and was later used as a support for the analysis phase of the study.

After the visit all inspection reports from the project were sent to the author for analysis. Delimitation was made to only analyze the inspection reports of the construction contract, since the number of noted defects in the construction works was sometimes up to 100 times the number of other contracts and that by combining all available inspection reports, including several pre-inspections, the Final Inspection and the two Continuous Final Inspections, more than 2000 defects could be analyzed.

All defects were manually transferred from PDF format to a spreadsheet. Then the following were done for every single defect:

1. All dates from when the defect was noted in a report were added, giving transparency to how long a defect was left un-rectified.
2. BSAB 96 Space codes were added where room or defect description with sufficiently good safety indicated a correct space code.

A smaller part of the defects were also classified on the defect description. Since BSAB does not have any tables for the classification of the defects itself, a modified version of the classification system from Johnsson and Meiling (2009) was used. Modifications were made due to their specialization towards offsite timber housing construction, toward a more generalized table in the vein of BSAB 96.

4. ANALYSIS AND RESULTS

During transfer to of data to spreadsheet from the Continuous Final Inspection (CFI) it was discovered that the UID of defects had been restarted from 1. It is thus probable that a not so slender number of defects could be registered twice. It's not certain that doublets may be identified with sufficient reliability, but this paper does not look at the studied data quantitatively and have made no more efforts to erase these doublets. However, this also results in a lost transparency about the specific defects throughout the project. Questions such as "when the defect was first discovered?" and "how long did it take to rectify it?" are thus made more difficult to answer. For the sake of transparency renumbering old defects has to be avoided, if experience feedback from defects within inspection reports is desired.

The first step after data input was to see if BSAB 96 space codes could be applied onto defects, just by reading the report. About 300 of the ~2000 defects did only have a number as Section/Room, Figure 3. Here room number 30233 does not give any clue to what kind of space it is and complementing documentation is needed.

1	PL	Section/Room	BSAB space	E/B	NR
241	2	30233		E1	235
242	2	30233		E1	236
243	2	30233		E1	237
244	1	Allmänt plan 1	**22 - Spaces for public activities**	E1	238
245	1	30118 Fläktrum	261.D - Ventilation unit spaces	E1	239
246	1	30118 Fläktrum	261.D - Ventilation unit spaces	E1	240
247	1	30118 Fläktrum	261.D - Ventilation unit spaces	E1	241

Figure 3. Example of BSAB 96 Space coded from readable Section/Room description.

However, by reading the defect description or by looking at the defects nearby, an additional 65 spaces could be understood, see Figure 4. In this example the word "tvättställ" and "speglar" (wash-basin and mirror) gives away the kind of space we are looking at.

1	PL	Section/Room	BSAB space	E/B	No.	Defect description
295	3	30307	**228.BE** - Toilet space	E1	289	Vägg till vänster om inspektionslucka tandar mot pelare
296	3	30307	**228.BE** - Toilet space	E1	290	Glipor väggvinkel på var sida om speglar+ upp mot tak
297	3	30307	**228.BE** - Toilet space	E1	291	Inspektionslucka saknas under tvättställ
298	3	30310-14		E1	292	Ej besiktningsbart
299	3	30305		E1	293	Golv ej besiktningsbart

Figure 4. BSAB 96 Space coding from Defect description.

Next was to try to codify the defect descriptions. The purpose of codifying the defects is to quantify them, allowing statistics and measurement of defect rates, see Table 2a-b. Table 2a compete with either the *Element*, the *Designed Element* or *Work Result* tables of BSAB 96, but since using the BSAB tables would need a lot more information about the defect, this is not applicable only from studying the inspection report. A possibility with a database solution is to continue the "Why" question by using the quality tool "5 Why" with a free-text option, but that will not be implemented in this manual version.

Table 1. Proposed coding of defect descriptions, what element was defective, developed from Johnsson and Meiling (2009).

What was defective?				
0 Unrelated	2 HVAC	3 Opening	4 Lining	7 Floor
1 Int. installations	2-1 Radiator	3-1 Windows	5 Wall	7-1 Clinker
1-1 Radiator	2-2 Pipes	3-2 Doors	5-1 Tiles	7-2 Carpet
1-2 Pipes	2-3 Electricity	3-3 Openings	5-2 Wallpaper	7-3 Parquet
1-3 Electricity		3-4 Linings	5-3 Painting	8 Completions
		3-5 Threshold	6 Ceiling	8-1 Balcony
				9 Information

Table 2. Continued proposed coding of defect descriptions, developed from Johnsson and Meiling (2009).

Defect Type?	Rectification measures?	When (phase)?	Why did it occur?
0 Unrelated	0 Unrelated	0 Unrelated	0 Unrelated
1 Unfinished	1 None	1 Structural design	1 Transport
2 Missing	2 Cleaning	2 Prefab	2 Damaged
3 Damaged	3 Adjustment	3 Transport	3 Bad craftsmanship
4 Erroneous	4 Completion	4 Assembly	4 Structural error
	5 Repair	5 Warranty time	
	6 Exchange		

Figure 5 shows defect descriptions from the inspection report having been coded with the "what" (Table 1) and "defect type" and "rectification measure" (Table 2). The "when" and "why" fields cannot be filled from only studying inspection reports, they need further investigation.

Many descriptions were counting several missing articles within one defect record, e.g. "Gummimatta och träsocklar fattas" meaning that rubber carpet *and* wooden skirting were missing in the specific inspected space. This poses a problem during coding. There are two different ways to handle this, depending on what is most important for the organization. Either the record could be split up in two *or* the most important part for the organization to document could be chosen. It is suggested to choose the former, to not lose any data.

BSAB space	E/B	No.	What	Defect type	Rectification measures	Defect description
22 - Spaces for public activities	E1	8	5 Wall	1 Unfinished	4 Completion	Allmänt ej lagat vid elutlopp i väggar vid högtalare
231.G - Elavator space	E1	9	7-2 Carpet	2 Missing	4 Completion	Gummimatta och träsocklar saknas
231.G - Elavator space	E1	10	5 Wall	1 Unfinished	4 Completion	Hål i yttervägg vid kabelgenomföringar är ej igensatt
231.G - Elavator space	E1	11	3-4 Linings	2 Missing	4 Completion	Smygplåt till hiss saknas
231.G - Elavator space	E1	12	6 Ceiling	2 Missing	1 None	Tak av gipsskivor saknas. Avhjälps ej
231.G - Elavator space	E1	13	9 Information	4 Erroneous	3 Adjustment	Fel våningsnr i hiss TH33

Figure 5. Excerpt of coded defects from defects description (in Swedish).

5. CONCLUSIONS

It is vital to recognize that documentation of experience itself is not a means for improvements; instead filed text represents information, not knowledge. This kind of information does not in itself have the capacity to solve problems. Instead, the analyzed defects information could serve as mere indications for potential systematic problem-solving.

The objective of this paper was to evaluate the generation of defects information from Final Inspections and to present and discuss the results through the spectacles of Classification and System theory. Tentative analysis of inspection reports have indicated that it is difficult to understand the nature of the specific defect without the context of the project, e.g. through specifications, drawings or photographs. The study indicates that with improved standardization around space descriptions BSAB 96 Spaces coding will be easier, but with a Room Finish Schedule, which the contractors working in the project uses, this may not be necessary.

5.1 Future research

This paper reports from an ongoing project regarding analysis of inspection data. When finished, the proposed model will be further developed together with case companies within the project. The most important part to study is on what level of detail the effects should be coded. Instead of the current *Table 1*, are instead the BSAB 96 *Designed Element* or *Work Result* tables more useful? The model will be further tested on yet another project to validate the results from this first case. In farther future there are plans for validating the proposed EF system framework by the development of a database demonstrator.

Some contractors have begun standardizing their construction work using so called technical platforms (different terms are used in different companies) (Styhre and Gluch 2010). Within design this connects to the *Object Type* in BIM modeling software. It would be interesting to study how to tag these Type codes on to defects, and it is hypothesized that this could provide good quality statistics for the different parts of the platforms. There could also be ways to "stitch" defects directly on objects in a

BIM model, for easier communication about where defects have occurred and for better documentation for experience feedback.

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Appendix 1. The BSAB 96 Spaces table, the author's translation from the original Swedish. Omitted are those codes not applicable in the case project. For instance, code *1 - Spaces for outdoor activities* is for instance just about as big as its indoor counterpart.

- 1 - Spaces for outdoor activities
  - 14 - Communication, storage and deployment spaces, etc.
    - 141 - Communication spaces
- 2 - Spaces for indoor activities
  - 21 - Spaces for housing
  - 22 - Spaces for public activities
    - 221 - Spaces for lodging
      - 221.B - Hotel rooms, motel rooms, etc.
    - 222 - Spaces for production, exposing or selling of goods or services
      - 222.B - Spaces for office work
        - 222.BB - Office room
        - 222.BC - Office space
        - 222.BD - Group work room
        - 222.BE - Conference room
      - 222.F - Spaces for industrial extraction, production, repairment, etc.
      - 222.G - Spaces for preparing of food, serving, etc.
        - 222.GB - Spaces for preparing of food
        - 222.GC - Spaces for serving of food
          - 222.GCB - Restaurants
          - 222.GCC - Coffeehouses
          - 222.GCD - Staff dining room
        - 222.GD - Washing-up spaces
    - 223 - Spaces for public performances
      - 223.A - Spaces for performance of several purposes
        - 223.AB - Auditoriums and assembly halls
      - 223.B - Spaces for performance of cultural or religious activities
        - 223.BB - Theatre auditoriums
        - 223.BC - Concert halls
    - 227 - Spaces for operation-tied tools and equipment
      - 227.B - Spaces for telecom and datacom equipment
      - 227.C - Spaces for cinema projectors
      - 227.D - Operation spaces for auditorium or assembly hall
      - 227.V - Spaces for storing of operation equipment
      - 227.X - Spaces for cleaning of equipment, etc.
    - 228 - Various spaces for public activities
      - 228.B - Spaces for personal hygiene or dressing rooms
        - 228.BB - Shower spaces
        - 228.BC - Bath spaces
        - 228.BD - Dressing room space
        - 228.BE - Toilet space
          - 228.BEB - Handicap toilet
          - 228.BEC - Unisex toilet
          - 228.BED - Ladies' room
          - 228.BEE - Men's' room
        - 228.BF - Sauna space
      - 228.C - Spaces for resting
      - 228.D - Spaces for textiles care
        - 228.DB - Washing spaces
        - 228.DC - Drying spaces
    - 229 - Additional spaces for public activities
  - 23 - Communication spaces, deployment spaces, storage spaces, etc.
    - 231 - Communication spaces
      - 231.B - Access balconies
      - 231.C - Wind catchers
      - 231.D - Entrance hall
      - 231.E - Corridors and passages
      - 231.F - Staircases
      - 231.G - Elevator space
    - 232 - Spaces for customer reception
      - 232.D - Reception, etc.
    - 233 - Indoor spaces for vehicle or vessel deployment
      - 233.B - Garage for road vehicles
    - 234 - Warehouse, storage, archive and distribution spaces
      - 234.B - Warehouse space
      - 234.C - Storage space
      - 234.D - Archive space
      - 234.E - Cooler and freezer spaces
      - 234.F - Garbage space
  - 26 - Operation, control and channelization spaces
    - 261 - Operation spaces
      - 261.B - Substations
      - 261.C - Distribution box spaces
      - 261.D - Ventilation unit spaces
      - 261.E - Lift machine spaces
      - 261.F - Operation centrals, monitoring spaces, etc.
    - 262 - Control spaces, channelization spaces, etc.
  - 28 - Various spaces for indoor activities
    - 281 - Unutilized and non-furnished spaces for indoor activities
  - 29 - Additional spaces for indoor activities