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IPMA CROATIA international project management association
IPMA Young Crew Croatia

Digitisation of Health and Safety can improve the effectiveness of prevention towards Vision Zero: some case studies

Alfredo Soeiro
UPorto and ISHCCO

Who am I?

- Civil Engineer UPorto and UFlorida (PhD)
- Researcher on Construction Safety and on Digital Technologies in Construction
- Specialist of Professional Engineering PT
- Vice-presidente of ISHCCO (www.ishcco.org)
- Ambassador of ENETOSH (www.enetosh.net)
- Secretary general of AECEF (www.aecef.net)

Session plan

- Construction Safety context
- Prevention through Design
- Data about construction accidents
- Using digital tools
- Decision making
- Technical examples

Legislation in European Union

Directive 92/57/EEC - Temporary or mobile construction sites

“Whereas unsatisfactory architectural and/or organizational options or poor planning of the works at the project preparation stage have played a role in more than half of the occupational accidents occurring on construction sites in the Community;”

Role of coordinator

Article 2
Definition
“(e) 'coordinator for safety and health matters at the project preparations stage' means any natural or legal person entrusted by the client and/or project supervisor, during preparation of the project design, with performing the duties referred to in Article 5;”

Knowledge competence of coordinator - example

- Describe Construction Safety Coordination (CSC) n accordance with European Directive;
- Present management systems of CSC;
- Remember risk evaluation methods in CSC;
- …

Wrong sequence of operations
One dead and four wounded
Stability evaluation
Training
Simulation

Skills competence of coordinator - example

- Prepare procedures for CSC;
- Apply prevention equipment in CSC;
- ……..
    - Describe Construction Safety Coordination (CSC) in accordance with European Directive;
    - Present management systems of CSC;
    - Remember risk evaluation methods in CSC;
    - …

Attitudes competence of coordinator - example

- Develop CSC plans for training;
- Define responsibilities of staff involved in CSC;
- ……..

Acceptable load
Industrial hall
One dead
Circulation path
No Safety project

Prevention through design

National Safety Council
Design for Construction Safety (OSHA)
Australian Safety and Compensation Council
Construction Industry Institute
Construction Design Management Regulations
Safety Design (HSE)
Gambatese, Hinze, Baker, Driscoll, …

What is the percentage of accidents prevented during the design?

Analyze fatal or serious accidents

Define types of design:

- Structures, architecture and other

Classify the major causes of the accidents in two groups:

- Preventive measures possible during design or preparation phase
- Otherwise

Fatal accident causes

Brasil (SFIT) – 675
Canada (CCOHS) – 940
USA (FACE, NIOSH, PtD) – 116
Portugal (ACT) – 203
United Kingdom (HSE) – 100
Singapore (WSH Council) – 41

Research method

Descriptive information

- Causes
- Seriousness

Analytical information

- Factor
- Preventive measures

Design or Preparation phase useful

- Type of design
- Designer guidance

Phases of research

- Method of Analysis for Accident Related Design and Preparation
- Matrix that analyzed frequency and gravity of accidents
- Classify each type of preventive measure linking to phases of design and of preparation
- Create a prevention guide for designers and planners in each speciality and phase

Phase flow

1. Descriptive information (accident causes, seriousness of accident)
2. Preventive measures that should have been taken
3. Could design or preparation prevent the accident?
4. If no then analysis stops
5. If yes which type of design and preparation?

Phases of causes of accidents

Source	Conceptual design	Execution planning	Equipment selection
Brasil	27,6	41,4	13,8
Canada	23,6	18,4	5,0
USA	40,7	22,8	23,6
Portugal	38,4	28,5	3,3
Singapore	45,0	25,0	2,5
%	35,1	27,2	9,6

Accidents prevented before execution

Percentage of accidents avoidable in conceptual design and preparation phases from the seven sources and about 2000 accidents

62

Why the usefulness of digital tools?

Data cloud analysis
Virtual and augmented reality
Design and Preparation analysis
Simulation for training
Adjusted to each situation
Elasticity of budget
Use on site or on design/preparation
Possibilities are immense

Example of AR and VR

PPTX SHO2022

Example of Data Cloud

HKNOW Video

Decision making with digital tools

- Store and manage information in construction
- Engineers, technicians, architects, designers, technical directors, regulators, and educators
- Facilitate access to the data in an organized manner.
- Complexity versus making proper decisions
- Decision-making and optimization tools synergy with BIM tools

Sinergy BIM and Optimization digital tools

- BIM is the acronym that started as Building Information Model, then Modelling and currently Management.
- Digital Twins
- Quantity surveying, design clash conflicts, planning and scheduling, safety, architectural design, structural analysis, comfort (acoustic and thermal) evaluation
- System's responses and sensitivity

Processes

- Cloud computing
- Data base
- Use of building information
- Access
- Machine learning
- Performance based designs
- Unlimited possibilities
- Information “rich” models with “hungry” data algorithms
- Complex designs

CSETIR

- Project financed by Erasmus+
- Construction Safety Education and Training using Immersive Reality
- 4 universities and one construction company
- 3 years
- Half million Euros
- ISHCCO, AECEF, ENETOSH and others invited to validate and tune up

Examples analyzed

1. OSHA PIXO safety compliance Virtual Reality

2. Fulmax

3. VR Safety Training for Construction companies (LandMarkVR)

Examples analyzed (cont.)

4. CERTIFYME.NET

5. SRI International Augmented Reality Solutions for Construction Inspection

6. CAT VR Training

Conclusions – all about digital information (DI)

DI about accidents
DI management about construction tasks
DI about related preventive measures
DI of scenarios for simulation
DI for training
DI for analyzing non-conformities
DI accessible in mobiles, tablets, etc.

Let us save LIVES!

Hvala vam!

Thank you!