The Distribution of Accidents and Work Injuries using GIS technique: Baghdad as a Case Study

Tamarah S. Abduljabbar¹, and Fouad H. Saad²

¹Ministry of labor and social affairs, National center for occupational health and safety, Information technology department, tamarafm77@yahoo.com, Baghdad, Iraq.
²Ministry of labor and social affairs, Labor and vocational training directorate, GIS section, fouadhsaad77@gmail.com, Baghdad, Iraq.

Abstract. The research involved collect data through data extraction from satellite images, spatial and non-spatial data which provide from field survey that used in design of geodatabase and digital maps for study area through last three years (2015-2017) to record the frequency of work injuries occurring in Baghdad and spatial distribution for these work injuries. On the other side this research maintain the issue of losses the efforts of awareness teams which work with national center of occupational safety and health through apply GIS technique help the planners to prepare focused and effective plans through benefit from the spatial distribution of accident and work injuries to publish the knowledge of occupational safety and health between the labors in private sector according to how extent the types and numbers of work injuries. Also the research involved building geodatabase for the locations of governmental hospitals which covered by the system of monitoring and recording work injuries and spatial analysis for the types and numbers of work injuries by using satellite images and ArcGIS program to produce cartography maps involved the numerous classifications in addition to display the spatial relationship between the industrial activities and the type of work injuries in Baghdad area.

1 Introduction

• The work injuries consider the most important indicator that reflect the reality of occupational health and safety, and the extent of commitment and apply of safety requirements in the work sites in various labor sectors, in addition to the importance of work injuries through them direct impact on the national economy and society (man power) in particular. As a result of rapid and great improvement in information technology, this leaded to convert classical database to geodatabase by used GIS technique which provide the rapid analysis and less time consumption to gain accurate spatial data and statistics for several years and find the relationship between the type, numbers of accident and any other spatial issues such as the type and numbers of economic activities in each area in study area, and other potentials for the GIS technique which enabled to identify the type of problem and provide the support to decision makers to determine the suitable strategy of occupational safety and health to prevent or reduce these accidents (Prithvish Nag and Smita Sengupta. Introduction to Geographical Information Systems. India 2008. Page 154).

2 Literature Review

• Atay, H., Ergen, E., Toz, G., 2010. GIS based decision support system for health and safety management in linear projects, Proceedings of The International Conference on Computing in Civil and Building Engineering, Nottingham, UK.
• Sergio B. Henricy, M.S. Senior GIS Specialist Applied Information Systems Clayton Group Services, Inc, and Ed Stewart Senior Project Manager Clayton Group Services, Inc. GIS in Occupational Health and Safety Services.

3 Research aim

Building geodatabase by using GIS technique to identify the spatial analysis for the types and numbers of work injuries and the reasons of occurrence, and thus enable the awareness and assessment of the work environment.
teams which work with national center for occupational health and safety to apply the appropriate action to reduce and minimize work injuries through choose the suitable lectures and work environment devices that meet the type of work injuries for each area in Baghdad province.

4 Research problem

As a result of the great losses (economic and society) which resulting yearly from accidents and work injuries, this required prepared analytic studies through building geodatabase for last three years to know the reasons of variation and spread type of work injuries somewhere without the other.

5 Research Methodology

The methodology adopted for this research based on many stages which extract from the Iraqi Labor Law Chapter 13 and how to use geographic information systems in this field through access to a precise geodatabase of work injuries in the study area. These stages represented by the following:

- Using the ArcGIS program to collect and enter the initial data and convert it from the paper data to digital data.
- Apply (GIS Cloud) to create form which used to collect data about the maintenance workshops in study area through the field survey.
- Apply ArcCatalog 10.5 software to define the type of the spatial data (Polygon), (point) and named they according to the requirements of the study.
- Apply ArcMap window to process and create dataset in the study area.

6 Study area (Area of interest AOI)

The study area was chosen for (Baghdad) province which located between longitude 43° 50’ 00” E to 44° 58’ 00” E and between latitudes 32° 47’ 00” N to 33° 47’ 00” N

The temporal boundaries included the recording of work injuries and economic activities for the years 2015, 2016 and 2017 and spatial and non-spatial data about maintenance workshops for year 2018.

![Figure 1: Study area](Source / researcher preparation)
7 Data of research

This section included several activities as shown below:

- Collection and identification of spatial data and non-spatial data. Determine the location by handy GPS mobile application of hospitals which participating in the system of monitoring and recording of accidents and injuries in Baghdad governorate which (15) hospitals, and the non-spatial data obtained through a form prepared by the National Occupational Health and Safety Center included details of work injuries (age of the injured, type of injury, cause of injury, time of injury and other required data) and distributed to hospital emergency sections under the Labor Law (37) for year 2015.

The participating hospitals recorded about (5450) work injury for three years, the number of hospitals participating in the system in 2015 was only (9) hospitals, the number increase to became (15) hospital in 2017. This participation has an effective impact on the registration and monitoring of work injuries, especially in the private sector, which classify as a random sector that are not registered and are not committed to the social security law to inform about these injuries.

- The data which collect from field survey about maintenance workshops, which scattered in the province of Baghdad in these field survey used GIS cloud portal as shown in figure (1) & mobile data collection (MDC) application by creating data collection form in Arabic language as shown in figure (2) to collect spatial and non-spatial data, this activity done according to MOLSA tasks through apply industrial services law number 30 for year 2000 which under this law the ministry grant license of vocation practice for maintenance workshops about (7701) workshops. (GIS cloud user guide)

- The satellite images used in this research provided by ESRE for the year 2016 used to cover the study area.

Figure 2 GIS cloud dashboard
Source / researcher preparation
8 Building geodatabases in ArcCatalog program

The most important process during deals with GIS environment is applying appropriate design for geodatabase. From ArcCatalog program create geodatabase involved several features class:

- Polygon feature class for Baghdad province border and Baghdad main districts border.
- Point feature class for hospitals which participating in the system of monitoring.
- Polygon feature class for water bodies in study area.

9 Data processing in ArcMap program

After design geodatabase apply the methods of data visualization, spatial analysis for data input and then demonstrate the outcomes in the form of digital maps or paper maps, from ArcMap program apply the steps bellow:

- Apply digitizing process to determine baghdad province border, Baghdad main districts border, and other water bodies in Baghdad from ESRI online Basemap.
- Apply topology process for polygon layers.
- Export shapefile layer for maintenance workshops from GIS cloud dashboard as shown in figure (3) to ArcMap program.
- Add excel sheet file for hospitals location, and numbers and types of work injuries.
- Apply layout process to product maps depending on spatial analysis and organization requirements for instance digital maps, paper maps, reports, statistics, and charts...etc. The layouts involved classification of baghdad districts according to the density of work injuries as shown in figure (4), spatial relationship between types of work injuries and maintenance workshops as shown in figure (5), and spatial relationship between the type of...
work injuries according to place of injuries in human body and maintenance workshops as shown in figure (6).
See all data in this link: [http://arcg.is/1KbaI9](http://arcg.is/1KbaI9)
Figure 6 Spatial relationships between types of work injuries and maintenance workshops
Source / researcher preparation

Figure 7 Spatial relationships between types of work injuries in human body and maintenance workshops
Source / researcher preparation
10 Conclusions

1. The applying of GIS technique provide amazing potential to analysis work injuries and them spatial relationship with economic activities to supply support to decision makers in order to addressing problems and making appropriate decisions to policy-making in the sector of occupational health and safety.

2. The possibility of observing an increase in work injuries for hospitals located in the areas which involved a lot of maintenance workshops, also observed the relationship between the type of work injuries according to place of injuries in human body and type of maintenance workshops.

3. The connection of work injuries with the spatial factor of injury occur is important which decrease time and cost consumption, which provide planning to guidance the occupational health and safety teams to prepare awareness lectures for labor and choosing site environment examination devices that are suitable for types of work injuries most occurring in a particular area without the other.

11 Recommendations

1. There is a necessity to collect spatial data for all economic activities and not only data on the maintenance workshops in order to obtaining accurate information to help specialists and decision makers to obtain a real perception of the reality of the working environment, and thus will reflect positively on the labor sector.

2. Support the cooperation between the National Center for Occupational Health and Safety and the Ministry of Health and Environment to increase the number of hospitals participating in the national system to monitor and record work injuries to all hospitals in Iraq for the importance of data received from these organizations to approach and prepare the truth more realistic statistics especially in the private sector and economic activities.

3. Coordinat with the occupational health and safety departments in the governorates to implement the annual and strategic plans set by the center based on the data received to reduce the work injuries, through the awareness teams and the inspection teams deployed in all governorates.

12 References

- Clark, K., 2001. Getting Started with Geographic Information Systems. Prentice Hall, NJ.
- GIS cloud user guide.