POST – DISASTER DAMAGE ASSESSMENT FOR THE CITY OF NABLUS

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ABSTRACT: This paper documents the damage inflicted on the city of Nablus during the Israeli invasion from April 2002 to March 2003. Throughout a period of eight months the whole city of Nablus with its invaluable historic core was cruelly subjected to a large damage. The destruction in the Old Town was tremendous. Many monumental buildings were fully destroyed. Site investigations revealed that almost all buildings, which dated back to more than 600 years, were affected by the Israeli aggression. Damages, detected, ranged from light to severe damages and total destruction. The Israeli brutal attack spread to the whole city targeting private buildings, public institutions, electrical and water system, communication network, as well as roads and landscape of the city.

The paper gives an assessment of the damage in different parts of the city of Nablus, outside and inside the historic core as well as the lifelines in the whole city. A comprehensive report of three sections was prepared that gives detailed information about the extent and level of damages. The method of investigation was based on questionnaire surveys, interviews with residents and on site observations. The disaster field investigation assessment has been prepared according to the categories of damage evaluation adopted in the European Macro Seismic Scale EMS 98 and Federal Emergency Management Agency (FEMA).

Results of empirical investigations revealed that different neighborhoods of Nablus suffered less damage compared to the historic core of the city, however, in different parts of the city, streets with all lifelines were extensively vandalized. More than three hundred buildings suffered sever damages (grade 4 and 5). Around five thousand buildings suffered light (grade 1 and 2) and moderate damages (grade 3). The total estimated cost of rehabilitation and reconstruction of Nablus city exceeds 140 million USD distributed as follows: around 40% for the old city, 30% for buildings outside the old city and 30% for infrastructures.

INTRODUCTION

This paper documents the damage inflicted on the city of Nablus during the Israeli invasions from April 2002 to March 2003. The whole city of Nablus with its invaluable historic core was cruelly subjected to large damages (Figure1). In addition to heavy causalities among civilians and great losses and sufferings, the Israeli aggression caused unimaginable devastation in public and private properties.

The historic core of the city, which dates back to many centuries ago, was the most affected. The Israeli Army bombarded the historic town using F16 fighters, heavy tanks and Apache helicopters. The destruction in the Old Town was tremendous and is expected to increase if urgent

actions were not taken. The Old Town of Nablus has a very dense urban fabric composed of two main commercial streets and six residential quarters. Many buildings of cultural importance in the Old Town were detected fully destroyed.

Site investigations revealed that almost all buildings, in the historic core were affected by the Israeli aggressions. Destruction, which was detected, ranged from light damage such as broken windows, doors, and fallen plaster to severe damage and total destruction.

The Israeli brutal attacks spread to the whole city of Nablus targeting private buildings public institutions, electrical and water systems, communication network, as well as roads and landscape. Great destruction also affected several neighborhoods near and around the old Town. Many shops, offices and houses were seriously damaged and had to be demolished. As a result several families lost their homes or their sources of living.

The paper describes the damage that took place in Nablus including the Old Town, a historic site and an important part of the cultural heritage of Palestine. The paper gives some details of damaged buildings and sites as well as destruction of lifelines.

POST DISASTER INVESTIGATION AND METHODOLOGY OF FIELD INVESTIGATION

The main objective of the post disaster activities is to control and reduce the risks of losses during a short period of destructive invasions, as well as to provide basic data for activities of wider scope.

Goals of post- disaster investigation:

- To obtain appropriate information on the severity of the disaster in terms of the number of usable, damaged and also dangerous buildings.
- To develop a database for uniform estimation of economic losses so that an appropriate rehabilitation and assistance program may be devised as the affected region is reconstructed.
- To record and classify grades of damages so that damaged buildings may be repaired and strengthened in an orderly fashion.

Post disaster damage evaluations should be organized so that teams may rapidly use a systematic methodology. Basic information from these evaluations should enable local and national governmental authorities to make critical decisions and also to employ economically justified and technically consistent risk reduction measures in a uniform manner for the entire country.

Disaster Damage Inspection

The post-disaster damage inspection was based on the methodologies established by UNDP/UNIDO project [1] Earthquake Engineering Research Institute [2], and European Macroseismic Scale [3]. These methodologies are synthesized in the Earthquake Damage Inspection Form and developed on the basis of the experience gathered in earthquake damage and usability classification in past earthquakes.

Level of Damage in Buildings

Damage resulting from the blast has generally been highly variable. Moreover, building performance depends on many factors. Combination of structural materials, structural systems, and architectural design create variety of buildings; as well as variety of damage observed.

In order to present the estimated effect of Israeli army invasions to Nablus City, it is necessary to define several standardized states of damage (Damage grades). Based on European

Macroseismic Scale (EMS-98) the damage grades (figure 2) for both reinforced concrete and masonry buildings were classified according to the following:

Grade 1: Negligible to slight damage (slight non-structural damage):

- Hairline cracks in very few walls.
- Fall of small pieces of plaster. Fall of loose stones from upper parts of buildings in very few cases.

Grade 2: Moderate damage (slight structural damage, moderate non- structural damage), in the case of old masonry buildings (O.M.B):

- Fall of fairly large pieces of plaster.
- Partial collapse of chimneys.

Grade 3: Substantial to heavy damage (moderate structural damage, heavy non-structural damage), in the case of O.M.B:

Large and extensive cracks in most walls Roof tiles detach. Chimneys fracture at the roofline; failure of individual non-structural elements (partitions, gable walls).

Grade 4: Very heavy damage (heavy structural damage, very heavy non- structural damage), in the case of O.M.B:

- Serious failure of walls; partial structural failure of roofs and floors.

Grade 5: Destruction (very heavy structural damage): Total collapse or near total collapse.

Damaged buildings are represented on maps by different colors. Grade 1 and 2, usable after local hazards are removed (Green). Grade 3 and many buildings with damage Grade 4, entry limited (Yellow). Few of Grade 4 damaged buildings and all of Grade 5 damaged buildings, entry prohibited (Red).

The paper presents an assessment of the damage for different parts of the city of Nablus, the old town and new neighbourhoods outside the old town [4]. A 24-hour report was carried out as a preliminary evaluation. Based on this report, a more accurate and detailed report was prepared that gives more information about the degree and level of damage. The report consists of three sections:

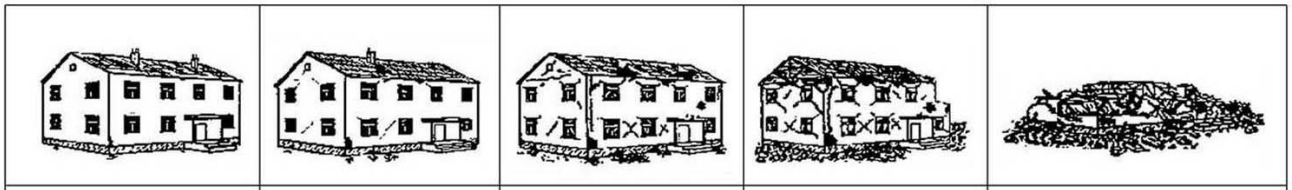
1. The Old Town
2. The city of Nablus outside the Old Town
3. Infrastructure.

For the purpose of investigation, each of the above mentioned section was divided into zones and each zone was reported by specific inventory. The survey was carried out by teams of 4-5 professionals consist of architects and engineers. The work was managed by a steering committee of An-Najah University, the Municipality of Nablus, UNDP, the Palestinian Engineers Association and the Palestinian Contractors Union.

PERTINENT RESULTS OF PRELIMINARY DAMAGE SURVEY

Based on the above investigation methodology, one survey form was filled in for each building. In case of light damage one survey form was used for group of buildings with the same degree of damage. Data analysis was carried out and the output was summarized and presented in tables (see table 1).

Figure 1: Selected Distruction Sites of City of Nablus.



Grade 1	Grade 2	Grade 3	Grade 4	Grade 5

Figure 2: Classification of Damage

Table (1): Summary Cost for Rehabilitation and Reconstruction of Nablus City

Category			Type of Damage			Service Damage Cost ($)	Consolidation Cost ($)	Total	Total with Contingency 25 %
			Total Destruction Cost ($)	Partial Damage Cost ($)	Light Damage Cost ($)				
BUILDING	Old City	Mix Use*	12,275,000	17,786,200	9,054,000	925,000	2,198,500	42,238,700	52,798,375
		Relegion		69,000	72,500			141,500	176,875
		Non-governamental							
	Outside Old City	Mix Use*	4,775,000	1,525,000	2,850,000	4,160,000	525,000	13,835,000	17,293,750
		Schools		285,000	305,000	87,000	45,000	722,000	902,500
		Governamental	4,275,000	860,000	225,000	930,000	270,000	6,560,000	8,200,000
Life Lines		Stone Tiling** (Roads)		785,000				785,000	981,250
		Roads and it's features***		24,630,000			875,000	25,505,000	31,881,250
		Solidwaste		285,000				285,000	356,250
		Electricity		3,100,000				3,100,000	3,875,000
		Water and Sanitation		2,200,000				2,200,000	2,750,000
Refugees Camps			2,850,000	2,400,000	1,950,000	1,450,000	245,000	8,895,000	11,118,750
Cars/ Vehicules			1,960,000	625,000	517,000			3,102,000	3,877,500
Temporary Housing					1,200,000			1,200,000	1,500,000
Removals and Cleaning					4,500,000			4,500,000	5,625,000
Total (USD)								**113,069,200**	**141,336,500**

* Mix use: residential and/ or commercial.
** Stone Tilling: used only in the old city
*** Features: sidewalks, median, road sign, traffic lights and retaining walls.

Any other items which are not mentioned in the above table (like indirect losses, agriculture, health etc.) are not included in the total cost mentioned above.

Following up the damage assessment survey and taking into consideration the international standards " procedures and recommendations" [1] and [5] the damaged buildings in Nablus have been presented on the city maps by using the ratings and typical postings (Green, Yellow and Red).

It was observed that destruction caused by the Israeli invasion to the Old Town affected the whole area; damage was distributed in all quarters. It touched several building of different uses. Results of empirical investigations revealed that different neighborhoods of Nablus outside the Old Town suffered less damage compared to the historic core however, in different parts of the city, streets with all lifelines were extensively vandalized. More than three hundred buildings suffered sever damages (grade 4 and 5). Around five thousand buildings suffered light (grade 1 and 2) and moderate damages (grade 3). The total cost of rehabilitation and reconstruction of Nablus city exceeds 140 million USD distributed as follows: around 40% for the old city, 30% for buildings outside the old city and 30% for lifeline structures.

The Old Town

Results of the inventory carried out in the Old Town revealed that 162 Buildings or group of buildings were very badly damaged or totally destroyed (Grade 5& 4). The total cost for reconstruction amounts to $12,275,000

Two hundred and twenty one buildings or group of buildings were partially damaged and need urgent repair and renovation. Urgent intervention is needed in many cases as the urban fabric of the Old Town forms one mass. Thus weak or unstable buildings will weaken and endanger other attached structures. The total cost for repair of the partial damages reaches to $17,786,000.

If not partially or totally damaged, buildings of the Old Town, suffered from light damages (slight structural and moderate non-structural damages). The expenses of the repair of light damages are $ 9,126,500.

Many of the affected sites consist of many small residential units, shops, small workshops and businesses. The Old Town of Nablus has unique characteristics of complex, overlapping and cluster houses, so it is extremely difficult to draw boundary lines between buildings. Houses in the historic core are composed of multi and split levels, small rooms, stairs and courtyards. Damage of any part of one house can affect other attached units.

The city of Nablus outside the Old Town

Results of the inventory undertaken on different neighborhoods of Nablus outside the Old Town revealed that they suffer less damage compared to the historic core. The total cost for reconstruction of destroyed buildings is $ 9,050,00, and $ 2,670,000 for partial damage repair.

As a result of practices carried out by Israeli soldiers on many of the seized houses and apartments during savage invasion, furniture and personal properties were severely damaged, electrical equipment were destroyed and valuable belongings were stolen (see the summary of service damage cost presented in table 1 and figure 3). Light damages were detected in several buildings distributed on different neighborhoods of the city. An amount of $ 3,380,000 is required for repair.

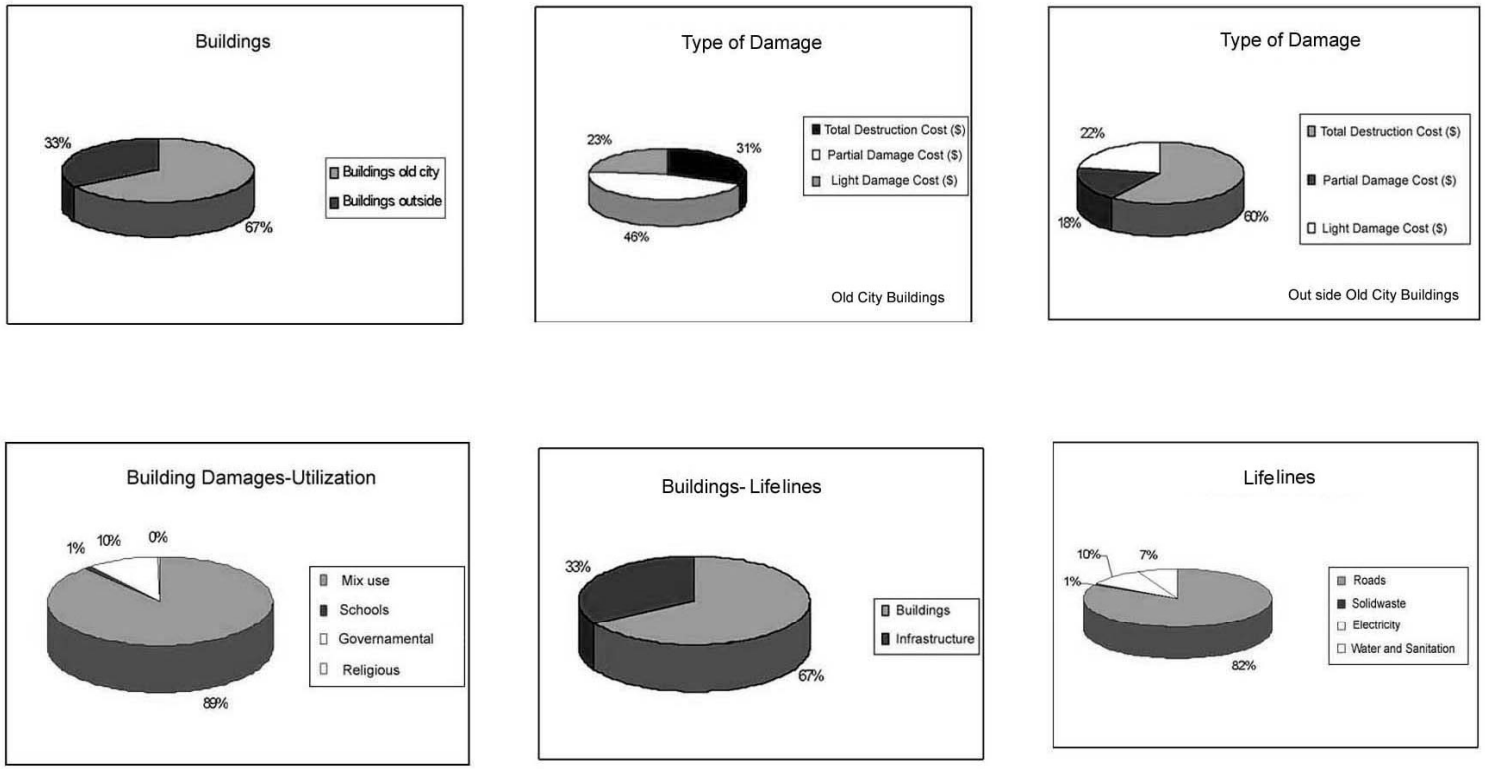


Figure (3): The relationship between different Damage Types and Rehabilitation cost.

Infrastructure

Streets, electrical and water systems, communication network, as well as roads and landscape of Nablus were extensively vandalized by Israeli invasions. Vandalism extended to sidewalks, curb stones, sign posts, traffic lights and electricity columns. All street furniture in the city center such as phone boxes, parking meters, fences, trees, and landscaping were destroyed. The total expenses needed for repair and rebuild of roads amount to $ exceeds 25,415,000 For more details please refer to quantities and expenses tables (see Tables 1 and figure 3).

RECOMEMDATIONS

Based on the preliminary investigation of the damage , there was an urgent need to use some temporery protection and to set out different crieteria and meauseures to be applied on this proposed temporary protection.

The main purpose of the preliminary investigation is not only to identify the current sturctural conditions of the buildings but also to determine in details the nature and the degree of damage and to design and install emergency measures for temporary support. This is improtant in order to overt the risk of causalities and injuries, as well as to minimize the possible material losses in case of increased damage to the structure.

The immediate temporary support was recommended for several buildings which were severely damaged but not collapsed during the invasion. Severe damage appeared either as in a form of rupture of a column, or as a serious cracking of bearing load walls. Immediate measures can relieve damaged elements of their load by means of additional temporary elements and thus protect the structure against a future shocks or effects of gravity loads on severely damaged elements.

The purpose of temporary protection is to provide temporary strength or support for those damaged elements and connections on which the safety of the whole structural system depends. The measures for temporary protection must also provide safety for the people in the areas adjacent to the damaged building. It also provides safety to workmen who are repairing and installing the damaged structures.

The total cost of rehabilitation and reconstruction of the city of Nablus has exceeded 140 million USD distributed as follows: around 40% for the old city, 30% for buildings outside the old city and 30% for infrustructures.

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