

ANNEX 4

STRUCTURAL CALCULATIONS REPORT & DRAWINGS

FOR THE REHABILITATION OF THE KHAIR KHANA 52-BED HOSPITAL, KABUL, AFGHANISTAN

Table of Contents

Reports

1	INTRODUCTION	3
2	STRUCTURAL ANALYSIS AND DESIGN SPECIFICATIONS	4
3	CERTIFICATION ON STRUCTURE BY WADAN CONSULTING ASSOCIATES AND INTERSOS.....	9

Structure Drawings

Title	Drawing No.
Structure Drawing	S/01
First floor slab, reinforcement drawing	S/02
Second floor slab, reinforcement drawing	S/03
Beams, structure drawing	S/04
Beams, structure drawing	S/05
Beams, structure drawing	S/06
Columns, ramp structure drawing	S/07
Col/Stairs/W.T structure drawing	S/08

1 INTRODUCTION

Maternity blocks and auxiliary buildings were demolished and a new structure was built. The new 2-story structure is composed of foundations, pillars, beams and slabs.

The calculation was executed by our Consultant, Wadan Consulting Associates, Peshawar, Pakistan. The firm knows local standards and construction practices. The structural report is not included, but the specifications followed by the Consultant are enclosed herein, as well as the Certification of Structural Design.

All the structural designs were verified by Intersos who remains responsible for any aspect of design and construction.

Each page of this report and each drawing is signed and certified by Eng. F. Travan, the project manager for Intersos, being a competent technician.

2 STRUCTURAL ANALYSIS AND DESIGN SPECIFICATIONS

WADAN CONSULTING ASSOCIATES

CONSULTING ARCHITECTS, ENGINEERS, INTERIOR DESIGNERS, LANDSCAPE ARCHITECTS, BUILDERS

Project : KHAIR KHANA HOSPITAL, KABUL.

**Report Title: STRUCTURAL ANALYSIS AND DESIGN
SPECIFICATIONS**

WADAN CONSULTING ASSOCIATES

CONSULTING ARCHITECTS, ENGINEERS, INTERIOR DESIGNERS, LANDSCAPE ARCHITECTS, BUILDERS

where,

b = width of beam
d = depth of beam
a = depth of compression block

Md = design moment capacity of the section

Flexural design of ' T ' beam

Asf = $0.85 f_c'(b - b_w) \times hf/f_y$
Mn1 = $As_f \times f_y (d - hf/2)$
a = $(A_s - A_{sf}) \times f_y / (0.85 \times f_c' \times b_w)$
Mn2 = $(A_s - A_{sf}) \times f_y \times (d - a/2)$
Mn = $Mn1 + Mn2 = A_{sf} \times f_y \times (d - hf/2) + (A_s - A_{sf}) \times f_y \times (d - a/2)$

Where,

b = effective flange width of T-Beam
b_w = web width of the T-Beam

hf = thickness of flange
z d = depth of Beam
a = depth of compression block in web
Mn1 = normal moment capacity of the flange section.

Mn2 = normal moment capacity of the web section.
A_s = total area of steel provided.
A_{sf} = area of steel provided in the web to balance the compression force in the flange section.
f_c' = crushing strength of concrete.
f_y = yield strength of steel.

Shear design of Beams

Shear resistance capacity of the beam is given as,

$\phi V_c = 0.85 \times 2 \times (f_c') \times b \times d$
S = $0.85 \times A_v \times f_y \times d (V_u - \phi V_c)$
S max = $A_v \cdot f_y / 50 \times b_w$
S max = d/2
S max = 50 cm

Note :

To avoid excessive cracks width in beam webs the ACI Code limits the yield strength of the reinforcement to $f_y = 414 \text{ N/mm}^2$ or less. In no case, according to ACI Code, as $V_s = V_u - \phi V_c$ to exceed $8 \times (f_c') \times b \times d$ regardless of the amount of the web steel used. Where,

ϕV_c = shear resisting capacity of the beam section.
S = spacing of stirrups.

WADAN CONSULTING ASSOCIATES

CONSULTING ARCHITECTS, ENGINEERS, INTERIOR DESIGNERS, LANDSCAPE ARCHITECTS, BUILDERS

Av = stirrups (s) legs area e.g. for one stirrups there are two numbers of legs.
fy = yield strength of steel.
d = effective depth of section.
bw = width of the Beam web.
fc' = crushing strength of concrete.

3 CERTIFICATION ON STRUCTURE BY WADAN CONSULTING ASSOCIATES AND INTERSOS

WADAN CONSULTING ASSOCIATES

CONSULTING ARCHITECTS, ENGINEERS, INTERIOR DESIGNERS, LANDSCAPE ARCHITECTS, BUILDERS

To
INTERSOS Afghanistan
C/o INTERSOS Pakistan
26/A Circular Road,
University Town Peshawar
N.W.F.P, Pakistan.
May 20th 2003

Subject: Certification of Structural Design for Khair Khana Hospital, Kabul

It is certified that the structural design for the project of Khair Khana Hospital, Kabul has been undertaken by Wadan Consulting Associates in Sep, 2002.

Furthermore,

The statical calculations have been made conforming to the ACI Code (318-95) and according to the anti-seismic consideration ACI Code (21.3.1)

The dimensions of the structure and the steel area indicated in the drawings (from S-01 to S-08) have been calculated according to the above mentioned regulations and comply with the security criteria foreseen in the mentioned regulations, provided that the reinforcement conform to the following.

1. Steel yield strength = 275N/mm² (40000Psi)
2. Concrete crushing strength = 20N/mm² (3,000 Psi)

Yours truly,
Engr. Abdur Rashid



Project Engineer
Wadan Consulting Associates.

WADAN CONSULTING ASSOCIATES
OFF: SPRINGER PLAZA, UNIVERSITY ROAD, PESHAWAR.
PH # 091-853695

