Sudan University of Science and Technology

College of Engineering

School of Civil Engineering

Department of Construction

A Thesis Submitted in Partial Fulfillment for B.Sc Degree in Civil Engineering

Formwork Design And Construction

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PREFACE

قال تعالى :

بسم الله الرحمن الرحيم

((أَفَمَنْ أَسَّسَ بُنْيَانَهُ عَلَىٰ تَقْوَىٰ مِنَ اللَّهِ وَرِضْوَانٍ خَيْرٌ أَمْ مَنْ

أَسَّسَ بُنْيَانَهُ عَلَىٰ شَفَا جُرُفٍ هَارٍ فَانْهَارَ بِهِ فِي نَارِ جَهَنَّمَ ۗ وَاللَّهُ

لَا يَهْدِي الْقَوْمَ الظَّالِمِينَ))

(سورة التوبة 109)

DEDICATION

I dedicate this dissertation to:-

(my Father)

For opening my eyes to the world and instilling the importance of hard work and higher education

(my lovely Mother)

For her patience and understanding and for giving me a chance to prove and improve myself through all my walks in life

(my Friends and Family)

For walking with us throughout the long distance

(my Teachers)

For providing all suggestions and information that helped us through this project

(Thank you)

With love

ACKNOWLEDGEMENTS

All praises to **The Allah Almighty** who has created this world of knowledge for us. He is The Gracious, The Merciful. He bestowed man with intellectual power and understanding, and gave him spiritual insight, enabling him to discover his "Self" know his Creator through His wonders, and conquer nature. Next to all His Messenger **Muhammad** (*SAW*) who is an eternal torch of guidance and knowledge for whole mankind.

I wish to thank my committee members who were more than generous with their expertise and precious time. A special thanks to **T. Mahmoud Khogly** , my research supervisor for his countless hours of reflecting, reading, encouraging, and most of all patience throughout the entire process.

I would like to acknowledge and thank my school division for allowing me to conduct my research and providing any assistance requested.

Finally I would like to thank the beginning teachers, mentor-teachers and administrators in our school division that assisted me with this project. Their excitement and willingness to provide feedback made the completion of this research an enjoyable experience.

ABSTRACT

Formwork contributes a major part in the construction industry and has a high impact of the total cost in most of the building construction activities. It often ranges from 40 to 60% of the total cost of the construction work. They mold the concrete to the required size and shape while controlling its position and alignment.

Timber, Metals and Plastics with different types, grades and specifications are materials used in fabricating formworks.

Formwork System can be classified as Vertical Formwork (Column and Wall) and Horizontal Formwork (Slab and Beam). A formwork system includes the mold or sheathing as well as supporting members, joists and stringers that act as primary and secondary beams, hardware, and necessary bracing.

The possible loads acting on formwork are Vertical, Horizontal and Lateral loads. Vertical loads are usually associated with the dead load and the live load .External forces such as wind exert horizontal loads on the forms. Internal pressures on vertical formwork result from the liquid or semi-liquid behaviour of the fresh concrete.

This research presents the principles and techniques for analysis, design and construction of formwork for concrete structures. The selection and effective use of formwork also dominate the success of a project in terms of speed, quality and dimensional accuracy of the final product.

تجريد

تشكل الفرم جزء هام من صناعة الخرسانة . كما لها تاثير كبير على التكلفة الكلية في جميع مراحل التشييد . وقد تصل تكلفتها من(40 – 60) % من تكلفة تشييد المشروع . والفرم هي التي تعطي الخرسانة الشكل و الحجم النهائي المطلوب.

تصنع الفرم من الخشب والمعدن (حديد - ألمنيوم) وكذلك البلاستيك بأنواع وأشكال ومقاسات مختلفة . وتصنف أنظمة الفرم الى الفرم الرأسية (الأعمدة و الحوائط) والفرم الأفقية (البلاطات والعارضات).

الأحمال المسلطة علي الفرم هي اما أحمال رأسية أو أحمال أفقية ، الأحمال الرأسية تتكون من الأحمال الميتة (وزن الخرسانة – وزن الفرم نفسها) والأحمال الحية (وزن العمال – الأدوات المستخدمة) ، بالاضافة الي قوي خارجية أخري تؤثر علي الفرم مثل أحمال الرياح.

الضغط المسلط علي الفرم الرأسية ناتج من ضغط الخرسانة الطازجة حيث تكون في حالة سيولة.

هذا البحث يتناول المبادئ والتقنيات الأساسية في تصميم وتشييد الفرم للمنشآت الخرسانية. مما يساعد علي اختيار نوع الفرم المستخدمة الذي له تأثير مباشر في انجاح المشروع المنفذ بالسرعة والدقة والجودة المطلوبة.

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TABLE OF SYMBOLS

SYMBOL	Definition
ACI	American Concrete Institute
$\boldsymbol{l}$	length of span, center to center of supports
F_b	allowable unit stress in bending
F_bKS	plywood section capacity in bending
F_C	allowable unit stress in compression parallel to grain
$F_{c\perp}$	allowable unit stress in compression perpendicular to grain
F_sIb/Q	plywood section capacity in rolling shear
Fv	allowable unit stress in horizontal shear
f_c	actual unit stress in compression parallel to grain
$f_{c\perp}$	actual unit stress in compression perpendicular to grain
f_t	actual unit stress in tension
A	area of section
E	modulus of elasticity
I	moment of inertia
P	applied force (compression or tension)
S	section modulus
Δ	Deflection
b	width of member

SYMBOLS	Definition
d	depth of member
w	uniform load per foot of span
Pm	calculated lateral pressure
Cw	unit weight coefficient
Cc	chemistry coefficient
R	rate of fill of concrete in form
T	temperature of concrete in form
w	unit weight of concrete
ρ	density of concrete
h	depth of fluid