

INFRASTRUCTURE DESIGN AND PLANNING OF YOUTH CENTER IN BENGKULU CITY

Report of Final Project

As one of the requirements to achieve the bachelor's degree in
Universitas Atma Jaya Yogyakarta



By:

ALVIN PIRES **201317977**

RICHARDO HADINATA DJOENARKO **201317980**

VINAYAK MUNESH PANJABI **201318351**

**INTERNATIONAL CIVIL ENGINEERING PROGRAM
CIVIL ENGINEERING DEPARTMENT
FACULTY OF ENGINEERING
UNIVERSITAS ATMA JAYA YOGYAKARTA
YOGYAKARTA**

ABSTRAK

Bengkulu Youth Center berfungsi sebagai pusat pemberdayaan dan keterlibatan generasi muda di kota Bengkulu, Indonesia. Abstrak ini memberikan gambaran umum tentang fitur-fitur utama, inisiatif, dan dampak pusat ini terhadap komunitas pemuda setempat. Youth Center Bengkulu bertindak sebagai katalisator pertumbuhan pribadi dan pengembangan masyarakat dengan menawarkan berbagai program dan sumber daya yang disesuaikan dengan kebutuhan dan minat generasi muda.

Pusat ini berfungsi sebagai ruang fisik di mana kaum muda dapat berkumpul, berkolaborasi, dan menjelajahi berbagai cara untuk pengembangan pribadi dan profesional.

Inti dari misi pusat ini adalah penyediaan kesempatan pendidikan. Ia menawarkan layanan dukungan akademis, termasuk program bimbingan belajar dan bimbingan, untuk meningkatkan hasil pendidikan individu muda. Selain itu, pusat ini menyelenggarakan lokakarya, seminar, dan sesi pelatihan tentang berbagai mata pelajaran, seperti kewirausahaan, kepemimpinan, teknologi, dan seni, memberdayakan generasi muda dengan keterampilan dan pengetahuan praktis. Menyadari pentingnya membina hubungan sosial, Youth Center Bengkulu mendorong jaringan dan kolaborasi di kalangan generasi muda. Organisasi ini menyelenggarakan acara sosial, kegiatan olah raga, dan festival budaya, menciptakan lingkungan yang dinamis dan inklusif di mana individu dapat membangun persahabatan yang langgeng dan mengembangkan rasa memiliki.

Ia menawarkan layanan konseling, kampanye kesadaran kesehatan, dan kegiatan rekreasi yang meningkatkan kebugaran fisik dan kesehatan mental. Dengan mengatasi aspek-aspek penting ini, pusat ini bertujuan untuk meningkatkan kualitas hidup generasi muda di Bengkulu secara keseluruhan. Sejak didirikan, Youth Center Bengkulu telah memberikan dampak yang signifikan terhadap komunitas pemuda setempat. Hal ini telah memberdayakan banyak orang dengan membekali mereka dengan keterampilan penting, mendorong pertumbuhan pribadi, dan mendorong keterlibatan masyarakat. Pusat ini telah membantu kaum muda menyadari potensi mereka, menginspirasi mereka untuk menjadi kontributor aktif bagi masyarakat dan mengadvokasi perubahan positif.

Kesimpulannya, Youth Center Bengkulu mempunyai peran penting dalam mendukung dan membina generasi muda Bengkulu. Melalui beragam program dan inisiatifnya, ini berfungsi sebagai katalisator bagi pengembangan pribadi, pendidikan, dan sosial. Dedikasi pusat ini dalam memberdayakan generasi muda tidak diragukan lagi telah memberikan dampak positif pada komunitas lokal, membina generasi muda yang percaya diri, cakap, dan bertanggung jawab secara sosial.

Kata Kunci: desain, struktur, geoteknik, manajemen biaya dan waktu

ABSTRACT

The Bengkulu Youth Center serves as a vibrant hub for empowering and engaging young individuals in the city of Bengkulu, Indonesia. This abstract provides an overview of the center's key features, initiatives, and impact on the local youth community. The Bengkulu Youth Center acts as a catalyst for personal growth and community development by offering a wide range of programs and resources tailored to the needs and interests of young people.

The center serves as a physical space where youth can gather, collaborate, and explore various avenues for personal and professional development.

At the heart of the center's mission is the provision of educational opportunities. It offers academic support services, including tutoring and mentorship programs, to enhance the educational outcomes of young individuals. Additionally, the center organizes workshops, seminars, and training sessions on various subjects, such as entrepreneurship, leadership, technology, and the arts, empowering youth with practical skills and knowledge. Recognizing the importance of fostering social connections, the Bengkulu Youth Center encourages networking and collaboration among young people. It organizes social events, sports activities, and cultural festivals, creating a vibrant and inclusive environment where individuals can build lasting friendships and develop a sense of belonging.

It offers counseling services, health awareness campaigns, and recreational activities that promote physical fitness and mental wellness. By addressing these crucial aspects, the center aims to improve the overall quality of life for young people in Bengkulu. Since its establishment, the Bengkulu Youth Center has made a significant impact on the local youth community. It has empowered countless individuals by equipping them with essential skills, fostering personal growth, and promoting community engagement. The center has helped young people realize their potential, inspiring them to become active contributors to society and advocates for positive change.

In conclusion, the Bengkulu Youth Center plays a vital role in supporting and nurturing the youth population of Bengkulu. Through its diverse range of programs and initiatives, it serves as a catalyst for personal, educational, and social development. The center's dedication to empowering young individuals has undoubtedly made a positive impact on the local community, fostering a generation of confident, capable, and socially responsible youth.

Keywords: design, structure, geotechnic, cost and time management

STATEMENT

We, the undersigned below,

Student's Name 1 : Alvin Pires

Student's Number : 201317977

Student's Name 2 : Ricardo Hadinata Djoenarko

Student's Number : 201317980

Student's Name 3 : Vinayak Munesh Panjabi

Student's Number : 201318351

Sincerely affirm that the concluding project bearing the title:

“INFRASTRUCTURE DESIGN AND PLANNING OF YOUTH CENTER IN BENGKULU CITY”

We sincerely affirm that the Final Project, entitled [Title], is an original creation and has not been plagiarized from the efforts of others. The undersigned contributors have collaboratively participated in this project with an equitable distribution of contributions. This declaration serves as an additional acknowledgment included with the Final Project documentation.

Yogyakarta, 21 February 2024.



(..... Alvin Pires)



(Richardo Hadinata Djoenarko....)



(Vinayak Munesh Panjabi....)

VALIDATION

Final Project Report

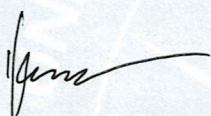
INFRASTRUCTURE DESIGN AND PLANNING OF YOUTH CENTER IN BENGKULU CITY

By:

Alvin Pires	201317977
Richardo Hadinata Djoenarko	201317980
Vinayak Munesh Panjabi	201318351

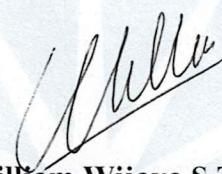
Checked by:

Lecturer 3
TAPI 2



(Ir. AY. Harijanto
Setiawan, M.Eng., Ph.D.)
NIDN: 0501086402

Lecturer 2
TAPI 2



(William Wijaya S.T. M.
Eng.)
NIDN: 0529039402

Lecturer 1
TAPI 1



(Johan Ardianto, S.T.,
M.T.)
NIDN: 0503069301

Approved by:
Final Project's Supervisor
Yogyakarta,



(Johan Ardianto, S.T., M.T.)
NIDN: 0503069301

Validated by:
Head of Civil Engineering Department




(Prof. Ir. Yoyong Arfiadi, M.Eng., Ph.D.)
NIDN: 0515015901

VALIDATION

Final Project Report

INFRASTRUCTURE DESIGN AND PLANNING OF YOUTH CENTER IN BENGKULU CITY

By:

		
Alvin Pires 201317977	Ricardo Hadinata Djoenarko 201317980	Vinayak Munesh Panjabi 201318351

Has been examined and approved by:

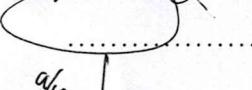
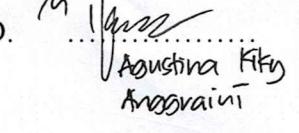
Name	Signature	Date
Leader : Johan Ardianto, S.T., M.TEng		6/2/24
Secretary : Dr. Ir. Junaedi Utomo, M.Eng.		9/2/24
Member : Ir. AY. Harijanto Setiawan, M.Eng., Ph.D.		06.02.2024

TABLE OF CONTENTS

ABSTRACT.....	iii
STATEMENT.....	iv
VALIDATION.....	v
TABLE OF CONTENTS.....	vii
LIST OF FIGURES	xi
LIST OF TABLES	xiii
CHAPTER I INTRODUCTION.....	1
1.1 General Description	1
1.2 Regulations and Planning Standards.....	1
1.3 Structural Material Specifications.....	1
1.4 Objective.....	2
1.5 Research Methodologies	2
1.6 Structure Planning Method	2
1.6.1 Structure System	2
1.6.2 Structural Model	2
1.6.3 Service Limit Performance	2
1.6.4 Ultimate Limit Performance	3
CHAPTER II YOUTH CENTER SUPERSTRUCTURE DESIGN.....	3
2.1 General Description of Structure	3
2.2 Project Description.....	5
2.2.1 1 st Story	6
2.2.2 2 nd Story	7
2.2.3 3 rd Story.....	8
2.3 Soil Interpretation Data and Site Class Determination	10
2.4 Structure System Determination	11
2.5 Structural Factored Load.....	12
2.5.1 Combination of Factored Load	13
2.5.2 Dead Load (Self Weight)	15
2.5.3 Additional Dead Load.....	15
2.5.4 Live Load	15
2.5.5 Wind Load	16
2.5.6 Earthquake Loading	18
2.6 Structural Modelling	22
2.7 Evaluating Structural Systems Output and Structural Irregularities	29

2.7.1	Modal Mass Ratio Check.....	29
2.7.2	Load Combination Base Shear Check.....	32
2.7.3	Structural Irregularity.....	33
2.8	Consequence of Irregularity.....	35
2.8.1	Consequence of Horizontal Irregularity	35
2.9	Consequence of Vertical Irregularity	36
2.10	Roof Structure Design.....	37
2.10.1	Purlin.....	37
2.10.2	Sag Rod.....	44
2.10.3	Truss.....	44
2.10.4	Connection	49
2.10.5	Anchor.....	52
2.11	Beam Design.....	56
2.11.1	Beam Flexural Design.....	57
2.11.2	Beam Shear Design.....	63
2.11.3	Beam Torsion Design.....	65
2.11.4	Conclusion	69
2.12	Tie Beam Design.....	70
2.12.1	Loading	71
2.12.2	Longitudinal Reinforcement	73
2.12.3	Transversal Reinforcement	76
2.12.4	Conclusion	78
2.13	Column Design	79
2.13.1	Internal Forces.....	80
2.13.2	Strong Column-Weak Beam Requirement.....	81
2.13.3	Plastic Hinge Zone	83
2.13.4	Outside Plastic Hinge Zone.....	86
2.13.5	Conclusion	88
2.14	Beam-Column Joint	88
2.14.1	Reinforcement.....	89
2.14.2	Conclusion	91
2.15	Slab Design	92
2.15.1	Determination of Dimension and Slab Type.....	92
2.15.2	Shear Strength.....	93
2.15.3	Moment Strength.....	94
2.15.4	Reinforcement.....	94

2.15.5	Conclusion	95
2.16	Stair Design.....	95
2.16.1	Stair Data	96
2.16.2	Loading	96
2.16.3	Reinforcement.....	97
2.16.4	Landing Slab Data.....	97
2.16.5	Landing Slab Reinforcement	98
2.16.6	Landing Beam Data	98
2.16.7	Landing Beam Reinforcement	99
CHAPTER III YOUTH CENTER SUB-STRUCTURE DESIGN		100
3.1	General Description of Sub-Structure.....	100
3.2	Interpretation of Soil Data.....	101
Depth (m)	101
Depth (m)	102
3.3	Potential of Liquefaction.....	104
3.4	Foundation Bearing Capacity.....	108
3.5	Deep Foundation Design.....	117
3.2.1	Pile Cap.....	118
3.2.2	Pile	126
3.6	Settlement	130
3.3.1	Single Pile Settlement	130
3.3.2	Group Pile Settlement	131
3.7	Differential Settlement.....	133
3.8	Conclusion	134
CHAPTER IV YOUTH CENTER COST AND TIME MANAGEMENT		135
4.1	Introduction.....	135
4.2	Work Breakdown Structure (WBS)	136
4.3	Volume Of Work	138
4.4	Unit Price Cost Analysis	140
4.5	Bill of Quantity	141
4.6	Duration	142
4.7	Relations Between Activities	142
4.8	Resource Scheduling.....	144
4.9	S-Curve	145
CHAPTER V CONCLUSION.....		148
5.1	Roof.....	148

5.2	Beam	148
5.3	Tie Beam.....	148
5.4	Column.....	149
5.5	Beam-Column Joint	149
5.6	Slab	149
5.7	Stairs	149
5.8	Foundation	150
5.9	Cost and Time Management	150

LIST OF FIGURES

Figure 2. 1 Flowchart of Planning Super Structure.....	5
Figure 2. 2 Flowchart of Soil Interpretation Data	10
Figure 2. 3 Pitched Roof Wind Load (Source SNI 1727:2013 figure 27.4-1)	17
Figure 2. 4 Response Spectrum Graph.....	20
Figure 2. 5 Static Equivalent Load (Source: SNI 1726:2019 Figure 10).....	21
Figure 2. 6 Structural Modelling Flowchart.....	22
Figure 2. 7 Material Properties for Concrete	23
Figure 2. 8 Material Properties for Steel.....	24
Figure 2. 9 Building Model Left View.....	28
Figure 2. 10 Building Model Right View	28
Figure 2. 11 Building Model Front View	28
Figure 2. 12 Second Story Plan View	29
Figure 2. 13 Third Story Plan View	29
Figure 2. 14 Fourth Story Plan View	29
Figure 2. 15 Roof Structure Design Flowchart	37
Figure 2. 16 Purlin Tributary Area.....	39
Figure 2. 17 Load Projection of D, ADL, and LL.....	40
Figure 2. 18 Load Projection of WL	40
Figure 2. 19 Super Imposed Dead Load on Truss.....	45
Figure 2. 20 Live Load on Truss	45
Figure 2. 21 Wind Load on Truss	46
Figure 2. 22 First Truss	46
Figure 2. 23 Second Truss.....	46
Figure 2. 24 Third Truss	46
Figure 2. 25 Joint with Maximum Axial Force.....	49
Figure 2. 26 Beam Design Flowchart	56
Figure 2. 27 Tie Beam Design Flowchart	70
Figure 2. 28 Column Design Flowchart.....	79
Figure 2. 29 Moment acts on column	82
Figure 2. 30 Largest Moment Capacity.....	85

Figure 2. 31 Shear Force on Column due to Probability Moment of Beam and Column.....	90
Figure 2. 32 Tension (T) and Compression on Beam-Column Joint	90
Figure 2. 33 Slab Type A	92
Figure 2. 34 Interior Slab-Beam Cross-Section	93
Figure 2. 35 Clear Distance Dx and Dy on Slab	93
Figure 2. 36 General Equation for Coefficient of Flexural Resistance (k)	94
Figure 2. 37 Stair Design Flowchart	95
Figure 3. 1 Flowchart of Substructure Design	101
Figure 3. 2 Liquefaction Flowchart.....	104
Figure 3. 3 Bearing Capacity Flowchart	108
Figure 3. 4 Lateral Load Calculation Flowchart	111
Figure 3. 5 Structural Analysis for Point Load	117
Figure 3. 6 Pile Cap Design Flowchart	118
Figure 3. 7 Pile Cap Preliminary Design TYPE 1	119
Figure 3. 8 Pile Cap Preliminary Design TYPE 2	120
Figure 3. 9 Shear Force Diagram of Pile in Ly	121
Figure 3. 10 Shear Force Diagram of Pile in LX	121
Figure 3. 11 Two Way Shear Area.....	123
Figure 3. 12 Pile Design Flowchart	126
Figure 3. 13 Pile Group Width and Length.....	132
Figure 4. 1 Cost and Time Planning Flowchart	136
Figure 4. 2 WBS Diagram.....	137
Figure 4. 3 Start to Finish Diagram.....	143
Figure 4. 4 Start to Start Diagram	143
Figure 4. 5 Finish to Start Diagram.....	144
Figure 4. 6 Finish to Finish Diagram	144
Figure 4. 7 Resource Schedule Diagram.....	145
Figure 4. 8 S Curve	146

LIST OF TABLES

Table 2. 1 Risk Parameter of Building Site.....	11
Table 2. 2 Class Site Classification.....	11
Table 2. 3 Parameters of Structure	12
Table 2. 4 Parameters of Wind Load	16
Table 2. 5 Coefficient Pressure for Wind Load	17
Table 2. 6 Wind Load on Roof Surface	17
Table 2. 7 Design of Response Spectrum	19
Table 2. 8 Static Equivalent Parameter in X direction.....	21
Table 2. 9 Static Equivalent Parameter in Y Direction.....	22
Table 2. 10 Section Properties	24
Table 2. 11 Mass Participating Ratio	30
Table 2. 12 Base Reaction.....	33
Table 2. 13 Torsional Irregularity Check	34
Table 2. 14 Interior Angle Irregularity calculation	34
Table 2. 15 Mass Irregularity Check.....	35
Table 2. 16 Torque Magnification Factor in X Direction	36
Table 2. 17 Torque Magnification Factor in Y Direction	36
Table 2. 18 Purlin Dimension	38
Table 2. 19 Purlin Properties.....	38
Table 2. 20 Purlin Tributary Area	38
Table 2. 21 Top and Bottom Purlin Load	39
Table 2. 22 Middle Purlin Load	39
Table 2. 23 Maximum Loading and Moment of Top and Bottom Purlin	41
Table 2. 24 Maximum Loading and Moment of Middle Purlin.....	41
Table 2. 25 Profile Check for Compact, Non-Compact, and Slender.....	41
Table 2. 26 Formula for λ , λp , and λr	41
Table 2. 27 Purlin Lb, Lp, and Lr for Y Direction.....	42
Table 2. 28 Purlin Lb, Lp, and Lr for X Direction.....	42
Table 2. 29 Moment Design Calculation for Y Direction Load	42
Table 2. 30 Moment Design Calculation for X Direction Load	43
Table 2. 31 Deflection at Y Direction	43

Table 2. 32 Deflection at X Direction	43
Table 2. 33 Sag Rod and Tie Rod Calculation.....	44
Table 2. 34 Truss Profile	44
Table 2. 35 Load Recap on Truss.....	45
Table 2. 36 Truss Axial Force Output.....	47
Table 2. 37 Truss Displacement.....	47
Table 2. 38 Tension Member Check	47
Table 2. 39 Compression Member Check	48
Table 2. 40 Slenderness Check	49
Table 2. 41 Joint with Maximum Axial Force	49
Table 2. 42 Bolt Properties.....	50
Table 2. 43 Shear Strength.....	50
Table 2. 44 Slip Critical Strength.....	51
Table 2. 45 Bearing Strength	51
Table 2. 46 Nominal Moment of Bolt.....	51
Table 2. 47 Weld Connection Calculation	52
Table 2. 48 Anchor Properties	53
Table 2. 49 Reaction and Maximum Load of Truss	53
Table 2. 50 Anchor Shear Strength	53
Table 2. 51 Anchor Compressive Strength	53
Table 2. 52 Anchor Dimension Properties for Shear Checking	54
Table 2. 53 Anchor Spalling Shear Strength in Concrete	54
Table 2. 54 Anchor Pry Out Shear Strength in Concrete	54
Table 2. 55 Anchor Breakout Strength in Concrete	55
Table 2. 56 Anchor Number	55
Table 2. 57 Beam Properties and Dimensions	57
Table 2. 58 Beam Internal Force	58
Table 2. 59 Dimension and Geometry Checking for Beam	58
Table 2. 60 Negative Support Flexural Design	59
Table 2. 61 Positive Support Flexural Design	60
Table 2. 62 Negative Span Flexural Design	61
Table 2. 63 Positive Support Flexural Design	62

Table 2. 64 Shear Internal Force	63
Table 2. 65 Shear Design at Support.....	63
Table 2. 66 Shear Design at Span	65
Table 2. 67 Section Geometry Parameter	65
Table 2. 68 Section Dimension Requirement Check	66
Table 2. 69 Torsion Longitudinal Reinforcement.....	68
Table 2. 70 Beam Reinforcement Recap.....	69
Table 2. 71 Tie Beam Properties.....	70
Table 2. 72 Tie Beam Calculations	71
Table 2. 73 Tie Beam Longitudinal Reinforcement Calculations.....	73
Table 2. 74 Tie Beam Transversal Reinforcement Calculations.....	76
Table 2. 75 Recapitulation of Tie Beam Reinforcement.....	78
Table 2. 76 Material and Section Properties of Column	79
Table 2. 77 Force and Geometry Requirement	80
Table 2. 78 Internal Axial Force and Moment	81
Table 2. 79 Internal Shear Force	81
Table 2. 80 Internal Forces for Axial Checking from SP Column.....	81
Table 2. 81 Strong Column-Weak Beam Check.....	82
Table 2. 82 Plastic Hinge Zone	83
Table 2. 83 Plastic Hinge/Support Transversal Reinforcement	83
Table 2. 84 Plastic Hinge Zone/Support Shear Strength with $fpr = 1.25fy$	85
Table 2. 85 Out of Plastic Hinge Zone/Span Transversal Reinforcement	86
Table 2. 86 Out of Plastic Hinge Zone/Span Shear Strength.....	86
Table 2. 87 Column Reinforcement Recap	88
Table 2. 88 Beam-Column Parameters	88
Table 2. 89 Effective Dimension of Beam-Column.....	89
Table 2. 90 Beam-Column Transversal Requirements	89
Table 2. 91 Shear Strength Check	90
Table 2. 92 Hook Design	91
Table 2. 93 Reinforcement Recap on Beam-Column Joint.....	91
Table 2. 94 Transversal Hook Length.....	91
Table 2. 95 Check Rebar Spacing	92

Table 2. 96 Slab Load	93
Table 2. 97 Slab Reinforcement.....	95
Table 2. 98 Stair Loading.....	96
Table 2. 99 Landing Slab Loading.....	97
Table 2. 100 Landing Slab Dimension and Properties.....	97
Table 2. 101 Landing Slab Load	98
Table 2. 102 Reinforcement Recap and Capacity	98
Table 2. 103 Landing Beam Data	99
Table 2. 104 Landing Beam Load.....	99
Table 2. 105 Landing Beam Reinforcement Recap	99
Table 3. 1 Soil Data from Standard Penetration Test BH1	101
Table 3. 2 Soil Data from Standard Penetration Test BH2	102
Table 3. 3 Cyclic Resistance Ratio (CRR).....	105
Table 3. 4 α and β value	106
Table 3. 5 Cyclic Stress Ratio (CSR).....	106
Table 3. 6 Safety Factor from CRR and CSR	107
Table 3. 7 Tip Strength of Bore Pile	109
Table 3. 8 Skin Stress of Bore Pile	110
Table 3. 9 Moment Capacity of Bore Pile.....	111
Table 3. 10 Lateral Strength of Bore Pile	112
Table 3. 11 Allowed Lateral Strength due to Deflection	113
Table 3. 12 Relative Density for Sand	114
Table 3. 13 Coefficient of Modulus Variation	115
Table 3. 14 Number of Required Pile	115
Table 3. 15 Parameter of Pile Group Efficiency	116
Table 3. 16 Pile Efficiency.....	116
Table 3. 17 Type 1 Pile Dimension and Properties.....	118
Table 3. 18 Type 2 Pile Dimension and Properties.....	119
Table 3. 19 Pile Load TYPE 1	120
Table 3. 20 Pile Load TYPE 2	120
Table 3. 21 Shear Force and Moment in Ly and Lx (Type 1)	122
Table 3. 22 Shear Force and Moment in Lx (Type 2).....	122

Table 3. 23 Concrete Shear Strength for Two Way Shear around Column Type 1	123
Table 3.24 Concrete Shear Strength for Two Way Shear around Column Type 2	123
Table 3.25 Concrete Shear Strength for Two Way Shear around Pile Type 1 ...	124
Table 3. 26 Concrete Shear Strength for Two Way Shear around Pile Type 2 ..	124
Table 3.27 Two Way Shear Concrete Strength (SNI 2847:2019 table 22.2.1b). ..	124
Table 3. 28 Longitudinal Reinforcement at Long Span (Ly and Lx) – Type 1 ..	125
Table 3. 29 Longitudinal Reinforcement at Long Span (Lx) – Type 2.....	125
Table 3. 30 Pile Longitudinal Reinforcement Type 1.....	127
Table 3. 31 Pile Longitudinal Reinforcement Type 2.....	127
Table 3. 32 Spiral Reinforcement TYPE 1	128
Table 3. 33 Spiral Reinforcement TYPE 2	128
Table 3. 34 Cutting Length TYPE 1	129
Table 3. 35 Cutting Length TYPE 2	129
Table 3. 36 Settlement Parameter	130
Table 3. 37 Settlement Calculation	130
Table 3. 38 Group Pile Settlement Parameter.....	132
Table 3. 39 Pile Group Settlement Calculation.....	132
Table 3. 40 Biggest Column Axial Force Difference	133
Table 3. 41 Differential Settlement.....	134
Table 3. 42 Pile Reinforcement Recap Type 1	134
Table 3. 43 Pile Reinforcement Recap Type 2	134
Table 4. 1 Technical Specification.....	139
Table 4. 2 Bill of Quantity for Youth Center Construction	141
Table 4. 3 Table of Resource Usage	144