THE DETAILED DESIGN
ON
PORT REACTIVATION PROJECT IN LAUNION PROVINCE
OF
THE REPUBLIC OF EL SALVADOR

FINAL REPORT

DESIGN CALCULATION REPORT

Utility Works

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**OCTOBER 2002** 

NIPPON KOEI CO., LTD.

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CALCULATION REPORT COTTORER 2002 NIPPON KOE 0 109 728 SF

# JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) COMISION EJECUTIVA PORTUARIA AUTONOMA (CEPA)

# THE DETAILED DESIGN ON PORT REACTIVATION PROJECT IN LAUNION PROVINCE OF THE REPUBLIC OF EL SALVADOR

## FINAL REPORT

## **DESIGN CALCULATION REPORT**

**Utility Works** 

**OCTOBER 2002** 

NIPPON KOEI CO., LTD.

1169702(6)

## WASTEWATER SYSTEM

	DESIGN CALCULATION CO		
Project	Detailed Design on Port Reactivation Project in La Union Province	Project Code	JC1N004/2N001
Section	Utility Works	Calc. File No.	
Sub-Section	Wastewater System	Calc. Index No.	

## Subject:

**Determination of Diameter and Slope for Pipe** 

## **Calculation Objective:**

To calculate and check a hydraulic grade line, discharge volume and velocity of pipeline from the building to wastewater treatment facility.

#### References, Calculation Notes and Comments

**Design Condition** 

1) Velocity within pipe: Maximum 3 m/s, Minimum 0.6 m/s

2) Roughness Coefficient: 0.013 (Concrete Pipe), 0.010 (PVC)

3) Minimum Overburden: Thickness of Pavement with 30cm as clearance

4) Maximum Interval of Manhole: 50 m (D300<)

5) Calculation Model: Manning Formula

$$V = 1/n \times R^{2/3} \times I^{1/2}$$

$$Q = A \times V$$

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	DESIGN CALCULATION CO		
Project	Detailed Design on Port Reactivation Project in La Union Province	Project Code	JC1N004/2N001
Section	Utility Works	Calc. File No.	
Sub-Section	Wastewater System	Calc. Index No.	

#### Subject:

Oil/water Separator-1 for Maintenance and Repair Shop, RTG Repair Yard, Fuel Station and Power Supply External Transformer

#### Calculation Objective:

To determine the size and details of the tank for the Separator

#### References, Calculation Notes and Comments

The formulas and variables applied in the calculation are as follows:

Service Design Flow = Qsv(lit/min) = Ac(m2) x 25 (lit/8 hours/m2)

Rain runoff =Qsr(m3/sec)=CiAc(ha)/360

Rise Rate = Vp = 1.79(dp-dc)d2x10-8/n

Allowable horizontal velocity = Vh = 15Vp, but < 0.05f/s

Surface area = As(m2) = KQ(m3/sec)/Vp(m/sec) = LW

Width = W =  $\sqrt{(As/5)}$ 

Length = L = from 3W to 5W

Depth = D(m) = Qr(m3)/L(m)W(m)

For the design it is assumed that proper BMPs (Best Management

Practices) will be applied for the function of the Shop. Practices such

as not disposing the oil removed from motors into the drainage that

leads to the Oil/water separator.

The details are defined based on models proposed by USEPA and API

Being:

Ac = catchment area

i=130 mm/hour

dp = density of oil (gm/cc), range 0.82 to 0.95, a mean value of 0.9 assumed

dc = density of water (gm/cc), a value was selected from the attached table, being the water temperature of 30°C

d=diameter of the droplet to be removed (μ), a value was assigned assuming an influent of 750mg/l and considering an effluent of 20mg/l, according to salvadoran requirements: NSO 13.07.03:01

C=Runoff coefficient, dimensionless

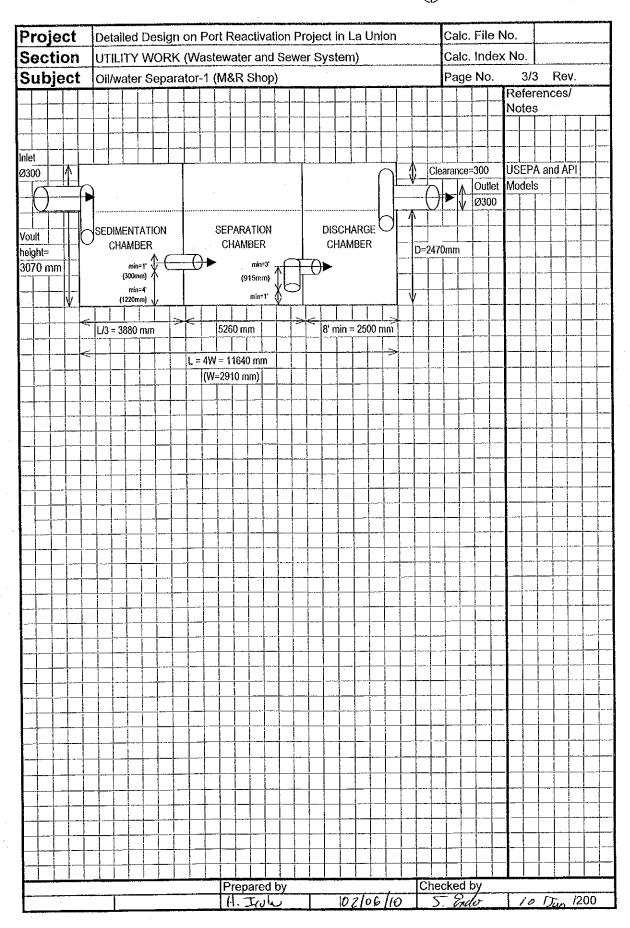
n = absolute viscosity of water (poises), a value was selected from the table attached, being the water temperature of 30°C

K = dimensionless factor describing turbulence, range 1.2 to 2.0, a mean value of 1.5 was assumed

Qr = Retained flow rate, which is defined by the required time of retention (Tr) of Q in the tanks in order to separate the oil.

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	DESIGN CALCULATION CO		
Project	Detailed Design on Port Reactivation Project in La Union Province	Project Code	JC1N004/2N001
Section	Utility Works	Calc. File No.	
Sub-Section	Wastewater System	Calc. Index No.	

#### Subject:

Oil/water Separator-2 for Storm Water Route-A

#### Calculation Objective:

To determine the size and details of the tank for the Separator

#### References, Calculation Notes and Comments

The formulas and variables applied in the calculation are as follows:

2/3 1/2

Design Flow (Manning Formula): Q = Ac x 1/n x R x 1

Rise Rate =  $Vp = 1.79(dp-dc)d^2x10-8/n$ 

Allowable horizontal velocity = Vh = 15Vp, but < 0.05l/s

Surface area = As(m2) = KQ(m3/sec)/Vp(m/sec) = LW

Width =  $W = \sqrt{(As/5)}$ 

Length = L = from 3W to 5W

Depth = D(m) = Qr(m3)/L(m)W(m)

For the design it is assumed that proper BMPs (Best Management

Practices) will be applied for the function of the Shop. Practices such

as not disposing the oil removed from motors into the drainage that

leads to the Oil/water separator.

The details are defined based on models proposed by USEPA and API

Being:

Ac = catchment area

i=60.9 mm/hour (Precipilation Intensity with a return period of one year)

dp = density of oil (gm/cc), range 0.82 to 0.95, a mean value of 0.9 assumed

dc = density of water (gm/cc), a value was selected from the attached table, being the water temperature of 30°C

d=diameter of the droplet to be removed (μ),a value was assigned assuming an influent of 750mg/l and considering an effluent of 20mg/l, according to salvadoran requirements: NSO 13.07.03:01

C=Runoff coefficient, dimensionless

n = absolute viscosity of water (poises), a value was selected from the table attached, being the water temperature of 30°C

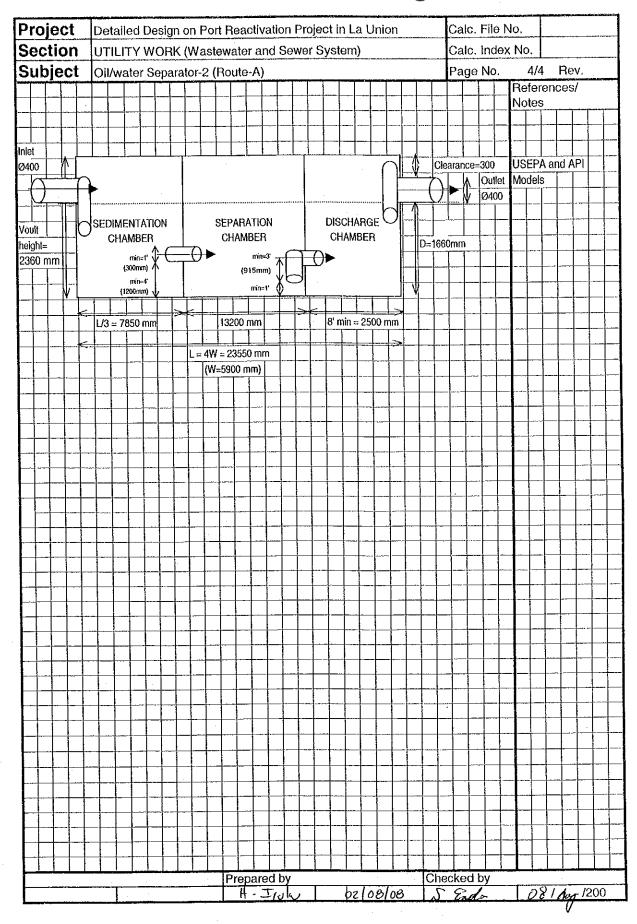
K = dimensionless factor describing turbulence, range 1.2 to 2.0, a mean value of 1.5 was assumed

Qr = Retained flow rate, which is defined by the required time of retention (Tr) of Q in the tanks in order to separate the oil.

	Prep	ared	No. of	Che	cked	Rev	riewed	Superseded
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Project	Detailed Design on Port Reactivation Project in La Union Province	Project Code	JC1N004/2N001
Section	Utility Works	Calc. File No.	
Sub-Section	Wastewater System	Calc. Index No.	

#### Subject:

Oil/water Separator-3 for Storm Water Route-B

#### Calculation Objective:

O.Mouster

To determine the size and details of the tank for the Separator

#### References, Calculation Notes and Comments

The formulas and variables applied in the calculation are as follows:

2/3 1/2

Design Flow (Manning Formula):  $Q = Ac \times 1/n \times R \times 1$ 

Rise Rate =  $Vp = 1.79(dp-dc)d^2x10-8/n$ 

Allowable horizontal velocity = Vh = 15Vp, but < 0.05f/s

Surface area = As(m2) = KQ(m3/sec)/Vp(m/sec) = LW

Width =  $W = \sqrt{(As/5)}$ 

Length = L = from 3W to 5W

Depth = D(m) = Qr(m3)/L(m)W(m)

For the design it is assumed that proper BMPs (Best Management

Practices) will be applied for the function of the Shop. Practices such

as not disposing the oil removed from motors into the drainage that

leads to the Oil/water separator.

The details are defined based on models proposed by USEPA and API

#### Being:

Ac = catchment area

i=60.9 mm/hour (Precipitation Intensity with a return period of 1 year)

dp = density of oil (gm/cc), range 0.82 to 0.95, a mean value of 0.9 assumed

dc = density of water (gm/cc), a value was selected from the attached table, being the water temperature of 30°C

d=diameter of the droplet to be removed (µ), a value was assigned assuming an influent of 750mg/l and considering an effluent of

20mg/l, according to salvadoran requirements: NSO 13.07.03:01

C=Runoff coefficient, dimensionless

n= absolute viscosity of water (poises), a value was selected from the table attached, being the water temperature of 30°C

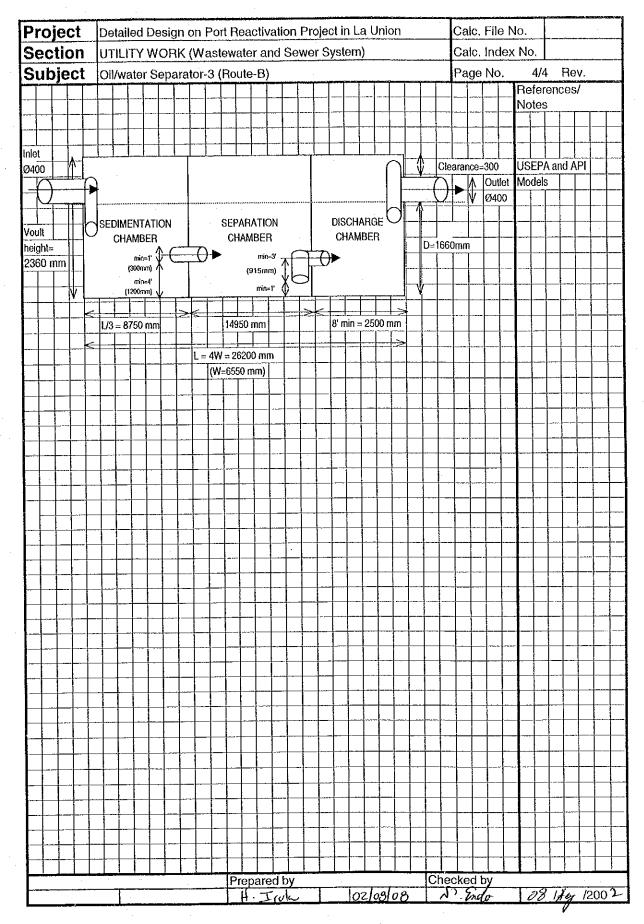
K = dimensionless factor describing turbulence, range 1.2 to 2.0, a mean value of 1.5 was assumed

Qr = Retained flow rate, which is defined by the required time of retention (Tr) of Q in the tanks in order to separate the oil.

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	DESIGN CALCULATION CO		
Project	Detailed Design on Port Reactivation Project in La Union Province	Project Code	JC1N004/2N001
Section	Utility Works	Calc. File No.	
Sub-Section	Wastewater System	Calc. Index No.	

#### **Calculation Objective:**

To determine the size and details of the tank for the Separator

#### References, Calculation Notes and Comments

The formulas and variables applied in the calculation are as follows:

2/3 1/2

Design Flow (Manning Formula):  $Q = Ac \times 1/n \times R \times 1$ 

Rise Rate =  $Vp = 1.79(dp-dc)d^2x10-8/n$ 

Allowable horizontal velocity = Vh = 15Vp, but < 0.05l/s

Surface area = As(m2) = KQ(m3/sec)/Vp(m/sec) = LW

Width =  $W = \sqrt{(As/5)}$ 

Length = L = from 3W to 5W

Depth = D(m) = Qr(m3)/L(m)W(m)

For the design it is assumed that proper BMPs (Best Management Practices) will be applied for the function of the Shop. Practices such as not disposing the oil removed from motors into the drainage that leads to the Oil/water separator.

The details are defined based on models proposed by USEPA and API

#### Being:

Ac = catchment area

i=60.9 mm/hour (Precipitation Intensity with a Return period of 1 year)

dp = density of oil (gm/cc), range 0.82 to 0.95, a mean value of 0.9 assumed

dc = density of water (gm/cc), a value was selected from the attached table, being the water temperature of 30°C

d=diameter of the droplet to be removed (μ), a value was assigned assuming an influent of 750mg/l and considering an effluent of

20mg/l, according to salvadoran requirements: NSO 13.07.03:01

C=Runoff coefficient, dimensionless

n= absolute viscosity of water (poises), a value was selected from the table attached, being the water temperature of 30°C

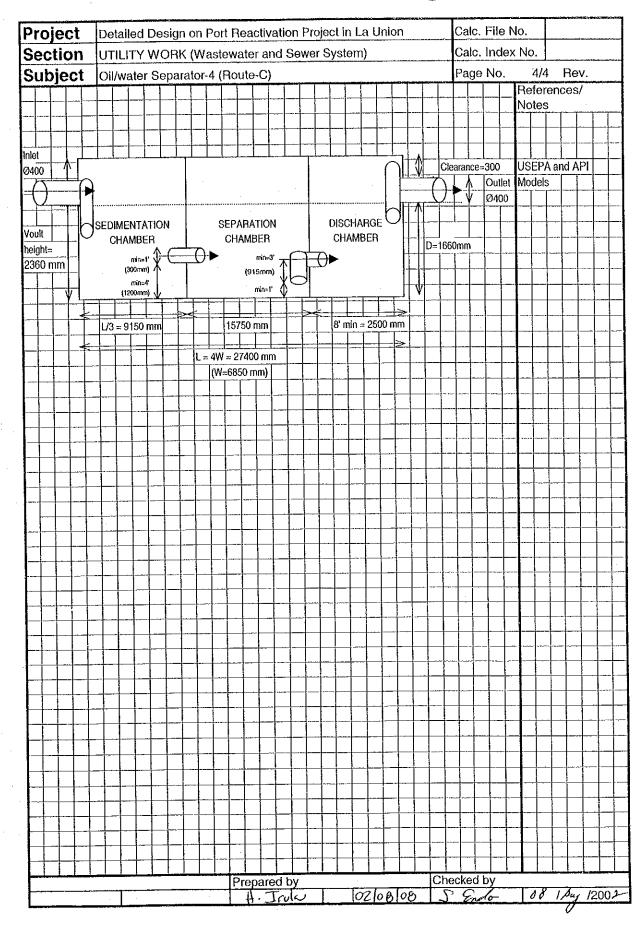
K = dimensionless factor describing turbulence, range 1.2 to 2.0, a mean value of 1.5 was assumed

Qr = Retained flow rate, which is defined by the required time of retention (Tr) of Q in the tanks in order to separate the oil.

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Project	Detailed Design on Port Rea	ctivation Project in La Union	Calc. File No.
	UTILITY WORK (Wastewate	er and Sewer System)	Calc, Index No.
Subject	Oil/water Separator-4 (Route	∍-C)	Page No. 2/4 Rev.
			References/ Notes
CALCULATIONS	FOR STORMWATER DRAINAGE (Res Culvert)		
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CR1 CAS 30 30	0008 0012 09 (09 00% 0006	CP-7 33:00 +5:632 +4:275 0:20 +4:205	0.457 0892 0.151 0.457 0.892 0.131
CA6 CA7 10 20	0.006 0.006 0.006 0.006	CP-R-3 3500 +3637 +4775 029 +4705 CP-R-2 1000 +5632 +4275 020 +4255	0.457 0.807 0.131 0.457 0.807 0.131
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C-6 17 55 C-7 42 56	0139 0159 013 609 0031 0206 0266 0.7 609 0014		
C.8 87 53	0.231 0.231 0.7 609 0.027 0.141 0.141 0.7 609 0.017 0.376	CF-11 87.40 +5136 +3267 9.15 +3076	1.219 1335 1537
C-10 92 174 C-12 25 94	0.00 0.00 0.7 609 0.000 0.00 0.00 0.5 609 0.007 0.005 0.005 609 0.004 6.004	CF-12-1 26 00 +4 973 +7 413 0.20 +7 361	D.610 0591 0281
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C-18 52 93 C-19 23 91	0.91 0.61 0.3 60.9 0.042 0.24 0.24 0.3 60.9 0.024 0.222 0.237 0.85 60.9 0.033 0.033	CP-13-1 2500 447(1 +310: 020 +308	0.610 051 0224
C-20 30 91 C-21 78 33	0227 027 07 609 0007 0215 0213 0.7 609 0025		
C22 53 25 OH Separator i	0.307 0.309 0.85 609 0.000 0.706 0.706	CP-13 28:50 +4711 +2:472 020 +2:454 AP-1 350 +4711 +3:211 034 +3:832	1.219 1.542 1.298 0.400 0.912 0.115
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Project	Detailed Design on Port Reactivation Project in La Union Province	Project Code	JC1N004/2N001
Section	Utility Works	Calc. File No.	
Sub-Section	Wastewater System	Calc. Index No.	
Subject: Oil/water So	eparator-5 for Storm Water Route-D		

## Calculation Objective:

To determine the size and details of the tank for the Separator

References,	Calculation	Notes and	I Comments

The formulas and variables applied in the calculation are as follows:

2/3 1/2

Design Flow (Manning Formula):  $Q = Ac \times 1/n \times R \times 1$ 

Rise Rate = Vp = 1.79(dp-dc)d2x10-8/n

Allowable horizontal velocity = Vh = 15Vp, but < 0.05f/s

Surface area = As(m2) = KQ(m3/sec)/Vp(m/sec) = LW

Width = W =  $\sqrt{(As/5)}$ 

Length = L =from 3W to 5W

Depth = D(m) = Qr(m3)/L(m)W(m)

For the design it is assumed that proper BMPs (Best Management

Practices) will be applied for the function of the Shop. Practices such

as not disposing the oil removed from motors into the drainage that

leads to the Oil/water separator.

The details are defined based on models proposed by USEPA and API

Being:

Ac = catchment area

i=60.9 mm/hour (Precipitation Intensity with a Return period of 1 year)

dp = density of oil (gm/cc), range 0.82 to 0.95, a mean value of 0.9 assumed

dc = density of water (grr/cc), a value was selected from the attached table, being the water temperature of 30°C

d=diameter of the droplet to be removed (µ), a value was assigned assuming an influent of 750mg/l and considering an effluent of 20mg/l, according to salvadoran requirements: NSO 13.07.03:01

C=Runoff coefficient, dimensionless

n = absolute viscosity of water (poises), a value was selected from the table attached, being the water temperature of 30°C

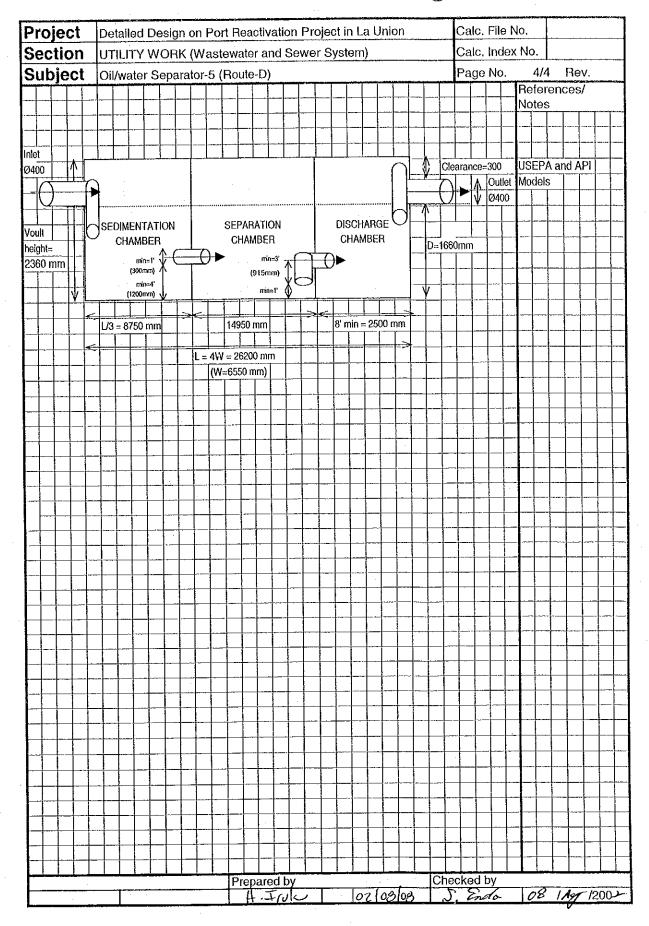
K = dimensionless factor describing turbulence, range 1.2 to 2.0, a mean value of 1.5 was assumed

Qr = Retained flow rate, which is defined by the required time of retention (Tr) of Q in the tanks in order to separate the oil.

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Sub-Section	Waste	water Syst	em	Cald	. Index No.		
Subject:							
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Fuel Statio	n and Pow	er Supply E	xternal Tra	ansformer	ı		
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PROJECT: La Union Port Developme	ent Project.		Calc. File No.		Prepared by	P.17.6
SECTION: Utility Work	CTION: Utility Work BJECT: Structural Design of Oil Separator-1 (M&R Shop)			Aug-02	Checked by Page	5'. Endo 217
SUBJECT: Structural Design of C	DECT. Structural Design of On Separator-1 (Mart Shop)					211
OIL SEPARATOR	0.200	12.840 5,260	0,200	2.50		
			•		-	- -
002						3.710
						0 0 0 0 0
		PLAN				ı
<b> -</b>		12.840				
0.200 3.880	2.470 LIQUID LEVEL			.800	8 0.250	3.070
Weight			•			
Foundation =	45.73 to	1 .	Top Slab =	27.12	ton	
Exterior Walls =	92.84 to	n	Interior Walls =	8.58	ton	
γ liquid =	1.00 to	n/m³	Liquid =	28.75	ton	
γ soil =	1.50 to	n/m³	Soil =	74.72	ton	
Concrete covers =	6.62 to	n	Total weight =	284.4	ton	

PROJECT: La Union Port Development Project.	Calc. File No.		Prepared by	R.M.G
SECTION: Utility Work	Calc. Index No.		Checked by	J. Engli
SUBJECT: Structural Design of Oil Separator-1 (M&R Shop)	Date	Aug-02	Page	3/7

#### **Footing Dimensions**

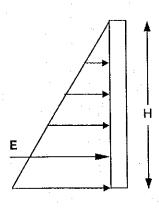
Area = 
$$47.64 \text{ m}^2$$

Soil pressure, 
$$\sigma =$$

5.97 ton/m<sup>2</sup>

0.60 kg/cm<sup>2</sup>

#### a) Exterior Wall design



Earth Pressure (E) =  $1/2 \gamma h^2 ka$ 

$$H = 3.07$$
 m

 $ka = tan(45 + \phi/2)$ 

φ = 30.00 degrees

$$h = 4.47 \text{ m}$$

ka = 0.333

$$\gamma = 1.50$$
 ton/m<sup>3</sup>

$$E = 5.00 \text{ ton/m}$$

Total E = 5.00

ton

Moment at base (ExH/3) = 5.11 ton-m

$$f'c = 280 \text{ kg/cm}^2$$

fy = 4200 kg/cm<sup>2</sup>

h = 40.00 cm

d = 34.37 cm

Mu = 6.99 ton-m

$$fy^2/1.7bf'c As^2 - fyd As + Mu/\phi = 0$$

 $\phi = 0.90$ 

370.59

144333

777039.4

 $As = 5.46 \text{ cm}^2$ 

PROJECT: La Union Port Development Project.

SECTION: Utility Work

SUBJECT: Structural Design of Oil Separator-1 (M&R Shop)

Calc. File No.

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#### Asmin

$$(4/3)$$
Asreq = 7.28 cm<sup>2</sup>

$$(14/fy) b d = 11.46 cm^2$$

#### Asmax:

$$\rho b = 0.0459$$

Asmax 
$$(0.75\rho b) = 118.43$$
 cm<sup>2</sup>

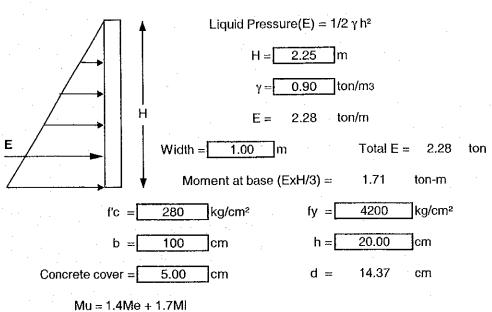
$$As = 7.28$$
 cm<sup>2</sup> o.k!! As < Amax

Bar area (Av) = 
$$1.27$$
 cm<sup>2</sup>

# of bars = 
$$5.75$$

4 17.40 cm

#### b) Interior Wall design



$$Mu = 3.19$$
 ton-m

$$fy^2/1.7bf'c As^2 - fyd As + Mu/\phi = 0$$

$$\phi = 0.90$$

PROJECT: La Union Port Development Project.	Calc. File No.		Prepared by	RMG
SECTION: Utility Work	Calc. Index No.		Checked by	S Endo
SUBJECT: Structural Design of Oil Separator-1 (M&R Shop)	Date	Aug-02	Page	5/7

370.59

60333

354375

6.10 cm² As =

Asmin

(4/3)Asreq =

8.14 cm<sup>2</sup>

Use Asmin = 4.79 cm<sup>2</sup>

(14/fy) b d =4.79 cm<sup>2</sup>

Asmax:

 $\rho b =$ 

0.0459

Asmax  $(0.75 \rho b) =$ 49.50 cm<sup>2</sup>

As = 6.10 cm<sup>2</sup> o.k!! As < Amax

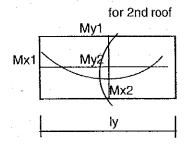
Bar N =

Bar area (Av) = 1.27 cm<sup>2</sup>

# of bars = 4.82 Spacing = 20.76

20.00 cm

#### c) Top Slab design



d =

fc =

fy =

19.35 cm

210 kg/cm2

4200 kg/cm2

2.9 m 5.3 m

ly/lx=

1.8

25 cm

coefficient of bend (thioretical result fix end)

 $Mx1/(w lx^2) =$  $Mx2/(w lx^2) =$  0.082

 $My1/(w lx^2) =$  $My2/(w lx^2) =$  0.040 0.057 0.010

wDL= wLL=

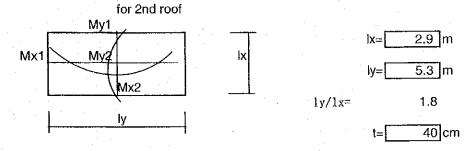
2.325 t/m2 0.610 t/m2

OJECT: La Union I	ort Development Proje	ect.	Calc. File No.		Prepared by	R.M.G
CTION: Utility W	TION: Utility Work				Checked by	S Ende
JBJECT: Structur	al Design of Oil Sepa	arator-1 (M&R Shop	) Date	Aug-02	Page	6/7
DL	•	LL				
Mx1=	1.61 tm/m	Mx1=	0.42	2 tm/m		
Mx2=	0.79 tm/m	Mx2=	0.2	l tm/m		
My1=	1.12 tm/m	My1=	0.29	9 tm/m		
My2=	0.20 tm/m	My2=	0.0	5 tm/m		
1.4DL+1.7Ll	La de Agrada de Caractería.	fy2/1.7bfc' fyd	Mu/f			, ·
Mx1=	2.98 tm/m	494.1 812	270 331144.1	1 As=	4.18	cm²/m
Mx2=	1.45 tm/m	494.1 812	270 161533.71	2 As=	2.01	cm²/m
My1=	2.07 tm/m	494.1 812	270 230185.5	4 As=	2.88	cm²/m
` My2=	0.36 tm/m	494.1 812	270 40383.42	8 As≔	0.50	cm²/m

		Short Span	Long Span			
	Use Bar	Area	Pitch	Use Bar	Area cm2	Pitch cm
End	4	cm2 1.27	cm 30.3	3	0.71	24.7
Center	3	0.71	35.4	3	0.71	143.0

#### d) Bottom Slab design

DL Mx1= Mx2= My1= My2=



coefficient of bend (thioretical result fix end)

				Mx1/(	w lx²) =	0.082	
	d =	34.35 cm		Mx2/(	w lx²) =	0.040	
	fc =	210 kg/cm2		My1/(	$w lx^2) =$	0.057	
	fy = ' '	4200 kg/cm2		My2/(	$w lx^2) =$	0.010	
				wDL=	6.00	t/m2	
				wLL=	0.61	t/m2	
•			LL				
	4.17 tm/m		Mx1=		0.42 tm/m		
	2.03 tm/m	4.4	Mx2=		0.21 tm/m		
	2.90 tm/m		My1=		0.29 tm/m		
-	0.51 tm/m		My2=		0.05 tm/m		

PROJECT: La Union Port Development Project.	Calc. File No.		Prepared by	R.M.G
SECTION: Utility Work	Calc. Index No.		Checked by	J. Grav
SUBJECT: Structural Design of Oil Separator-1 (M&R Shop)	Date	Aug-02	Page	7/7
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1.4DL+1.7	LL	fy2/1.7bfc¹	fyd	Mu/f		
Mx1=	6.55 tm/m	494.1	144270	728100.411 As=		5.14 cm²/m
Mx2=	3.20 tm/m	494.1	144270	355170.932 As=		2.48 cm²/m
My1≔	4.56 tm/m	494.1	144270	506118.578 As=	•	3.55 cm²/m
My2=	0.80 tm/m	494.1	144270	88792.733 As=		0.62 cm <sup>2</sup> /m

	Short Span				Long Span				
	Use Bar	Area	1	Pitch		Use Bar	Area		Pitch
		cm2	. •	cm			cm2		cm
End	4		1.27		24.7	4		1.27	35.7
Center	4		1.27		51.0	4		1.27	205.4

	:				PPOIN NO	CI CO., EID.
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Section	Utility Works		Cal	c. File No.		
Sub-Section	Wastewater Sys	stem	Cal	c. Index No.		
Subject: Oil/water S	eparator-2 for Storm	n Water Dra	inage Rοι	ıte-A		
* . * .				. :		
Calculation C	Objective:	·				
To determine	the structural arrangemen	t of the tank fo	0;I/iVi-tor or the Separa			
References, Calcul	ation Notes and Commen	ts				
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Prep	pared No. of	Che	cked	Revi	ewed	Superseded
Rev	Date Pages	by	Date	by	Date	by Calc No.
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SECTION: Utility Work Calc. Index No. Check SUBJECT: Structural Design of Oil Separator-2 (Route A) Date Aug-02 Page	ked by 5, End ~
SUBJECT: Structural Design of Oil Separator-2 (Route A)   Date   Alig-02   Page	
	2/1
OIL/WATER SEPARATOR - 2 (ROUTE A)	
24 750	
0,490 7,850 0,200 13,300 0,2	00 2 500 0,400
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
00000	1
PLAN	
24,750	i .
0 200	
ELEVATION Weight	
Foundation = 159.19 ton Interior Walls = 13.37 ton	
Exterior Walls = 150.38 ton Liquid = 39.09 ton	
$\gamma$ liquid = 1.00 ton/m <sup>3</sup> Soil = 532.97 ton	
$\gamma \text{ soil} = \boxed{1.50 \text{ ton/m}^3}$ Traffic load = $\boxed{0.61 \text{ ton/m}}$	m²
Concrete covers = 12.73 ton Traffic load = 101.15 ton	4.
Top Slab = 116.28 ton Total weight = 1125.2 ton	

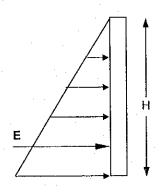
PROJECT: La Union Port Development Project.	Calc. File No.		Prepared by	R.Martinez
SECTION: Utility Work	Calc. Index No.		Checked by	S. Sido
SUBJECT: Structural Design of Oil Separator-2 (Route A)	Date	Aug-02	Page	3/7

#### **Footing Dimensions**

Area = 
$$165.83 \text{ m}^2$$

Soil pressure, 
$$\sigma = 6.79$$
 ton/m<sup>2</sup>  $0.68$  kg/cm<sup>2</sup>

#### a) Exterior Wall design



Earth Pressure (E) = 
$$1/2 \gamma h^2 ka$$

$$\phi = 30.00$$
 degrees

$$h = 4.57 \text{ m}$$

$$\gamma = 1.50$$
 ton/m<sup>3</sup>

Moment at base (ExH/3) = 4.59 ton-m

$$h = 40.00$$
 cm

$$Mu = 8.16$$
 ton-m

$$fy^2/1.7bf'c As^2 - fyd As + Mu/\phi = 0$$

$$\phi = 0.90$$

$$494.12 \text{ As}^2 - 144333 \text{As} + 907084 = 0$$

$$As = 6.43 \text{ cm}^2$$

PROJECT: La Union Port Development Project.	Calc. File No.		Prepared by	R.Martinez
	Calc. Index No.		Checked by	S. Golo
SUBJECT: Structural Design of Oil Separator-2 (Route A)	Date	Aug-02	Page	4/7

#### Asmin

$$(4/3)$$
Asreq = 8.57 cm

$$(14/fy)$$
 b d =  $11.46$  cm<sup>2</sup>

#### Asmax:

$$\rho b = 0.0345$$

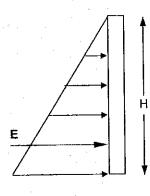
Asmax 
$$(0.75 \text{pb}) = 88.82 \text{ cm}^2$$

$$As = 8.57 \text{ cm}^2$$

#### o.k!! As < Amax

Bar area 
$$(Av) = 1.27$$
 cm<sup>2</sup>

#### b) Interior Wall design



Liquid Pressure(E) = 
$$1/2 \gamma h^2$$

$$\gamma = 0.90$$
 ton/m<sup>3</sup>

$$fc = 210 \text{ kg/cm}^2$$

$$fy = 4200 \text{ kg/cm}^2$$

$$d = 14.37$$
 cm

$$Mu = 1.4Me + 1.7Ml$$

$$Mu = 1.74$$
 ton-m

$$fy^2/1.7bfc As^2 - fyd As + Mu/\phi = 0$$

$$\phi = 0.90$$

PROJECT: La Union Port Development Project.	Calc. File No.		Prepared by	
SECTION: Utility Work	Calc. Index No.		Checked by	
SUBJECT: Structural Design of Oil Separator-2 (Route A)	Date	Aug-02	Page	5/7

3.29 As = cm<sup>2</sup>

Asmin

(4/3)Asreq = 4.38 cm<sup>2</sup>

Use Asmin = 4.38 cm<sup>2</sup>

(14/fy) b d = 4.79 cm²

Asmax:

ρ**b** = 0.0345

> Asmax (0.75pb) =37.13 cm<sup>2</sup>

o.k!! As < Amax As= 4.38 cm<sup>2</sup>

Bar N =

Bar area (Av) = 1.27cm²

# of bars = 3.46

28.92 Spacing = cm

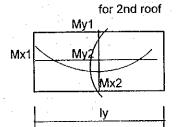
Use N 4 @ 28.00 cm

25.37 cm

210 kg/cm2

4200 kg/cm2

#### c) Top Slab design



d =

fc =

fy =

5.9 m 13.2 m

ly/lx= 2.2

30 cm

## coefficient of bend (thioretical result fix end)

 $Mx1/(w lx^2) =$ 

0.08 0.041 0.042 0.010

 $Mx2/(w lx^2) =$  $My1/(w lx^2) =$ 

 $My2/(w lx^2) =$ 

2.985 t/m2

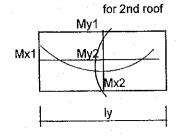
wDL≃ wLL=

0.610 t/m2

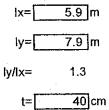
ort Development Pro	ect.		Calc. File No.		Prepared by	R.Martine:
			Calc. Index No.		Checked by	S. Godo
	oarator-2 (Route	e A)	Date	Aug-02	Page	6/7
		1			•	
			1.70	tria lua		
8,31 tm/m						
4.26 tm/m	i,	/lx2=				
4.36 tm/m	Ŋ	/ly1=	0.89	tm/m		
1.04 tm/m	. 4	√ly2=	0.21	tm/m		4
_	fy2/1.7bfc'	fyd	Mu/f			
14.53 tm/m	494.1	106533	1613946.31	As=	16,40	cm²/m
	494.1	106533	827147.484	As=	8.07	cm²/m
	494.1	106533	847321.813	As=	8.27	cm²/m
1.82 tm/m	494.1	106533	201743.289	As=	1,91	cm²/m
	8.31 tm/m 4.26 tm/m 4.36 tm/m 1.04 tm/m 1.4.53 tm/m 7.44 tm/m 7.63 tm/m	Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Route   Rout	LL	Calc. Index No.   Date	Calc. Index No.   Date   Aug-02	Calc. Index No.   Checked by

	Short Span			Long Span			
	Use Bar	Area cm2	Pitch cm	Use Bar	Area cm2	Pitch cm	
End	5	1.98	. 12.1	4	1.27	15.3	
Center	4	1.27	15.7	3	0.71	37.3	

# d) Bottom Slab design







# coefficient of bend (thioretical result fix end)

		$Mx1/(w lx^2) =$	0.064
d =	34.37 cm	$Mx2/(w lx^2) =$	0.030
fc =	210 kg/cm2	$My1/(w lx^2) =$	0.042
fy =	4200 kg/cm2	$My2/(w lx^2) =$	0.010

wDL=	6.18	
wLL=	0.61	]t/m2

DL		LL	4.4
Mx1=	13.76 tm/m	Mx1=	1.36 tm/m
Mx2=	6.45 tm/m	Mx2=	0.64 tm/m
Mv1=	9.03 tm/m	My1=	0.89 tm/m
My2=	2.15 tm/m	My2=	0.21 tm/m
		_	4

PROJECT: La Union Port Development Project.	Calc. File No.		Prepared by	R.Martinez
SECTION: Utility Work	Calc. Index No.		Checked by	5 Godo
SUBJECT: Structural Design of Oil Separator-2 (Route A)	Date	Aug-02	Page	7/7

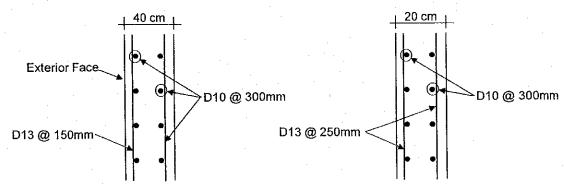
1.4DL+1.7L	L	fy2/1.7bfc'	fyd	Mu/f	
Mx1=	21.57 tm/m	494.1	144333	2396743,62 As=	17.68 cm²/m
Mx2=	10.11 tm/m	494.1	144333	1123473,57 As=	8,00 cm²/m
Mv1=	14.16 tm/m	494.1	144333	1572863 As=	11.34 cm²/m
My2=	3.37 tm/m	494.1	144333	374491.19 As=	2.62 cm²/m

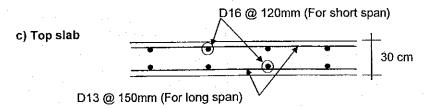
	Short Span			Long Span			
	Use Bar	Area	Pitch	Use Bar	Area	Pitch	
		cm2	cm		cm2	cm	
End	5	1.98	11.2	4	1.27	11.2	
Center	4	1.27	15.8	4	1.27	48.4	

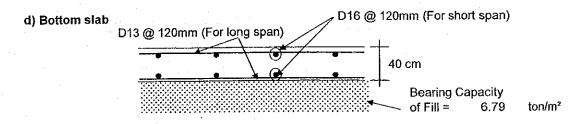
#### STEEL REINFORCEMENT

## a) Exterior wall

## b) Interior wall







	DE	SIGN CA	LCULATI	ON COV	ER SHEE	T	
Project	Detailed I	Design on Por in La Union		Project Pr	oject Co	de JC	1N004/2N001
Section	Utility '	Works		Ca	lc. File No.		
Sub-Section	Waste	water Sys	tem	Ca	lc. Index No.		
Subject:							
Oil/water	Separator-3	8 & 5, for S	torm Wate	r Drainage	e Route-B	& D	
				•			
	:				:		
Calaulatian	Ohioativa						·
Calculation	Objective	•				•	
							•
To determine	e the structural	arrangement	of the tank fo	o.Vutvor or the Separa			
10 doternine	, the structural	anangomon	or the tallete	n the copula			
	,						
References, Calcu	ulation Notes a	ind Comments	<u>S</u>				
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by	Date	Pages	by	Date	by	Date	by Calc No.
0 R.M.G.		7	S. Endo	08 Ay,02	BF7	12 July 02	<u> </u>
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	<b>W</b>	MILLO	4 WOLL C	.,,
ROJECT: La Union Port Development Project.	Calc. File No.		Prepared by	
CTION: Utility Work	Calc. Index No.		Checked by	1.62.
BJECT: Design of Oil Separator-3&5 (Route B&D)	Date	Aug-02	Page	2/7
OIL/WATER SEPARATOR - 3 & 5 (ROUTE B & D)			·	<del>7</del>
100 9750 220	14920		200 2399 199	
8 [1]			1	
1233	( <del>1)</del>			
	<del>_</del>		-!	- C
D M				
PLAN				
	1	9	. 1	
				270
\$			L	\$
	- p30			32
5 5 - 88 9			The second second	
8				
ELEVATION	•			
Weight				•
Foundation = 193.33 ton	Interior Walls =	14.84	ton	
Exterior Walls = 153.83 ton	Liquid =	= 43.49	ton	
	Cail -	= 579.39	ton	
$\gamma$ liquid = 1.00 ton/m <sup>3</sup>	2011 =	- 519.39	OH	
$\gamma \text{ soil} = 1.50 \text{ ton/m}^3$	Traffic load =	0.61	_ton/m²	
Concrete covers = 15.02 ton	Traffic load =	= 122.85	ton	
Top Slab = 141.89 ton	Total weight	= 1264.6	ton	

SECTION: Utility Work   Calc. In	ndex No.	Checked by	S. G.do
SUBJECT: Design of Oil Separator-3&5 (Route B&D) Date	Aug-0	2 Page	3/7

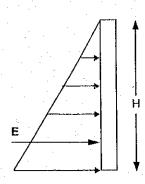
### Footing Dimensions

Soil pressure, 
$$\sigma =$$

ton/m²

0,63 kg/cm<sup>2</sup>

# a) Exterior Wall design



Earth Pressure (E) =  $1/2 \gamma h^2 ka$ 

ka = tan(45+φ/2)

 $\phi = 30.00$  degrees

ka = 0.333

E = 6.78 ton/m (Earth+Traffic pressure)

ton

$$fc = 210 \text{ kg/cm}^2$$

$$fy = 4200 \, kg/cm^2$$

$$Mu = 9.49$$
 ton-m,

fy²/1.7bfc As² - fyd As + Mu/
$$\phi = 0$$

$$\phi = 0.90$$

$$494.12 \text{ As}^2 - 144333 \text{As} + 1054326 = 0$$

$$As = 7.50 \text{ cm}^2$$

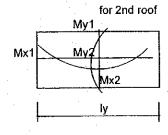
OJECT: La Union Port Development Project.	Calc. File No.		Prepared by	R.Martine
CTION: Utility Work	Calc. Index No.		Checked by	S. Indo
IBJECT: Design of Oil Separator-3&5 (Route B&D)	Date	Aug-02	Page	4/7
Asmin				
(4/3)Asreq = 10.00 cm² Use Asmin	= 10.00	cm²		
$(14/fy) b d = 11.46 cm^2$				
Asmax: $\rho b = 0.0345$				
Asmax (0.75pb) = 88.82 cm²	÷			
	s < Amax			
Bar N = 4	Bar area (Av) =	1.27	cm²	
# of bars = 7.89 Spacing	= 12.67	cm		
Use N 4 @ 12.7 cm				•
b) Interior Wall design	i			
Liquid Pressure(E)	= 1/2 γ h²			
H = 1.66	m			
$ \begin{array}{c cccc}  & & & & & & & & & \\  & & & & & & & \\  & & & &$	ton/m3			
Width = 1.00 m	Total E	= 1.24	ton	
Moment at base (ExH/3)	= 0.69	ton-m		
$fc = 210 \text{ kg/cm}^2$ fy	= 4200	kg/cm²		٠
<u></u>	= 20.00	cm		
Concrete cover = 5.00 cm d  Mu = 1.4Me + 1.7Ml	= 14.37	cm		•
Mu = 1.4We + 1.7Wii	ton-m			

		MIPPON KOEI CO.,LTI			
PROJECT: La Union Port Development Project.	Calc. File No.		Prepared by		
SECTION: Utility Work	Calc. Index No.		Checked by	S. Godo	
SUBJECT: Design of Oil Separator-3&5 (Route B&D)	Date	Aug-02	Page	5/7	
494.12 As <sup>2</sup> - 60333 As+ 192892 = 0					
$As = 3.29 \text{ cm}^2$	·				
Asmin	·.				
(4/3)Asreq = 4.38 cm <sup>2</sup> Use Asmin =	4.38	cm²			
(14/fy) b d = 4.79 cm <sup>2</sup>				•	
Asmax : ρb = 0.0345				·	
Asmax $(0.75 \text{pb}) = 37.13 \text{ cm}^2$					
As = 4.38 cm <sup>2</sup> o.k!! As	< Amax	· .	•		
	ar area (Av) =	1.27	cm²		
# of bars = 3.46 Spacing =	28.92	cm	. '		
Use N 4 @ 28.00 cm					
c) Top Slab design					
for 2nd roof My1					
Mx1 My2 ix	lx=	6.55	]m		
Mx2	ly=	14.95			
ly ly	ly/lx=				
	=}		]cm		
d = 25.37 cm	nt of bend (thic Mx1/(w lx²) Mx2/(w lx²)	· =	0.08 0.041		
fc = 210 kg/cm2 fy = 4200 kg/cm2	My1/(w lx²) My2/(w lx²)		0.042	}	
	wDL= wLL=	3.431 0.610			

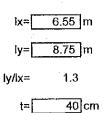
100				9		. , , , , , , , , , , , , , , , , , , ,	
PROJECT: La Union F	Port Development Pro	oject.		Calc. File No.		Prepared by	R.Martinez
SECTION: Utility Wo				Calc. Index No.		Checked by	S. Endi
SUBJECT: Design of		(Route B&D	)	Date	Aug-02	Page	6/7
51			LL				
DL Mx1=	11.77 tm/m		Mx1=	2.09	tm/m	•	
Mx2=	6.03 tm/m		Mx2=	1.07	tm/m		
My1=	6.18 tm/m		My1=	,	tm/m		•
My2=	1.47 tm/m		My2=	0.26	tm/m		
1.4DL+1.7Ll	_	fy2/1.7bfc'	fyd	Mu/f			
Mx1≕ [	18,26 tm/m	494.1	106533	2029269.18	As=	21.12	cm²/m
Mx2=	10.27 tm/m	494.1	106533	1141338.54	As=	11.31	cm²/m
My1=	10.52 tm/m	494.1	106533	1169176.07	As=	11,60	cm²/m
My2=	2.51 tm/m	494.1	106533	278375.255	as.	2.65	cm²/m

		Short Span	Long Span				
	Use Bar	Area cm2	Pitch cm	Use Bar	Area cm2	Pitch cm	
End	5	1,98	9.4	4	1.27	10.9	
Center	4	1.27	11.2	3	0.71	26.9	

## d) Bottom Slab design







## coefficient of bend (thioretical result fix end)

		000111010111 01 20112 (011101011111	
	•	$Mx1/(w ix^2) =$	0.064
d =	35.37 cm	$Mx2/(w lx^2) =$	0.030
fc =	210 kg/cm2	$My1/(w lx^2) =$	0.042
fy =	4200 kg/cm2	$My2/(w lx^2) =$	0.010
-	. · · · · · · · · · · · · · · · · · · ·		

wDL=	5.67	t/m2
wLL≔	0.61	t/m2

DL		LL	
Mx1=	15.57 tm/m	Mx1=	1.67 tm/m
Mx2=	7.30 tm/m	Mx2=	0.79 tm/m
Mv1=	10.22 tm/m	My1=	1.10 tm/m
My2≈	2.43 tm/m	My2=	0.26 tm/m

						. (@	NIPPO	N KOEI C	O.,LTD.
PROJECT: La Union	Port Develo	pment l	Projec	et.		Calc, File No.	:	Prepared by	R.Martine:
SECTION: Utility W	/ork	:				Caic. Index No		Checked by	S. Endo
SUBJECT: Design	of Oil Sepa	rator-3	&5 (F	Route B&D		Date	Aug-02	Page	7/7
1.4DL+1.7L Mx1= Mx2= My1= My2=	L 23,22 11.55 16.17	tm/m tm/m	Span	fy2/1.7bfc' 494.1 494.1 494.1 494.1 Pitch	fyd 148533 148533 148533	Mu/f	7 As= 7 As= 8 As=	18.51 8.90 12.63	cm²/m cm²/m cm²/m cm²/m
End	5		1.98	10.7	4	1.2		1 .	
Center	4		1.27	14.2	4	1.2		1	
100,1101	<u> </u>	I <u></u>	• • • •		·			<b>_1</b>	
		STEE	L REI	NFORCEM	ENT				
a) Exterior	wall	•				b) Interior	wall		
Exterior Face D13 @ 125mm	40 cm		D10		13 @ 250m			≻D10 @ 300	mm
c) Top sla	b -		<del> (</del>	D16 @ 1	00mm (Fo	or short span	) 0 cm		
	D13 @ 100	mm (Fo	or lon	g span)	<u>"</u>				
d) Bottom	slab D13	@ 100n	nm (F	or long spa	in)			short span)	
	<b>1</b>	•		· \	<u>*</u>	. 4	0 cm  Bearing  of Fill =	Capacity 6.28	ton/m²

	DESIGN CAL	CULATIO	N COVE	R SHEET		
Project	Detailed Design on Port in La Union		roject Pro	ject Coc	le JC1N	N004/2N001
Section	Utility Works		Calc	File No.		
Sub-Section	Wastewater Syst	tem	Calc	. Index No.		
Subject: Oil/water S	eparator-4 for Storm \	Nater Draina	age Route	-C		
					:	
Calculation C	biective:					
	the structural arrangement		0\\/W≎1e/ he Separato	or		
References, Calcul	ation Notes and Comments				•	
					·	
				·		· .
Rev Prep	pared No. of	Check			ewed	Superseded
by	Date Pages	by	Date	by	Date	by Calc No.
0 R.M.G.	7	S. Endo 1	8 Ayrov	15 FT	127 (gr)	
A S. Gentle					ļ	

PROJECT: La Union Port Development Project.	Calc. File No.		Prepared by	
SECTION: Utility Work SUBJECT: Design of Oil Separator-4 (Route C)	Calc. Index No. Date	Aug-02	Checked by Page	J. Gods- 217
OIL/WATER SEPARATOR - 4 (ROUTE C)	Joaco	rug-02	<u> </u>	1 <u>-7-</u>
28 600				
0,000 9150 0,200	15.750		0,700 2,500 0,4	03
00 00 11 11 12 12 12 12 12 12 12 12 12 12 12	11			
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0				
23.600				
2 453	CL = 4.77)		2 2 3 5 6 7 6 7 6 7 6 7 6 7 6 7 6 7 6 7 6 7 6	
			8	
ELEVATION Weight				
Foundation = 210.04 ton	Interior Walls =	15.52	ton	
Exterior Walls = 160.63 ton		45.48		
$\gamma$ liquid = 1.00 ton/m <sup>3</sup> $\gamma \text{ soil = 1.50 ton/m}^3$	Soil = Traffic load =	661.56	ton ton/m²	
Concrete covers = 15.57 ton	Traffic load =		<b>-</b>	
Top Slab = 158.54 ton	Total weight =	1400.8	ton	

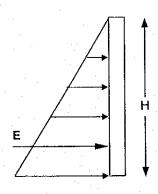
PROJECT: La Union Port Development Project.	Calc. File No.		Prepared by	R.Martinez
SECTION: Utility Work	Calc. Index No.		Checked by	S. Endo
SUBJECT: Design of Oil Separator-4 (Route C)	Date	Aug-02	Page	3/7

## **Footing Dimensions**

$$B = 7.65$$
 m

0.64 kg/cm<sup>2</sup>

#### a) Exterior Wall design



Earth Pressure (E) = 1/2 γ h² ka

 $ka = tan(45+\phi/2)$ 

 $\phi = 30.00$  degrees

$$h = 5.06 \text{ m}$$

$$\gamma = 1.50$$
 ton/m<sup>3</sup>

E = 7.02 ton/m (Earth+Traffic pressure)

Moment at base (ExH/3) = 5.52 ton-n

$$fc = 210 \text{ kg/cm}^2$$

$$fy = 4200 \text{ kg/cm}^2$$

$$d = 34.37$$
 cm

$$fy^2/1.7bfc As^2 - fyd As + Mu/\phi = 0$$

$$\phi = 0.90$$

$$494.12 \text{ As}^2 - 144333 \text{As} + 1091771 = 0$$

$$As = 7.77 \text{ cm}^2$$

PROJECT: La Union Port Development Project.	Calc. File No.		Prepared by	R.Martinez
SECTION: Utility Work	Calc. Index No.		Checked by	S. Endo
SUBJECT: Design of Oil Separator-4 (Route C)	Date	Aug-02	Page	4/7

#### Asmin

$$(4/3)$$
Asreq = 10.36 cm

$$(14/fy) b d = 11.46 cm^3$$

#### Asmax:

$$\rho b = 0.0345$$

Asmax 
$$(0.75 pb) = 88.82 cm^2$$

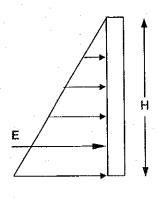
$$As = 10.36 \text{ cm}^2$$

#### o.k!! As < Amax

Bar area (Av) = 
$$1.27$$
 cm<sup>2</sup>

Use N 4 @ 12.2 cm

## b) Interior Wall design



Liquid Pressure(E) = 
$$1/2 \gamma h^2$$

$$\gamma = 0.90$$
 ton/m3

ton-m

$$f'c = 210 \text{ kg/cm}^2$$

$$fy = 4200 \text{ kg/cm}^2$$

$$Mu = 1.74$$
 ton-m

$$fy^2/1.7bf'c As^2 - fyd As + Mu/\phi = 0$$

$$\phi = 0.90$$

PROJECT: La Union Port Development Project.	Calc. File No.		Prepared by	R.Martinez
SECTION: Utility Work	Calc. Index No.		Checked by	S. Endo
SUBJECT: Design of Oil Separator-4 (Route C)	Date	Aug-02	Page	5/7

$$494.12 \text{ As}^2 - 60333 \text{ As} + 192892 = 0$$

 $As = 3.29 \text{ cm}^2$ 

Asmin

(4/3)Asreq = 4.38 cm<sup>2</sup>

Use Asmin = 4.38 cm<sup>2</sup>

 $(14/fy) b d = 4.79 cm^2$ 

Asmax :

 $\rho b = 0.0345$ 

Asmax  $(0.75 \text{pb}) = 37.13 \text{ cm}^2$ 

As = 4.38 cm<sup>2</sup> o.k!! As < Amax

Bar N = 4

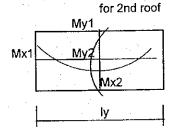
Bar area (Av) = 1.27 cm<sup>2</sup>

# of bars = 3.46

Spacing = 28.92 cm

Use N 4 @ 28.00 cm

## c) Top Slab design



d=

fc =

fy =

25.37 cm

210 kg/cm2

4200 kg/cm2

lx

lx= 6.85 m ly= 15.75 m

ly/lx= 2.3

t= 30 cm

## coefficient of bend (thioretical result fix end)

 $Mx1/(w | x^2) = Mx2/(w | x^2) =$ 

0.0

 $My1/(w lx^2) = My2/(w lx^2) =$ 

0.041 0.042 0.010

wDL= wLL= 3.575 t/m2 0.610 t/m2

							4 1 4		
							MIPPO	A KOEI CO	D.,LTD.
ROJEC	T: La Union	Port Develop	nent Project	i.		Calc. File No.		Prepared by	R.Martine
ECTIC	N: Utility W	/ork			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Calc. Index No.		Checked by	S. End
		of Oil Separa	ator-4 (Rou	ite C)		Date	Aug-02	Page	6/7
	DL.				LL				
	Mx1=	13.42 tı	m/m		Mx1=	2.29	tm/m		
	Mx2=	6.88 tı	m/m		Mx2=	1.17	tm/m		
	My1≔	7.04 tı	m/m		My1=		tm/m		
	My2=	1.68 ti	m/m		My2=	0.29	tm/m		
	1.4DL+1.7L	1 .		fy2/1.7bfc'	fyd	Mu/f		•	
	Mx1=	20.73 ti	m/m	494.1		2303498.52	As=	24.38	cm²/m
	Mx2=	11.62 ti		494.1		1291376.54			cm²/m
	My1=	11.91 ti		494.1		1322873.53			cm²/m
	My2≃	2.83 ti		494.1	106533				cm²/m
						1.1.1		4.	
		5	Short Span	-		Long Span		]	
				Pitch	Use Bar	Area	Pitch	]	, -
	ļ	l lo	m2	cm		cm2	cm		
	End	5	1.98	8.1	4	1.27		1	
	Center	5	1.98	15.4	3	0.71	23.8	<u> </u>	
	d) Bottom	Slab design							
			or 2nd roof						. · ·
		My1	<i></i>		-			<b>,</b>	
÷		l X			ļ	lx=	6.85	]m	
	Mx1	My2		lx				<b>1</b>	
		1				ly=	9.15	]m	
			VIx2		Ĺ	ly/lx=	1.3	!	
		1 1	у	1		iy/ix-	1.0		
		<del>                                     </del>	<u>y</u>			t=	40	cm	
						·			
					coefficien	nt of bend (thic		ult fix end)	
•						Mx1/(w lx²)	) = '	0,064	]
		d =	35.37	cm		Mx2/(w lx <sup>2</sup> )	) =	0.030	
		fc =		kg/cm2		My1/(w lx <sup>2</sup> )		0.042	1
		fy =		kg/cm2		My2/(w lx <sup>2</sup> )		0.010	1
		ij-	7200	rigi onite		1113 E (11 1A )			J

17.40 tm/m

8.15 tm/m

11.42 tm/m 2.72 tm/m

DL

Mx1=

Mx2= My1= My2=

wDL= wLL=

LL Mx1= Mx2= My1= My2=

]t/m2 t/m2

5.79 0.61

1.83 tm/m

0.86 tm/m

1.20 tm/m

0.29 tm/m

PROJECT: La Union Port Development Project.	Calc. File No.		Prepared by	R.Martinez
SECTION: Utility Work	Calc. Index No.		Checked by	S Endo
SUBJECT: Design of Oil Separator-4 (Route C)	Date	Aug-02	Page	7/7

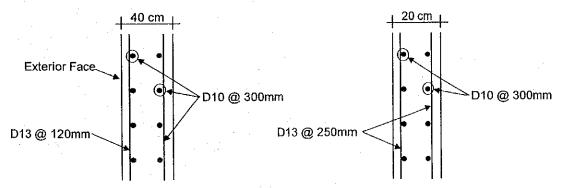
1.4DL+1.7l	_L		fy2/1.7bfc'	fyd	Mu/f		
Mx1=	25.91	tm/m	494.1	148533	2878911.49	As=	20.83 cm²/m
Mx2=	12.88	tm/m	494.1	148533	1430587.48	As≕	9.96 cm²/m
My1=	17.12	tm/m	494.1	148533	1901900.86	As=	13.40 cm²/m
Ŵy2=	4.29	tm/m	494.1	148533	476862.493	As=	3.25 cm²/m

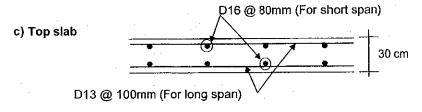
		Short Span	Long Span					
	Use Bar	Area	Pitch	Use Bar	Area	Pitch		
		cm2	cm		cm2	cm		
End	. 5	1,98	9.5	4	1.27	9.5		
Center	4	1.27	12.7	4	1.27	39.0		

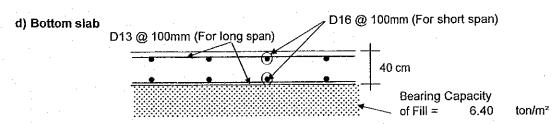
#### STEEL REINFORCEMENT

## a) Exterior wall

## b) Interior wall







## WATER SUPPLY SYSTEM

	DESIGN CALCULATION C	DESIGN CALCULATION COVER SHEET											
Project	Detailed Design on Port Reactivation Project in La Union Province	Project Code	JC1N004/2N001										
Section	Utility Works	Calc. File No.											
Sub-Section	Water Supply System	Calc. Index No.											

# Subject:

**Pipe Strength Analysis** 

# Calculation Objective:

To calculate and check the allowable stress and deflection ratio for PVC pipe such as VU and VP.

## References, Calculation Notes and Comments

**Design Condition** 

1) Specific Weight: 18 kN/m3

2) Overburden : 1m3) Load : 250kN (RTG)

4) Allowable Stress and Deflection Ration: 17.7N/mm2 and 5 %

5) Formula for Allowable Stress  $\sigma=((k1 \times qd + k2 \times qt) \times r^2)/Z$ 

6) Fomula for Allowable Deflection Ration

 $\delta$ = ((k3 x qd + k4 x qt) x r^4) / (E x l)

 $V = (\delta/(h - t)) \times 100 (\%)$ 

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Live Load  Load Impact Coefficien Decrease Coefficien Bending Stress  Central Radius of Section Modules Vertical Earth Pre Specific Weight  Deflection	Pipe  Ssure  Ch	P	25 0. 0. 4.21 0.10 0.07 77. 15. 0.018 0.111 0.7 0.00 0.7 0.00 0.00 294 73.	6 kN/m2  0 kN  5 9  N/mm2  7 mm 1 mm3/mm 0 N/mm2 6 N/mm2  tion Raf 7 mm	ilo	Allewable Stres			OK								
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DESIGN CALCULATION COVER SHEET											
Project	Detailed Design on Port Reactivation Project in La Union Province	Project Code	JC1N004/2N001								
Section	Utility Works	Calc. File No.	·								
Sub-Section	Water Supply System	Calc. Index No.									

# Subject:

**Pipeline Network Analysis** 

# Calculation Objective:

To calculate and check a water head, hydraulic grade line, discharge volume and velocity of pipeline from water storage tank to port area by using a program of pipeline network analysis.

## References, Calculation Notes and Comments

**Design Condition** 

1) Water Level of Reservoir: L..W.L.

2) Velocity within pipe: Maximum 3 m/s

3) Effective Head: Between 15 m and 75 m

4) Piezometric Head: 80 % oo

5) Calculation Model: Hazen Willoams Formula

H=10.666 x  $C^{-1.85}$  x D  $^{-4.87}$  x Q  $^{1.85}$  x L

H: Loss Head (m)

C: Velocity Coefficient: 110

D: Diameter of Pipeline (m)

Q: Discharge (m<sup>3</sup>/s)

L: Length of pipe between panel point (m)

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Name of File

La Union-1

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Number of Reservoir

Number of Point of Contact

Number of Pipe

Number of Pump Accuracy of Convergence Number of Repetition

0 Nos. 0.08 cm 16 Nos.

105 Nos.

Hydraulic Water Head (Max 1 Nos. 101 Nos.

Output Data

Hydraulic Grade Line Velocity (Max)

42.343 m 10.179 °%/<sub>0</sub> 0.992 m/s

CALCULATION Detailed Design on Port Reactivation Project in La Union Province CALC FILE No .: CALC INDEX No .: PAGE 2 INITIAL DATE

PREPARED BY & Ender 08 Aug CHECKED BY

Input I	Data							Outpu	t Data							Hydraulic		Pressure-
•		Water Head	Ground	Effective Water I		charge	Remarks	ST	EN		meter Pipe	Length of Pipe (m)		ischarge dume (l/s)	Velocity (m/s)	Grade Line	oss of Head re	educing Water
No.		<b>(</b> m)	Level (m)	(m)	Volu	me (l/s)					mm)	Pipe (m)	V.	ишис (вз)	(1,2 3)	( <sup>20</sup> / <sub>0</sub> )	. ,	head (m)
																4 505		0.000
	1		47.000		3.000	-17.857 0.000			1 2	2	200 200	37. 900 63. 200	110 110	17.857 17.857	0. 569 0. 569		0.098 0.164	0.000
	3	-	45, 000 38, 500		4. 902 11. 237	0.000			3	4	200	59. 300	110	17.857	0. 569	2. 597	0. 154 0. 648	0.000 0.000
	. 4	49. 583	36,000		13.583	0. 000 0. 000			4 . 5	5 6	200 200	249, 400 47, 900	110 110	17. 857 17. 857	0. 569 0. 569		0. 124	0.000
	5 6		27. 000 25. 000		21. 936 23. 811	0, 000			6	7	200	46. 400	110	17.857	0, 569		0. 121 0. 044	0,000 0,000
	7	48.691	21.000		27. 691 28. 647	0. 000 0. 000			7 8	- 8 - 9	200 200	17. 000 37. 000	110 110	17. 857 17. 857	0. 569 0. 569		0,096	0.000
	8 9		20.000 16.000	,	32, 550	0.000	1		9	10	200 200	71, 000 393, 900	110 110	17. 857 17. 857	0. 569 0. 569		0. 184 1. 023	0.000 0.000
	10 11		7, 000 5, 000		41. 366 42. 343	0, 000 0, 000			10 11	11 12	150	30.500	110	9.072	0.514	3,008	0.092	
	12	47.251	5, 000	_	42, 251	0.000			12 12	13 14	150 150	5. 000 14. 000	110 110	+++++ 9, 072	+++++ 0. 514		0.042	0.000
	13 14		5. 000 5. 000		42. 209	0.000			14	15	80	40.000	110	0. 305 8. 767	0. 061 0. 49 <del>6</del>		0.005 0.014	
	15 16		20. 000 5. 000		27. 204 42. 045	0.305 0.000			14 93	93 94	150 100	5. 000 40. 000	110 110	++++	++++	+++++	++++	11111
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	22	· ——	5.000		41. 753	0.000			20 21	21 22	150 150	29, 000 5, 000	110 110	8. 736 +++++	0. 495 ++++		0.081 ++÷++	0. 000 <del>11++</del> +
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	46 47	41, 772	5. 000 5. 000		36.772	5. 830			81	85 -	150	53.000	110	17. 513	0.992	10.170	0. 539 ++++	0. 000 +++++
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	75		7.000						58	59	150	2.000	110	0.000	0.000	0.000	0.000	0.000
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