NILU: TR 2/99

NILU : TR 2/99
REFERENCE : O-97007
DATE : SEPTEMBER 1999
ISBN : 82-425-1062-8

CorrCost Excel v1.0

User Manual

Guri Krigsvoll

Contents

Page

CorrCost Excel v1.0

User Manual

1. Introduction

CorrCost Excel v1.0 is a simplified model for calculation of degradation rate and lifetime for specified materials in an area where the pollution levels are known. The model also calculates the total costs of material degradation and the costs that are caused by pollution.

There are 2 versions of the program, Corrcost_97.xls and Corrcost_97_2.xls. They are similar, but have different lifetime equations for some metals. The difference is described in Chapter 3. The programs require Excel97.

2. Background information

This program is made to meet a request of a simple model to calculate the lifetime for building materials in different environments and the costs related to material corrosion.

Lifetime is in this model defined as the interval for which a repair or replacement takes place.

The model is based on statistics for distribution of materials and buildings.

3. Description of the model

3.1 Work sheets

The model contains a number of work sheets. A list of the sheets and their function are given in the tables below.

The area is divided into several cells. The used grid is 52*56 cells, each cell is 1km*1km.

Table 1: Work sheets and description.

Name of sheet	Function	Type
SO2	Defines the yearly average level SO_2 for all grid points.	Input data. The user can use results from other programs like KILDER.
NO2	Defines the yearly average level NO_2 for all grid points. NO_2 is used to calculate the levels for O_3.	Input data. The user can use results from other programs like KILDER.
Buildings	Defines the dominating building types for the cell. Each cell is divided in 16 cells, 250m*250m	Input data given by the user.
Material	Defines the material distribution for each building type Defines the costs for maintenance, repair or replacement for each material. Defines the limit for accepted corrosion for some metals. Gives the total amount of each material, lifetime in ambient air, total costs and costs due to pollution for each material.	Input data. Defined by the user Input data. Defined by the user Defined by the user. Results
Concrete Bricks Bricks-pl Bricks-pl,p Steel-g Steel-p Steel p-g Copper Alum Alum-p Zn-steel Zn-steel-p Wood painted Stone Bitumen	Calculates the lifetime for the material in each cell.	Result files

Am.concrete Am.bricks Am.bricks-pl Am.bricks-pl,p Am.steel Am.steel (2) Am.steel (3) Am.steel-p Am.steel-p-g Am.copper Am.alum Am.alum-p Am.Zn-steel Am.Zn-steel-p Am.wood-p Am.stone Am.stone (2) Am.bitumen	Calculates the amount of the material in each cell. These sheets are hidden.	Result file
Costs	Calculates the total costs for material degradation for each cell and for the whole area.	Result file
Costs-b	Calculates the costs for material degradation in ambient air for each cell and for the whole area	Result file
Costs-pol	Calculated the costs for material degradation due to pollution for each cell and for the whole area. These costs are the difference between Costs and Costs-b.	Result file
Parameters	Definition of input parameters, constants, etc.	Input given by the user

3.2 Buildings and materials

3.2.1 Definition of buildings

The buildings are defined into 10 categories given in the table below. As input data in the sheet "Building" it should be used the code for the building of the dominating category in the 250m*250m cell. The program adds the number of buildings in 16 cells (4*4) into one (1km*1km) for further calculations.

Table 2: Definition of building category

Category	Description
A	Old buildings 1-5 floors
B	Old buildings, more than 5 floors
C	New buildings, 5-10 floors
D	New buildings, more than 10 floors
E	Commercial and institutions, old buildings
F	Commercial and institutions, new buildings
G	Industry buildings
H	Farmhouse buildings
I	Monuments
J	Blank, no buildings

The user may change the building descriptions to meet his/hers needs. Statistical information of the material distribution for the new categories has to exist.

3.2.2 Material distribution

A statistical material distribution should be available for each building category. The model has a sheet "Material" where the amount of each material for each building type should be used as input.

Which materials that are included in the model are given in Table 3. For some of the materials lifetime equations are missing. The model can later on be expanded with more materials and equations.

When using Corrcost_97_2 the limits for corrosion (in µm) for galvanised steel sheets (maintenance and replacement), galvanised steel wire and profiles, copper and stone have to be defined.

3.2.3 Replacement and maintenance costs

Maintenance costs are given for each material. For galvanised steel sheets both maintenance and replacement costs are required. The user can choose the percentage of Material Steel to be replaced and maintained. This is done in the sheet "Parameters".

The user may choose what currency he/she wants.

3.3 Pollution levels

The model needs the yearly average fields for NO_2 and SO_2 distribution as input in the sheets "NO2" and "SO2". The ozone level is calculated with the formula:

$$O3 = O3_{ambient} * e^{-0,014*NO2}$$

where $O3_{ambient}$ is the level of ozone in ambient air and NO2 is the level of NO_2 in the actual cell.

The level of O_3 (ozone) and SO_2 (SO2) in ambient air should be defined in the sheet "Parameters". Default value ozone is defined as 60.5 $\mu g/m^3$. In unpolluted air is the concentration of ozone 40 $\mu g/m^3$.

3.4 Climatic data

Meteorological data as Rain, Time of wetness (TOW), relative humidity (RH) and average temperature (temp) should be defined by the user in the sheet "Parameters". The latest two are optional (required when using Corrcost_97_2).

3.5 Lifetime equations

The model contains lifetime or degradation equations for several common materials. The materials and their equations are given in the tables below.

Table 3: Materials and their lifetime equations.

Material	Sheet name	Lifetime
Concrete	Concrete	If SO2 < 10, 50 years, else 40 years
Bricks	Bricks	If SO2 < 10, 70 years, else 65 years
Bricks and plaster	Bricks-pl	$L=\frac{1000}{0.124*SO2+15.5+0.013*rain*H+}$
Bricks and painted plaster	Bricks-pl,p	$L=\frac{1000}{0.278*SO2+18.8+0.07*rain*H+}$
Tiles		No equation
Steel sheet, galvanised, repair	Steel-g	$L=\frac{20}{0.51+0.0015*tow*SO2*O3+0.00282*rain*H+}$
Steel sheet, galvanised, replacement	Steel-g	$L=\frac{30}{0.51+0.0015*tow*SO2*O3+0.00282*rain*H+}$
Steel wire, galvanised, replacement	Steel-g	$L=\frac{30}{0.51+0.0015*tow*SO2*O3+0.00282*rain*H+}$
Steel profile, galvanised, maintenance	Steel-g	$L=\frac{60}{0.51+0.0015*tow*SO2*O3+0.00282*rain*H+}$
Painted steel	Steel-p	$L=\frac{1000}{1.37*SO2+103+0.35*rain*H+}$
Painted galvanised steel	Steel-p-g	$L=\frac{1000}{0.803*SO2+81.5+0.2*rain*H+}$
Copper sheets, replacement	Copper	$L=\frac{100}{0.53+0.00031*SO2*O3+0.0045*rain*H+}$
Coil coated aluminium sheets	Alum	$L=\frac{1000}{0.107*SO2+32.2+0.027*rain*H+}$
Coil coated aluminium sheets, painted	Alum-p	$L=\frac{1000}{0.37*SO2+62.9+0.095*rain*H+}$

Coil coated galvanised steel sheets	Zn-steel	$L=\frac{1000}{0.155*SO2+38+0.039*rain*H+}$
Coil coated galvanised steel sheets, painted	Zn-steel-p	$L=\frac{1000}{0.37*SO2+62.9+0.095*rain*H+}$
Wood		No equations
Painted wood	Wood-p	$L=\frac{1000}{1.03*SO2+87.5+0.26*rain*H+}$
Limestone	Stone	$L=\frac{5000}{3.3+0.6*tow*SO2+0.037*rain*H+}$
Calcareous stone	Stone	$L=\frac{5000}{2,8+0,6*tow*SO2+0,037*rain*H+}$
Bitumen	Bitumen	$L=\frac{1000}{0.327*SO2+47.7+0.08*rain*H^+}$
Glass		No equation
Plastic		No equation
Ceramics		No equation

TOW = time of wetness, fraction of the year
Rain = average yearly rain (mm)
H^+ = mg/dm^3
SO2 = yearly average concentration of SO_2, $\mu g/m^3$
O3 = yearly average concentration of O_3, $\mu g/m^3$

Table 4: Materials and their degradation equations. ML= mass loss in g/m^3.

Material	**Degradation rate**
Weathering Steel	$\ln(ML) = 3.54 * 0.33*\ln(t) + 0.02RH - 0.036*(T-10)$
Zinc Galvanised steel	$ML = 1.35*SO2^{0.22}*\exp\{0.18*RH-0.021(T-10)\}*t^{0.85} + 0.029*rain*H^{+}* t$
Aluminium	$ML = 0.0021*SO2^{0.23}RH*\exp\{-0.061(T-10)\}*t^{1.2} + 0.000023*rain*Cl^{-}* t$
Copper	$ML = 0.0027*SO2^{0.32}*O3^{0.79}RH*\exp\{-0.032(T-10)\}*t^{0.78} + 0.05*rain*H^{+}* t^{0.89}$
Bronze	$ML = 0.026*SO2^{0.44}RH*\exp\{-0.067(T-11)\}*t^{0.86} + \{0.029*rain*H^{+} +0.00043*rain*Cl^{-}\}* t^{0.76}$
Limetone	$R = t^{0.96}*(2.7*SO2^{0.48} *\exp(-0.018T) + 0.019*Rain*H^{+})$

ML = mass loss, (g/m^3)
R = corrosion (µm)
t = time (year)
RH = relative humidity (%)
Rain = average yearly rain (mm)
H^+ = mg/dm^3
SO2 = yearly average concentration of SO_2, $\mu g/m^3$
O3 = yearly average concentration of O_3, $\mu g/m^3$
T = average yearly temperature, C. T > 10°C

Lifetime may be calculated from this equation by replacing the ML with a limit for accepted corrosion, $Corr_{lim}$. Condidering a steady-state situation based on the difference in ML for year 9 and 8, the following equations are made.

For galvanised steel we have found this equation:

$$L = \frac{\rho * Corr_{lim}}{0.86*SO2^{0.22} exp(0.018*Rh-0.021*(T-10)) + 0.029*rain*H^{+}}$$

ρ	= Density (zinc 7.13 kg/dm^3)
$Corr_{lim}$	= Accepted corrosion (µm)
RH	= Relative humidity (%)

For copper the equation is:

$$L = \frac{\rho * Corr_{lim}}{0.0014*SO2^{0.32}*O3^{0.79}*Rh*exp(-0.032*(T-10)) + 0.036*rain*H^{+}}$$

ρ = Density (copper 8.92 kg/dm^3)

For stone the equation is:

$$L = \left\{\frac{Corr_{lim}}{2.7*SO2^{0.48}*exp(-0.018T) + 0.019*rain*H^{+}}\right\}0.96$$

4. Running the model

4.1 Input data

4.1.1 Sheet Material

The material distribution in m^2 for each building category should be defined in the table Type of materials, m^2.

The costs for maintenance or replacement should be given in the table Material cost table in this sheet.

The model calculates with either repair or replacement costs, depending of the equation used, except for galvanised steel sheets where half the amount is repaired, the other half replaced. The user can change this percentage in Sheet Parameters.

An example of a Material sheet (2 pages) is shown in Appendix.

4.1.2 Sheet Buildings

The dominating building category should be defined for each 250*250 m cell. Every cell should have a letter A-J.

The program uses this letters for further calculation of amount of material.

An example of a part of a Buildings sheet is shown in Appendix.

4.1.4 Sheet SO2 and NO2

The values for SO_2 and NO_2 should be defined for each cell. An example of a part of a SO2 sheet is shown in Appendix.

4.2 Results

4.2.1 Costs

The sheet "Cost" gives the total cost for degradation of building materials, and the costs in every cell, 1*1km.

The sheet "Cost-b" gives the cost for degradation of building materials in with levels of SO2, NO2 and ozone as in ambient air. Both the total cost and the costs for every cell, 1*1km, are shown.

The sheet "Cost-pol" gives the costs for degradation of building materials due to pollution by subtracting the corrosion costs in ambient air from the total corrosion costs. Both the total cost and costs for each cell are given.

There is no unit connected to the costs, the user may chose what currency he will use.

An example of the Costs sheet is given in Appendix.

The sheet Material show the costs related to each material, both total costs, costs in ambient air and costs due to pollution.

4.2.2 Lifetime

There are sheets for the different materials that give the materials lifetime in each cell. An example of a lifetime sheet is given in Appendix.

For galvanised steel is only the lifetime for "Steel sheet, galvanised, repair" calculated for the whole area, while the 3 other should be found by multiplying the calculated lifetime with the relation between the levels for accepted corrosion. This is taken care of in the cost calculations.
For each material the lifetime in ambient air is given in the sheet Material.

4.2.3 Amount of material

The sheets that give amount of material all have a name starting with Am. They are hidden sheets, but may be found under Format-Sheet-Unhide. Both the total amount and the amount in each cell are given.

An example of a sheet showing the amount of material is given in Appendix.

5. Examples

5.1 City area

- Define the parameters in the Sheet Parameter.
- Define the material distribution for each building category. Since this table is based on statistics, the same table should be used for all calculations.
- Define the building types in Sheet Buildings. If the region wanted is covering less 52*56 km grid, ensure that there is no building codes in the area outside the actual region.
- Define the levels for SO2 and NO2. Ensure that the area and then the co-ordinates correlates to the area used in Buildings.
- Start the calculations with the F9 button.

5.2 Single building

- When the model is used to calculate the costs for a single building use one of the building categories should be defined with the correct material distribution. Code J, blank, is recommended to use for this purpose (should in other cases be zero for all materials).
- In the sheet Buildings the building type is defines for one cell. All other cells are blanks.
- The levels for NO2 and SO2 for the same co-ordinates are defined.
- Start calculations with the F9 button.

Appendix A

Calculation sheets

Type of material, m2	A	B	C	D	E	F	G	H	I	J
Concrete	1	1	1	1	1	1	1	1	1	0
Bricks	1	1	1	1	1	1	1	1	1	0
Brick+plaster	1	1	1	1	1	1	1	1	1	0
Bricks-painted plaster	1	1	1	1	1	1	1	1	1	0
Tiles	1	1	1	1	1	1	1	1	1	0
Zn steel, sheets	1	1	1	1	1	1	1	1	1	0
Zn steel, wire	1	1	1	1	1	1	1	1	1	0
Zn steel, profile	1	1	1	1	1	1	1	1	1	0
Painted steel	1	1	1	1	1	1	1	1	1	0
Painted, galvanised steel	1	1	1	1	1	1	1	1	1	0
Copper sheets	1	1	1	1	1	1	1	1	1	0
Coil coated aluminium sheet	1	1	1	1	1	1	1	1	1	0
Coil coated aluminium sheet, painted	1	1	1	1	1	1	1	1	1	0
Coil coated galvanised steel sheet	1	1	1	1	1	1	1	1	1	0
Coil coated galv. steel sheet, painted	1	1	1	1	1	1	1	1	1	0
Wood	1	1	1	1	1	1	1	1	1	0
Painted wood	1	1	1	1	1	1	1	1	1	0
Limestone	1	1	1	1	1	1	1	1	1	0
Calcareous sandstone	1	1	1	1	1	1	1	1	1	0
Bitumen felt	1	1	1	1	1	1	1	1	1	0
Glass	1	1	1	1	1	1	1	1	1	0
Plastic	1	1	1	1	1	1	1	1	1	0
Ceramics	1	1	1	1	1	1	1	1	1	0
	0	0	0	0	0	0	0	0	0	0
	0									
	0									
Other										
SUM	23	23	23	23	23	23	23	23	23	0

Material

Material costs	Cost	Limit	Lifetime, ambient air	Total amount	Cost	Cost, amb	Cost, pol
Concrete	20		40.0 year	956	468.4	478.0	-9.6
Bricks	20		65.0 year	956	292.0	294.2	-2.1
Brick+plaster	10		59.0 year	956	164.6	161.9	2.7
Bricks-painted plaster	20		44.2 year	956	445.0	432.7	12.3
Tiles	15		year				
Zn steel, sheets, maintenance	10	20	23.7 year	478	158.3	201.4	-43.1
Zn steel, sheets, replacement	10	30	35.6 year	478	105.5	134.3	-28.8
Zn steel, wire	20	30	35.6 year	956	422.1	537.1	-115.0
Zn steel, profile	20	60	71.2 year	956	211.0	268.5	-57.5
Painted steel	10		8.2 year	956	1196.1	1165.8	30.3
Painted, galvanised steel	10		10.8 year	956	902.3	884.6	17.8
Copper sheets	10	100	127.4 year	956	63.9	75.1	-11.1
Coil coated aluminium sheet	10		29.7 year	956	324.3	321.9	2.4
Coil coated aluminium sheet, painted	10		14.7 year	956	658.5	650.3	8.2
Coil coated galvanised steel sheet	10		24.9 year	956	387.1	383.7	3.4
Coil coated galv. steel sheet, painted	10		14.7 year	956	658.5	650.3	8.2
Wood	10		year				
Painted wood	10		9.8 year	956	995.0	972.3	22.8
Limestone	10		865.1 year	956	11.9	11.1	0.8
Calcareous sandstone	10	5 000	865.1 year	956	11.9	11.1	0.8
Bitumen felt	10		19.2 year	956	506.0	498.7	7.2
SUM				17 208	7 983	8 133	-150

Material

Building types

X/Y		1				2				3				4				5				6				7		
		0.25	0.5	0.75	1	0.25	0.5	0.75	1	0.25	0.5	0.75	1	0.25	0.5	0.75	1	0.25	0.5	0.75	1	0.25	0.5	0.75	1	0.25	0.5	0.75
56	1	a	a	a	a	b	b	b	b	c	c	c	c	j	j	j	j	b	b	b	b	c	c	c	c	b	b	b
	0.75	a	a	a	a	b	b	b	b	c	c	c	c	j	j	j	j	b	b	b	b	c	c	c	c	b	b	b
	0.5	a	a	a	a	b	b	b	b	c	c	c	c	j	j	j	j	b	b	b	b	c	c	c	c	b	b	b
	0.25	a	a	a	a	b	b	b	b	c	c	c	c	j	j	j	j	b	b	b	b	c	c	c	c	b	b	b
55	1	b	e	d	g	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c
	0.75	b	h	j	j	f	g	h	a	f	g	h	a	f	g	h	a	f	g	h	a	f	g	h	a	f	g	h
	0.5	b	h	h	d	e	b	a	c	e	b	a	c	e	b	a	c	e	b	a	c	e	b	a	c	e	b	a
	0.25	a	c	c	d	d	e	f	g	d	e	f	g	d	e	f	g	d	e	f	g	d	e	f	g	d	e	f
54	1	b	e	d	g	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c
	0.75	b	h	j	j	f	g	h	a	f	g	h	a	f	g	h	a	f	g	h	a	f	g	h	a	f	g	h
	0.5	b	h	h	d	e	b	a	c	e	b	a	c	e	b	a	c	e	b	a	c	e	b	a	c	e	b	a
	0.25	a	c	c	d	d	e	f	g	d	e	f	g	d	e	f	g	d	e	f	g	d	e	f	g	d	e	f
53	1	b	e	d	g	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c
	0.75	b	h	j	j	f	g	h	a	f	g	h	a	f	g	h	a	f	g	h	a	f	g	h	a	f	g	h
	0.5	b	h	h	d	e	b	a	c	e	b	a	c	e	b	a	c	e	b	a	c	e	b	a	c	e	b	a
	0.25	a	c	c	d	d	e	f	g	d	e	f	g	d	e	f	g	d	e	f	g	d	e	f	g	d	e	f
52	1	b	e	d	g	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c
	0.75	b	h	j	j	f	g	h	a	f	g	h	a	f	g	h	a	f	g	h	a	f	g	h	a	f	g	h
	0.5	b	h	h	d	e	b	a	c	e	b	a	c	e	b	a	c	e	b	a	c	e	b	a	c	e	b	a
	0.25	a	c	c	d	d	e	f	g	d	e	f	g	d	e	f	g	d	e	f	g	d	e	f	g	d	e	f
51	1	b	e	d	g	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c
	0.75	b	h	j	j	f	g	h	a	f	g	h	a	f	g	h	a	f	g	h	a	f	g	h	a	f	g	h
	0.5	b	h	h	d	e	b	a	c	e	b	a	c	e	b	a	c	e	b	a	c	e	b	a	c	e	b	a
	0.25	a	c	c	d	d	e	f	g	d	e	f	g	d	e	f	g	d	e	f	g	d	e	f	g	d	e	f
50	1	b	e	d	g	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c
	0.75	b	h	j	j	f	g	h	a	f	g	h	a	f	g	h	a	f	g	h	a	f	g	h	a	f	g	h
	0.5	b	h	h	d	e	b	a	c	e	b	a	c	e	b	a	c	e	b	a	c	e	b	a	c	e	b	a
	0.25	a	c	c	d	d	e	f	g	d	e	f	g	d	e	f	g	d	e	f	g	d	e	f	g	d	e	f
49	1	b	e	d	g	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c
	0.75	b	h	j	j	f	g	h	a	f	g	h	a	f	g	h	a	f	g	h	a	f	g	h	a	f	g	h
	0.5	b	h	h	d	e	b	a	c	e	b	a	c	e	b	a	c	e	b	a	c	e	b	a	c	e	b	a
	0.25	a	c	c	d	d	e	f	g	d	e	f	g	d	e	f	g	d	e	f	g	d	e	f	g	d	e	f

Buildings

Parameters

Ozon level in ambient air	Ozon	60.5	µg/m3
H^+ in rain	H^+	0.025	
Time of wetness	tow	0.32	Fraction
Average yearly rain	rain	600	mm/year
Humidity	Rh	68.00 %	
Average yearly temperature	temp	12	C
Concentration of SO2 in ambient	so2	10	µg/m3
Percentage of steel for maintenance	perc	50.00 %	

Consentration of SO2

X/Y	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
56	18.9	10.0	10.0	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2
55	19.0	15.0	15.0	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2
54	19.0	18.0	25.0	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2
53	19.0	15.0	25.0	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2
52	19.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
51	19.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
50	19.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
49	19.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
48	19.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
47	19.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
46	19.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
45	19.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
44	19.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
43	19.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
42	19.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
41	19.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
40	19.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
39	19.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
38	19.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
37	19.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
36	19.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
35	19.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
34	19.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
33	19.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
32	19.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
31	19.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
30	19.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
29	19.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
28																			
27																			
26																			

SO2

Consentration of NO2

X/Y	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
56	73.5	12.0	70.0	65.0	12.0	70.0	65.0	12.0	70.0	65.0	12.0	70.0	65.0	12.0	70.0	65.0	12.0	70.0	65.0	12.0
55	40.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
54	60.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
53	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
52	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
51	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
50	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
49	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
48	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
47	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
46	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
45	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
44	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
43	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
42	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
41	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
40	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
39	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
38	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
37	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
36	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
35	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
34	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
33	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
32	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
31	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
30	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
29	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
28	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
27	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0
26	132.6	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0	80.0	64.0	132.0

NO2

Total costs 7 983

X/Y	1	2	3	4	5	6	7	8	9	10	11	12	13
56	141	135	132	0	132	129	129	132	129	129	0	0	0
55	126	135	137	132	131	132	132	0	0	0	0	0	0
54	125	138	148	132	131	132	132	0	0	0	0	0	0
53	122	135	148	132	131	132	132	0	0	0	0	0	0
52	122	130	131	132	130	131	132	0	0	0	0	0	0
51	122	130	131	132	130	131	132	0	0	0	0	0	0
50	122	130	131	132	130	131	132	0	0	0	0	0	0
49	122	130	131	132	130	131	132	0	0	0	0	0	0
48	122	0	0	0	0	0	0	0	0	0	0	0	0
47	122	0	0	0	0	0	0	0	0	0	0	0	0
46	122	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0

Cost

Costs, ambient air 8 133

X/Y	1	2	3	4	5	6	7	8	9	10	11	12	13
56	136	136	136	0	136	136	136	136	136	136	0	0	0
55	119	136	136	136	136	136	136	0	0	0	0	0	0
54	119	136	136	136	136	136	136	0	0	0	0	0	0
53	119	136	136	136	136	136	136	0	0	0	0	0	0
52	119	136	136	136	136	136	136	0	0	0	0	0	0
51	119	136	136	136	136	136	136	0	0	0	0	0	0
50	119	136	136	136	136	136	136	0	0	0	0	0	0
49	119	136	136	136	136	136	136	0	0	0	0	0	0
48	119	0	0	0	0	0	0	0	0	0	0	0	0
47	119	0	0	0	0	0	0	0	0	0	0	0	0
46	119	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0

Cost-b

Costs due to pollution -150

X/Y	1	2	3	4	5	6	7	8	9	10	11	12	13
56	5	-1	-4	0	-4	-7	-7	-4	-7	-7	0	0	0
55	7	-1	1	-4	-6	-4	-4	0	0	0	0	0	0
54	6	2	11	-4	-6	-4	-4	0	0	0	0	0	0
53	2	-1	11	-4	-6	-4	-4	0	0	0	0	0	0
52	2	-6	-5	-4	-6	-5	-4	0	0	0	0	0	0
51	2	-6	-5	-4	-6	-5	-4	0	0	0	0	0	0
50	2	-6	-5	-4	-6	-5	-4	0	0	0	0	0	0
49	2	-6	-5	-4	-6	-5	-4	0	0	0	0	0	0
48	2	0	0	0	0	0	0	0	0	0	0	0	0
47	2	0	0	0	0	0	0	0	0	0	0	0	0
46	2	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0

Lifetime concrete

Lifetime= 50 if $SO_2<10$, else 40 years

X/Y	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
56	40.0	40.0	40.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
55	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
54	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
53	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
52	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
51	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
50	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
49	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
48	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
47	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
46	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
45	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
44	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
43	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
42	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
41	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
40	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
39	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
38	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
37	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
36	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
35	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
34	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
33	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
32	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
31	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
30	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
29	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
28	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
27	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
26	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0

Concrete

Amount of concrete 956 m2

X/Y	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
56	16	16	16	0	16	16	16	16	16	16	0	0	0	0	0	0	0	0	0
55	14	16	16	16	16	16	16	0	0	0	0	0	0	0	0	0	0	0	0
54	14	16	16	16	16	16	16	0	0	0	0	0	0	0	0	0	0	0	0
53	14	16	16	16	16	16	16	0	0	0	0	0	0	0	0	0	0	0	0
52	14	16	16	16	16	16	16	0	0	0	0	0	0	0	0	0	0	0	0
51	14	16	16	16	16	16	16	0	0	0	0	0	0	0	0	0	0	0	0
50	14	16	16	16	16	16	16	0	0	0	0	0	0	0	0	0	0	0	0
49	14	16	16	16	16	16	16	0	0	0	0	0	0	0	0	0	0	0	0
48	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Am.conc

Norwegian Institute for Air Research (NILU)
P.O. Box 100, N-2007 Kjeller – Norway

REPORT SERIES TECHNICAL REPORT	REPORT NO. TR 2/99	ISBN 82-425-1062-8 ISSN 0807-7185
DATE 7/10-1999	SIGN.	NO. OF PAGES: 22 PRICE: NOK 45,-
TITLE CorrCost Excel v1.0 User Manual		PROJECT LEADER Jan Fredrik Henriksen
		NILU PROJECT NO. O-97007
AUTHOR(S) Guri Krigsvoll		CLASSIFICATION * A
		CONTRACT REF.

REPORT PREPARED FOR:
NILU

ABSTRACT
CorrCost Excel v1.0 is a simplified model to calculate service life and costs for degradation of building materials. The program calculates the total costs and the costs due to pollution.

NORWEGIAN TITLE
CorrCost Ecxel v1.0. Bruker manual.

KEYWORDS		
Service life	Costs	Corrosion

ABSTRACT (in Norwegian)

** Classification*	*A*	*Unclassified (can be ordered from NILU)*
	B	*Restricted distribution*
	C	*Classified (not to be distributed)*