Evaluation report on the Concetti Design

ZONE Display case

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Parcs Canada Parks Canada

Introduction

A number of factors contribute to the deterioration of museum objects: relative humidity, temperature, light (mainly ultraviolet), dust, air pollutants, and bodily intrusions, such as careless handling, shocks, and vandalism. These factors can come into play individually or together. The conditions in which objects are preserved and exhibited are important. Space in which these conditions can be regulated is therefore required. Display cases are confined spaces whose environment can be controlled, which is why they require design and production standards that promote optimal preservation conditions. Optimal conditions are achieved through the use of components made of inert materials that do not react with the objects exhibited, a buffer material that regulates the variations in exhibition conditions or stabilizes, absorbs, or draws off emanations, and an esthetic design that enhances the visual experience and security of the exhibition space.

Context of Request and Setup

In spring 2001, Mr. François Marcotte of Concetti Design contacted Mr. Yvon Beaudoin of the Parks Canada Heritage Presentation Department to evaluate their *Zone* display case. Mr. Beaudoin turned to the Conservation-Restoration Department to get informed advice from conservation professionals. Mr. Sten J. Holm, who was head of the Conservation Department at the time and is now retired, tested the *Zone* display case. Mr. Beaudoin's request lists the points the Concetti Design representatives wanted the professionals to judge the display case on:

1. Ease of setup
2. Hermeticity
3. Quality and choice of materials used
4. Security
5. Type of lighting used
6. General appearance

The display case was installed on the department's premises in late August 2001. Concetti Design staff mounted the case, cleaned the individual components to ensure maximum starting cleanliness, and applied the quantity of ArtSorb buffer material they deemed necessary. Three samples of new sheets of metal (lead, aluminum, and silver) were placed inside the case on a clear glass shelf at shoulder level.

Two Smart Reader 2 electronic temperature and relative humidity loggers by ACR Systems were calibrated and programmed by Mr. Holm, who oversaw the project. One logger was placed on the shelf inside the case with the samples, while the other logger was set three feet away from the display case. After Mr. Holm retired, the file was handed over to me. Little setup and followup data had been collected up to that point.

Environmental Conditions in the Display Case

The display case was set up in late August 2001 in a room off the conservation laboratory. The room was about 8 m^2 in size and was not directly exposed to natural light. The temperature and relative humidity were similar to those of the building and represented a normal work environment. However, the laboratory is a much dustier workspace than an office because of the electrical machinery and equipment used there regularly. There was a moderatedaily flow of traffic near the display case. During the last two weeks of the test, a humidifier was placed in the room on two occasions to increase the humidity level and determine whether significant changes occurred inside the case. The door to the room was closed.

Evaluation and Results of the Readings

? ?*Ease of setup*

Setup and takedown of the display case were a model of efficiency. Vacuum discs are recommended for handling the rather heavy glass panels and it is recommended that two people set up and take down the case. A conveniently placed, easy-to-reach drawer makes it easy to position the buffer material that regulates the environmental conditions. A sliding glass door provides full and easy access to the objects exhibited.
We were unable to observe the flexibility of fitting various modules together because our model was a vertical rectangle. However, the ease with which we were able to put the components together led us to believe that adding modules to the *Zone* display case would be just as easy.

? ?*Hermeticity*

Data was read by two electronic temperature and relative humidity loggers, whose margin of error is ±3% for humidity and ±0.1ºC for temperature. The readings were transferred to and saved in a Microsoft Excel file for statistical analysis. Because readings were taken every twenty minutes for almost four months and would therefore take up over 200 printed pages, we have included an appendix of daily average readings only. As with all our factual data, these readings are available in electronic form in a Microsoft Excel document. Please note that a programming error and delay in placing a logger inside the display case allowed us to compare the two loggers

over a period of four months only, rather then the six months initially planned on. The readings of the logger inside the display case began on October 1, 2001, while those of the logger outside the case began on August 31, 2001, when the case was set up. However, this time period was long enough to gather significant data and allow us to observe a trend.

DUST

When the display case was opened in late January 2002, we observed that no trace of dust had been measured inside the display case, either on the samples, the glass shelf, or the bottom of the case. The samples were observed under binoculars.The horizontal surfaces were wiped with a clean tack cloth used to dust furniture. No deposit or residue was observed. Dust tightness is therefore excellent given that the laboratory generates a fair amount of dust with its electrical equipment and machinery.

CORROSION

No trace of corrosion or alteration was observed under the binoculars on the surface of the samples after six months of exposure. Resistance to atmospheric pollutants therefore seems assured.

RELATIVE HUMIDITY AND TEMPERATURE

The readings taken by the loggers revealed that there were variations and that variations in the environmental conditions inside the display case were very gradual. Variations are, however, normal; unless its environment is in a vacuum, no display case can ever claim to be 100% hermetic. Attaining such a degree of hermeticity is rather difficult and costly. Certain factors such as faulty setup and imperfect sealing joints play a role. Though a display case can never claim to be completely leakproof, it is preferable to make it as close to 100% hermetic as possible. When a buffer material is used, the variations are completely gradual.

The daily variation in relative humidity observed in the *Zone* display case was at most .5%. A maximum daily variation of ±3% meets accepted museum standards, therefore placing the *Zone* display case well within the maximum allowed.

A daily and monthly variation in temperature of roughly 1.5°C is considered excellent according to accepted museum standards. Through lack of proper setup and equipment, we were unable to vary the temperature in the room as we could the relative humidity. The temperature readings were in general similar to the variations in the building's environmental conditions and particularly to those in the laboratory. The temperature curves varied very little and were almost identical for both loggers. The temperature varied between 19.9°C and 23.3°C for the logger inside the display case and between 19.9°C and 23.8°C for the one outside the case. No important conclusions can therefore be drawn from this other than the fact that the variations meet museum standards and that, like in the case of relative humidity, hermeticity is not 100%.

There is no question that the transition inside the display case must be very gradual and extremely moderate and occur over a sufficient time span so that the materials of the object displayed can gradually adapt to the environmental changes. The *Zone* display case performs this role extremely well. The graphs illustrating the variations (see Appendix) clearly show the

efficiency of the display case. Objects placed in the *Zone* display case are therefore in good museum hands.
In view of the readings, however, we cannot assert perfect hermeticity. Installation, the tightness of the seals, or a lack of buffer material can contribute to permeability of the internal and external environments. The display case is nevertheless considered sufficiently hermetic. In our opinion, its degree of hermeticity falls into Class III of the table taken from *Exhibit Conservation Guidelines* by Toby Raphael, U.S. National Park Service, Division of Conservation, 1999, hybrid Macintosh and PC CD-ROM.

Degree of hermeticity	**Exchange rate of air equivalent to the entire volume of the display case**
I Non-hermetic display case	1 volume per hour or less
II Moderately hermetic display case	1 volume per 24 to 36 hours
III Very hermetic display case	1 volume per 72 hours or more
IV Totally hermetic display case	No air exchange

? ?*Quality and choice of materials used*

The museum display case is a closed space that requires compatibility between its own materials and the objects displayed in it. The volatile substances emitted by the case's materials and/or their migration toward the object displayed during contact between the materials and the object are potential risks that must be properly regulated or eliminated. It is therefore important to choose the appropriate materials, particularly when the display case is hermetically sealed.
The materials should be as inert as possible. If they cannot be inert, the harmful substances they emit should be regulatable. To successfully regulate emanations in a closed space, the case components need enough time for their volatile substances to escape from the case before objects are exhibited in them or there needs to be a sufficient exchange of air between the internal and external environments. If the case components emit volatile substances, it is, in our opinion, preferable that the display case not be too hermetically sealed. For a complete picture of constraints and solutions, refer to the articles published by Jean Tétreault, a scientist with the Canadian Conservation Institute (CCI). These articles are available on the CCI Website at http://www.cci-icc.gc.ca/ in the Conservation Information section. Information is also available in *Preventive Conservation in Museums, Reference Manual*, produced in cooperation with UQAM, the CCQ, and the CCI, 1995, and accompanied by 19 videocassettes.
The materials used inside the *Zone* display case are

1. MDF (pine fiber structure)
2. Finishing products: catalyst 999-017A, Plastofix 488-035 and white coloring 041-6101
3. Anodized aluminum
4. Stainless steel
5. Polyethylene foam
6. Silicone cushion

MDF (Medium Density Fiberboard) is a composite agglomerate made mainly of wood fiber particles bonded most often with a urea-formaldehyde resin and possibly containing additives. Organic acids are emitted by the wood in these panels while formaldehyde and other acids are emitted by the synthetic resin that serves as a bonding agent. Some bonding agents are

acceptable, such as those that have a phenol-formaldehyde base or are laminated with phenolic products; others, such as urea-formaldehyde resin, are not acceptable.
The volatile substances emitted by the wood and resin are rendered almost inert when they are covered with a waterproof film or vapor barrier. Applying several layers of a coating or acrylic (latex) resin is still the most economical procedure.
The pine MDF and the coating material of the *Zone* display case contain formaldehyde. We do not know whether it is urea-formaldehyde or not and must therefore ensure that the materials have a sufficient amount of time to dry so that the volatile substances can evaporate if the surface is not 100% hermetic or contains these substances itself.
The anodized aluminum, stainless steel, and polyethylene foam are solid, stable components.
The silicone cushion is used as a gasket seal in the assembly of the components and comes into contact with the inside of the display case. The silicone used in the *Zone* display case seemed to be totally stabilized; no corrosion caused by the emission of volatile substances was observed. It should be added that agents or pastes with an acid or even alkaline silicone base that are used as gasket seals emit acetic acid vapors (a vinegar smell), in which case the volatile substances should be given enough time to evaporate.

? ?*Security*

The high resistance tempered glass sides of the display case are a good 10 mm thick. The base is very stable and is balanced through integrated levels. The shoulder-level glass shelf on which the samples were placed inside the display case tested was secured with a safe metal rod mechanism to the upper module that contained the lighting system. This shelf was therefore not in contact with the glass structure around it and was made secure with a concealed lock mechanism.

The excellent overall stability of the case, the lock mechanism, and the type and thickness of the glass sides make the *Zone* display case fully secure against vandalism and random shocks.

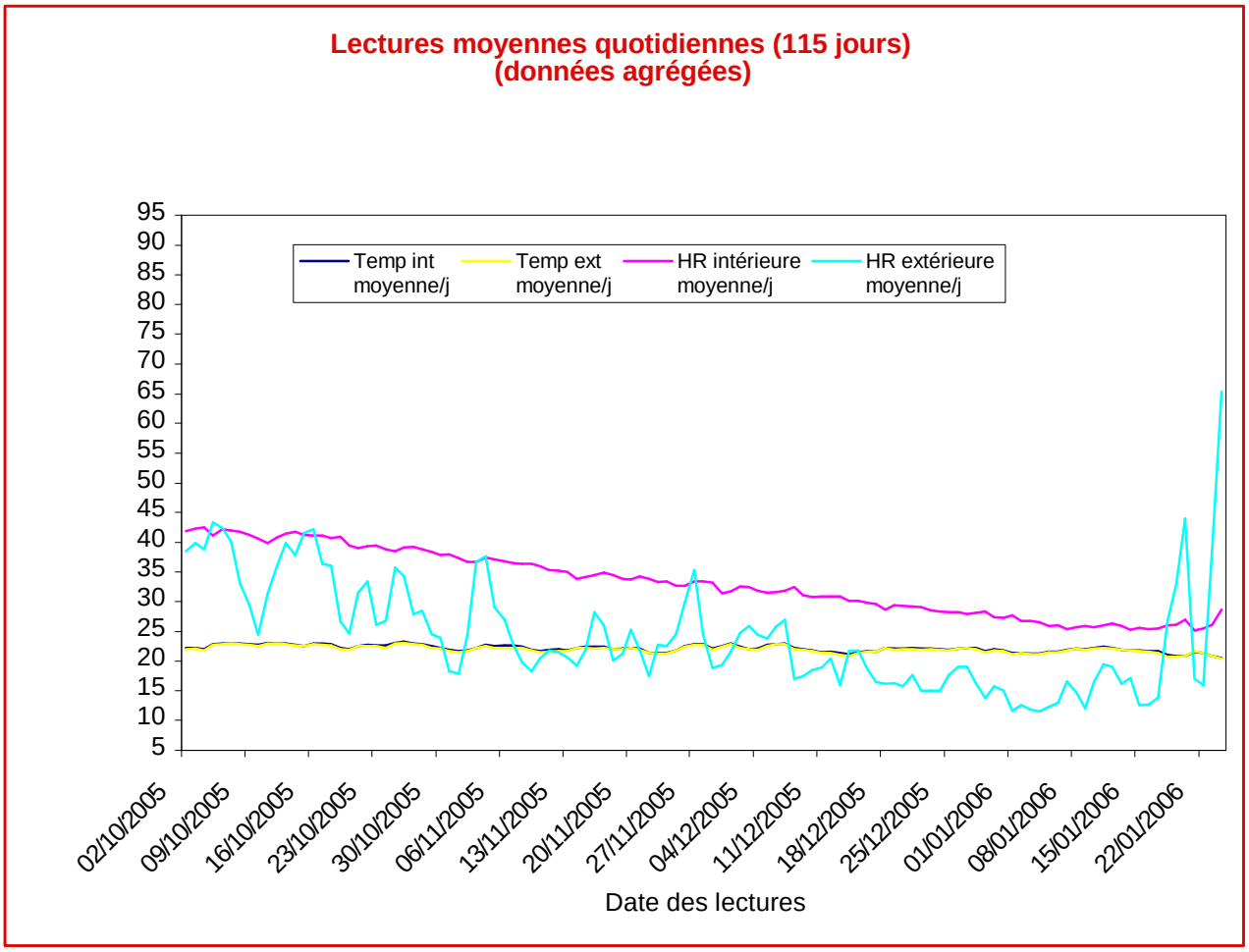
? ?*Type of lighting used*

The display case tested did not have any lighting. We therefore did not test the brightness of or the heat emitted by the lighting system. According to available data, the system seems fairly flexible in the range of light it allows and ensures good diffusion and ventilation. The case containing the lighting system is fitted on top and is therefore separate from the glass case where objects are exhibited. A UV stabilizer also separates the two cases.

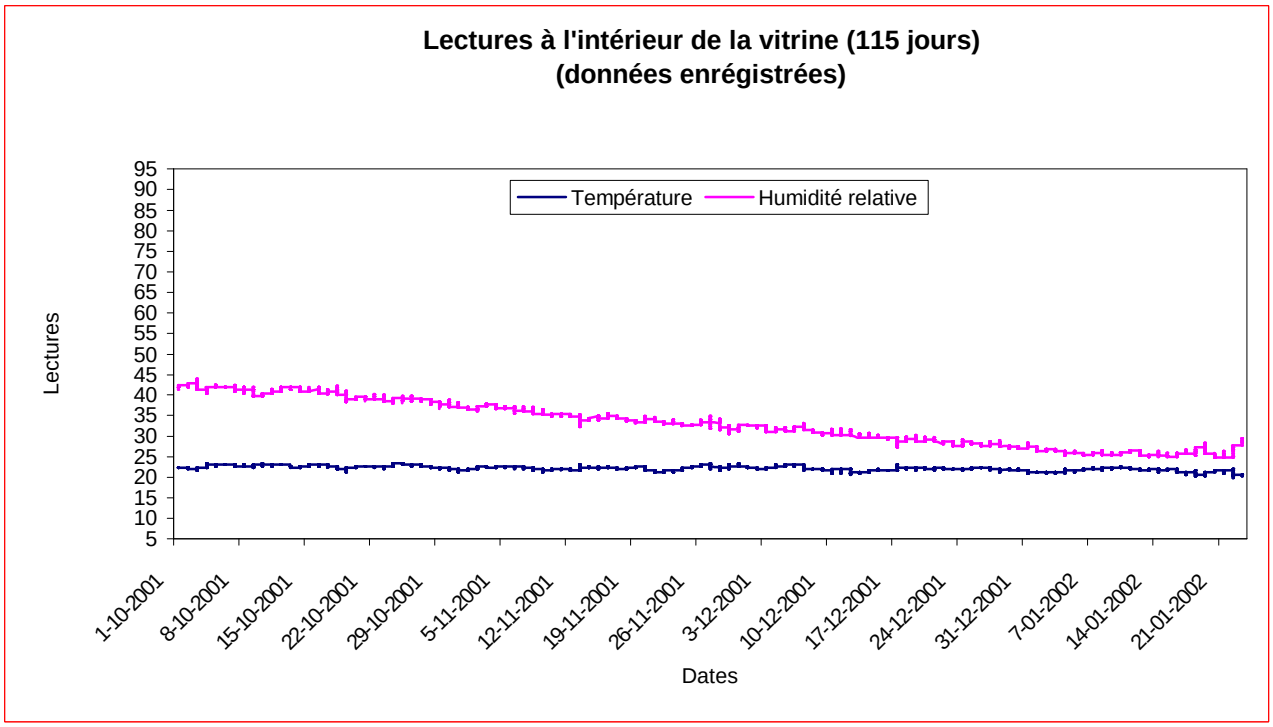
? ?*General appearance*

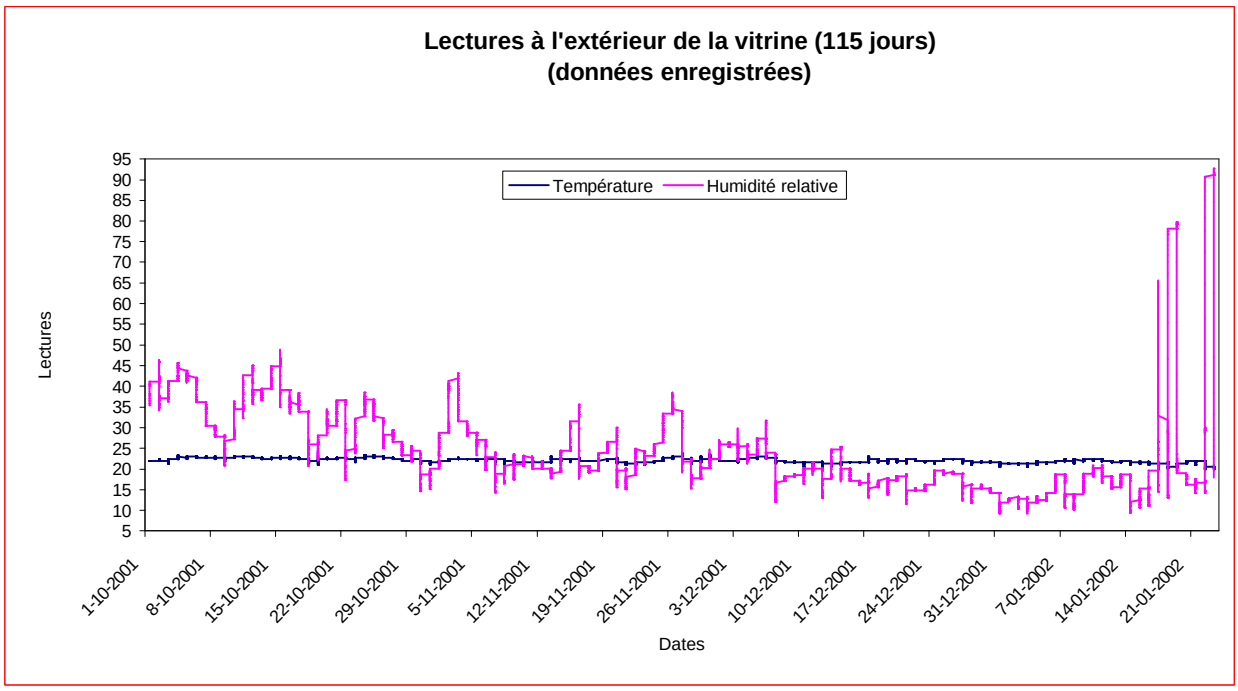
The *Zone* display case has a discreet yet well-made look. The exhibit area inside allows for a variety of layouts and features plenty of space for objects to be exhibited.

Display case Zone Concetti Design



Display case Zone Concetti Design




Lectures à l'extérieur de la vitrine (115 jours)
(données enregistrées)
Température
Humidité relative
Lectures
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
1-10-2001
8-10-2001
15-10-2001
22-10-2001
29-10-2001
5-11-2001
12-11-2001
19-11-2001
26-11-2001
3-12-2001
10-12-2001
17-12-2001
24-12-2001
31-12-2001
7-01-2002
14-01-2002
21-01-2002
Dates

Daily Average Readings Inside and Outside the Display Case

Date of Readings	Daily Average Internal Temp.	Daily Average External Temp.	Daily Average Internal RH	Daily Average External RH
02/10/2001	22.3	22	41.8	38.5
03/10/2001	22.3	22.1	42.3	39.9
04/10/2001	22	21.8	42.5	38.9
05/10/2001	22.8	22.7	41.1	43.3
06/10/2001	23	22.8	42.2	42.4
07/10/2001	23	22.9	42	40.1
08/10/2001	22.9	22.8	41.7	33.1
09/10/2001	22.8	22.7	41.3	29.4
10/10/2001	22.7	22.5	40.6	24.4
11/10/2001	23.1	22.9	39.9	31.3
12/10/2001	23	23	40.8	36.1
13/10/2001	23	22.8	41.5	39.9
14/10/2001	22.7	22.6	41.7	37.8
15/10/2001	22.5	22.5	41.2	41.6
16/10/2001	22.9	22.8	41.1	42.2
17/10/2001	22.9	22.7	41.1	36.3
18/10/2001	22.8	22.6	40.7	36.1
19/10/2001	22.2	22	40.9	26.6
20/10/2001	22	21.9	39.4	24.7
21/10/2001	22.5	22.5	39	31.5
22/10/2001	22.7	22.5	39.3	33.4
23/10/2001	22.6	22.5	39.4	26.2
24/10/2001	22.6	22.3	38.9	26.7
25/10/2001	23.1	23	38.5	35.8
26/10/2001	23.3	23.1	39.1	34.3
27/10/2001	23	22.8	39.2	27.9
28/10/2001	22.8	22.7	38.8	28.4
29/10/2001	22.5	22.3	38.4	24.5
30/10/2001	22.3	22.1	37.8	23.9
31/10/2001	21.9	21.7	37.9	18.3
01/11/2001	21.7	21.5	37.4	17.9
02/11/2001	21.8	21.7	36.7	24.4
03/11/2001	22.3	22.2	36.7	36.7
04/11/2001	22.7	22.5	37.5	37.6
05/11/2001	22.5	22.3	37.1	29.1
06/11/2001	22.6	22.3	36.8	27
07/11/2001	22.6	22.3	36.5	22.7
08/11/2001	22.4	22.2	36.3	19.7
09/11/2001	21.9	21.8	36.3	18.3
10/11/2001	21.7	21.5	36	20.5
11/11/2001	21.9	21.6	35.3	21.8

12/11/2001	22	21.7	35.2	21.5
13/11/2001	21.8	21.7	35	20.6
14/11/2001	22.3	22.3	33.8	19.3
15/11/2001	22.4	22.3	34.2	21.9
16/11/2001	22.4	22.1	34.5	28.2
17/11/2001	22.4	22.3	34.8	26
18/11/2001	22	22	34.5	20.1
19/11/2001	22.1	22	33.8	21.2
20/11/2001	22.3	22.2	33.7	25.2
21/11/2001	22.1	21.9	34.3	21.9
22/11/2001	21.4	21.3	33.8	17.4
23/11/2001	21.3	21.2	33.3	22.7
24/11/2001	21.4	21.2	33.4	22.5
25/11/2001	21.8	21.8	32.7	24.5
26/11/2001	22.5	22.4	32.7	29.9
27/11/2001	22.8	22.7	33.4	35.3
28/11/2001	22.8	22.7	33.4	24.4
29/11/2001	22.1	21.9	33.2	18.8
30/11/2001	22.5	22.4	31.4	19.4
01/12/2001	22.9	22.8	31.8	21.6
02/12/2001	22.4	22.2	32.6	24.8
03/12/2001	22	22	32.5	25.9
04/12/2001	22.1	21.9	31.9	24.4
05/12/2001	22.7	22.5	31.5	23.7
06/12/2001	22.8	22.8	31.6	25.8
07/12/2001	22.9	22.8	31.9	26.9
08/12/2001	22.2	22	32.4	17
09/12/2001	22	21.9	31.1	17.5
10/12/2001	21.8	21.7	30.7	18.5
11/12/2001	21.5	21.4	30.8	18.9
12/12/2001	21.6	21.4	30.8	20.4
13/12/2001	21.3	21	30.9	16
14/12/2001	21.1	20.9	30.1	21.7
15/12/2001	21.5	21.4	30.1	21.8
16/12/2001	21.7	21.6	29.8	18.7
17/12/2001	21.6	21.6	29.6	16.5
18/12/2001	22.3	22.3	28.7	16.2
19/12/2001	22.1	21.9	29.4	16.3
20/12/2001	22.1	22	29.3	15.7
21/12/2001	22.2	22	29.2	17.7
22/12/2001	22.1	21.9	29.1	15
23/12/2001	22.1	22	28.6	15.1
24/12/2001	22	21.9	28.3	15.1
25/12/2001	21.9	21.8	28.2	17.7
26/12/2001	22.1	22.1	28.2	19

27/12/2001	22.3	22.3	27.9	19
28/12/2001	22.2	22	28.1	16.3
29/12/2001	21.7	21.5	28.3	13.8
30/12/2001	22	21.8	27.4	15.7
31/12/2001	21.8	21.7	27.3	15
01/01/2002	21.3	21.1	27.7	11.6
02/01/2002	21.3	21.3	26.7	12.6
03/01/2002	21.2	21.1	26.7	11.8
04/01/2002	21.2	21.1	26.5	11.5
05/01/2002	21.6	21.5	25.9	12.3
06/01/2002	21.6	21.5	26	13
07/01/2002	21.9	21.8	25.4	16.6
08/01/2002	22.1	22.1	25.7	14.7
09/01/2002	22	21.9	25.9	12.1
10/01/2002	22.2	22.1	25.7	16.5
11/01/2002	22.4	22.3	26	19.5
12/01/2002	22.2	22.1	26.4	19.1
13/01/2002	21.9	21.9	25.9	16.2
14/01/2002	21.8	21.8	25.2	17.1
15/01/2002	21.8	21.7	25.6	12.6
16/01/2002	21.7	21.6	25.3	12.7
17/01/2002	21.7	21.4	25.5	13.9
18/01/2002	21	20.8	26	26.7
19/01/2002	20.9	20.8	26.2	33
20/01/2002	20.9	20.9	27	44
21/01/2002	21.6	21.7	25.1	17
22/01/2002	21.4	21.4	25.5	16
23/01/2002	20.9	20.9	26.2	38.9
24/01/2002	20.5	20.4	28.7	65.3