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Vandal Resistant Telecom
MAJOR PROJECT 81



VANDAL RESISTANT PUBLIC COMMUNICATIONS SYSTEM

DEGREE PROJECT REPORT

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Acknowledgements

1. SUMMARY

This report is the year's work on the subject of vandalism to public communications equipment. The sections are found in approximate chronological order: from the search to identify the problem areas of present equipment, to the final specifications of design solutions.

The report outlines briefly some of the attitudes and motivation of vandals but should the reader require a more comprehensive study in this area the thesis study on vandal motivation deals with the subject more thoroughly.

2. INTRODUCTION

The project commenced in November 1980 and its progress can be divided into three separate sections which roughly span the three terms of the Academic Year:

- 1) the first term: Data Collection
- 2) the second term: Data Analysis
- 3) the third term: Design Development.

Data was collected through a survey of existing kiosks in Dublin City and additional information was obtained through research literature (notably from the U.K.) on the subject. In order to analyse the data collected clarification of the survey was established to separate what may be held as malicious damage from recognisable 'wear and tear'. This has been presented in the form of quantified charts and diagrams.

However, while the survey pointed out obvious weaknesses in existing equipment, the designer's back up thesis on delinquent behaviour prompted the consideration of psychological deterrents for the vandal and it is thought that this aspect is as important as the elimination of the failure points on standard equipment.

Finally though there are many factors to consider when choosing a design solution for this problem, a brief assessment of the objectives would be:

To find a design solution that would deter or eliminate vandalism while providing a compatible interface for use by the general public.

3. OBJECTIVES

- 1) To provide an environment in which members of the public may use a public communications system without difficulty.

For this purpose:

- a. "A member of the public" is a person between 153 and 179 cm. in height, and not more than 54.4cm. in width across his elbows (i.e. 95% of adult population).

The public also includes people immobilised by reason of disability, the hard of hearing or those with sight defects and persons carrying luggage, shopping or young children.

- b. "Without difficulty" means without undue distraction from noise or weather, and with sufficient room to physically relate to, and manipulate the equipment.

- 2) To protect the equipment from extremes of weather and to provide security for both equipment and cash, from physical abuse and petty theft.
- 3) To project by means of its aesthetic appeal, an attractive corporate image.
- 4) To indicate clearly to the public that the communications equipment is available.
- 5) To protect and give access to such directories and customer information as is considered necessary to ensure effective use of the equipment.

Note: It is noted that a new system currently under development in France will provide this service by a subscriber computer directory link-up.

4. PROCEDURE

4.1 Damage Survey

a. The Survey

In order to define the nature and rates of malicious damage of kiosks, a random sample of 100 of a total of 720 kiosks was taken in the Dublin Corporation area.

The findings were recorded on special survey sheets and the information transferred to one large data sheet for analysis (see Sheets 5 & 6).

A numerical score was allocated to each type of damage and marked on the survey sheets, thus the overall pattern of damage to each kiosk emerged (See Survey sheets and Table 1).

The rates of damage were broken into five classes, based on the accumulative scores and plotted on a map of Dublin (See Presentation Sheet 7). This identified vandal-prone locations.

As the pattern of heavily damaged kiosks appeared to be in scattered groups several questions were postulated. On a map of the City centre (See Presentation Sheet 8) correlation has been established between damage and the level of youth traffic as related to leisure amenities.

Table 1.

<u>DAMAGE TYPE</u>	<u>SCORE</u>
Posters	15
Graffiti	5
General filth	35
Missing pad	10
" handset	50
" coinbox or plate	50
" door	45
" pane	45
" directories	45
" door spring	40
" dial ring	35
" screws	2
" notices	45
Broken panes	40
Fractured pane	35
Damaged surface	15
Damaged light	45
Damaged sign	30
Jammed coin slot	45
Aerosol damage	20
Damaged shelves	20
Damaged window frames	35
Attempted entry	45
Fire damaged window	35
" " notices	35
" " coin identity	15

ACCUMMULATED SCORES

Most Seriously Damaged	250-300+
Seriously Damaged	200-249
Damaged	150-199
Minimal Damage	100-149
In Good Condition	0-100

NOTES:

Empty rectangular box for notes.

LOCATION.

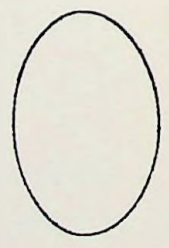
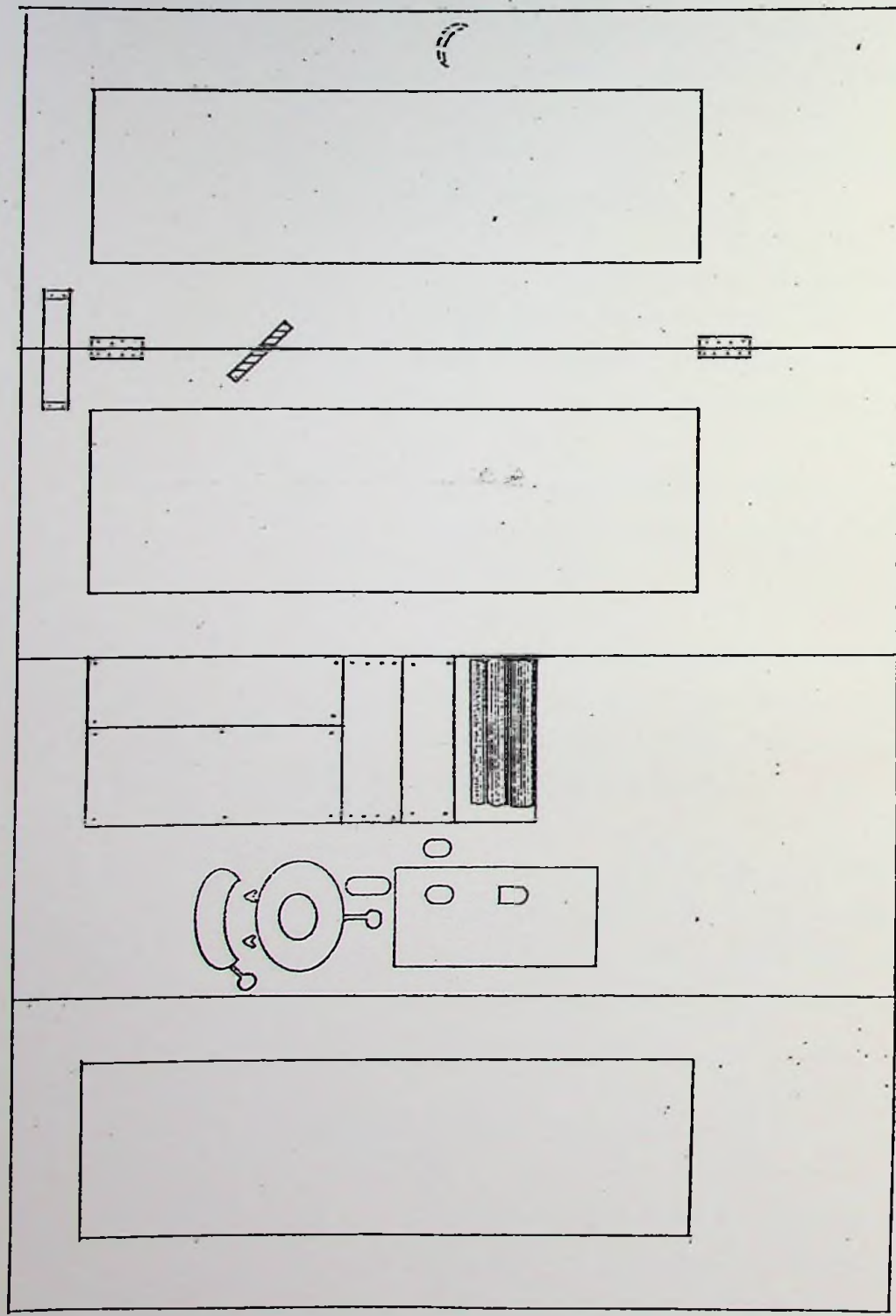
Empty rectangular box for location.

DOOR

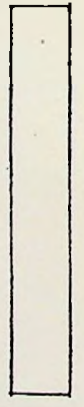
R.H.S.

BACK

L.H.S.



OVERHEAD LAMP.



TELEPHONE

SIGNS.

b. Damage Description

The following pages include a detailed description of the type of damage inflicted on equipment in the kiosks and recommendations for its prevention.

b. Damage Description and Recommendations

1. HANDSET - Damage

- 1) On virtually every vandal resistant type handset there was evidence of attempts made to shatter it. Persons had most obviously held the handset by the mouthpiece and battered the back of the earpiece off the dial housing. However, although this does not smash the handset or break the connection, it leaves nicks on the handset making it look and feel scruffy.
- 2) It has been reported to me by the Department of Posts and Telegraphs that some handset speakers are destroyed by the insertion of small pieces of wire into the casing perforation.
- 3) On the standard phones some ear and mouthpiece covers were removed in order to expose and damage the speakers.
- 4) Seven handsets were found to be removed from the standard models, these were mostly torn out though some had been cut off with a pliers, knife or other sharp instrument.
- 5) The armoured cables supplied with the vandal resistant type instruments provide a reasonable answer to the cables being torn out or cut, but they are not as comfortable to use as the standard variety.

HANDSET - Recommendations

- 1) To eliminate the current type of handset in favour of a fixed speaker or other system that would not endanger the cable connection or provide sufficient space for the handset to

be beaten off other items of equipment.

- 2) Both speakers must be protected against the insertion of wire or other small sharp instruments in the speaker cover perforations.
- 3) Whatever design is specified it must have hidden fixings for speakers and a protective conduit for the cable.

2. DIAL HOUSINGS - Damage

- 1) Eleven dial steady rings were removed from their positions between dial and housing. They may be easily removed with a key or similar instrument.
- 2) One vandal resistant type dial housing was found to have been beaten by a heavy blunt instrument like a hammer but had survived this treatment.
- 3) One housing cover on a standard model was removed completely, exposing the interior mechanics.
- 4) One dial had been bent and twisted on a standard instrument.

DIAL HOUSINGS - Recommendations

- 1) Item (2) in the dial housing notes above showed successful resistance of an armoured housing to serious ill treatment. Any type of housing chosen should be capable of resisting this type of treatment.
- 2) If a dial is specified, it should be recessed to

reduce the effective leverage without restricting its function.

- 3) If a button type system is specified the button design and housing could be similar to that used in modern vandal resistant lifts.

3. COIN SLOTS - Damage

- 1) Damage from inserting levers into coin slots thus knocking them off alignment.
- 2) Several boxes were out of order, having had cardboard forced into the coin slots by petty thieves to block the money flow system. The thief returns later to remove the blockage and to collect whatever coins have accumulated.
- 3) The coin identity frame had been burnt or broken away in two cases, but many more showed burn marks from cigarette types.

COIN SLOTS - Recommendations

- 1) If coin slots are maintained they should be of sturdier construction in order to prevent damage from levers.
- 2) At this point it is worth recommending the removal of money from the system completely, thus frustrating the petty thief.
- 3) The display might be either etched or engraved on the top of the coinbox.

4. COINBOX HOUSINGS - Damage

- 1) Two coinbox front covers had been levered off, exposing the interior. This is possible by cutting off the lock lip with a cold chisel or large screwdriver and by the levering of the cover loose from the top seam.

I found one case where this had been done and then the coin chute cut as a step to shaking out the money. However, I understand from the Dept. of P. & T. that it is more common for a child's hand to be used to retrieve the money once the heavy work has been done by an older person.

- 2) Four coin return cups had been interfered with, making them loose on their mountings (most likely the work of a petty thief).
- 3) The top horizontal surface beside the coin display had been beaten on three occasions with a heavy blunt instrument to no apparent purpose.
- 4) Three housings had liquids poured on them: two were probably alcohol; the third was most likely urine.

COINBOX HOUSINGS - Recommendations

- 1) Some coinbox fronts have been replaced by the Department with heavier plate and sturdier locks. Another method has been to weld $\frac{1}{2}$ " x $\frac{3}{8}$ " steel bar around the cover edges.
- 2) The top right hand side of the front cover and the top horizontal surfaces are most subject to scratching, therefore a baked finish is the least requirement.

- 3) Surfaces positioned in such a way as to render them open to attacks of violence should be reinforced as necessary.

5. DISPLAY BOARD - Damage

- 1) Once a couple of screws have been removed from the transparent display cover (usually perspex) it may be pulled back and snapped off at the next screw exposing the information sheet to damage.
- 2) If vandal resistant (prison door) screws are fitted and the cover is vandalised these are difficult for maintenance workers to remove.
- 3) The cover having a lower flashpoint than the windows is more susceptible to fire damage and although two had been completely burnt away, three more were scarred by having a lighter or similar instrument held against them.
- 4) Three covers had been unscrewed and removed completely.

DISPLAY BOARD - Recommendations

- 1) A polycarbonate or toughened glass could be used instead of the present material and a simpler method of replacement with hidden fixings should be sought.
- 2) Is all the information necessary on a vandal resistant type instrument? Could the essential information not be engraved on the housing?

6.

SCRATCH PANEL - Damage

- 1) The panel is awkward to use, positioned where it is on the back right hand side and for this reason the area behind the dial housing and up to the top of window cover at the back is abused by persons scratching messages: phone numbers etc. (66 kiosks).
- 2) Thirteen panels had been detached and removed from the kiosks for some unknown purpose. The screw holes proved that they had been fitted.
- 3) One panel had been destroyed by fire (incidentally as the rest of the box suffered similarly).
- 4) Perhaps a slight angle on the panel would make it easier to use.

SCRATCH PANEL - Recommendations

- 1) The display board should change positions with the scratch panel.
- 2) The back area within bounds of reach should have a more durable surface than the present wooden one.
- 3) None of the panels was found to have been scratched by a sharp instrument.

7. THE DIRECTORY SHELF - Damage

- 1) Wear patches and a build up of grease were found on the left hand third of the lip from the elbow, forearms and hands of the callers.
- 2) The angled teak shelf had been split on six occasions. Some of these appeared to have been a joint in the timber which had become widened with keys or similar instruments.
- 3) The centre of the angled tray and book lip appeared to have been subject to heavy blows.
- 4) Forty four kiosks (almost 50%) have some or all directories missing.
- 5) One set of directories had been set on fire in their tray, damaging the shelf, information notice, scratch panel and wooden back of the box.

THE DIRECTORY SHELF - Recommendations

- 1) The shelf could be made from a less expensive and more durable material than teak.
- 2) Fire resistance is most important.
- 3) The directories cannot be fixed permanently inside the kiosk in case they are set on fire by vandals.
- 4) The lip and angle should be carefully designed: stainless steel might be a possible material.

8. BACK WALL OF KIOSK - Damage

- 1) The wall area from the button of the dial housing to the top of window height is more subject to a large amount of now serious graffiti (68% of kiosks).
- 2) The wood has a varnish coating to protect it and this makes it more inflammable.

BACK WALL OF KIOSK - Recommendations

- 1) The back wooden surface looks very untidy with the amount of graffiti on it. It may be possible to avoid this by
 - a. making the present scratch panel more obvious
 - b. by providing a patterned curve or similar surface which is difficult to write on
 - c. by some sort of metal cladding.

9. THE SIDES OF THE KIOSK - Damage

- 1) From the top of the windows to a level of 40cm. below on the door side of both frames, varying amounts of scratching were noticed, though it was usually more prominent on the left hand side.

Various reasons can be given for this pattern, among them being the position of the caller in the box. If a person is right handed he may lean his back against the right hand side of the kiosk and lift his hand to this area of the left hand side and vice versa with left handed persons.

In texture these abrasions are very light and similar in build up to those made by fingernails behind door handles. However, in a kiosk other

hard objects like small change and keys are found in the hand. These also bear some responsibility for the pattern.

- 2) In the position just under the pattern described above between 40 cm. and 70cm below the top of the windows on the door side of the frames, wear patches are to be found. These are usually at elbow height where the caller's upper arm bears his weight as he leans against the frame while using the telephone. The paint appears to have been rubbed off just like a callous and several old patches could be seen under freshly pointed frames.
- 3) The sides of the frames adjacent to the back of the kiosk - there was very little damage of any sort. A scatter of graffiti on the left hand side is misleading, as it merely refers to a blue felt tip message, stating "Jesus Saves" which appeared on virtually all kiosks visited.
- 4) The top of the window frames seem to suffer little from any type of damage apart from very occasional graffiti. The only marks I found in this area were on one particular box in Eglinton Road, where concerted effort had been made by a group of persons to cover the box in slogans and names from top to bottom and inside out.
- 5) The bottom section of the box is subject to some scuffing from footwear but there was no serious damage.

THE SIDES OF THE KIOSK - Recommendations

- 1) From a careful assessment of the heights at which we may expect unconscious wear described, it may

be necessary to reinforce certain areas of a frame with a tougher surfaced material than the present paint. A ceramic surface or insert could be a possibility.

- 2) In the design of a new kiosk it may be possible to encourage or discourage the user from standing in such a way as he may cause damage. This may be possible by providing a type of hand rest for the caller that would hold his interest and help to make him comfortable. On the other hand it would be possible to make certain areas or surfaces less tactilely appealing.

10.

WINDOW PANES - Damage

- 1) The two side panes suffered similar types of damage though this was slightly heavier and more spread out on the left hand side. Most of this damage appeared to be the idle scratching of lines and falls between the top of the window and 70cm. below.
- 2) Small posters were found at approximately 140cm from the ground on six occasions: this was about eye height.
- 3) Odd scattered bits of graffiti were found on a few occasions but none of these were serious. At a height of below 115cm from the top of the windows was virtually unmarked.
- 4) Aerosol marks were only found on the window panes, the frames were untouched. Approx. 10% of kiosks had suffered from this type of damage and these had all three panes daubed. Out walking I frequently came across series of boxes that had been sprayed in similar fashion, suggesting

that the same youth or group of youths were involved in damaging several different kiosks.

- 5) Fire damage to the panes was mostly between 110cm and 70cm. from ground level, suggesting very young or exceptionally short-sized offenders. As in point (4) above I found a few series of boxes that had been systematically damaged in this way.
- 6) Once a continuous flame like that from a lighter is held against the macrylon it starts to deteriorate by bubbling and warping. This results in distorted vision through it and makes appearance unattractive.
- 7) Levers had been worked under the exterior aluminium retaining frame of the panes and the panes were subsequently snapped. There exists a danger of passers by being caught or injured by the protruding twisted metal.
- 8) Fractures and cracks in the macrylon seem to appear at a pattern related to the joint heights of normal adults, suggesting that adults or older youths could be responsible, e.g. hip, elbow, forehead, shoulder, knees.

WINDOW PANES - Recommendations

- 1) Since fire may be considered an inevitable form of attack, any type of plastic window may have to be eliminated.
- 2) Frosted or translucent panes may add to the insecurity of a single vandal or petty thief as it reduced his view of persons approaching. However, it is more likely he will be working with a partner.

- 3) At standard joint heights, it may be worthwhile installing metal frames or supports to bear the brunt of blows. However, this could mean having smaller panes which may not be a viable proposal.
- 4) The exterior aluminium retaining frame is sturdy but not resistant to the persistent vandal, a strong material like galvanised iron could possibly be used.
- 5) A type of heavy glass installed in all standard kiosks in England could be worth investigating.

11. DOORS - Damage

- 1) Two doors had been torn off their hinges and removed.
- 2) Four doors were missing their glazed panels.
- 3) One door had been badly warped by fire.
- 4) At internal elbow height of the opening side of the door frame, there was some evidence of wear. This is due to persons opening the door with their elbow and forearm while leaving the box.
- 5) The door panes generally suffered similar types and patterns of damage as the side panels.
- 6) Nine door return springs were not functioning; three of these had either one or the other disconnected; one had snapped in half and the remainder had been removed.
- 7) One door stop strap had been removed.

DOORS - Recommendations

- 1) Are doors really necessary in a vandal resistant instrument?
- 2) Elbow height may need to be reinforced to cope with damage from rough openings.
- 3) The springs are as resistant as the wood into which the screws are attached.

Door Width 750mm (minimum)*

*This may require some users to turn edgewise when entering the structure.

850-950mm (optimum)

A door width much the same as that of the structure would be advantageous provided that this does not make the door too heavy.

3) Standards for Internal Dimensions of Structures for Disabled Users:

"Disabled Users" includes the ambulant disabled as well as the wheelchair users.

Height of Data Input Device

if required 750mm (minimum)

800mm (optimum)

They should also be the same height as an integral shelf.

Internal Height of Structure

2 m (minimum)

2.5m (optimum)

Internal Width of Structure

1150mm (minimum)

To allow manoeuvring of chair within a three-sided or pedestal structure.

Depth of Structure

1 m (minimum)

1.2m (optimum)

The minimum depth would leave the back of a wheelchair sticking out: a possible safety hazard.

4) Criteria for Positioning Standard
Pay Phones

The figure below shows the height of operating controls in various countries compared with a criterion for the mounting of the equipment, which places its base now lower than 94cm. and its top no higher than 140cm. from the ground.

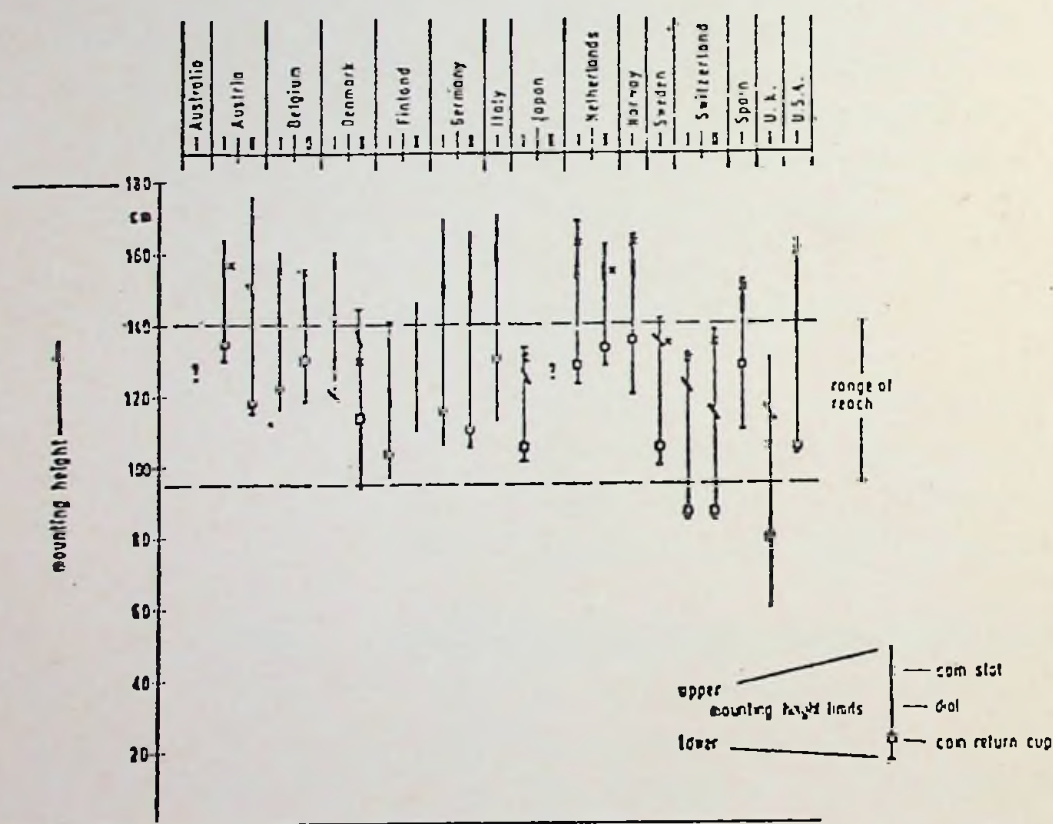


FIG.1 Position of Operating Elements of Coin Telephones

- i) The range of reach shown in Fig.1 above which is given in Para 4.2 of The 5th Human Factors Symposium on Telephony, is acceptable. However,

it was not designed to meet the requirement that the telephone can be used for emergency calls by a child of 8 years. Any controls above a height of 1.2m. may prove to be inaccessible to short youths aged 8 years (1.3m for short youths of 9).

- ii) The British Post Office's Research Department Report No.89, titled "Dialling Problems in Call Offices with Pay on Answer Coinbox", suggest that the diagonal mounting of the coin-box in the back left hand corner of the structure is preferred.

5) Display of Customer Information

- i) At present the area given to customer information in this country equals approx. 1000cm^2 , the minimum recommended typeface is 10/m universal medium.
- ii) Approximately two thirds of this area is used for essential instructions, describing how to use the system, call up the operator and make emergency calls. The other third includes a formica scribble pad.
- iii) The area given in (i) does not include space for directories, tariff information, telephone instructions for the hard of hearing, location of the nearest kiosk, prosecution or publicity notices, and commercial advertisements.
- iv) It is important to note that where S.T.D. systems are in use abroad, local and S.T.D.

should also be given.

- v) Any operating instructions appearing on the equipment (i.e. pictograms) can release extra space required by (iv) above.
- vi) From an ergonomics viewpoint, the centre of any display should be mounted at 1.55m from the ground.
- vii) Average persons (See Objectives 1) a.) with poor eyesight may find it difficult to read codes at the upper and lower extremes of the list.
- viii) It is possible that a larger display than the one described in (i) may be desirable in certain locations.

6) EFFECTS OF AMBIENT NOISE

Attenuation Provided by Various Types of Structure

The attenuation A of the various structures is estimated as follows:

- i) For existing types of structure (kiosks)
A = 15 dB-20 dB, but are capable of improvement at extra cost, e.g. by sound-proofing the means of ventilating the kiosk.
- ii) For a 3 sided structure (booth)
A = 12-18dB, depending on the effectiveness of the users as a 'door'.
- iii) For a pedestal structure A = 5-7dB.

- iv) For a structure providing no protection for the user there is no attenuation (very slight attenuation may be caused by the handset but this negligible).

Attenuation Required for Particular Locations

- i) At 'high street' sites. At least 15 dB attenuation needed, preferably 20 + dB, to reduce the effect of traffic noise. Existing kiosk not really good enough for some locations.
- ii) At main line stations, 12-15 dB. A structure with directional attenuation may have advantages in allowing the Public Address system to be audible while reducing the noise from trains etc.
- iii) Pedestrian precincts, 12-15 dB.

In all cases, careful siting can be of great benefit.

The Hard of Hearing

If the hard of hearing use a pick-up type hearing aid, then there should be no problem due to ambient noise.

If they use an acoustically coupled aid, then they will have similar problems to people with normal hearing. In some ways, a hearing aid user may have less difficulty due to ambient noise than a person with normal hearing, because hearing aids tend to discriminate against the low frequency 'rumbling' noises present (for example) in traffic noise, which can otherwise be very troublesome.

7) The Structure's Environment

The main variations in environment in which structures must meet the stated objectives are:

- i) Completely open and/or noisy locations in two distinct situations -
 - a. urban thoroughfares
 - b. rural and other locations, generally regarded as of particular aesthetic environment
- N.B. Both situations may be in vandal prone areas
 - a. from locals
 - b. from coaches and/or day trippers
- ii) Locations in suburbs where there is less traffic, pedestrian or police activity in the evening and subject to attacks from the petty thief.
- iii) Locations partially or fully exposed to weather but will less ambient noise (e.g. shopping centres)
- iv) Locations exposed to high levels of ambient noise but under cover (e.g. shopping concourses, railway stations etc)
- v) Recognised highly vandal prone locations

7) Variations in Structure

i) A totally enclosed structure with a door. For 7) i) a. and b. and also 7) iii), varying in outward appearance, possibly in colour, to satisfy the needs of the environment but still identifying its purpose in Objectives 3) and 4).

N.B. Doors are regarded as a protection against noise as well as against weather.

ii) A booth without a door for locations at 7) ii) and for some locations at 7) iv)

iii) A pedestal structure for other locations at 7) iv) where wall mounting is impractical.

iv) A wall mounted structure giving the same degree of protection as the pedestal type; again recommended for siting in locations 7) iv).

v) A variant of one of the foregoing (especially when they are en suite) especially designed for the use of disabled persons.

vi) An extremely robust structure probably of the pedestal type, giving protection and security to the equipment as in Objective 2). This is for location in heavily vandal prone areas and more detailed structure characteristics are given in the following section.

4.3

Vandal Motivation

While much vandalism is undertaken by young children or socially deprived youths, this is by no means true in all cases and the results of vandalism may be seen at all levels of the community to a greater or lesser degree.

This project concentrates on designing to resist abuses from youths in the 13 - 17 age group. The vast majority of the damage observed during the survey is consistent with persons of this approximate physical size and mental development. In addition, the most severely damaged kiosks examined almost always occurred in areas where peer groups congregated during their leisure time or are on the routes to and from these leisure areas to each other or to socially deprived residential developments.

As this area has been researched in greater detail in the thesis, it is sufficient to outline here the main motivation for persons of varying age groups to commit acts of malicious damage and so describe them briefly under the following headings:

- 1) Boys aged 12 years and under
- 2) Youths aged 13 to 16 years
- 3) Youths aged 16 and upwards
- 4) Occasional vandals

- 1) Boys Aged 12 Years and Under

Boys of this age seldom damage with malicious intent but more with a lack of thought of what may result from their actions. Spontaneous damage not usually in supervised areas like streets is found amongst this group as at this age there is a tendency to take things apart to find out how they work.

In their book, "Designing Against Vandalism", the Design Council suggest that "acts of wilful destruction may be subordinate to the general spirit of competition between young boys as to who can achieve most".

2) Youths Aged 13 to 16 Years

In this age group play recedes in importance as an activity; the boys tend to form peer groups and vie with each other for prestige within their group by postures of daring and toughness. Often enough vandalism may be the cheapest way for them to do this as the chances of chastisement and prosecution are very low. The damage tends to occur in public areas unsupervised by local communities.

In the latter part of this age group vandalism is undertaken more frivolously than hitherto, as the youths become involved in a widening pattern of criminal activities and vandalism recedes in importance as a status achievement.

3) Youths Aged 16 and upwards

At this age the peer groups begin to split up due to the demands of jobs, a greater awareness of the opposite sex and the youths' new responsibilities within society. The overall crime rate begins to fall off and vandalism is no exception.

However, some youths who are ill-equipped or hesitant to compete in the new areas of activity may remain in the diminishing group into their late teens. These disturbed, often aggressive individuals feel obliged to engage in more extreme forms of delinquency in order to justify continued membership of the group and acts of vandalism by such

persons may be very costly to the victims.

Vandalism from this group and indeed from the latter may be closely associated with damage due to breaking and entering or to frustration at failure to find valuables. In these cases vandalism is merely a step towards achieving entry and would account for most property damage done by young adults.

4) Occasional Vandals

While most criminal damage is undertaken by the three age categories described, there are a few possibilities that should also be considered.

This category would include damage done by the vagrant in order to attract official attention and perhaps a bed for the night. It should also be mentioned those acts of damage committed by students or members of well-to-do sports clubs during 'rag' weeks or match celebrations.

Although in these latter two cases, the perpetrations may tend to be regarded by the authorities as mere high spirits, rather than vandalism proper, the resulting damage (particularly after soccer matches) may be quite serious.

5. RESULTS

5.1 General Specification

1) Installation

The structure should be inexpensive to install, store and transport (i.e. possibly sectionalised design).

2) Maintenance

a. The structure should be easy to maintain from a non technical point of view (i.e. work on painting and cleaning should be minimal).

b. From an engineering viewpoint structures should give easy access to the equipment and provide suitable conditions for maintenance.

3) Materials

a. It is important to seek out the best materials and processes for use in the manufacture of the structure. Bearing in mind that a particular material is as 'strong' relative only to the design in which it is incorporated.

b. The structure should have a plant life equal to its usefulness, and should wear out at the point when the design is expected to become obsolescent.

Note: The latest British kiosk has a plant life of 40 years; the British Post Office consider it may become outmoded long before it become unserviceable.

c. The system must be robust against extremes

of weather and attacks by vandals. It should also be capable of suffering the rigours of storage, transport and erection without damage.

- d. The basic materials apparently available are cast iron, mild steel, stainless steel and anodised aluminium for the framework of the structure and toughened glass or polycarbonate for the windows etc. (acrylic is not flare-proof and therefore would not be regarded as suitable). One circular kiosk marketed by Vetros spazio srl (Italy) is built of fibre glass. A variant of the K8, first produced by WMTB and now more widely used for temporary locations, is also built of fibre glass. Injection moulding over strengthened frames might be possible but would involve the use of PVC which would be neither vandal resistant nor flare-proof. A nylon dip finish would be weather-resistant, but not vandal-resistant. The latest developments in ceramics produce an extremely tough, self-coloured, scratch-proof material, but it would be difficult to fire the very large parts required for kiosk construction.

Warerite or GRP might be suitable for booth and pedestal type structures.

This review has been unable to identify other suitable materials, but this is not to say they do not exist. Self coloured materials which are also highly scratch-proof should be chosen if possible.

4) Aesthetic Appeal

- a. It is hoped that the final design will satisfy the public needs.
- b. Because vandal-prone areas may differ both architecturally and environmentally from each other, the final design will have to suit many different situations.
- c. The design must be identifiable as a public communications point
- d. Once a member of the public has approached the equipment, its design must suggest the way in which it must be manipulated in order for the person to communicate.

5) Characteristics of Vandal Resistant Structures

- a. The design should offer no hazards to users, passers by, maintenance staff or vandals, even when damaged.
- b. To assist with security persons using the equipment should be clearly visible; as clear as panes and strong 24-hour lighting can make it.
- c. Coated surfaces (especially dark ones) with light under covers should be excluded as much as possible.
- d. Scratch-proof materials should be used where possible (cost is highly restrictive in this area).
- e. The dial, if specified, should be recessed and of heavier gauge steel to afford

minimum purchase for levers. (Perhaps without holes but with indentations for finger tips).

- f. The 'pips' should be capable of resisting rough handling and could possibly be re-sited, enabling dial tone to be obtained by a pressure or separate switch.
- g. Hidden fixings, or those requiring specialised tools for installation and removal should be used as little as possible.
- h. Materials selected should be as fire resistant as practicable.
- i. Ordinary glass should be replaced by armoured varieties (wire reinforced glass may act as a challenge) or strong plastics such as polycarbonates which may be easily replaced by maintenance workers but are impractical for the vandal or petty thief to remove.
- j. A strong shelf for the customers' use with housing for relevant directories.
- k. Handsets should be made from shatterproof plastics with reinforced cables.
- l. The equipment should be protected from damage by liquids, including urine. For this purpose the kiosk must be of a well ventilated design.
- m. The coin insertion mechanism and return tray should be as tamperproof as possible.

- n. The money compartment and coinbox housing should be made from heavy gauge steel.

6) It is noted that the following systems which eliminate damage from the petty thief are in use under test abroad:

- a. The use of inserted cardboard strip instead of coinage. This strip may be bought in the post office, pubs and shops on the same basis as stamps
- b. The use of special aluminium slugs which are bought on the same basis as in (a) above, but which are re-usable.
- c. The use of a direct credit card which will charge the call to the user's bank account.

Note: In all the above cases, emergency calls may be dialled free of charge.

- d. The use of a magnetised plastic card (re-usable).

6. CONCLUSIONS : PROTOTYPE BUILDING

The first consideration in the selection of materials and processes for design solutions is the low number required and, as a result, only methods that would satisfy lower technology construction were examined.

Three prototypes were built and this is outlined in the following sections.

Briefly, the materials used were:

Prototype 1	reinforced concrete
Prototype 2	formed steel skin with a rigid foam filling
Exhibition Prototype	formed steel skin with a rigid foam filling and steel support pedestal.

6.1 PROTOTYPE 1

This prototype was a single concrete moulding reinforced with expanded metal and round bar. It was inexpensive to construct and proved a very robust structure.

The design was rejected for the following reasons:

- 1) Difficulties in handling due to weight.
- 2) Danger to members of the public should it topple during siting or due to a traffic accident.
- 3) Wheelchair customers were unable to manoeuvre close enough to the structure on account of the site for the support pedestal.
- 4) The shell could be cracked by vandals, weakening the structure and requiring complete replacement.

6.2

PROTOTYPE 2

This prototype was constructed from a 20 gauge formed steel sheet and filled with rigid polyurethane foam. It was very light and could be easily carried by one man.

The enclosure was incredibly strong once the foam had solidified within it and difficult to damage using the body. However, more substantial damage could have been possible if rubble left over from street excavations was used as assistant material.

The polyurethane foam is an inflammable substance but it is considered that the open air site and steel skin should be able to conduct away any localised heat applied.

The foam slightly distorted the metal as it expanded and a more even application with a support cabinet would be required in production.

Street Testing

The prototype was tested on a site in College Green, which already contains two standard kiosks and which is a high risk location, as well as being the noisiest in the survey area, having traffic moving all round it and three sets of traffic lights within twenty feet.

The Department of Posts and Telegraphs wired up an amphetamine to the enclosure from the existing kiosk and it was possible to make sample calls from it.

The noise readings did not vary beyond certain ranges during the entire test period from 9 a.m. to 12 noon, and were as follows:

- 1) Inside the kiosk with the door fully closed:
60 - 70 dB.

- 2) Inside the kiosk with the door ajar:
70 - 80 dB.
- 3) On the adjacent pavement: 70 - 80 dB.
- 4) In the prototype: 65 - 75 dB.

It was possible to communicate with reasonable privacy and satisfaction, using the amphiphone as it was not possible to hear a conversation from more than a foot away from the enclosure. While the volume was nowhere near the minimum required.

It was also noted that the caller's head did not have to be fully inserted into the hood in order to hear the speaker sufficiently but could be upright and outside the trough, allowing more varied positions and greater comfort.

6.3

EXHIBITION PROTOTYPE AND CONCLUSION

The diversity in mood and mode of vandal attacks complicate the materials selection process as the seriousness of these attacks will depend entirely on the individual concerned and whatever assistant material they may find to hand.

The material need not be the most resilient available as cost and vandal satisfaction factors must be considered. There may be more excitement in breaking something described as unbreakable than smashing something which is disposable.

A wide range of materials was examined in the materials selection chart and the following were selected for the various components:

- 1) The hood: 22 gauge mild steel formed seam welded and galvanised.
- 2) The pedestal: 5" square section hollow steel tube with a baked finish.
- 3) The hood finish: self adhesive vinyl sheet (permanent variety) complete with symbols, operating instructions, S.T.D. codes etc.
- 4) The customer shelf and lighting guard: formed steel sheet gauge with an enamel finish.
- 5) The enclosure cap and light cover: 22 gauge mild steel with a baked finish, jointed with aluminium extrusions.
- 6) The identification sign: 4mm. perspex with the symbols milled out and solid filled with black resin.

6.3.1 NotesSelf Adhesive Vinyl

- 1) The material will always present a clean, even finish to the customer.
- 2) It may become damaged or scratched but is easily repaintable on site and requires no setting time.
- 3) It may be removed by a serviceman so that dents to the steel sheet can be repaired by polyester paste.
- 4) The external hood spaced could be sold to advertisers thus reducing costs.
- 5) The material is disposable and does not hold a challenge to vandals.
- 6) It may not be shattered by heavy blows.

Steel Pedestal

- 7) This supports the enclosure and houses components safely.
- 8) It can be handled without difficulty by two workmen.
- 9) It allows sufficient manoeuvrability for wheelchairs.
- 10) It is visually acceptable.
- 11) It is not easily damaged.

The Component Housing and System

- 12) It provides complete security for components.
- 13) It has no joints that allow access to levers.
- 14) The push buttons are of a diameter that allows them to be depressed but does not allow excessive pressure to be applied.
- 15) The system will use a magnetised card for payment and so eliminate petty theft.
- 16) The selection switches will provide dial tone.
- 17) The push buttons have numerals engraved on them and are filled with a solid substance like resin - this does not allow them to become illegible by scratching.

The Shelf and Lighting Guard

- 18) Both hinge out once the component box is removed, providing dry access to the light and extra component storage space beneath the shelf.
- 19) The storage space could be used for future technological development (by providing space for a computer directory link-up).
- 20) The material is rigid and washable and could be used for scribbling phone numbers.

The Enclosure's Cap and Signs

- 21) The signs may be removed and polished if aerosol paints are used on them.

- 22) Violent blows would have to be very accurate to damage the perspex because of the sign guards.
- 23) Perspex is unaffected by aerosol sprays.
- 24) The cover is out of normal reach of graffiti writers.
- 25) The cover is fixed in position by jointing extrusions and locked in by mounting bolts which are only accessible from inside the lighting guard.

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APPENDIX A: COSTING

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Component	Dimensions	Production Method	Material Cost	Manufacture Cost	Totals
2 part steel hood	1.95m x 1.15m 22 gauge mild steel	Twelve bends in material, then joined by Argon welding & galvanised	12.50	5.00	17.50
Rigid polyurethane foam filling	6 pints required	fitted with hood in special painting support	18.00	2.50	20.50
Hood locking bracket & pins	.80m length B.M.S. flat bar	drilled for locking pins bent & inserted in hood before foam fill	.25p	.35	.60
Light guard	.25m x .35m x 4½mm m/stl. plate baked finish	cut out and locking slot machined, then formed	2.66	2.00	4.66
Shelf	.25 x .35m x 4½mm m/stl. plate baked finish	cut out and locking slot machined, then formed.	2.66	2.00	4.66
Self Adhesive Vinyl cover	1.85m x 1.15m	screen printed complete with instructions	3.75	1.50	5.25
Steel pedestal	.125m ² 5mm thick steel section x 1.89m	cut to size, welded & ground to radius on angle, bored for locking pins, baked finish applied	21.35	11.00	32.35
Steel mounting ferrule	.125m ² 5mm thick steel section x .45m	cut to size & joined by 4 welds 150mm long each	1.00	1.00	1.00
Steel lighting cones	.125 x 1.295 m 22 gauge m/steel	slots machined out, then 12 bends & argon welded. Brackets spot welded to it. Baked finish applied	.72p.	7.50	8.32

APPENDIX A : (SHEET 2) COSTING

Component	Dimensions	Production Method	Material Cost	Manufacture Cost	Totals
Perspex signs 4 required	1.2m x .350m 3mm translucent perspex	cut to requirements; one is formed, then stencil applied - insignia	3.00	1.50	4.50
Sign brackets 8 required	120mm x 20mm 22 gauge m/steel	spot welded to cover cap; drilled for fixing bolts to hood	.05	.20	.25
Enclosure cap	.365m x .37m 22 gauge m/steel	bent at edges to fit extrusion and baked finish applied	1.35	2.00	3.35
Aluminium extrusion	H - section 2	cut and formed to shape	.80	.24	1.04
Component housing	3-sided steel box 4½mm thick x .34m x .7m	openings machined out; brackets welded for locking; baked finish	3.45	16.50	19.95
		Paint finishes	10.00	5.00	15.00
TOTAL COSTS:			80.54	58.29	£ 138.93

APPENDIX B: MATERIALS SELECTION

APPENDIX B: MATERIALS SELECTION

Material	Cost	Surface Finish	Slash & Scratch Resistance	Cost of Repair	Finish after Repair	Impact Resistance	Fire Resistance
F.F. Finished aluminium	High	Good	Low	Impractical	Fair	Poor	High
F.F. stainless steel	High	Good	Good	High	Fair	High	High
F.F. galvanised iron	Med.	Poor	Good	medium	Good	High	High
F.F. Alucobond	High	Good	Low	Impractical	Poor	Poor	Good
Concrete	Low	Good	Low	High	Poor	Poor	High
Dip-coated Nylon	High	Good	Medium	Impractical	Poor	Good	Medium
Dip-coated Teflon	High	Good	Poor	Impractical,	Poor	Good	Good
Dip-coated Vyflex	Low	Poor	Poor	Impractical	Poor	Good	Good
Glass	Med.	Good	Good	High	Good	Poor	High
Perspex	Med.	Good	Poor	High	Good	Poor	Low
Macrylon	High	Good	Fair	High	Good	Good	Fair
Self-adhesive Vinyl	Med.	Good	Fair	Medium	Good	Good	Fair
Paper finishes	Low	Good	Poor	Low	Poor	Poor	Fair

APPENDIX B: MATERIALS SELECTION (SHEET 2)

Material	Cost	Surface Finish	Slash & Scratch Resistance	Cost of Repair	Finish After Repair	Impact Resistance	Fire Resistance
Brush painted	Med.	Poor	Poor	Medium	Poor	Poor	Fair
Spray painted	Med.	Good	Poor	Impractical	Poor	Poor	Poor
Baked finish	Med.	Good	Fair	Impractical	Good	Poor	Good
Ceramic	High	Good	Good	Impractical	-	Poor	Good

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