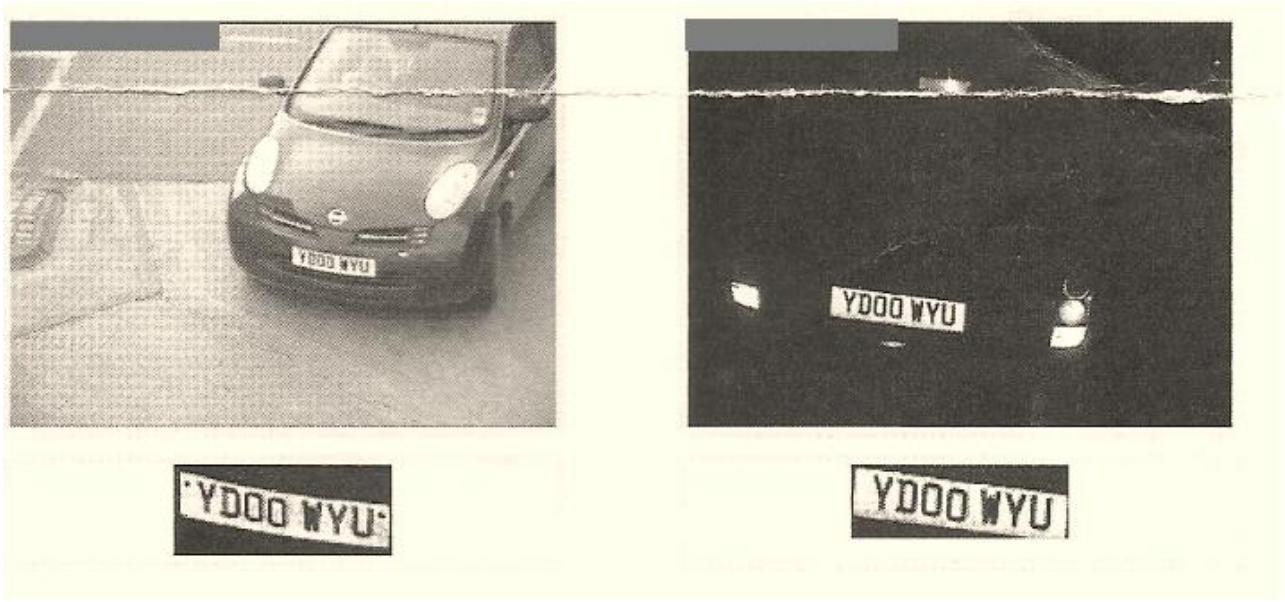
Issues around ANPR use in car parks

This document explains how parking operators use ANPR (Automatic Number Plate Recognition), highlighting the issues which assessors will need to be aware of when considering appeals.

A typical modern ANPR system will comprise of a digital camera with extra hardware and software which can recognise number plates. When a number plate is detected an image is recorded and stored. The numberplate is decoded using OCR (Optical Character Recognition) and this is stored along with the date and time of the image. An entry numberplate can be matched up with an exit numberplate, the time difference calculated, and thus the duration of stay.

ANPR systems need to work at night as well as in the daytime; in good weather and bad; in rain, mist, fog and snow. For this reason, they do not just use the same spectrum our eyes use; they also use the infra-red or near infra-red band [5][6]. This works at night and also works well in bad weather conditions.

This explains the photographs seen on a typical parking charge. If the photograph is at night, all you may see is a blurry car with headlights and no visible numberplate. This is the image taken using natural light. Below that will be a small box with the numberplate; black letters on a white background with the fixing pegs also showing in black. This is the infra-red image. It may also be digitally enhanced to sharpen the font or to straighten any skew. Alternatively the operator may just provide the infra-red image.



This explains why in some photographs the rear numberplate does not appear yellow, why the fixing pegs are so visible and why the font might not appear exactly the same as it looks to the naked eye.

Assessor Point

If an appellant complains that the image of the car does not show the numberplate or that the numberplate does not 'look correct', then a valid explanation by the operator is that they are using infra-red or near infra-red technology.

The ANPR system has to solve two basic problems. First, it has to recognise that there is a numberplate in its field of view. Then it has to decode that numberplate. Both of these are subject to error. Several published studies are available, variously quoting the success rate as between 93% and 98% [1],[3],[5].Not all of these studies are for car park situations; some are for fast moving vehicles where the problem is slightly harder due to speed. National ACPO ANPR Standards (NAAS)

compliance for police enforcement allows an error rate of 7% [4, 2.2.4] for a static ANPR Camera.

Assessor Point

Although 93%, or even 98% accuracy may seem good, on an average day many hundreds of thousands of cars enter and exit car parks. Thus misreads will be a common occurrence.

The operator should be able to supply the assessor with the rated accuracy for the system they are using. However, the assessor should bear in mind this will not always be correct [3]

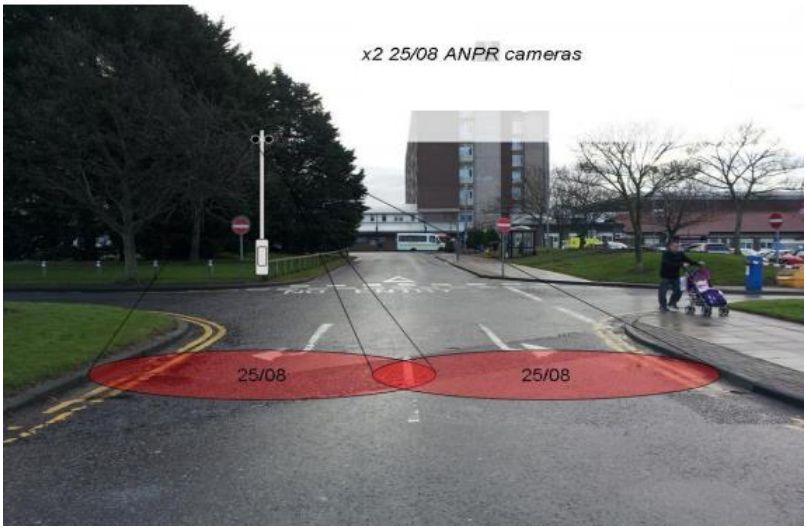
One decoding problem which must be overcome is skew. The number plates are not read head on - the cameras are not sited in the middle of the road at number plate level. Instead the cameras are high up on poles. The image therefore has to be adjusted to compensate for this.

A bigger problem is character recognition. Certain characters, such as the letter 'oh' and number 'zero' can be easily confused. One study [1] indicated that 10 characters caused over 55% of the misreads (G,S,O,C,4,D,K,H[1] ,7,M), and that the two most common causes of misreads were fixing pegs and smudge marks.

Assessor Point

The assessor can check the pictures supplied for the presence of these 10 characters, especially if they are adjacent to a fixing peg, or if the numberplate appears smudged or dirty.

A third problem is coverage. The cameras only have a limited field of view, so if the road is wide two, three or more cameras may be needed to ensure that wherever a vehicle drives the numberplate is detected. Most cameras have a width range of 4m although some more expensive ones go up to 12m.

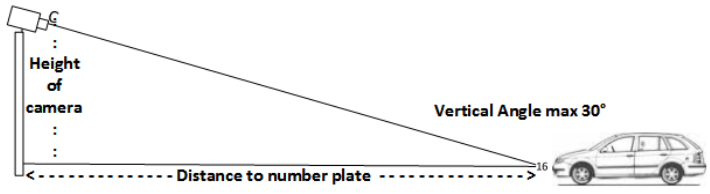


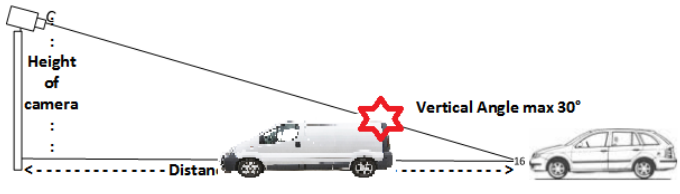
[1] The actual study recorded the letter K twice. A personal email [2] to the author confirmed this was a misprint and the second K should be an H.

Assessor Point

Operators will typically have created installation engineering diagrams similar to the preceding photographs. These can supplied as part of the evidence pack to show how the operator achieves coverage.

A fourth problem is that the cameras do not have x-ray capabilities! If a pedestrian crosses the road or a vehicle drives close to the one in front then the camera will never see the numberplate at all. This problem can be lessened by siting the cameras as high as possible, but this increases the skew problem.





Assessor Point

This is probably the most common cause of missed images. The higher the camera, and the closer it is to the read area, the less likely it is that this problem will occur.

Car parks where high sided vehicles can be present are more likely to suffer from this problem. However this problem will always exist in areas where vans and pedestrians can occur, which will account for most situations.

The higher the camera, and the closer it is to the capture point, the less likely this problem is to occur.

A fifth problem is drop-out. If any one part of the whole system stops working for any period of time, then some images might not be recorded. A car could drive in and out of the car park and not be recorded.

Assessor Point

Some sites have an on-site storage capability, so that if communication to headquarters is down the data can be stored and sent at a later date. This is more secure than other systems, but there still could be problems if a local failure occurs.

A sixth problem is related to timestamps. If more than one camera is used, the clocks may be out of synchronisation. There has been at least one reported occasion where one camera was recording at GMT, while the other camera was using summer time, thus adding an hour to each visit.

Assessor Point

All cameras should be synchronised to the same time source. The NAAS standard requires synchronisation every 10 minutes with a GPS time source [4, 2.1.1].

A seventh problem is that the times recorded are the entry and exit to a car park, and not the actual duration the vehicle is parked. This can cause a parking charge to be incorrectly issued when delays in parking or leaving the car park occur. Some car parks can take half-an-hour to leave at busy times; car parks near football grounds can be especially problematical.

Assessor Point

The operator can provide their data on a normal day to show average flow, and also on the day in question. This can help identify if congestion is occurring.

Double visits

The main problem reported with ANPR technology is multiple short visits being recorded as one long visit. This results in a parking charge notice being issued when it should not. It is easy to see how this problem can occur.

ANPR technology is not the same as CCTV technology; it does not record a continuous stream of images. Instead, a photograph is only taken and recorded when a numberplate is detected.

There are three separate situations to consider; character misreads, misconfiguration and numberplate misses.

If a character misread occurs, the operator can detect this by searching through their log for a numberplate which is similar to the missing one. Although in theory time consuming, in practice this should be easy because only unmatched numbers need to be searched. The operator can show they have done this and provide a list of unmatched numbers for the day.

In a misconfiguration situation, the operator has their software configured to record the duration of stay as the first entry and last exit, and to ignore entries and exits which occur in between. This should also be easy to detect on investigation.

Number plate misses are a bigger problem. As the system only records information when a number plate is detected, the operator will have no record on their system of that particular entry and exit, so no matter how long they search their database they will never be able to resolve the problem. Some operators acknowledge this is a problem and are receptive. Others bury their head in the sand and pretend the problem does not exist.

Assessor Point

If the operator merely states they have checked for a double visit and does not provide any other information, they either do not understand their own technology or are trying to misdirect away from the actual problem.

The most likely cause of number plate misses is a close following vehicle obscuring the number plate, especially a lorry, van or other high sided vehicle. This will be more common in times of traffic congestion. This will also be more common in car parks where high sided vehicles are common, such as motorway service stations. In cases where large numbers of incidents are reported in one car park it is also possible the operator has misaligned the cameras so they either do not cover the entire road or the camera is not high enough so blocking often occurs.

In some reported situations the operator has neglected to place cameras on all entrances and exits. Operators often forget service roads and internal entrances/exits. In other cases there may be no well-defined barriers to the car park, so if a motorist chooses to exit in a non-standard way, they will not be recorded.

In one reported situation an operator was recorded issuing a charge when the two visits were on opposite sides of a motorway service station - a clear example of misconfiguration.

Operators in situations where high accuracy is needed install induction loops in the ground which detect the presence of a vehicle and record an image even when a numberplate is not detected. If the operator has installed one of these, and has checked their images, then it is highly unlikely that a double visit has occurred.

In other situations a drop out may have caused the miss. Operators can check their systems to see if a drop-out has occurred.

Short Overstays/Long Overstays

It is important to note that ANPR records the time of entry and exit to the car park, and not the time parked. Car park operators use grace periods to account for this, but these are not always enough.

In the case where the motorist has stated that they either had to queue to park, or queue to leave, it may be that the terms and conditions of the car park have not been breached and the ANPR evidence is therefore not relevant.

Even if the terms and conditions state the time counted is the time in the car park and not the time parked, this will not always be enough.

Consideration should be given to the prominence of this condition within the small print of the signage, and also whether the driver was prevented from leaving the site through no fault of their own, such as congestion or breakdown.

The case of ParkingEye v Mrs X (3JD08933), although only a small claim hearing, concerned a driver who spent 31 minutes driving around trying to park at Fistral beach during Whit Week. The driver eventually left without parking or paying. The judge ruled this was not against the terms and conditions of the signage.

Pay and Display

In pay and display car parks it is important to note that the technology exists to accurately inform the motorist how long they have stayed and whether the numberplate they entered has been recorded.

If a charge has been raised against a motorist who miskeys their number, or overstays, then this should be borne in mind, and the question asked whether the system is designed to generate as many motorist errors as possible, or to be fair to both parties.

In the Bristol Eye Hospital, the car park there operates on the basis that you key your number when you leave the car park. The system does not allow mis-entries, and informs you how much to pay. This car park has generated minimal charge notices in the last three months.

In comparison, the system at NHS Northumbria requires the motorist to guess how long they stayed at the time of departure. If they guess wrongly or incorrectly enter their registration, a charge is issued. This system is generating revenue at the rate of £1 million a year for the operator.

It may be the case that in systems such as the second one, the operator is not correctly taking steps to minimise their losses.

Returning within the time period

An operator may argue that even if a double visit occurred, the driver must have returned to the car park within the time period allowed. For instance, the conditions may be no returns within 2 hours.

This is potentially unsound reasoning for two reasons

1) PoFA 2012 sch 4 9(2)(c) requires any Notice to Keeper to describe the circumstances in which the charge arose. As this is unlikely to have been met, then keeper liability does not apply. If the operator has not identified the driver then the charge is not applicable.
2) Multiple drivers may have used the same vehicle, in which case the conditions have not been infringed and no liability arises

Because of the possibility of (2), many landowners do not enforce a minimum return duration, even if the signage indicated this is a contravention. Thus, if the motorist challenges this, the operator may need to provide evidence from the landowner that this condition is enforced.

Quality of Evidence

Operators have a large amount of evidence they can submit. The more they submit, the more confidence can be given to their account.

Evidence could include

- Details of the system, including; whether infra-red is used; diagrams showing the positioning and number of detection zones; the height of the camera above ground and distance from the detection zones; whether results are stored locally to protect against drop-out
- Details of the event in question; accuracy tests in the car park, including analysis over a period of entries without an exit, and exits without an entry; the weather on the day; what steps were taken to detect if a double visit occurred (simple statements that a number of tests were carried out are not helpful); whether the system was analysed for mis-reads, drop-outs, camera alignment with the actual detection zones; if the motorist claimed to regularly double visit, or that the congestion occurred, whether the operator has analysed their data to confirm this
- Plans of the car park showing that all entrances and exits are covered by ANPR, and that the car park is ringed by barriers.
- Independent accuracy tests of the system
- In-house accuracy tests
- Details of systems to improve accuracy and stop double visits being incorrectly recorded, such as induction loops

Motorists are usually not so well off, because they are not expecting to be issued with an incorrect ticket for double visits, and so in the general case will not have evidence to disprove the operator's claim.

Any witness statement provided on behalf of the motorist should therefore be given appropriate weighting. The operator is always at liberty to bring a case for perverting the course of justice if they think the witness is lying.

Other evidence could include a timed photograph of the vehicle clearly outside the car park, emails, receipts or other items which show the motorist was elsewhere during the time claimed.

References

[1] Accuracy of Automatic Number Plate Recognition (ANPR) and Real World UK Number Plate Problems. Mike Rhead, Robert Gurney, Soodamani Ramalingam, University of Hertfordshire

[2] Personal email from Soodamani Ramalingam

[3] ANPR System Performance, Liam Keilthy, Parking Trend International, June 2008

[4] National ACPO ANPR Standards (NAAS), Version 4.12 No 2011.

[5] Anpr-tutorial.com

[6] Manufacturer advert for Rapier 30 ANPR Cameras