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Yard House, Basingstoke, RG21 7NX

Re: Seema Misra

**Technical expert's report to the Court prepared by Charles Alastair
McLachlan, a Director of Amsphere Consulting Ltd.**

90 Fenchurch Street
London EC3M 4BY
England

This report contains 42 pages

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Contents

1	INTRODUCTION.....	1
2	SUMMARY OF FINDINGS.....	3
3	CONCLUSIONS.....	15
4	TERMS OF REFERENCE.....	17
5	APPENDIX A	29
6	APPENDIX B	30
7	APPENDIX C	31
8	APPENDIX D	32
9	APPENDIX E.....	33
10	APPENDIX F.....	34
11	APPENDIX G.....	35
12	APPENDIX H	36
13	APPENDIX I.....	37
14	APPENDIX J.....	38
15	APPENDIX K.....	39
16	APPENDIX L.....	40

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1 Introduction

1.1 Background to to the Horizon system

1.1.1 Accounting systems are usually designed around a 'double entry' booking keeping principle. The double entry book keeping principle means that for every entry into the system there is an equal and opposite entry that should maintain the 'balance' between the accounts.

1.1.2 So, for example, if somebody at the till sells a stamp for £1 paid in cash then the stock account would be reduced by £1 value of stock and the cash on hand account would be increased by £1 – overall the balance between the accounts would be unchanged.

1.1.3 As part of the process of financial control, it would be normal for the value of stamps to be physically counted and recorded (stock value) and the value of cash on hand physically counted and recorded (cash value) and these two values compared ('reconciled') to what is recorded in the accounting system.

1.1.4 The sub post office uses specialised terminals to conduct business using the Horizon system. This activity is recorded in messages of two types – transaction messages and event messages. The messages are transmitted to and from the Horizon data centre managed by Fujitsu.

1.1.5 The Horizon system developed and managed by Fujitsu is integrated to a number of other systems controlled by Post Office Ltd (POL) and various 3rd parties (for example, the Driver Vehicle Licensing Agency (DVLA),

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merchants services providers for debit card services (such as Link) and E-Top Up for mobile phone credit). This full set of systems and the operational processes supporting them, I will refer to as **the Post Office Limited Operating Environment**

1.2 Hypothetical issues with the Horizon system

1.2.1 The User Interface gives rise to incorrect data entry: poor user experience design and inadequately user experience testing can give rise to poor data entry quality. In cases that users are working under pressure, insufficiently trained or are using a system presented in a language different from their first language the problems of data entry can be exacerbated.

1.2.2 The Horizon system fails to properly process transactions: accounting systems are usually carefully designed to ensure that accounts balance after each "double entry" transaction. In particular, a database technology referred to as 'two-phase' commit is used to ensure that either both entries or neither entry is recorded on the system.

1.2.3 External systems across the wider Post Office Limited Operating Environment provide incorrect externally entered information to the Horizon accounts through system or operator error outside Horizon.

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2 Summary of findings

2.1 Introduction

My findings are subject to certain limitations in the manner in which I was able to pursue my investigations and which may have impacted my ability to provide a complete picture.

2.1.1 Reliance on Fujitsu

For my understanding of the Horizon system and the manner in which it integrated into the full Post Office Limited Operating Environment, I am completely reliant on the information provided by Gareth Jenkins of Fujitsu. Gareth Jenkins has provided every possible assistance subject, however, at all times to the instructions of his employers and Post Office Ltd.

It should be noted that Fujitsu were originally contracted to design, build and operate the Horizon system and continue to manage and develop the system under contract to Post Office Ltd. In addition, I understand that Fujitsu have recently been awarded a contract by the Post Office Ltd to operate, manage and develop other systems in the Post Office Limited Operating Environment.

2.2 Although Gareth Jenkins was able to explain the various interfaces to Horizon vis-à-vis the Post Office Limited Operating Environment, he was not able to comment on its operation. See Appendix A Horizon Architecture Diagrams Provided by Gareth Jenkins of Fujitsu.

2.2.1 Independent investigation

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The Post Office provided no opportunity for independent investigation of the operation of the Horizon system under test conditions or using video observation in a live environment.

The Post Office provided no opportunity to observe and review the training of sub post masters.

The Post Office provided no opportunity to examine the logs of defects, change requests and outstanding known issues for the Horizon system.

The Post Office provided no opportunity to understand and review the systems and processes in the Post Office Limited Operating Environment outside Horizon that could give rise to transactions in Horizon. In particular:

- It was not possible to examine the process for introducing Transaction Corrections that can give rise to changes in the cash that Horizon records at the branch
- It was not possible to examine the processes for Remittances (the movement of cash and stock) into and out of the branch that changes the cash and stock that Horizon records at the branch
- It was not possible to examine the processes for revaluing foreign currency which could change the value of cash held at the branch.
- It was not possible to examine the processes of reconciliation conducted by the Post Office that could give rise to Transaction Corrections.

2.2.2 Opportunities for reconciliation

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In the normal process of investigating the consistent operation of a system, I would expect to examine the end to end trail of paper vouchers, transaction files, log files and other electronic records across the Post Office Limited Operating Environment.

The Horizon system has been designed to operate as an accounting system and therefore is designed to ensure that for every set of credits there is a matching set of debits. In the set of transaction files I have been provided this design constraint is met. However, the only way to determine whether it is the correct set of credits or debts is to reconcile the Horizon transaction with externally held records. In a typical banking environment this would typically be a set of paper vouchers (debit slips, paying in slips, cheques, etc.) recorded at the counter as the transaction was conducted. These vouchers may be hand written or may be printed by out at the counter terminal. The cashier can then ensure that their till is balanced at the end of the shift and, if for example a cheque has been entered for the wrong value, deal with the matter immediately.

Unfortunately, the Horizon system has not been designed to automatically provide these vouchers and it does not appear that Post Office counter staffs are trained to ensure they retain them. It has not been possible, therefore, to reconcile the Horizon branch records to the actual transaction undertaken over the counter in the branch.

2.3 Problems of data entry at sub post office.

2.3.1 Incorrectly calibrated touch screen

The Horizon system provides a touch screen for data entry. If when you 'touch' the screen the screen does not respond properly it may be because the screen has not properly calibrated the position of the 'touch' to the representation of the button on

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the screen. The logs provided by Dunks show that Misra asked for guidance on how to re-calibrate the screen on at least one occasion.

If this gave rise to incorrect entry of cash amounts then this would explain discrepancies. The Horizon system does not record the recalibration of the touch screen as a system event so it is not possible to identify how frequently individual screens were re-calibrated.

The Horizon system does not automatically provide a voucher (i.e. a printed slip) to be retained at the counter for every transaction so it is not easy for the cashier to identify such data entry errors either immediately on entry or when seeking to balance the till at the end of the day.

The Post Office have not provided us with an opportunity to record the use of a system in a sub post office experiencing problems.

For all of these reasons it has not been possible to assess the impact of poor screen calibration on data entry.

2.3.2 Poor User Interface Design

Poor user interface design can contribute to poor data entry quality and user errors.

The Post Office have not provided us with an opportunity to conduct a user interface design audit or record the use of a system in a sub post office experiencing problems.

2.3.3 Use of the FASTCASH button

One of the features of the Horizon branch terminals is that it is possible to complete a transaction by use of the 'Fast Cash' button. When the 'Fast Cash' button is pressed, the value of the basket of items being transacted is added up and then any payment

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by debit card, cheque or whatever is accounted for. The outstanding balance is automatically calculated and treated as an over the counter cash payment and then 'clears the basket' (i.e. completes the transaction and makes the terminal ready for the next transaction).

It was anticipated that counter staff would use the 'Fast Cash' button as a matter of habit on every transaction in order to clear the basket. The Horizon system does not log whether the basket is cleared using the 'Fast Cash' button or some other method.

Both Jenkins and myself recognised that there could be circumstances in which a debit card transaction was not authorised but (either because the printer was not working or because of force of habit) the counter still cleared the basket using the 'Fast Cash' button. The result would be that the Horizon system recorded the receipt of an amount of cash over the counter covering the whole outstanding balance.

The effect of this would be to create a cash discrepancy (shortfall) in the till.

I have identified a number of transactions for which the 'Fast Cash' button could have given rise to such a discrepancy (see Appendix B and items in *italics* in the highlighted sections).

The total value of these transactions is £7,544.09. I have considered Jenkins report (see Appendix B) and believe that he may have overlooked the transaction of £7,000 on 11-Jan-07 at the bottom of Page 5 of the document 'Transactions Associated With Rejected Cards' in Appendix I for which I was unable to find a reversal.

Irrespective of the facts in relation to the transaction of £7,000, in my opinion the relevance of the 'Fast Cash' button in this matter is:

- the 'Fast Cash' button is demonstrated to be a source of data entry error (the reversals confirm this).

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- the specific circumstances relating to rejected card transactions give rise to a relatively small value of possible discrepancies during the 13 month period for which records have been provided compared to the total discrepancy found in the audit.
- there may be other circumstances in which the use of the 'Fast Cash' button gives rise to discrepancies which have not been identified or investigated because I was unable to record the live operation of the use of the Horizon system in a sub post office.

2.3.4 Insufficient training

The activities of a sub post office more properly correspond to those of a retail bank branch rather than a retailer of stamps and postal services. (A cursory review of Appendix H shows a transaction throughput of £48m recorded in the Horizon transaction logs in a 13 month period for example). The Post Office were unable to provide a definitive set of training materials, learning goals and competence assessments which would make it possible to understand the extent to which Misra was adequately trained and properly understood how to conduct the operations of a sub post office.

However, an examination of the transaction and event logs provided by Fujitsu from 1 Dec 06 – 31 Dec 07 shows that:

- The Declared Branch position had discrepancies vis-à-vis the Horizon totals at the end of almost every period.
- The Variance Checks conducted to reconcile the branch position vis-à-vis Horizon showed a discrepancy on the vast majority of occasions ranging from 18 pence to more than £11,000.

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Such a consistent and pervasive failure to ensure that the tills balanced on a daily basis can be explained by:

- a) Theft and/or fraud that the Post Office failed to investigate for at least 13 months
- b) Inability of individual branch counter staff to operate properly
- c) Inability of the sub post-mistress to train/manage staff and/or conduct end of day processes.
- d) Persistent system failure

I have not been able to conduct the kind of investigation which would exclude persistent system failure.

2.4 Problems with Horizon

2.4.1 The Calendar Square, Falkirk Problem

Jenkins provides a summary of the problem first identified in proceedings relating to a sub post office in Calendar Square, Falkirk. (see Appendix C). Unfortunately, as Jenkins acknowledges, we have not been provided the transactions for the period prior to March 2006 when we may have been able to independently determine whether this was an issue for West Byfleet between 30/06/2005 and the bug fix to Horizon provided in March 2006. Jenkins confirms that the implementation of the Horizon system at West Byfleet, where each counter terminal is managed as a separate "stock unit" rather than all the terminals being pooled, is precisely the circumstances which could give rise to the 'Calendar Square' problem.

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As far as the Calendar Square problem applies in relation to West Byfleet, in my opinion:

- It demonstrates that there have been faults with the Horizon system which give rise to discrepancies that can cause losses. It is not reasonable to exclude the possibility of system problems when considering a case such as Misra.
- I am unable to determine whether the Calendar Square problem contributed to the discrepancies at West Byfleet because the Post Office have not provided the relevant transactions and event logs.

2.4.2 The travellers cheque stock problem

The Horizon system is used to record the stock of travellers cheques held by the sub post office and account for the transactions when they are sold or encashed. In one of my branch visits I was shown a sequence of actions that demonstrated how the Horizon system reported on the stock of travellers cheques in a manner that was completely confusing and misleading.

Take the example of 10 travellers cheques of value USD 100 at the beginning of the day. If you run a stock report it will show 10 x USD TC 100 which corresponds to a value of USD 1,000.

A customer comes in and purchases one travellers cheque at USD100 and pays for it using a debit card.

If you then run a stock report it will show -90 x USD TC 100 which corresponds to a value of USD -9,000.

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In other words, the report has treated deducted the USD 100 from the travellers cheque item count of 10 to get -90. Clearly you can't hold a negative stock of a physical item such as a travellers cheque so the report is both meaningless and completely misleading.

I discussed this with Jenkins and he acknowledge that this is a known feature of Horizon and that the Post Office have not instructed Fujitsu to change the system to produce a meaningful stock report. Jenkins assured me that the Horizon system properly accounted for the travellers cheques in the end of day process but I had no opportunity to test whether this was true.

In my opinion, this stock report could give rise to counter staff or sub post masters seeking to correct the perceived problem through manual adjustments leading to real discrepancies.

2.5 System problems from beyond Horizon

2.5.1 Transaction Corrections

The Post Office Limited Operating Environment encompasses a large number of systems that use outputs from the Horizon system to conduct other processes to support Post Office operations. It is from these systems that Transaction Corrections arise.

Consider this hypothetical example by way of illustration:

At the Post Office counter a cheque was encashed for £50 and a cash payment to a customer of £50 was recorded on the system. However, as a result of the clearing process and various reconciliation processes, the face value for the cheque is identified as £5. This gives rise to a cash discrepancy of £45 which the branch would

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be expected to make up. A Transaction Correction would be issued to the branch for them to acknowledge and the branch accounts would be updated.

Both myself and Jenkins considered whether Transaction Corrections could be a source of the branch discrepancies. Jenkins limited his examination to Transaction Corrections to credit/debit card and banking transactions and identified relevant Transaction Corrections to the value of £1,840 (Appendix G). I have take a slightly wider scope of transactions of interest which have a total absolute value of £ 19,257.21 and absolute value of £ 82,918.35 (Appendix J).

Jenkins acknowledges in his e-mail that he is unable to comment on the integrity of the processes used by Post Office Limited to create Transaction Corrections or the operating processes used to generate them.

Unfortunately, the Post Office failed to make anybody available to discuss the operation of the Post Office Limited Operating Environment and the reconciliations, error rates, controls and internal audit processes used to ensure integrity.

In my opinion, the value of the Transaction Corrections identified by Jenkins or the transactions of interest identified by myself is not the issue. What is clear is that Transaction Corrections are generated from outside Horizon. We have no evidence as to whether or not:

- a) The Transaction Corrections are of the correct value
- b) Some Transaction Corrections should be applied at all
- c) Some Transaction Corrections are omitted

The Post Office seek to address concerns (a) and (b) by providing the sub post master with an opportunity to 'request evidence' (i.e. challenge) a Transaction Correction.

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There is no record of Misra requesting evidence in the transactions provided between 1 Dec 06 and 31 Dec 07.

However, as discussed above, the Horizon system does not automatically provide the paper vouchers that would support a dispute over a transaction at the branch.

Further, this process does not address the possibility (c) that some necessary Transaction Corrections are omitted.

Jenkins appears to assume that the limited value of the Transaction Corrections he has identified means that they cannot explain the discrepancy in the Misra case. He overlooks the possibilities that:

- The values are incorrect
- There are missing Transaction Corrections which would reduce the cash balance expected by the Horizon system (i.e. be in favour of Misra).

In my opinion, we have insufficient evidence to exclude in correct or missing Transaction Corrections as an contributing factor to the discrepancies in the Misra case.

2.5.2 Remittances

The systems supporting the movement of cash and stock to and from the sub post office are integrated into Horizon through Remittance transactions (colloquially referred to as Rems). There is no suggestion in this case that there were problems with the operation of the Remittance system. However, it should be noted that I am currently instructed in other cases in which the defendant suggests that the system gives rise to incorrect cash balances being recorded on the branch system. The Post

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Office have not, at this stage, provided me with an opportunity to investigate these claims.

It is worth noting that Jenkins has analysed the transactions and identified a pattern or remittance transactions which is consistent with Misra's statement that she declared cash held in remittance pouches in the safe which was not actually present.

2.5.3 If the potential source of the incorrect transaction processing can be identified then it would be helpful to be able to reproduce the problems under controlled test conditions in a consistent and reproducible manner. This would require the assistance of Fujitsu in providing access to the test environments maintained in support of the Horizon system.

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3 Conclusions

- 3.1 It is evident that trial balances (Variance Checks) and period balances (Branch declarations) showed a continuous pattern of discrepancies through out the period for which transactions were provided. It appears that no action was taken by the Post Office to investigate these discrepancies or to ensure that Misra was competent to prevent them from arising. Instead, Misra removed an employee under suspicion of theft and implemented independent stock units for each counter. Neither action appears to have resolved the issue.
- 3.2 The possibility that problems with screen calibration and the use of the 'fast cash' button contributed to the discrepancies at West Byfleet has not been excluded by the investigations of Jenkins and myself. However, it is difficult to demonstrate that they are of a magnitude to explain the full amount of the discrepancy.
- 3.3 The Horizon system has had problems in the past as acknowledged by Jenkins in relation to Calendar Square. Unfortunately, the Post Office has not provided us with the opportunity to independently assess the possible impact on West Byfleet nor have they provided a list of known defects in Horizon. The 'travellers cheque' problem is an illustration of the known defects we independently identified but Jenkins confirmed that Fujitsu maintain a full list which has not been released.
- 3.4 The Horizon system is a component of the full Post Office Operating Environment. Other elements of this environment can result in changes to the cash balances recorded at the branch. Both Transaction Corrections and Remittances will act in this way. Jenkins was unable to provide any opinion as

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to the integrity of these systems and I was provided with no opportunity to investigate them. The Post Office has provided no evidence as the integrity of these systems and the processes used to manage them.