BENCHMARKING PLAN
FOR
AUTOMATED FINGERPRINT IDENTIFICATION SYSTEM
(AFIS)

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Executive Summary

Technology is changing rapidly due to global competition around the world. With growing demands for increased operational efficiency and process improvement in AFIS, law enforcement agencies are turning to benchmarking as a means of setting realistic goals and measuring efficiency and performance against others. In other words, " It is moving from where we are to where we want to be."

This document provides all the information you need to carry out effective benchmarking studies and improve performance. Focused on best practice across different systems, it offers essential guidance on how to collect, verify & analyze data, avoid difficulty and structure reports to achieve the best results.

The aim of benchmarking is to generate ideas that can be used to improve current AFIS in terms of efficiency and performance. To conduct Benchmarking of AFIS successfully, it is important to involve professional staff who have a deep understanding of the operating characteristics, knowledge of computer H/W, S/W and technology of the AFIS being benchmarked. A team consisting of the following will carry out the benchmarking process:

- **Core Team:** This team includes, an Information Technology/Database Administrator Expert and Finger Print Experts having good knowledge of computer H/W & S/W and experience of administration of AFIS (at least for 2 year).
- **Observers:** Representative of CFPB, FPB of Madhya Pradesh may be called to overall supervise the process.

Major roles & responsibilities of team:

- To carry out various benchmarking tests and procedures as per approved Benchmark Plan.
- To supply (neutralized/standard) benchmark fingerprint database and test slips.
- To assign rating to all benchmark tests.
- To award points to vendor/its AFIS.
- To publish the benchmark results.

The entire process of benchmarking is planned to be transparent, i.e. the whole testing process , testing criteria and weights given to various factors, etc will be decided before actual benchmarking is carried and is made available to participating vendors. Broadly, following factors are considered in benchmarking:

- Core functions
- General functions
- Accuracy
- Speed and
- Vendor profile

Different systems will be tested on the common database and test data. All the system will have similar hardware specifications in order to have uniform testing environment. The test database and test data used in the benchmark will be real life data.

The benchmarking team will evaluate all systems and generate assessment report. This report will have details of features, performance and other details of the systems benchmarked.

All fingerprint systems need not be benchmarked. Pre-qualification criteria may be applied before a full-fledged benchmark process is carried out.

Concept of total cost of ownership is defined. This will help in final selection of system. Final selection of a system may be based on two factors:

- Benchmark score.
- Total cost of ownership over a period of five years.

For practical reasons, it is recommended that evaluation be carried out one vendor at a time. It is suggested that any new version from a vendor already bench marked can be carried after 6 months from the earlier benchmark date.

(Purushottam Sharma)
IPS
Chairman: AFIS Benchmarking Committee

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SECTION 1- BENCHMARK PLAN

1.1 INTRODUCTION

The core idea of benchmarking is to identify the best systematic and scientific practices which accelerate the strategic change leading to both breakthrough and continuous improvement in one's own performance by adopting good practices used by others or guidelines established by professional national or international organizations that are recognized for superior performance. Benchmarking typically measures accuracy and system throughput along with functionality and operational simplicity.

Benchmarking of any product is necessary because if we don't know what the standard is, we cannot compare ourselves against it. Without benchmarking it is not possible to ensure that our processes and practices are in line or are better than the competition. Some benefits of benchmarking:

- Teaches organization new lessons in competitiveness.
- An easily grasped, functional tool.
- Fundamental business skill that supports quality excellence
- Exposes people to new ideas,
- Serves as a catalyst for learning,
- Tests the rigor of internal operating targets,
- Raises the organization's level of maximum potential performance.

Automated fingerprint identification system (AFIS) technology has a successful 25-year history in law enforcement and criminal detection. To take advantage of rapid advances in technology and standards in the AFIS arena, it is essential to benchmark AFIS products with standard tests.

This document is a reference document to specify the evaluation process structured as a valuable learning experience, which can remove most of the risks prior to making a final decision.

It is proposed to have a National AFIS system at NCRB, which will store Finger print data of all states. All states should have their state AFIS. State can deploy Remote stations at district, sub divisional or police station level as required. All these AFIS system will be interconnected having automatic remote updating and query facility. Under CCTNS phase II implementation, a heavy emphasis is made on tracking of criminal by using biometrics. Since all states will be connected to NCRB data center through MPLS, it is proposed by this committee to house AFIS database as part of CCTNS for better utilization. AFIS having web enabled updating and query processing facility will be appreciated.

The National, State and Remote Station AFIS will be of the following capacity: -

- **National AFIS**: 1,00,00,000 (1Crore) and above(up to 1.5 Cr) ten print and palm print card, 5,00,000 (5 lac)and above latent print.
- **State AFIS**: 5,00,000 to 25,00,000 ten print and palm print card, 1,00,000 and above latent print.
- **Remote Station AFIS**: 50,000 to 1,00,000 ten print and palm print card, 25,000 and above latent print.

1.2 BENCHMARK PRE-QUALIFICATION CRITERIA

- Vendor should have at least one registered office in India; proof of the same is required.
- AFIS should have all the core functionality described in the benchmark document. Committee initially tests this feature, if available then only it will continue to conduct the benchmark.

1.3 BENCHMARK ITEMS

Benchmark items are planned to cover up all the following factors considered for benchmarking;

- Core functions
- General functions
- Accuracy
- Speed and
- Vendor profile

The following features should be considered for benchmarking:

- **System Configuration**:- Configuration of hardware and database brought by vender for benchmarking will be checked against the configuration specified in benchmarking test case 2.1.
- **Data conversion tools to convert the data of existing AFIS and NIST File in Batch Mode**:- Data conversion tool is needed to convert the digitized data of existing AFIS. Data loss, quality / visibility of converted image will be checked by adopting the procedure specified in benchmarking test case 2.2.
- **Finger Print Data acquisition and Image Processing Tools**:- Capability of AFIS regarding Finger Print Data, image processing capabilities and tools will be tested against ten print slips, palm prints and latent prints by adopting the procedure specified in benchmarking test case 2.3.

- **Rolled Print Search (against rolled print database):-** Capability, speed and accuracy of AFIS regarding Rolled Print Search against Rolled Print test database will be checked by adopting the procedure specified in benchmarking test case 2.4.
- **Rolled Prints Search (against latent print database):-** Capability, speed and accuracy of AFIS regarding Rolled Print Search against latent print test database will be checked by adopting the procedure specified in benchmarking test case 2.5
- **Rolled Prints Update**:- Capability, speed and accuracy of AFIS regarding Rolled Print Update in Rolled print database will be checked by adopting the procedure specified in benchmarking test case 2.6
- **Latent Print Search (against latent print database):-** Capability, speed and accuracy of AFIS regarding Latent Print Search against latent print test database will be checked by adopting the procedure specified in benchmarking test case 2.7
- **Latent Print Search (against rolled print database)**:- Capability, speed and accuracy of AFIS regarding Latent Print Search against Rolled print test database will be checked by adopting the procedure specified in benchmarking test case 2.8
- **Latent Fingerprint Update**:- Capability, speed and accuracy of AFIS regarding Latent Print Update in Latent print database will be checked by adopting the procedure specified in benchmarking test case 2.9
- **Pain Palm Print search (against Palm Print):-** Capability, speed and accuracy of AFIS regarding Palm Print search against Palm Print test database will be checked by adopting the procedure specified in benchmarking test case 2.10.
- **Palm Print Update**:- Capability, speed and accuracy of AFIS regarding Palm Print Update in Palm print database will be checked by adopting the procedure specified in benchmarking test case 2.11.

- **Latent Palm Print Search with plain palm print database**:- Capability, speed and accuracy of AFIS regarding Latent palm print search against Palm Print test database will be checked by adopting the procedure specified in benchmarking test case 2.12
- **Latent Palm Print Search with latent palm print database**:- Capability, speed and accuracy of AFIS regarding Latent palm print search against Latent Palm Print test database will be checked by adopting the procedure specified in benchmarking test case 2.13
- **Latent palm print update**:- Capability, speed and accuracy of AFIS regarding Latent Palm Print Update in Latent Palm print database will be checked by adopting the procedure specified in benchmarking test case 2.14
- **Document Case Processing**:- Capability of creating a temporary database for Document cases, search within a document case and inter case search, export and import facility to temporary database will be checked by adopting the procedure specified in benchmarking test case 2.15.
- **Remote Query processing and reporting**:- Capability of processing queries from remote workstations and Report module of AFIS will be checked by adopting the procedure specified in benchmarking test case 2.16.
- **Data Portability**:- Capability and features of AFIS communication module of AFIS will be checked by adopting the procedure specified in benchmarking test case 2.17.
- **Criminal's non finger prints Information Management and report Module:-** Capability and features of non fingerprint Information Management module like synchronization of central and remote non fingerprint database, storage and retrieval of data, online notification and report generation etc. will be checked by adopting the procedure specified in benchmarking test case 2.18.

- **Web based Remote Query**:- Capability and features of AFIS Web module will be checked by adopting the procedure specified in benchmarking test case 2.19.
- **System Administration:-**Capability and features of User Administration and Access Permission Control, Database Backup and Recovery, Report Generation, Statistics Generation, System Monitoring and Log Management, Online Help will be checked by adopting the procedure specified in benchmarking test case 2.20
- **Other Standard Adherences**:- Capability and features of fingerprint data exchange, image compression and transmission specifications will be checked by adopting the procedure specified in benchmarking test case 2.21.1
- **Network Support and Scalability**:- Capabilities and features of AFIS support for Local Area Network, Scalability to address increasing database size, workload, matching load etc. will be checked by adopting the procedure specified in benchmarking test case 2.21.2.
- **Maintenance and support**:- Capability and Strength of AFIS vender will be checked by adopting the procedure specified in benchmarking test case 2.21.3.
- **Matching Accuracy & system throughput**:- Matching accuracy will be calculated by using search accuracy data observed and noted in test cases 2.4 to 2.14, 2.22 and throughput will be calculated by using speed (time taken by AFIS in finger print search) data observed and noted in test cases 2.4 to 2.14, 2.22 and Statistical formula specified in benchmarking test case 2.22

1.4 APPROACH

The benchmark tests will be performed at customer location. The test will require approximately two to three days. Three to five representatives will attend each benchmark. The AFIS operational configuration will be setup. The test databank will be of 5,00,000 (five Lacs) ten-digit fingerprint records, 2000 latent fingerprint records and 500 Palm print records.

At the beginning of the benchmark testing, the vendor will describe the hardware and software used in the benchmark system and how it compares to their proposed system. The approach to benchmark:

- After setting up the system, the system configuration and the database tests will be performed.
- Data conversion tools to convert the image and demographic data of existing AFIS at NCRB and states.
- Finger Print, Demographic Data acquisition, Image Processing Capabilities and tools will be tested against 10 Ten Print slips, 10 Palm prints and 10 Latent Prints.
- For testing the Ten Digit Search, Palm Print and Latent Print Search:
  - Search for corresponding fingerprint and palm print in the database.
- For testing the Ten Digit Update, Palm Print Update and Latent Print Update:
  - Search for possible match of corresponding fingerprint in the database and update.
  - Add fingerprint, palm print slips and latent print (Unsolved Latent) to database.

For matching and throughput testing, a set of above tests (ten digit searches, ten digit update, latent print search, latent print addition, palm print search and update) should be performed on 100 numbers of slips and the results should be analyzed. The core team will record response time of procedure.

All the other specified features can be tested by the selection of appropriate slips and setting of the configuration and transaction parameters as required. All tests are to be conducted and in each case, the result will be recorded and analyzed. System Administration activities like the Database Backup and Recovery, Report Generation and Statistics Generation will be performed on the database for all the activities. Weightage may be given for each test case for further summarization of the AFIS strengths.

1.5 SUSPENSION CRITERIA AND RESUMPTION REQUIREMENTS

The need for suspension of benchmark would depend on the nature of problems that arise. If the environment can support the continuation of benchmark, it can be continued. In other words, the failure to execute a particular item or feature will not require that the entire test plan execution should be stopped. The affected portions of the benchmark plan are to be repeated when the problem is cleared.

1.6 RESPONSIBILITIES

AFIS vendor team carries out the tests and benchmark teams witness the same. Both benchmark team and the AFIS vendor will resolve the issues arising during benchmark.

Creation of database:

Benchmark team shall provide the test database information stored in existing AFIS installed at NCRB and states, to the AFIS vendor.

Test slips:

Benchmark team shall provide the test slips (rolled, chance and palm print) to carryout the benchmarking.

Hardware and System Software

The AFIS vendors should bring their own hardware, software and any other related equipment. The hardware and system software configuration would be specified at the time of benchmarking keeping in view the latest configuration available at that time. Components and minimum configuration are given at section 2.1.

1.7 AFIS PARAMETERS FOR EVALUATION OF FUNCTIONALITIES

Description of functionality / features of following factors considered in benchmarking:

- Core functions
- General functions
- Accuracy
- Speed and
- Vendor profile

Following is the list of AFIS parameters for evaluation. These parameters are divided into functionalities, which are further divided into features.

1.7.1 CORE FUNCTIONS

I Data Conversion Tool

a NIST file Identification & Error Management (to notify NIST decoding failure)

b Quality Measurement of converted data

c Speed and accuracy of converted slips

d Evaluation of tool with respect to user friendliness and effectiveness

II Finger Print Data Acquisition

1 Data acquisition from range of input devices (through USB port also)

a Live Scanner

b Scanner:- Photo scanning, Search/Record slip scanning.

c File

d Digital Camera

e Multi resolution scan (to manage images that were scanned with a resolution different from 500 dpi)

2 Data acquisition from different type/quality slips/prints

a Poor quality slips/prints and non formatted FP slips

b Large enough print scan area to cover entire print

c Xerox slips

d Juvenile prints

e Amputated / injured/ bandaged cases

f Photographs (scaled & unscaled)

g User define Template

Automatic Pattern Area Recognition & Segmentation

Flexible Print Area Box size and orientation (for all type of prints ie rolled/latent/palm)

3 Quality Control

a Sequence Check

b Sequence Correction

c Hand inversion tool (to invert entire hands during sequence correction.)

d Replacement of plain prints in place of corresponding poor quality rolled prints

III Image Processing Tools

I Ridge flow Matrix, Core and Delta

ii Automatic Pattern Recognition

iii Automatic Henry Classification of 10 digit F.P Record/Search Slip

Assign a primary pattern automatically

Provides secondary reference classification automatically.

Sub classification by measuring core and or delta distance and ridge count

iv Manual / Multiple Finger Print pattern Marking

v Minutiae Edition (Add, Remove, Rotate, counting, neighboring)

vi Selection Tool to select a specific area on a print.

IV Image Enhancement Tools

1 **Image manipulation tools** (without modifying the pixels grey level values)

I Zooming

ii Rotate an image & auto centering

iii Mirror an image

iv Trimming of image

v Skeleton editing

vi Invert (white powder print)

vii Increase/Decrease ridge thickness

viii Increase/Decrease valley thickness

2 **Histogram Transformation Tools**

I Adjust Contrast

ii Adjust Brightness

iii Equalization (to adjust automatically Brightness & Contrast .)

iv Logarithmic Transformation (to darkens the black pixels while lightly brightens the white pixels)

v Stretching Tool (Stretches the histogram by using all available gray levels. The user can choose the level of saturation (low, medium or high))

vi Friction ridge transformation / Auto Enhancement (to transforms the image using the other histogram transformations (equalization, logarithmic, exponential etc)

vii Binarization tool (to polarizes the image to get black and white pixels.)

viii Inverse Logarithmic Transformation

ix **Image Filter Tools**

x Fast Fourier Transformation (to remove the periodic noises and highlights the friction ridges using the combinations of Gabor Filters in all directions to separate overlaid /overlapped chance prints and suppressing background.)

xi Morphological Transformation (to remove the elements that are big (lines, blocks, text, etc) and that do not provide additional information to the prints.)

xii Sharpening Tools (to reinforces the dark regions and diminishes the bright regions while keeping the same image contrast.)

xiii Exponential Transformation (to brighten the white pixels while lightly darkens the black pixels.)

xiv Directional Ridge Enhancement (Gabor-that highlights friction ridges in a specific direction chosen by the user)

xv Directional Ridge Enhancement (Sobel- that creates a 3D effect on the friction ridges that are in a specific direction chosen by the user)

xvi Periodic artifact (noise) filters (Filter image parasitic background such as paper grains.)

xvii Image Enhancement History (to browse the image enhancement history and possibly undo or redo modifications, save enhanced images or come back to the original image.)

V Rolled Print Identification Process and Features

I Rolled print slip to rolled print database matching

ii Automated poor quality prints replacement

iii Match a database slip having less than 10 prints (amput/bandage) with 10 print slip

iv Search slip having less than 10 prints (amput/bandage)

v Search of poor quality prints

vi Search of xerox slips

vii Search of juvenile prints

viii Capable of Ten print to Ten print, Ten print to chance/latent print, chance print to Ten print Chance print to chance print search.

ix Automated selection of matching digits, which is best in quality in search slip and database

x Split screen verification format with charting,

xi Accept verification in batches.

VI Chance Print (single digit) Identification

I Single Chance Print search against rolled print database

ii Multiple Chance Print search against rolled print database

iii Search of lifted prints

iv Search of photographs (scaled)

v Search of photographs (unscaled)

vi Resubmission of chance print with changed parameters.(immediately)

vii Rotation & centering tolerance 360 degree

viii Ability to use print level features for faster matching (like finger position, core, delta etc)

ix User definable shortlist size

VII Solving previously unsolved chance prints

I Rolled print search against chance print database
ii Ability to resubmit a rolled print from the database to search against chance print database (at a later date)
iii Chance print search against chance print L database
iv Ability to resubmit a chance print from the database to search against chance print I
v Linking previous cases

VIII Palm print Identification

I Search of Palm print slip to Palm print database matching
ii Automated poor quality prints replacement
iii Search of xerox slips
iv Capable of Palm print to Palm print, Palm print to chance/latent Palm print, chance Palm print to Palm print, Palm Chance print to Palm Chance print search.
v Split screen verification format with charting,
vi Accept verification in batches.

IX Palm Chance Print Identification

I Palm Chance Print search against Palm print database
ii Search of lifted prints
iii Search of photographs (scaled)
iv Search of photographs (unscaled)
v Resubmission of chance print with changed parameters.(immediately)
vi User definable shortlist size

X Solving previously unsolved Palm Chance prints

I Palm print search against Palm Chance print database
ii Ability to resubmit a Palm print from the database to search against Palm Chance print database (at a later date)
iii Palm Chance print search against Palm chance print database
iv Ability to resubmit a Palm chance print from the database to search against Palm chance print
v Linking previous cases

XI Document Case Processing

I Creation of New document/evidence/disputed image and storage
ii Open existing document /evidence from the database
iii Search of Chance/disputed to Chance Print
iv Search of Chance/disputed to Suspect rolled Print
v Search of Chance/disputed to previous Chance/disputed Print
vi Split screen verification format with charting,
vii Accept verification in batches.

XII Remote Query Processing

I Search from remote Query station
ii Synchronization of
iii Update/Modify Information received from Remote Query Station
iv Complete Report of a criminal with finger print image, demographic data and mug shot
v Inter District/Inter State Slips updation of the information at remote station and AFIS.
vi Automatic mailing of trace case report (Text and Image) to districts in case of inter district trace.

XIII Data Portability (in neutralized nist format)

I Export rolled finger print
ii Export chance finger print
iii Export Palm print
iv Export evidence/disputed print

XIV Demographic Information and report Module

I Provision for entering Conviction details
ii Provision for entering Arrest details
iii Provision for entering Death details
iv Provision to mark/flag Absconding/Award/Notice issued by various National and International organization.
v Provision for Mugshots
vi Online notification of Absconding/Award/Notices in case of Match event.

XV Web based remote query

I Data acquisition from range of input devices :-
ii Live Scanner
iii Scanner:- Photo scanning, Search/Record slip scanning.
iv File
v Digital Camera
vi Data acquisition from different type/quality slips/prints
vii Poor quality slips/prints and non formatted FP slips
viii Photographs (scaled & unscaled)
ix Demographic data entry of the finger print slip
x Intimation of result/reports.
xi User management
xii Security

XVI SYSTEM ADMINISTRATION

I **Administration Module** (GU Interface that allows the system administration, system monitoring and ability to detect and possibly

solve errors intuitively)

ii **Access Permission control Module** (allows the administrator to create or modify the hierarchical structure of data ownership and to assign functional access permission for each user)

iii **User Administration Module** (allows the administrator to create user logins, assign functional access permissions and valid terminals)

iv **User Creation Tool** (Provide the administrator with a set of functions to manage users)

v **Invalid user login control** (Allows the system to control illegal user access attempts)

vi **Manage Password validity periods** (Allows the administrator to define password validity periods)

vii **Backup, Restore & Recovery** (To Secures the system in case of failure or disaster.)

viii **System Monitoring** (GUI Interface to monitor the status of all services/components /processes in progress, status of users and their activity and database status monitoring)

1.7.2 GENERAL FUNCTIONS

I STANDARDS ADHERENCES

i ANSI/NIST-ITL 2007 *for* fingerprint data exchange

ii WSQ compression for fingerprint images

iii JPEG compression for mug shot images

iv EFTS

II NETWORK SUPPORT AND SCALABILITY

i Various security features available in the AFIS (Compliance to all current Security Standards at System level, Application level, Database level, Network level)

ii Support for Local Area Network for AFIS Workstations/Servers

iii Support for distributed matching/database on different machines and scalability

iv Availability of Remote Workstations with Query facility.

v Availability of complete AFIS solution on standalone desktop system

vi Support for Wide Area Networks (IPVPN, Dialup, Satellite and Lease line Based or hybrid) with security features.

vii Scalability to address increasing database size, workload, matching load, remote systems, etc.

III MAINTENANCE AND SUPPORT

i **Backup Restore & Recovery** (Secures the system in case of failure or disaster.)

ii **System Monitoring** (web interface that allows the global system monitoring and administration)

iii **Monitoring and administration sub system**

iv **Online help** (allows the user to reach an online help from the main menu of the GUI)

v **Logs and stats** (Provides the administrator with a set of functions to manage logs and statistics)

vi **Log Browser** (allows the administrator to browse the log database through a straight forward interface)

vii **Log Migratory** (allows the system to transfer information contained in the temporary log database to the permanent log database)

vii **Batch Processing Management** (provides a means to manage batch processing and assure that this processing does not affect the system in a negative manner.)

1.7.3 SYSTEM SPEED AND ACCURACY

1 Rolled print speeds (Human)

1.1 Average Input time

1.2 Average Verification time

1.3 Others, if any

1.4 Total human intervention time (overall)

2 Rolled print speeds (Machine)

2.1 Average Input time

2.2 Average Verification time

2.3 Others, if any

2.4 Total machine time (overall)

3 Latent print speeds (Human)

3.1 Average Input time

3.2 Average Verification time

3.3 Others, if any

3.4 Total human intervention time (overall)

4 Latent print speeds (Machine)

4.1 Average Input time

4.2 Average Verification time

4.3 Others, if any

4.4 Total machine time (overall)

5 Palm print speeds (Human)

5.1 Average Input time

5.2 Average Verification time

5.3 Others, if any

5.4 Total human intervention time (overall)

6 Latent palm print speeds (Machine)

6.1 Average Input time

6.2 Average Verification time

6.3 Others, if any

6.4 Total machine time (overall)

7 System end-to-end speeds

7.1 Rolled print search end-to-end time

7.2 Rolled print update end-to-end time

7.3 Latent print search end-to-end time

7.4 Latent print update end-to-end time

7.5 Palm print search end-to-end time

7.6 Latent palm print update end-to-end time

7.8 Rolled print backlog end-to-end time

8 System matching Accuracies

8.1 Ten-print (correct acceptance)

8.2 Ten-print (correct rejection)

8.3 Ten-print (false acceptance)

8.4 Ten-print (false rejection)

8.5 Latent-print (correct acceptance)

8.6 Latent-print (correct rejection)

8.7 Latent-print (false acceptance)

8.8 Latent-print (false rejection)

8.9 Palm-print (correct acceptance)

8.10 Palm-print (correct rejection)

8.11 Palm-print (false acceptance)

8.12 Palm-print (false rejection)

SECTION 2 - BENCHMARK TEST CASES

SYSTEM CONFIGURATION

2.1 SYSTEM CONFIGURATION

Hardware requirement to setup National, State and remote station AFIS proposed by the vendor

2.1.1 Test Case Items

AFIS Workstation, Server and Database configuration

2.1.2 Input (Test Data) Specifications

The following hardware and system software platforms shall be used for carrying out the benchmark:

AFIS Workstation(s):

- Standard PC.
- Intel I3 Processor.
- 2 GB RAM.
- 500 GB SATA Hard Disk.
- Windows XP/2007 or later Operating System.
- Flat Bed Scanner.
- Live Scanner.
- Palm Print Scanner.
- Digital Camera.

AFIS Server

- Intel Xenon E5530, 2CPU(Quad Core) Processor Server.
- 16 GB RAM
- Sufficient Hard Disk (SCSI 10K rpm)
- Standard Linux or Windows Advanced Server

Ethernet Switch or Hub for the connectivity of the AFIS Workstation and Server

AFIS Database:

The test database contains:

- 5,00,000 Rolled fingerprint records (minutiae and image database).
- 2,000 Unsolved-scene-of-crime/Latent fingerprint records (minutiae and image database).
- 500 Palm Prints (minutiae and image database).
- 100 Latent Palm prints.

2.1.3 Output Specifications

The configuration used should be noted in **report template.**

2.1.4 Remarks

Note down the compliance / non-compliance or deviations from the specifications.

(Hardware, proprietary or otherwise which is specific to the AFIS has to be noted. Care should be taken that the AFIS hardware is just suitable for the benchmark database size and work load)

AFIS CORE FUNCTIONALITY

2.2 DATA CONVERSION TOOL TO CONVERT THE DATA OF EXISTING AFIS AT N.C.R.B. AND STATES

2.2.1. Test Case Items

- GUI Tool to convert existing database of AFIS established at NCRB and states.
- Capability of fast, efficient and optimal conversion of rolled print cards into a high quality converted database to achieve maximum AFIS performance.

2.2.2 Input (Test Data) Specifications

- Existing Ten-digit fingerprint database of 5,00,000 rolled fingerprint slips of National and State AFIS.
- Existing Latent fingerprint database of 2,000 latent fingerprint slips of National and State AFIS.
- Rolled print cards.

*(*Input data quantity may vary according to existing database of NCRB and states.)*

2.2.3 Output Specifications

- Conversion process and Error Management System.
- Slips should be converted and imported successfully in the AFIS under consideration.
- Data Loss will be checked.
- Quality/ visibility of the converted image.

2.2.4 Remarks

(All the details of the output specification should be noted down in report template)

2.3 FINGER PRINT DATA ACQUISITION AND IMAGE PROCESSING TOOLS

Finger print data acquisition, image processing capabilities and tools will be tested against ten print slips, palm prints and latent prints.

2.3.1 Test Case Items

- Image Data Acquisition Module (Data acquisition through card Scanner, Live scanner, Digital Camera and files).
- Encoder.
- Image Processing and Enhancement Tools.

2.3.2 Input (Test Data) Specifications

- Ten-digit fingerprint card/slip (Fully Rolled, Slab Plain Prints and Plain Thumb Print in sequence and with sequence error)
- Latent fingerprint cards lifted or photographed from different surfaces using different powders and methods.
- Palm print card (Plain and Writers Palm).
- Mug shot using a digital camera, file and from ten card.
- Over Inked Print, Overlapped print, smudged print.
- Missing, Bandaged & Damaged Finger / hands.
- Print on multicolored surfaces like Currency note, Revenue Stamps and magazines.

2.3.3 Output Specifications

- Image Capturing capability of fingerprint card/slip.
  a) From Flatbed scanner
  b) From Live Scanner
  c) From Digital Camera
  d) From File
- Multi Resolution Scan.
- Manual Intervention.
- User defined Template.
- Quality Control.
- Sequence Check.
- Sequence Correction.
- Replacement from plain print.
- Whether system recognize the Print area automatically or not.
- Print Capturing box size can be changed and re oriented dynamically without data loss.
- Automatic Pattern Recognition.
- Automatic Classification.

- Image processing capability (minutiae extraction, vectorization, Binarization, Skeletonization, ridge count etc.) and tools (minutiae edition, minutiae enhancement, reference points)
- Image Enhancement tools.

2.3.4 Remarks

(All the output specifications should be noted on report template)

2.4 ROLLED PRINT SEARCH WITH ROLLED FINGERPRINT DATABASE

2.4.1 Test Case Items

- AFIS Matcher (Server Module and Workstation)
- AFIS Database (Rolled fingerprints)

2.4.2 Input (Test Data) Specifications

- Rolled Print database of 5,00,000 rolled fingerprint slips
- Rolled Print slip(s) that has corresponding fingerprint(s) in the above database. Any special attributes - like missing finger, hands, etc

2.4.3 Output Specifications

- Time taken in processing.
- Fingerprint slip should detect trace from the database.
- Position of traced slip in shortlist.
- Number of database records against which minutiae matching took place.
- Hard copy of the search Rolled Print slip.
- Hard copy of the duplicate/database copy, if TRACED.
- If any filters are used, list the filters.
- If filters are used, number of database records filtered.
- Number of digits used for Matching.
- Whether system determines the fingers used for matching on the basis of quality of prints dynamically.
- Better Quality Replacement process.

2.4.4 Remarks

(All the output specifications should be noted on report template)

2.5 ROLLED PRINT SEARCH WITH LATENT FINGERPRINT DATABASE

2.5.1 Test Case Items

- AFIS Matcher (Server Module and Workstation)
- AFIS Database (rolled fingerprints)

2.5.2 Input (Test Data) Specifications

- Latent print database of 2,000 Latent print cards.
- Rolled Print slips that has corresponding fingerprint(s) in the above database. Any special attributes - like missing finger, hands, etc

2.5.3 Output Specifications

- Time taken in processing.
- Fingerprint slip should detect TRACE from the database.
- Position of traced print in shortlist.
- Number of database records against which minutiae matching took place.
- Hard copy of the search Rolled Print slip.
- Hard copy of the duplicate/database copy, if TRACED.
- If any filters are used, list the filters.
- If filters are used, number of database records filtered.
- Split screen verification format with charting of identical points.
- Hard copy of charting of identical prints.

2.5.4 Remarks

(All the output specifications should be noted on report template)

2.6 ROLLED PRINT UPDATE

2.6.1 Test Case Items

- AFIS Matcher (Server Module and Workstation)
- AFIS Database (Rolled fingerprints)

2.6.2 Input (Test Data) Specifications

- Rolled Print database of 5,00,000 rolled fingerprint slips
- Rolled Print slip that has no duplicates in database.
- Pattern class specified.
- Core /Delta Patterns known / Marked.

2.6.3 Output Specifications

- Time taken in processing.
- Selected latent fingerprint should be declared as UNTRACED and should be added to the finger print database.
- Number of database records against which minutiae matching took place.
- Hard copy of the search Rolled Print slip.
- If any filters are used, list the filters.
- If filters are used, number of database records filtered.

2.6.4 Remarks

(All the output specifications should be noted on report template)

2.7 LATENT FINGER PRINT SEARCH WITH LATENT FINGER PRINT DATABASE

2.7.1 Test Case Items

- AFIS Matcher (Server Module and Workstation)
- AFIS Database (Latent fingerprints)

2.7.2 Input (Test Data) Specifications

- Latent Finger Print database of 2,000 latent fingerprints.
- Latent fingerprint (single or sequence multiple) that has a duplicate in the above database.
- Latent Finger print parameters:
  - Probable Digit: Unknown.
  - Probable Pattern class marked: Known/Unknown
  - Resolution: Multiple
  - Size: Same and Enlarged (scaled and un-scaled)
  - Orientation: Known and Unknown.

2.7.3 Output Specifications

- Time taken in processing.
- Latent Fingerprint should be detected "TRACE" from the database.
- Number of database records against which minutiae matching took place.
- Hard copy of the Latent Finger print.
- Hard copy of the duplicate/database copy, if TRACED.
- If any filters are used, list the filters.
- If filters are used, number of database records filtered.
- Split screen verification format with charting of identical points.
- Hard copy of charting of identical prints.

2.7.4 Remarks

(All the output specifications should be noted on report template)

2.8 LATENT PRINT SEARCH WITH ROLLED FINGERPRINT DATABASE

2.8.1 Test Case Items

- AFIS Matcher (Server Module and Workstation)
- AFIS Database (chance fingerprints)

2.8.2 Input (Test Data) Specifications

- Rolled Fingerprint database of 500,000 rolled fingerprint slips.
- Latent fingerprint (single or sequence multiple) that has a duplicate in the above database.
- Latent print parameters:
  - Probable Digit: Unknown.
  - Probable Pattern class marked: Known/Unknown
  - Resolution: Multiple
  - Size: Same and Enlarged (scaled and un-scaled)
  - Orientation: Known and Unknown.

2.8.3 Output Specifications

- Time taken in processing.
- Latent Fingerprint should be detected as "TRACE" from the database.
- Number of database records against which minutiae matching took place.
- Hard copy of the latent fingerprint.
- Hard copy of the duplicate/database copy, if TRACED.
- If any filters are used, list the filters.
- If filters are used, number of database records filtered.
- Split screen verification format with charting of identical points.
- Hard copy of charting of identical prints.

2.8.4 Remarks

(All the output specifications should be noted on report template)

2.9 LATENT PRINT UPDATE

2.9.1 Test Case Items

- AFIS Matcher (Server Module and Workstation)
- AFIS Database (chance fingerprints)

2.9.2 Input (Test Data) Specifications

- Rolled fingerprint database of 5,00,000 rolled fingerprint slips
- Latent Finger Print database of 2,000 latent fingerprints.
- Latent fingerprint that has no duplicate in the database. .
- Latent finger print parameters.
  - Probable Digit: Unknown.
  - Probable Pattern class marked: Known/Unknown
  - Resolution: Multiple
  - Size: Same and Enlarged (scaled and un-scaled)
  - Orientation: Known and Unknown.

2.9.3 Output Specifications

- Selected latent fingerprint should be declared as UNTRACED and should be added to the latent finger print database.
- If any filters are used, list the filters:
- If filters are used, number of database records filtered:
- Number of database records against which minutiae matching took place
- Hard copy of the search latent fingerprint.

2.9.4 Remarks

(All the output specifications should be noted on report template)

2.10 PLAIN PALM PRINT SEARCH WITH PLAIN PALM PRINT DATABASE

2.10.1 Test Case Items

- AFIS Matcher (Server Module and Workstation)
- AFIS Database (Palm Prints)

2.10.2 Input (Test Data) Specifications

- Palm Print database of 500 Palm Prints.
- A Palm Print that has a duplicate in the above database.
- Probable Palm: Unknown

2.10.3Output Specifications

- Time taken in processing.
- Palm print slip should be detected "TRACE" from the database.
- Position of traced print in shortlist.
- Number of database records against which minutiae matching took place.
- Hard copy of the search Palm print.
- Hard copy of the duplicate/database copy, if TRACED.
- If any filters are used, list the filters.
- If filters are used, number of database records filtered.
- Split screen verification format with charting of identical points.
- Hard copy of charting of identical prints.

2.10.4 Remarks

(All the output specifications should be noted on report template)

2.11 PALM PRINT UPDATE

2.11.1 Test Case Items

- AFIS Matcher (Server Module and Workstation)
- AFIS Database (Palm Prints)

2.11.2 Input (Test Data) Specifications

- Palm Print database of 500 Palm Prints.
- Palm Print that has no duplicates in database.
- Probable Palm: Unknown

2.11.3Output Specifications

- Selected Palm print should be declared as UNTRACED and should be added to the Palm Print database.
- If any filters are used, list the filters:
- If filters are used, number of database records filtered:
- Number of database records against which minutiae matching took place
- Hard copy of the search Palm Print.

2.11.4 Remarks

(All the output specifications should be noted on report template)

2.12 LATENT PALM PRINT SEARCH WITH PLAIN PALM PRINT DATABASE

2.12.1 Test Case Items

- AFIS Matcher (Server Module and Workstation)
- AFIS Database (Palm Prints)

2.12.2 Input (Test Data) Specifications

- Plain Palm Print database of 500 Palm Prints.
- Latent Palm Print that has a duplicate in the above database.
- Probable Palm: Unknown

2.12.3Output Specifications

- Time taken in processing.
- Latent Palm print should be detected as "TRACE" from the database.
- Position of traced print in shortlist.
- Number of database records against which minutiae matching took place.
- Hard copy of the search latent palm print.
- Hard copy of the duplicate/database copy, if TRACED.
- If any filters are used, list the filters.
- If filters are used, number of database records filtered.
- Split screen verification format with charting of identical points.
- Hard copy of charting of identical prints.

2.12.4 Remarks

(All the output specifications should be noted on report template)

2.13 LATENT PALM PRINT SEARCH WITH LATENT PALM PRINT DATABASE

2.13.1 Test Case Items

- AFIS Matcher (Server Module and Workstation)
- AFIS Database (Palm Prints)

2.13.2 Input (Test Data) Specifications

- Latent Palm Print database of 100 latent palm prints.
- Latent Palm Print that has a duplicate in the above database.
- Probable Palm: Unknown

2.13.3Output Specifications

- Time taken in processing.
- Latent Palm print should be detected as "TRACE" from the database.
- Position of traced print in shortlist.
- Number of database records against which minutiae matching took place.
- Hard copy of the search latent palm print.
- Hard copy of the duplicate/database copy, if TRACED.
- If any filters are used, list the filters.
- If filters are used, number of database records filtered.
- Split screen verification format with charting of identical points.
- Hard copy of charting of identical prints.

2.13.4 Remarks

(All the output specifications should be noted on report template)

2.14 LATENT PALM PRINT UPDATE

2.14.1 Test Case Items

- AFIS Matcher (Server Module and Workstation)
- AFIS Database (Palm Prints)

2.14.2 Input (Test Data) Specifications

- Latent Palm Print database of 100 latent palm prints.
- Latent Palm Print that has a duplicate in the above database.
- Probable Palm: Unknown

2.14.3Output Specifications

- Selected Latent Palm print should be declared as UNTRACED and should be added to the Palm Print database.
- If any filters are used, list the filters:
- If filters are used, number of database records filtered:
- Number of database records against which minutiae matching took place
- Hard copy of the search Palm Print.

2.14.4 Remarks

(All the output specifications should be noted on report template)

2.15 DOCUMENT CASE PROCESSING

2.15.1 Test Case Items

- AFIS Matcher Workstation
- AFIS Database (temporary of suspects)

2.15.2 Input (Test Data) Specifications

- Temporary database of 10 suspects.
- A Plain Print that has a duplicate in the above database.
- A Plain Print that has a no duplicate in the above database.

2.15.3Output Specifications

- Search print should be declared as TRACED and should be added to the temporary database.
- If any filters are used, list the filters:
- If filters are used, number of database records filtered:
- Number of database records against which minutiae matching took place.
- If TRACED then automatic one to one marking of identical points.
- Hard copy of the marked prints.
- Export and Import facility of temporary database.

2.15.4 Remarks

(All the output specifications should be noted on the report template)

2.16. REMOTE QUERY PROCESSING AND REPORTING

2.16.1. Test Case Items

- AFIS Communication Server Module
- AFIS Matcher
- Report Module

2.16.2. Input (Test Data) Specifications

- Search query from remote query station and other AFIS system of Rolled, chance and palm print that has duplicates in the database.
- Search query from remote query station and other AFIS system of Rolled, chance and palm print that has no duplicates in the database.
- Search query from remote query station and other AFIS system of Rolled, chance and palm print that has duplicates of different districts and states in the database.

2.16.3. Output specifications

- If rolled, chance and palm print detected TRACE from the database then trace case report (text and image) should be send to the concern remote stations automatically.
- If rolled, chance and palm print detected UNTRACE from the database then untraced case report (text) should be send to the concern remote station automatically and updated in the database.
- Hard copy of the search Rolled, Chance and Palm print.
- Hard copy of the duplicate/database copy, if TRACED.
- Update/Modify Information received from Remote Query Station
- Complete Report of a criminal with Rolled, Chance and Palm print image, demographic data and mug shot
- Inter District/Inter State Slips updation of the information at remote station and AFIS.
- Automatic mailings of Result (Text and Image) in case of TRACE to districts in case of inter district trace.

2.16.4. Remarks

(All the output specifications should be noted on the report template)

2.17. DATA PORTABILITY

2.17.1. Test Case Items

- AFIS database, Data Export tool.

2.17.2. Input (Test Data) Specifications

- Database records of AFIS under consideration.

2.17.3. Output specifications

- Data should be exported in neutralized NIST standard form.

2.17.4. Remarks

(All the output specifications should be noted on the report template)

2.18.CRIMINALS NON FINGER PRINT INFORMATION MANAGEMENT & REPORT MODULE

2.18. 1 Test Case Items

AFIS Demographic information database and module.

2.18.2 Input (Test Data) Specifications

- Following Criminal's Non Finger print information: -
  - Conviction
  - Arrest
  - Death
  - Absconding/Award/Notice issued by various National and International organization.
  - Mug shots
- Information of Latent Prints and document cases.
- Update/Modify Information received from Remote Query Station.

2.18.3 Output Specifications

- Complete Report of a criminal with finger print image and mug shot.
- Updation /Modification of the Information received from Remote Query Station.
- Online notification of Absconding/Award/Notices in the event of TRACE.
- In case of Inter District/Inter State Slips updation of the information at remote station and AFIS.
- Synchronization of Central and Remote non-finger print database.
- Reports generation on various parameters like: crime wise; Police station, district, and range wise …etc.
- Storage and Retrieval of following Criminal's non-fingerprint information
  - Criminal Profile details
  - Criminal Conviction details
  - Criminal Absconding details
  - Criminal Death details
  - Arrestee Profile details
  - Arrestee Absconding details
- Hard copies of the reports generated.
- Unicode database
- Dossier of a criminal.

- Personal performance appraisal module
- Court presentation module

2.18. 4 Remarks

[AFIS Linkage and interface with storage and retrieval of' Personal (Demographic information along with mug shot storage and retrieval have been verified The system's ability to generate various types of reports as mentioned in the input specifications have been ascertained.}.

2.19. WEB BASED REMOTE QUERY

2.19.1. Test Case Items

- Web Module

2.19.2. Input (Test Data) Specifications

- Image Capturing of rolled fingerprint card/slip, Latent fingerprint cards lifted or photographed and Palm print card (Plain and Writers Palm) from any site/Police station
    a) From Flatbed scanner
    b) From Live Scanner
    c) From Digital Camera
    d) From File
- Demographic data of the concerned slip.

2.19.3. Output specifications

- Time taken in processing.
- Notification/Error reporting/Result from the Central database.
- User management
- Security

2.19.4. Remarks

(All the output specifications should be noted on the report template)

2.20. SYSTEM ADMINISTRATION

2.20.1 Test Case Items

- AFIS Workstation
- AFIS Server

2.20.2 Input (Test Data) Specifications

Data related to:

- Generate User-wise and activity-wise statistics User-wise details statistics
- Activity-wise statistics
- User-wise throughput report
- Daily, monthly and yearly activity reports Database size report

2.20.3 Output Specifications

- Nature and format of statistics (i.e. whether user-wise details, activity-wise, etc.) Hard copies of statistics generated.
- Nature and format of reports (Monthly, yearly, throughput, database size reports) Hard copies of reports generated.
- Backup facility for fingerprint database.
- Restoration facility to avoid data loss.

2.20.4 Remarks

{Ability of the AFIS to generate list and work-wise statistics been verified. Further the format reports / statistics generated are found to be compliant/non compliant with the specification)

AFIS GENERAL FUNCTIONALITY

2.21. AFIS GENERAL FUNCTIONALITY

2.21.1 STANDARDS ADHERENCES

2.21.1.1 Test Case Items

AFIS system

2.21.1.2 Input (Test Data) Specifications

- AFIS configuration
- Transaction file/packet
- Fingerprint Images
- Mug shots

2.21.1.3 Output Specifications

- Openness of the system
- ANSI/NIST-ITL-1- 2007 *for* fingerprint data exchange
- WSQ compression for fingerprint images
- JPEG compression for mug shot images
- EFTS

2.21.1.4 Remarks

(Note down the variations, if any; also the method used to confirm the results.)

2.21.2 NETWORK SUPPORT AND SCALABILITY

2.21.2.1 Test Case Items

AFIS configurations

2.21.2.2 Input (Test Data) Specifications

- Various security features available in the AFIS
- Support for Local Area Network for AFIS Workstations/Servers
- Support for distributed matching/database on different machines and scalability.
- Availability of Remote Workstations with Query facility.
- Availability of complete AFIS solution on standalone desktop system.
- Support for Wide Area Networks (IPVPN, Dialup, Satellite and Lease line Based or hybrid) with security features.
- Scalability to address increasing database size, workload, matching load, remote systems, etc.

2.21.2.3 Output Specifications

- The AFIS is found to cater each of above input specification.

2.21.2.4 Remarks

(Note down the variations, if any; also the method used to confirm the results.)

2.21.3 MAINTENANCE AND SUPPORT

AFIS long term Maintenance and support availability

2.21.3.1 Input (Test Data) Specifications

Customer support

- Site support by Phone (For minimizing the down time at a customer site)
- Incident and call management (to record and track all call received from customers)
- Installation of software updates (when a s/w update has been released it should be sent on site for installation after customer's approval)
- On site services (A team of engineers should attend the customer)

Training

- Administrator level training
- User level training
- Refresher training with the updates.

Software Maintenance

- Software modifications
- Software updates delivery.
- Indigenous application support and maintenance availability

Documentation

- Proper written document regarding the software.
- Document for administrators.
- Document for users.

Preventive maintenance

Hardware support and maintenance availability

- Hardware corrective maintenance.
- Spare parts management (Stand by system)

Support for Backlog conversion and facilities

Warranties

2. 21.3.2 Output Specifications

- Dependencies on configuration/location.
- Considerations on the commitment to integration of hardware and software separately
- Hardware and software annual maintenance contract (AMC)
- Upgradability
- Support in various parts of the country specifically areas like North East, J&K etc

2. 21.3.3 Remarks

(Note down the variations, if any; also the method used to confirm the results.)

AFIS PERFORMANCE (SPEED & ACCURACY)

2.22 MATCHING ACCURACY & SYSTEM THROUGHPUT

2.22.1 Test Case Items

AFIS Matcher (Server Module and Workstation)

2.22.2 Input (Test Data) Specifications

- Ten-digit fingerprint database of 5,00,000 rolled fingerprint slips
- Unsolved-scene-of-crime/Latent fingerprint database of 2,000 latent fingerprints.
- Palm Prints database of 500 Palm Prints.
- Latent Palm Print database of 100 Latent Palm Prints.
- Repeat test case 2.4,100 times with new ten digit fingerprint slips, which has duplicates in the database.
- Repeat test case 2.6,100 times with new ten digit fingerprint slips, which has no duplicates in the database.
- Repeat test case 2.8,100 times with new latent print, which has duplicates in the database.
- Repeat test case 2.9,100 times with new latent print, which has no duplicates in the database.
- Repeat test case 2.10,50 times with new palm print, which has duplicates in the database.
- Repeat test case 2.13,50 times with new palm print, which has no duplicates in the database.
- Search Record ID: XXXX
- Digit: Unknown
- Pattern: Unknown
- Type of Print: RLP/CHP/Palm

2.22.3 Output Specifications

For each case (total of 500), note the following:

#	Search # with Params	Type of print RLP/CHP /Palm	Search DB Size	Filtered Recs.#	Expected Result Trace/Untrace	System Result if (T/UT)	Position in short List (if result is traced)
1	Search Rec. ID	RLP	5,00,000		Trace/ Untrace	Trace/ Untrace	-
2	Search Rec. ID	CHP	2,000		Trace/ Untrace	Trace/ Untrace	-

3	Search Rec. ID	Palm	500		Trace/ Untrace	Trace/ Untrace	-

(*) Shortlist = List of most likely matches for a given fingerprint search record by an AFIS. For ten-print record searches it is considered as 10, for latent print record searches it is considered as 100 and for palm print record searches it is considered as 10.

For Rolled Finger prints:

- Correct identification in the first place.
- Hard copy of the search fingerprint.
- Hard copy of the traced database fingerprint.

For Latent prints:

- Correct identification in the first place
- Correct identification in 2-5 place
- Correct identification in 6-10 place
- Correct identification in 11-15 place
- Hard copy of the search fingerprint
- Hard copy of the traced database fingerprint

For Palm prints:

- Correct identification in the first place.
- Hard copy of the search palm print.
- Hard copy of the traced database Palm Print.

For Latent Palm prints:

- Correct identification in the first place
- Correct identification in 2-5 place
- Correct identification in 6-10 place
- Correct identification in 11-15 place
- Hard copy of the search palm print.
- Hard copy of the traced database Palm Print.

Rolled Print to Rolled Print Test

Scores are awarded only if the corrected candidate is matched in first place, according to the following table:

Stage	**Type of Slip**	**No. of Slips (N)**	**M**	**H**	**P=H*M**	**POINTS% (P/N)**
			Score	No. of hits	POINTS	
1	Juveniles	10	10	H_1	$P1=H_1*10$	
2	Poor quality	10	10	H_2	$P2=H_2*10$	
Sum			**Max P=100-**	**ΣH**	**ΣP**	**ΣP/100**

Latent Print to Rolled Print Test

Latent Prints will be acquired and database searches initiated in several phases. Encoding will be performed by an expert.

i) **Phase I** – No intervention of expert in the classification or encoding process. Automatic encoding only, without any use of filters such as finger number, pattern type, delta and center location, angle (360o), pattern types of adjacent or other fingers and palm part position and direction .

ii) **Phase II** – Minimal intervention of expert in encoding. All Latent Prints that were not matched in Phase I will be automatically re-encoded by an expert and be resent to the database for matching.

iii) **Phase III** – Maximum expert intervention. All Latent Prints that were not matched in Phase II will be resent to the database for matching after application of various filters such as finger number, pattern type, delta and center location, angle, pattern types of adjacent or other fingers and palm part position and direction.

Score calculation for Latent Print to Rolled Print Test

Phase	**Encoding method**	**No. of encoded latent print**	**M_1**	**H**	**P=H*M**	**M_2**	**H**	**P=H*M**	**M_3**	**H**	**P=H*M**	**M_4**	**H**	**P=H*M**	**Total Points**
			Score for 1st place	No. of hits	Total Points	Score for 2-5 Place	No.of hits	Total Points	Score for 6-10 place	No. of hits	Total Points	Score for 11-15 place	No. of hits	Total Points	
1	Automatic encoding only	50	10	H	**$P=H*M_1$**	9	H	**$P=H*M_2$**	8	H	**$P=H*M_3$**	7	H	**$P=H*M_4$**	ΣP
2	Automatic encoding (Minimal Intervention)	50 less all Phase 1 Hits	9	H	**$P=H*M_1$**	8	H	**$P=H*M_2$**	7	H	**$P=H*M_3$**	6	H	**$P=H*M_4$**	ΣP
3	Filtering	50 less all Phase 1 & II Hits	5	H	**$P=H*M_1$**	4	H	**$P=H*M_2$**	3	H	**$P=H*M_3$**	2	H	**$P=H*M_4$**	ΣP
														Total ΣP	

Latent Palm Print to Palm Print Test

Latent Palm Prints will be acquired and database searches initiated in several phases. Encoding will be performed by an expert.

i) **Phase I** – No intervention of expert in the classification or encoding process. Automatic encoding only, without any use of filters such as finger number, pattern type, delta and center location, angle (360^{o}), pattern types of adjacent or other fingers and palm part position and direction .

ii) **Phase II** – Minimal intervention of expert in encoding. All Latent Palm Prints that were not matched in Phase I will be automatically re-encoded by an expert and be resent to the database for matching.

iii) **Phase III** – Maximum expert intervention. All Latent Palm Prints that were not matched in Phase II will be resent to the database for matching after application of various filters such as finger number, pattern type, delta and center location, angle, pattern types of adjacent or other fingers and palm part position and direction.

Score calculation for Latent Palm Print to Palm Print Test

Phase	Encoding method	No. of encoded latent print	M_1	H	P=H*M	M_2	H	P=H*M	M_3	H	P=H*M	M_4	H	P=H*M	Total Points
			Score for 1st place	No.of hits	Total Points	Score for 2-5 Place	No.of hits	Total Points	Score for 6-10 place	No.of hits	Total Points	Score for 11-15 place	No. of hits	Total Points	
1	Automatic encoding only	50	10	H	$P=H*M_1$	9	H	$P=H*M_2$	8	H	$P=H*M_3$	7	H	$P=H*M_4$	ΣP
2	Automatic encoding (Minimal Intervention)	50 less all Phase 1 Hits	9	H	$P=H*M_1$	8	H	$P=H*M_2$	7	H	$P=H*M_3$	6	H	$P=H*M_4$	ΣP
3	Filtering	50 less all Phase 1 & II Hits	5	H	$P=H*M_1$	4	H	$P=H*M_2$	3	H	$P=H*M_3$	2	H	$P=H*M_4$	ΣP
														Total ΣP	

Score calculation for Rolled Print to Unsolved Latent Print

Phase	Search	No. of latent print	M	H	P=H*M	M	H	P=H*M	M	H	P=H*M	M	H	P=H*M		Total Points
			Score for 1st place	No. of hits	Total Points	Score for 2-5 Place	No.of hits	Total Points	Score for 6-10 place	No. of hits	Total Points	Score for 11-15 place	No. of hits	Total Points		
1	TP-UL	**10**	**10**	**H**	**H*10**	**8**	**H**	**H*8**	**6**	**H**	**H*6**	**4**	**H**	**H*4**	PΣ	
2	LP-ULP	**10**	**10**	**H**	**H*10**	**8**	**H**	**H*8**	**6**	**H**	**H*6**	**4**	**H**	**H*4**	PΣ	

Score calculation for Palm Print to Unsolved Latent Palm Print

Phase	Search	No. of latent print	M	H	P=H*M	M	H	P=H*M	M	H	P=H*M	M	H	P=H*M		Total Points
			Score for 1st place	No. of hits	Total Points	Score for 2-5 Place	No.of hits	Total Points	Score for 6-10 place	No. of hits	Total Points	Score for 11-15 place	No. of hits	Total Points		
1	PP-ULP	**10**	**10**	**H**	**H*10**	**8**	**H**	**H*8**	**6**	**H**	**H*6**	**4**	**H**	**H*4**	PΣ	
2	LPP-ULP	**10**	**10**	**H**	**H*10**	**8**	**H**	**H*8**	**6**	**H**	**H*6**	**4**	**H**	**H*4**	PΣ	

Accuracy:

False Rejection Rate (FRR) and False Acceptance Rate (FAR) are two measures to assess the accuracy of any biometric system.

- FRR is the probability that a system will fail to identify or verify the legitimate identity of a person (the system is unable to declare a trace of the search fingerprint record, when the duplicate fingerprint record is available in the database).
- FAR, is the probability that a system will incorrectly identify an individual (the system declares a trace of the search fingerprint record, when the duplicate fingerprint record is not available in the database).

  FRR and FAR are generally used in access control or fully automated systems. This is not applicable in AFIS for law enforcement agencies, where an expert makes the final decision.

Type		Accuracy (%)
Ten-print	(correct acceptance)	
Ten-print	(correct rejection)	
Ten-print	(false acceptance)	
Ten-print	(false rejection)	
Latent-print	(correct acceptance)	
Latent-print	(correct rejection)	
Latent-print	(false acceptance)	
Latent-print	(false rejection)	
Palm-print	(correct acceptance)	
Palm-print	(correct rejection)	
Palm-print	(false acceptance)	
Palm-print	(false rejection)	
Latent Palm-print	(correct acceptance)	
Latent Palm-print	(correct rejection)	
Latent Palm-print	(false acceptance)	
Latent Palm-print	(false rejection)	

Throughput:

Type	Average End to end time
Rolled-print	
Chance print	
Palm-print	
Latent Palm Print	

Weight for above tests

S.No	Test	Weight
1	Rolled Print to Rolled Print	6 %
2	Latent Print to Rolled Print	36 %
3	Latent Palm Print to Palm Print	36 %
4	Rolled Print to Unsolved Latent Print	20 %
5	Palm Print to Unsolved Latent Palm Print	2 %

2.22.4 Remarks

SECTION 3-SUMMARY

3.1 OVERALL BENCHMARK OUTPUT

#	**Bench Mark item**	**Weight**	**Marks**
1	Vendor Profile (Vendor Capabilities for Enhancements, support and maintenance)	5 %	
2	Hardware Compliance	10 %	
3	Compliance on System Architecture and Solution	5 %	
4	AFIS Performance (Speed and Accuracy)	40 %	
5	AFIS Core Functionality	30 %	
6	AFIS General Functionality	10 %	
	Total	**100 %**	

3.2 AFIS CORE FUNCTIONALITY

#	Benchmark Item	Weight	Rating
1	Data Conversion Tool		
2	Finger Print Data Acquisition		
3	Image Processing Tools		
4	Image Enhancement Tools		
5	Person Identification		
6	Latent Identification		
7	Solving previously unsolved latent cases		
8	Palm print Identification		
9	Palm Chance Print Identification		
10	Solving previously unsolved Palm Chance prints		
11	Document Case Processing		
12	Remote Query Processing		
13	Data Portability		
14	Demographic Information and report Module		
15	Web based remote query		
16	System Administration		

3.3 AFIS GENERAL FUNCTIONALITY

#	Benchmark Item	Weight	Rating
1	Standard Adherences		
2	Network Support & Scalability		
3	Maintenance And Support		

3.4 AFIS PERFORMANCE

#	**Benchmark Item**	**Weight**	**Rating**
1	Rolled print Operations-Human intervention time		
2	Rolled print Operations-Machine processing time		
3	Latent print Operations-Human intervention time		
4	Latent print Operations-Machine processing time		
5	Palm print Operations-Human intervention time		
6	Palm print Operations-Machine processing time		
7	Latent palm print Operations-Human intervention time		
8	Latent palm print Operations-Machine processing time		
9	System end-to-end speeds		
1	System matching accuracies		

3.5 AFIS VENDOR ORGANIZATION STRENGTHS

#	Benchmark Item	Weight	Rating

SECTION 4 -TEST RESULTS RECORDS

4.1 SYSTEM CONFIGURATION

#	Benchmark Item	Details	Method of Finding
1	AFIS Workstation Configuration		
2	AFIS Server Configuration		
3	Fingerprint input device (Scanner/Camera) configuration		
4	Others, if any		

4.2 ROLLED PRINT OPERATIONS - SEARCHES

#	Txn No (With Params)	Search DB Size	Filtered Recs #	Expected Result Trace /Untraced	System Result (T/UT)	Position in shortlist (if result is traced)	Human Interventio n time	Match Time	End-to-End Time
'I									
2									
3									
.									
.									
.									
.									
100									

4.3 ROLLED PRINT OPERATIONS. -UPDATES

#	Txn No (With Params)	Search DB Size	Filtered Recs #	Expected Result Trace/ Untraced	System Result (T/UT)	Position in shortlist (if result is traced)	Human Intervention time	Match Time	End-to-End Time
'I									
2									
3									
.									
.									
.									
.									
100									

4.4 LATENT PRINT OPERATIONS -SEARCH.

#	Txn No (With Params)	Search DB Size	Filtered Recs #	Expected Result Trace/ Untraced	System Result (T/UT)	Position in shortlist (if result is traced)	Human Intervention time	Match Time	End-to-End Time
'I									
2									
3									
.									
.									
.									
.									
100									

4.5 LATENT PRINT OPERATIONS -UPDATES.

#	Txn No (With Params)	Search DB Size	Filtered Recs #	Expected Result Trace/ Untraced	System Result (T/UT)	Position in shortlist (if result is traced)	Human Intervention time	Match Time	End-to-End Time
'I									
2									
3									
.									
.									
.									
.									
100									

4.6 PALM PRINT OPERATIONS -SEARCHES

#	Txn No (With Params)	Search DB Size	Filtered Recs #	Expected Result Trace/ Untraced	System Result (T/UT)	Position in shortlist (if result is traced)	Human Intervention time	Match Time	End-to-End Time
'I									
2									
3									
.									
.									
.									
.									
100									

4.7 PALM PRINT OPERATIONS -UPDATES

#	Txn No (With Params)	Search DB Size	Filtered Recs #	Expected Result Trace/ Untraced	System Result (T/UT)	Position in shortlist (if result is traced)	Human Intervention time	Match Time	End-to-End Time
'I									
2									
3									
.									
.									
.									
.									
100									

4.8 OTHER SEARCHES/UPDATES

#	Txn No (With Params)	Search DB Size	Filtered Recs #	Expected Result Trace/ Untraced	System Result (T/UT)	Position in shortlist (if result is traced)	Human Intervention time	Match Time	End-to-End Time
'I									
2									
3									
.									
.									
.									
.									
100									

SECTION 5. VENDOR PROFILE

#	Item	Vendor Feedback	Vrf by NCRB (Y/N)
1	Location of corporate headquarter		
2	Size of the company i) . Total ii) Development iii) Research iv) H/w maintenance		
3	AFIS development locations and team size		
4	Service facilities and locations i) In India ii) Outside India		
	Technical collaborators, if any		
	Company turnover in 2007-2008		
	Company turnover in 2008-2009		
	Company turnover in 2009-2010		
	Company turnover in 2010-2011		
5	Geographical distribution of the vendor (offices, locations and respective staff size)		
6	Total number of AIFS installations (workloads similar to this benchmark) i) In India ii) Outside India		
7	R& D setup for support in India		
8	Representations in India - details (Affiliations / subsidiaries / authorized representatives)		

5.1 VENDOR FEEDBACK ON SEMI/ NON-EXISTING/ADDITIONAL FEATURES

#	Feature	Ref	Time Estimate to Deliver	Estimate Cost

SECTION 6-TOTAL COST OF OWNERSHIP

H/W Configuration required and AFIS licensing policy

6.1 BASE SYSTEM

#	Database Size and daily workloads	Software licensing	Hardware configuration	Others, if any
1	**Database:**			
	50,000 rolled 10 digits records			
	1,000 latent print records			
	Daily Workload:			
	30 rolled 10 digits searches			
	30 rolled 10 digits updates			
	10 latent searches/updates			
2	**Database:**			
	100,000 rolled 10 digits records			
	5,000 latent print records			
	Daily workload:			
	100 rolled 10 digits searches			
	50 rolled 10 digits updates			
	25 latent searches/updates			
3	**Database:**			
	500,000 rolled 10 digits records			
	25,000 latent print records			
	Daily workload:			
	500 rolled 10 digits searches			
	200 rolled 10 digits updates			
	100 latent searches/updates			
4	**Database:**			
	10,00,000 rolled 10 digits records			
	50,000 latent print records			
	Daily workload:			
	1000 rolled 10 digits searches			
	400 rolled 10 digits updates			
	200 latent searches/updates			
5	**Database:**			
	25,00,000 rolled 10 digits records			
	2,00,000 latent print records			
	Daily workload:			
	2000 rolled 10 digits searches			
	1000 rolled 10 digits updates			
	500 latent searches/updates			

6.2 ANNUAL MAINTENANACE

#	Database Size and daily workloads	**Percentage price of the solution**		
		Software	Hardware	Others
1	1 st Year			
2	2 nd Year			
3	3 rd Year			
4	4 th Year			
5	5 th Year			

6.3 - RECORD CONVERSION (BACKLOG)

#	# of slips	Cost
1	100,000 rolled print slips	
2	200,000 rolled print slips	
3	300,000 rolled print slips	
4	400,000 rolled print slips	
5	500,000 rolled print slips	
6	600,000 rolled print slips	
7	700,000 rolled print slips	
8	800,000 rolled print slips	
9	900,000 rolled print slips	
10	10,00,000 rolled print slips	
11	11,00,000 rolled print slips	
12	12,00,000 rolled print slips	
13	13,00,000 rolled print slips	
14	14,00,000 rolled print slips	
15	15,00,000 rolled print slips	
16	16,00,000 rolled print slips	
17	17,00,000 rolled print slips	
18	18,00,000 rolled print slips	
19	19,00,000 rolled print slips	
20	20,00,000 rolled print slips	
21	21,00,000 rolled print slips	
22	22,00,000 rolled print slips	
23	23,00,000 rolled print slips	
24	24,00,000 rolled print slips	
25	25,00,000 rolled print slips	

SECTION 7 - AFIS EVALUTION (XL SHEET)

This is a tool to evaluate the vendors and their AFIS strengths. This tool helps in calculating the score for a system. It takes all the test results as input and gives the total score for the system as output. Following factors are considered for evaluation:

- AFIS core functions
- AFIS General functions
- AFIS Accuracy and Performance
- Vendor's strength in implementing AFIS

Further, these areas are sub divided into several items. All are given a weight, which indicates the desirability level. After the benchmark tests on these items, Vendor (or its AFIS) is given a rating, which is nothing but its strength in that benchmark test item. Based on weights and the rating, this tool assigns a score value. This tool, finally, calculates the overall score for every area and a whole benchmark.

As an example, AFIS core functions carrying the highest weight are divided into following sub-areas:

- Data Conversion Tool
- Finger Print Data Acquisition Image Processing Tools
- Image Enhancement Tools
- Rolled Print Identification Process and Features
- Latent Print Identification
- Solving previously unsolved latent cases
- Palm print Identification
- Palm Chance Print Identification
- Solving previously unsolved Palm Chance prints
- Document Case Processing
- Remote Query Processing
- Data Portability
- Criminals Non finger print Information and report Module
- Web based remote query
- System Administration

These sub areas are further split into benchmark test items. As mentioned above, all of these are given a weight and after the benchmark test, vendor (or its AFIS) is given ratings for every test item. This tool calculates the scores for individual item, sub-area, and area and finally, consolidates them into summary.

This tool also contains information on conventions followed, easing the user to use the tool.

Conventions followed in the Workbook

#	Parameter	Interpretation
1	**Weight Value**	
	5	Highest desirable level
	4	High desirable level
	3	Medium desirable level
	2	Low desirable level
	1	Lowest desirable level
2	**Rating Value**	
	A=5	Operational flow is straight forward and highly automated
	B=4	Operational flow is straight forward
	C=3	Functionality exists but difficult to achieve
	D=2	Functionality exists but highly to achieve
	E=1	Functionality exists but not straight forward (tedious, high manual intervention)
	F=0	Fail. Functionality does not exist
3	**Color**	
	Red Color	Don't change-these are important formulae
	Blue Color	Input Values. Evaluation Team has to assign these values after benchmarking vendor's AFIS

Description of various parameters present in System Performance Sheet

1	Weight	Value 2^ (Weight)
2	rng limit	Range Limit (maximum) according to rating as per data sheet attached
3	rng size	Range Size of the rating
4	sub-band	(rng limit - Value) / rng size
5	m-band	A - 4, B - 3, C - 2, D - 1, E - 0
6	Tot Val	m-band + sub-band
7	Received Marks	*2*^(Tot Val)

System Core Functions

Sr. No.	Feature	Weight	Weight Value	Expected Value	Rating (Grade)	Rating (Value)	Recd. Marks (Rating Value * Weight Value)	Expected Marks (Weight * Weight Value)	Comments
I	**Data Conversion Tool**								
i	Error Management (to notify failures with reason(s) for correction)								
ii	Speed and accuracy (end-to-end conversion time of ten .fiif, number of successfully converted slips out of 10)								
iii	Evaluation of tool with respect to user friendliness and effectiveness								
II	**Fingerprint Data Acquisition**								
1	**Data acquisition from range of input devices (through USB port also)**								
a	Live Scanner								
b	Scanner: Photo scanning, Search/Record slip scanning.								
c	File								
d	Digital Camera								
e	Multi resolution scan (to manage images that were scanned with a resolution 500 dpi and 1000 dpi)								
2	**Data acquisition from different type/quality slips/prints**								
a	Poor quality slips/prints and non formatted FP slips								
b	Flexible Print Area Box size and orientation (for all type of prints i.e. rolled/flat/latent/palm)								
d	Amputated / injured/ bandaged cases								
e	Photographs (scaled & unscaled)								

f	Facility to create user define Template								
g	Automatic Pattern Area Recognition & Segmentation								
3	**Quality Control**								
a	Sequence Check								
b	Sequence Correction								
c	Hand inversion tool (to invert entire hands during sequence correction.)								
d	Replacement of plain prints in place of corresponding poor quality rolled prints								
III	**Image Processing Tools**								
i	Ridge flow Matrix (Ridge Orientation Map), Core and Delta								
ii	Automatic Pattern Recognition								
iii	Assign Complete Henry Classification automatically								
iv	Facility to mark/change manually multiple Finger Print pattern results								
v	Minutiae Edition (Add, Remove, Rotate, Count, Neighbouring)								
vi	Selection Tool to select a specific area on a print.								
IV	**Image Enhancement Tools**								
1	**Image manipulation tools** (without modifying the pixels grey level values)								
i	Zooming								
ii	Rotate an image & auto centring								
iv	Trimming of image								
v	Skeleton editing								
vi	Invert (white powder print)								
vii	Increase/Decrease ridge thickness								
viii	Increase/Decrease valley thickness								

2	**Histogram Transformation Tools**								
i	Adjust Contrast								
ii	Adjust Brightness								
iii	Equalisation (to adjust automatically Brightness & Contrast .)								
iv	Logarithmic Transformation (to darkens the black pixels while lightly brightens the white pixels)								
v	Stretching Tool (Stretches the histogram by using all available gray levels. The user can choose the level of saturation (low, medium or high))								
vi	Friction ridge transformation / Auto Enhancement (to transforms the image using the other histogram transformations i.e. equalization, logarithmic etc)								
vii	Binarization tool (to polarizes the image to get black and white pixels.)								
viii	Inverse Logarithmic Transformation								
3	**Image Filter Tools**								
i	Fast Fourier Transformation (to remove the periodic noises and highlights the friction ridges using the combinations of Gabor Filters in all directions to separate overlaid /overlapped chance prints and supressing background.)								
ii	Morphological Transformation (to remove the elements that are big (lines, blocks, text, etc) and that do not provide additional information to the prints.)								
iii	Sharpening Tools (to reinforces the dark regions and diminishes the bright regions while keeping the same image contrast.)								
iv	Directional Ridge Enhancement (Gabor-that highlights friction ridges in a specific direction choosen by the user)								
v	Image Enhancement History (to browse the image enhancement history and possibly undo or redo modifications, save enhanced images or come back to the original image.)								
4	**Image Calibration Tool**								
i	Image scaling for image calibration with ruler (in mm)								
ii	Image scaling for photographic enlargement ratio (xN)								

iii	Image scaling with respect to papillary lines.								
V	**Rolled Print Identification Process and Features**								
i	Rolled print slip to rolled print database matching end to end process								
ii	Automated replacement of poor quality prints by better quality and archieval of related slips for reference in criminals profile.								
iii	Match a database slip having less than 10 prints (amput/bandage) with 10 print slip								
iv	Search slip having less than 10 prints (amput/bandage)								
v	Search of poor quality prints								
vi	Search of xerox slips								
viii	Automated selection of matching digits, which is best in quality in search slip and database, facility to select no of digits for search.								
ix	Automatic Rolled print update in case of unmatched								
VI	**Latent Print Identification**								
i	Single Chance Print search against rolled print database and palm print database (end to end process)								
ii	Multiple Chance Print search against rolled print database end to end process								
iii	Search of lifted prints								
iv	Search of photographs (scaled)								
v	Search of photographs (unscaled)								
vi	Resubmission of chance print with changed parameters (immediately)								
vii	Rotation & centering tolerance 360 degree (orientation independent search)								
ix	Ability to use print level features for faster matching (like finger position, core, delta etc)								

x	User definable shortlist size								
xi	Automatic Latent print update in case of unmatched								
VII	**Solving previously unsolved latent prints**								
i	Rolled print search against latent print database end to end process.								
ii	Ability to resubmit a rolled print from the database to search against latent print database (at a later date).								
iii	Latent print search against latent print database.								
iv	Ability to resubmit a latent print from the database to search against latent print.								
v	Linking previous cases.								
VIII	**Palm print Identification**								
i	Search of Palm print slip to Palm print database matching end to end process								
ii	Automated replacement of poor quality prints by better quality and archieval of related slips for reference in criminals profile.								
iii	Search of xerox slips								
iv	Capable of Palm print to latent Palm print search.								
v	Accept verification in batches.								
vi	Automatic palm print enrolment in case of unmatched								
IX	**Latent Palm Print Identification**								
i	Latent Palm Print search against Palm print database end to end process								
ii	Search of lifted prints								
iii	Search of photographs (scaled)								
iv	Search of photographs (unscaled)								
v	Resubmission of Latent Palm Print with changed parameters (immediately)								

vi	User definable shortlist size								
vii	Automatic Latent palm print enrolment in case of unmatched								
viii	Automatic latent palm print update in case of matched								
X	**Solving previously unsolved Palm Latent prints**								
i	Palm print search against Latent palm print database								
ii	Ability to resubmit a Palm print from the database to search against Palm Chance print database (at a later date)								
iii	Latent Palm Print search against Latent PalmPrint database								
iv	Ability to resubmit a Latent Palm Print from the database to search against Latent Palm print								
v	Linking previous cases								
XI	**Document Case Processing**								
i	Creation of New document/evidence/disputed image and storage								
ii	Open existing document /evidence from the database								
iii	Search of disputed to disputed Print								
iv	Search of disputed to Suspect rolled Print								
v	Search of disputed to disputed Print of other case.								
vi	Split screen verification format with charting,								
vii	Accept verification in batches.								
XII	**Remote Query Processing**								
i	Search from remote Query Station								
ii	Synchronization of Fingerprint and Non-finger print database of National, State and Remote Query Systems								
iii	Automatic Update/Modify Information received from Remote Query Station.								

iv	Inter District/Inter State Slips updation of the information at remote station and AFIS.								
v	Automatic mailing of Trace Case Report (Text and Image) to respective districts RQWS in case of trace.								
vi	Automatic mailing of Trace Case Report (Text and Image) to all respective districts in case of inter district trace.								
XIII	**Data Portability** (in NIST format)								
i	Export of rolled finger print.								
ii	Export of latent print.								
iii	Export of Palm print.								
iv	Export of evidence/disputed print.								
XIV	**Demographic Information and Report Module**								
i	Unicode database for Criminals Non Finger Print Information.								
ii	Facility to create the Dossier of a criminal								
iii	Provision for entering Conviction details								
iv	Provision for entering Arrest details								
v	Provision for entering Death details								
vi	Provision to mark/flag Absconding/Award/Notice issued by various National and International organization.								
vii	Provision for Mugshots								
viii	Online notification of Absconding/Award/Notices in case of Match event.								
ix	Person's record query and analysis tool of crime and criminal (flexible enough to use Multiple fields and wild cards during a query with phonetic search facility)								
x	Complete report of criminal with finger print image, demographic data and mugshots.								

xi	Reports generation on various parameters like: crime wise; Police station, district, range wise… etc.								
xii	Storage and Retrieval of following Criminal's non-fingerprint information								
xiii	Criminal Profile details								
xiv	Criminal Conviction details								
	Criminal Absconding details								
	Criminal Death details								
	Arrestee Profile details								
	Arrestee Absconding details								
XV	**Web based Remote Query**								
i	**Data acquisition from range of input devices**								
	Live Scanner								
	Scanner:- Photo scanning, Search/Record slip scanning.								
	File								
	Digital Camera								
	Data acquisition from different type/quality slips/prints								
ii	Poor quality slips/prints and non formatted FP slips								
iii	Photographs (scaled & unscaled)								
iv	Demograhic data entry of the finger print slip								
v	Intimation of result/reports.								
vi	User management								
vii	Security (web interface must comply all current security standards and must be on SSL)								
XVI	**System Administration**								
i	**Administration Module** (GU Interface that allows the system administration, system monitoring and ability to detect and								

	possibly solve errors intutively)								
ii	**Acess Permission control Module** (allows the administrator to create or modify the hierarchical structure of data ownership and to assign functional access permission for each user)								
iii	**User Administration Module** (allows the administrator to create user logins, assign functional access permissions and valid terminals)								
iv	**Manage Password validity periods** (Allows the administrator to define password validity periods)								
v	**Backup, Restore & Recovery** (To Secures the system in case of failure or disaster.)								
vi	**System Monitoring** (GUI Interafce to monitor the status of all services/components /processes in progress, status of users and their activity and database status monitoring)								
vii	**Online help** (allows the user to reach an context sensitive help from the main menu of the GUI)								
viii	**Logs and statistics** (Provides the administrator with a set of functions to manage logs and statistics)								
ix	**Log Browser** (allows the administrator to browse the log database through a straight forward interface)								
xii	**Reporting Module**								
a	Database size report Rolled print,Chance print and Palm print								
b	User wise statistical report								
c	Activity wise statistical report								
d	User wise through put report								
e	Daily report								

f	Monthly report								
g	Yearly report								
XVII	**Verification Tool**								
i	Screen to view search and corresponding database print at the same time								
ii	Demographic data must be retrieve on double click of shortlisted No.								
iii	Split screen verification format with charting.								
iv	Additional feature if any.								
XVIII	**GUI and Workflow**								
i	User Friendly, interactive and intuitive GUI Capabilities								
ii	Flexi and user defined workflow								
iii	Single Interface for all operations.								
XIX	**Court presentation module**								
i	Court presentation module for preparation of comparative analysis of prints, marking and expert opinion								
XX	**Other Essential Features**								
i	Auto archival data relating to person informed to be 'dead'?								
ii	Capability to define different default "deletion rules"/time-period by print types, like time-barred slips etc.								
iii	Capability to identify & delete records as per default "deletion rules"/time-period								
iv	Ability to have priority based processing of matching requests received from other workstations								
v	In case of better print replacement event, replaced print should not be purged from the database. These prints should be exists in criminal personal database.								

vi	Personal performance appraisal module of F.P. experts, personal preparing finger print slips, must include details of encoder and verifier activity to evaluate their performance.								
vii	Automatic slip identification using technologies like Barcode or OCR								
		Total							
		Score (%)							

SYSTEM ARCHITECUTRE & SOLUTION

S.No.	Components		Compliance (y/n)	Value Addition: Config./Qty. (if any)	Weight	Weight Value	Rating Value	Received Marks	Expected Marks
1	Software Components	Centralized State AFIS Software							
		Terminal at Central Site							
		District RQWS Software							
		Input Workstation System Software for Police Station							
		Mobile AFIS							
2	System Architecture	Data Backup							
		Server Redundancy							
		Load Balance							
		Disaster Recovery System							
		Stoage Area Network (SAN)							
3	Network Design	Proposed Connectivity							
		Network Security							

HARDWARE COMPLIANCE CALCULATION										
S.No.	**Hardware**		**Compliance (A/B/F)**	**Reason(s) for Non-compliance**	**Value Addition: Config./Qty. (if any)**	**Weight**	**Weight Value**	**Rating-> Value**	**Received Marks**	**Expected Marks**
1	Blade Server Chassis	Configuration								
		Quantity								
2	Blade Server	Configuration								
		Quantity								
3	Storage Area Network	Configuration								
		Quantity								
4	SAN Switches	Configuration								
		Quantity								
5	Tape Library	Configuration								
		Quantity								
6	Workstation	Configuration								
7	Laptop	Configuration								
8	Live Scanner	Configuration								
9	Laser-Jet Printer	Configuration								
10	Digital SLR Camera	Configuration								
11	Web Camera	Configuration								
12	Flat bed Scanners	Configuration								
13	Online UPS for Server with 2 hrs. Backup Time	Configuration								
		Quantity								
14	Online UPS for RQWS with 1 hr. Backup Time	Configuration								
		Quantity								
15	Network Equipment	Configuration								
		Quantity								
16	Network Printer	Configuration								

Calculation For System Performance

S.No	Features	Weight	Weight Value	Observed Value (In Secs)	Rng Limit	Rng Size	Sub Band	mBand	Total Value	Received Marks	Expected Marks
1	**System End to End Speeds**										
1.1	Rolled Print Search End to End Time										
1.2	Latent Print Search End to End Time										
1.3	Palm Print Search End to End Time										
1.4	Latent Palm Print Search End to End Time										
2	**System Matching Accuracies**										
2.1	Ten-print Accuracy (correct acceptance)										
2.2	Latent-print Accuracy (correct acceptance)										
2.3	Ten-print Accuracy (false acceptance)										
2.4	Ten-print Accuracy (false rejection)										
2.5	Latent-print Accuracy (false acceptance)										
2.6	Latent-print Accuracy (false rejection)										
2.7	Palm-print Accuracy (correct acceptance)										
2.8	Palm Print Accuracy (false acceptance)										
2.9	Palm Print Accuracy (false rejection)										
2.10	Latent Palm-print Accuracy (correct acceptance)										
2.11	Latent Palm Print Accuracy (false acceptance)										
2.12	Latent Palm Print Accuracy (false rejection)										

Vendor Profile

#	Features	Weight	Weight Value	Expected Value	Rating (Grade)	Rating (Value)	Recd. Marks	Expected Marks
1	**Vendor Details**							
1.1	Company							
1.1.1	Year of Incorporation							
1.2	**Turnover of Company (in Rs.Crores)**							
1.2.1	Turnover of latest Year							
1.2.2	Average Turnover of previous 3 years (excluding latest year)							
1.3	**Geographical presence in Maharashtra**							
1.3.1	Number of offices in Maharashtra							
1.4	Experience in AFIS software development, supply and installations (Tenderer / AFIS S/w OEM)							
1.5	Experience in AFIS hardware support/setup and installations of AFIS projects (Tenderer / AFIS S/w OEM)							
1.6	AFIS operational sites							
						Total		
						Score(%)		

General Functions

#	Feature	Weight	Weight Value	Rating Value	Received Marks	Expected Marks
	Standards Adherences and Openness of System					
i	ANSI/NIST-ITL-1- 2007 for fingerprint data exchange.					
ii	Certified Versions (NIST/FBI) of WSQ algorithm for compression for fingerprint images.					
iii	JPEG compression for mug shot images (ANSI/NIST-ITL-1- 2007)					
iv	EFTS (Electronic Fingerprint Transmission Specification).					
vi	Minutiae and related information encoded from a finger or palm:ANSI/NIST type-9 (ANSI/NIST-ITL-1- 2007)					
	Network Support and Scalability					
i	Various security features available in the AFIS (Compliance to all current Security Standards at System level, Application level, Database level, Network level)					
ii	Support for distributed matching/database, load ballancing and scalability					
iii	Availability of Remote Workstations and web based workstaion application with Query facility.					
iv	Availability of complete AFIS solution on standalone desktop system					
v	Support for Wide Area Networks (IPVPN, Dialup, Satellite and Lease line Based or hybrid) with security features.					
vi	Scalability to address increasing database size, workload, matching load, remote systems etc.					
vii	Modules related to seamless integration and scalability from State AFIS to National AFIS.					
viii	Documentation Proper written document regarding the software.					
ix	Document for administrators.					
x	Document for users.					
		Total				
		Percentage				

System Performance

Data Sheet

A		B		C		D		E		F
From	To	From	To	From	To	From	To	From	To	
0.00	225.00	225.00	490.00	490.00	875.00	875.00	1320.00	1320.00	1825.00	499995.00
0.00	632.00	632.00	1374.00	1374.00	2296.00	2296.00	3398.00	3398.00	5220.00	499995.00
0.00	235.00	235.00	510.00	510.00	905.00	905.00	1360.00	1360.00	1875.00	599994.00
0.00	634.00	634.00	1378.00	1378.00	2302.00	2302.00	3406.00	3406.00	5230.00	599994.00
100.00	100.00	99.00	90.00	0.00	0.00	0.00	0.00	<90	0.00	0.00
5.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	<5	0.00	0.00
10.00	9.00	9.00	8.00	8.00	0.00	0.00	0.00	<8	0.00	0.00
0.00	1.00	1.00	2.00	2.00	3.00	3.00	4.00	4.00	5.00	100.00
0.00	1.00	1.00	2.00	2.00	3.00	3.00	4.00	4.00	5.00	100.00

Company Name

Summary (Overall Technicle Evaluation Output)				
S.No.	**Evaluation Item**	**Marks**	**% Weight**	**Point**
1	Vendor Profile (Vendor Capabilities for Enhancements, support and maintenance)		5	
2	Hardware Complience		10	
3	Complaince on System Architecture and Solution		5	
4	AFIS Performance (Speed and Accuracy)		40	
5	AFIS Core Functionality		30	
6	AFIS General Functionality		10	
Total Marks			100	

SECTION 8.- PROPOSED HARDWARE FOR THE CENTRAL AND DISTRICT AFIS SYSTEM

(A) Minimum requirements

- Data Base size for 10,00,000 (Ten Lacs) Ten Print Finger Prints Record Slips with 1,00,000(One Lac) unidentified Chance Prints.
- Capacity to upgrade the system to 15,00,000(Fifteen Lacs) Ten Print Finger Prints Record Slips with 1,50,000(Two Lac) unidentified Chance Prints.
- To record approximately 300 Record Slips per day.
- To search approximately 500 Search Slips per day.
- To update Search & record data approximately 1000 Slips per day.
- To Search approximately 500 Chance Prints per day
- Having storing & matching capability of Palm Prints

(B) Hardware

S.No	Item	Servers	Processor	RAM	Storage Capacity
1	**Communication Server**				
		High End Blade Server Dell /IBM/HP	Intel®Xenon® E5530, 2CPU (Quad Core) or better	16GB DDR3 extendable upto 48GB	RAID Technology 720GB
2	**Database Server**				
		High End Blade Server Dell /IBM/HP	Intel®Xenon® E5530, 2CPU (Quad Core) or better	24GB DDR3 extendable upto 72GB	RAID Technology 2TB Extendable upto 4TB
3	**Webserver**				
		High End Blade Server Dell /IBM/HP	Intel®Xenon® E5530, 2CPU (Quad Core) or better	24GB DDR3 extendable upto 72GB	RAID Technology 1TB Extendable up to 2TB
4	**Matcher Server**				
		High End Blade Server Dell /IBM/HP	Intel®Xenon® E5530, 2CPU (Quad Core) or better	48GB DDR3 extendable upto 72GB	RAID Technology 2TB Extendable up to 4TB

5	**Network Laser Printer**	Laser Printer with Print speed 25ppm or above. Prints Quality 1200x1200dpi
6	**UPS**	Minimum 5KVA On-Line UPS or above

(C) System software & DBMS

S.No	Item	Operating System	RDBMS
1	**Communication Server**	Linux 5.5 & above	NA
2	**Database Server**	Linux 5.5 & above	Oracle 11g & above with clustering feature
3	**Webserver**	Linux 5.5 & above	NA
4	**Matcher Server**	Linux 5.5 & above	Oracle 11g & above with clustering feature. CPU based Licensing

(D) Networking Equipments

S.No	Item	Specification	Remark
1	**Router**	Dual FE, Multi service Access Router Ethernet Gigabyte Switch (Catalist3550-12T, CISCO) 10 10/100/1000 ports, 2 GBIC based port WS-G5483 1000BaseT GBIC Gigabyte Ethernet over copper GBIC.	
2	**Switch**	Ethernet Gigabyte Manageable Switch	
3	**RAS**	Chassis with one(5Mbps) card & one Routing card	
4	**Cabling work**		
5	**Data Transmission line**	One ISDN Line (5Mbps with 40 Channels)	

Specification of AFIS for Remote Query Stations

(A) Minimum requirements

- Data Base size for 1,00,000 (One lac) Ten Print Finger Prints Record Slips with 5000 unidentified Chance Prints.
- Capacity to upgrade the system to 2,00,000 (Two lac) Ten Print Finger Prints Record Slips with 10,000 (Ten Thousands) unidentified Chance Prints.
- To record approximately 100 Record Slips per day.
- To search approximately 200 Search Slips per day.
- To update Search & record data approximately 300 Slips per day.
- To Search approximately 50 Chance Prints per day.

(B) Hardware

S.No	Item	Particulars	Specification	Remark
1	**Workstation**			
		Type	WS	
		Processor	Intel I3 Processor	
		RAM	2GB	Extendable up to 5 GB
		Storage Capacity	500GB Sata H/D	Extendable up to 1TB
2	**Scanner**			
			2400dpi optical resolution, 2400x2400 dpi hardware resolution	
4	**Printer**			
			Laser Printer Laser Printer with Print speed 25ppm or above. Prints Quality 1200x1200dpi	
5	**UPS**	Offline	1KVA Off-line UPS	
6	**Data Transfer Line**	Broadband connection with minimum 512 Kbps speed		
7	**Anti-Virus**	Updated Licensed		
8	**Portable H/D**	500 GB Portable H/D		
9	**Operating System**	Windows XP/2007 or later		
10	**RDBMS**	Oracle 11i or later		

Technical Specification Of Finger Print Slap Live Scanner

S.NO	Description
1	Live Scanner with software capability to collect all elements on a ten print card, i.e. roll scans, 4-finger flat and thumb scans (4+4+2). All Live scan components proposed shall meet the following industry standards governing image capture & compression: 1. Full Compliance with ANSI/NIST Data format for the interchange of Finger Print, Facial & SMT Information (ANSI/NIST-ITL-1-2007 or current). 2. Certified to FBI Standard CJIS-RS-0010 (V7), Appendix F, IAFIS Image Quality specification for Scanner for 500 ppi and 1000 ppi identification flat system. Full Compliance with FBI NCIC CJIS WAN Protocol Specification, EFTS/EBTS and IAFIS Telecommunications Standard. 3. Electronic images must be of sufficient quality to allow for: (l) conclusive fingerprint comparisons (identification or non-identification decision); (2) fingerprint classification; (3) automatic feature detection; and (4) overall Automated Fingerprint Identification System (AFIS) search reliability. 4. The fingerprint comparison process requires a high fidelity image without any banding, streaking or other visual defects. Finer detail such as pores and incipient ridges are needed since they can play an important role in the comparison. Additionally, the gray-scale dynamic range must be captured with sufficient depth to support image enhancement and restoration algorithms. 5. The fingerprint scanner must be capable of producing images that exhibit good geometric fidelity, sharpness, detail rendition, gray-level uniformity, and gray-scale dynamic range, with low noise characteristics. The images must be true representations of the input fingerprints without creating any significant artifacts, anomalies, false detail, or cosmetic image restoration effects 6. Vendor have to integrate Live Scanner with existing State. Police AFIS in all aspect, i.e. live scanner can be directly operated from AFIS as well as Finger Print Images (Rolled and Slab) and demographic details captured through Live Scanner Application Software can be imported directly to AFIS. Vendor will develop all necessary interfaces and tools for AFIS and Live Scanner Integration. All required driver, SDK and API for integration will be procured and supplied by Vendor only.

2.	**Key Features and Specifications:**	
a	Resolution of resulting images	1000ppi, 500ppi software selectable.
b	Gray Scale	256 Gray Scale, 8 bit.
c	Dynamic Range	At least 80.0 % of the captured individual fingerprint images shall have a gray-scale dynamic range of at least 200 gray-levels.
d	Sensing Area	Single platen (single prism, single imager, uniform capture area) for rolling and taking plain and Slab impressions of finger. No moving parts in the Optics Deck.
e	Scan Area (Min.)	81 x 76 mm
f	Image Area:	
	- Rolled	41 x 38 mm (Roll Live scanner must be capable of capturing at least 80% of full roll arc length, where full roll arc length is defined as arc length from nail edge to nail edge.)
	- Slap (4 fingers)	81x 76 mm
g	Time for scanning a fingerprint	Maximum 4 seconds (for slaps – 5 seconds).
h	Image Compression Method	FBI-certified JPEG 2000 compression module.
i	Image Quality	FBI's IAFIS Image Quality Specification CJIS-RS-0010 (v7) appendix F Certified.
j	Interface	IEEE 1394 (FireWire)
k	**Capabilities**	
	i. Automatic finger detection	System should detect finger automatically.
	ii. Calibration and Diagnostic Test	Factory calibrated and sealed, with self-test / diagnostics at start-up.
	iii. Quality Check	The system issues a message regarding the quality of rolled and plain fingerprint images prior to capturing next finger.
	iv. Automatic change to the next finger	If the image quality is good, the system offers to scan the next finger
	v. Both Direction Capturing	Capability to allow the fingers to be rolled in a left to right or right to left direction when taking the rolled impressions.

	vi. Capability to compensate complicated cases	Capability to capture significant ridge definition of dry and sweaty skin (Ignores moisture and sweat to prevent blobs that degrade image quality) along with capability to compensate Smudge (accurse while rolling the finger on platen) and smeared image.
	vii. Automatic sequence	Automatic sequence checking of rolled print with respect to plain print.
1	Protection from Dust, Debris and Liquid	Rugged enough to withstand extreme working conditions in law-enforcement environment.
3.	**Software**	
a.	Operating Systems	OS Windows® XP/2007 or latest
b.	Application Software	The Live Scanner system Application: • Capable to store minimum of 1000 complete 10 print card. • Preview, zoom and 10 Print Card Printing facilities. • Ability to search for an individual's data by his touch fingerprint. • On Screen Prompt feature indicating the direction of Finger roll and correct finger. • Exporting of Ten–print cards files in the following formats: o International data exchange format ANSI/NIST ITL-1-2007: o FBI IAFIS CJIS-RS-0010 (v.7); o INTERPOL (INT-I) (v.4), November 19, 2002; o Print / reproduce 10digit slip (image and text data) in State Police / NCRB format; o Conversion tool to JPEG to WSQ vise versa.
4	**Accessories**	All required Cables, Adaptors, IEEE 1394 (Fire Wire) PCI / PCI Express card (As Required) for Desktop to connect Live Scanner through Fire-Wire Port by Fire-Wire cable, Suitable case / bag to carry live scanner.