

# **Site Preparation Guidelines for ICT Area/Room in Court Complex**

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## 1. Background

For the implementation of the ICT enablement project in the Indian judiciary, a key component is to setup IT infrastructure in all the court complexes. This setup is driven by the magnitude of IT infrastructure in various courts and the needs of the various stakeholders. In this document, we are providing a set of guidelines, which can be followed for preparing the sites for the various server and computer rooms which will be setup in the court complexes. These guidelines provide a generic framework for various aspects of site preparation, specifically for setting up server rooms in a local area network enabled environment. These aspects include

- Site selection
- Fitting out requirements
- Equipment layout planning
- Electrical requirements
- Air-conditioning system
- Fire prevention, detection, and suppression
- Prevention of water leakage
- Physical security

These guidelines can be applied to server rooms of varying capacity. The aim is to provide a generic framework, which can be suitably tailored by the respective court complexes based on the specific hardware and network components that are installed. Kindly note that it is imperative to follow the hardware and network installation manuals, which are provided along with the equipment.

## 2. Site Selection

When site preparation requirements for a computer/server room are prepared, it is important to understand the infrastructure to be installed and the physical environment in which it will operate. The following information must be sought

- Weight and dimensions of the computer equipment
- Electrical requirements of the computer equipment
- Total heat dissipation and cooling requirements of the computer equipment
- Types of signal cables
- Equipment footprint with clearance for maintenance and operation.

The followings are to be considered for site selection:

1. The computer room should be located away from the exterior walls of the building to avoid the heat gain from windows and exterior wall surfaces.
2. In case, exterior windows are unavoidable, windows that are double- or triple-glazed and shaded should be used to prevent direct sunlight from entering the computer room
3. The computer room should be maintained at a positive pressure relative to surrounding spaces.
4. There should be sufficient floor loading capability for computer equipment
5. A vapor barrier should be installed around the entire computer room envelope to restrain moisture migration. all pipes and cables that penetrate the envelope should be caulked and vapor sealed
6. Uniform room air distribution system should be maintained in the computer room
7. To avoid contamination, the site should be located away from heavy industries and areas with corrupted air.
8. The computer room should not be on top floor or ground floor or the basement of the building to avoid solar heat absorption or flooding.
9. The computer room should be away from dangerous goods storage, mechanical shock, excessive vibrations and high fire and water risks areas.
10. To eliminate the effect of electromagnetic interference, the computer room should be located away from generator room, lift plant room, or in some cases, the radar or telecommunication control rooms.
11. There should be minimum access by general public and irrelevant personnel to the computer room.

### 3. Fitting out Requirements

All materials to be used in the computer room should be non-combustible, self-extinguishing or fire retardant and have the properties of smooth surface finishing and non-dust shedding. Any pipes and ducts not serving the computer room should be removed.

**Walls/Partitions** – In the computer room, rigid floor-to-ceiling perimeter walls/partitions having 2-hour fireproof rating should be erected.

**Internal Partitions** - Partitions inside computer room may be built to the headroom height. Consideration for ample air circulation has to be made. Half-glazed partitions are recommended for partitions inside the computer room. Double-glassed partitions for noise reduction may be considered for printer area.

**Wall Finishing** - Internal walls are to be finished smoothly with emulsion paint or vinyl wall papers. Finishing of light color can enhance the illumination of the computer room.

**Kerb** - Concrete kerb of floor void height is required to be built along perimeter walls of the computer room and around the piping of air-conditioning equipment to prevent water penetration to and from the computer room.

**Thermal Insulator** - Thermal insulator is used on the structural floor and ceiling to prevent heat gain to computer room, especially when bottom discharged type air-conditioners are used. It also helps to save energy and to minimise the running cost of the air-conditioning system. Permanent thermal insulator may be embedded inside the structural floor (sandwich type) during building construction stage or laid on the structural floor (add-on type) for accommodation revised to be computer room. For the latter one, all junctions between the insulator and fixtures are watertight and airtight. Inclinations are required at areas around the floor drains. An alternative is to install the thermal insulator on the structural ceiling of the floor below the computer room.

For thermal insulator not embedded inside the structural floor, the following selection criteria are recommended:

- thermally insulated
- fire and water resistant
- dust-free and lightweights
- strong enough to be trod
- easy to maintain

**Raised Floor** - Raised floor is recommended to be used in computer room. It provides the following advantages:

- acts as an air podium for conditioned air distribution
- provides spaces for cable running
- enables simple equipment installation and provides flexibility for subsequent layout changes or equipment expansion
- protects the interconnecting cables, plugs and power connectors
- eliminates hazardous cabling underfoot
- maintains a cleaner environment

It is built of individual and interchangeable floor panels sturdily and rigidly above the structural floor. It must be evenly leveled and strong enough to withstand all necessary loads that exert on it. Additional support may be required if the panels are weakened by cutouts. Reference to the loading requirement of the computer

equipment should always be made. The floor panel should be made of non-combustible and dust-free material. Its covering material is necessary to be well-bonded, anti-static, thermally insulated and free from scuffing and staining.

**Floor Panel Fitting** - Cable cutouts and adjustable air grilles are required on designated floor panels for cable connection of computer equipment and air delivery respectively. The cutouts are protected by black extruded vinyl trimmings at the edges and covered by rubber grommet. The air grilles must have smooth edges and corners and be flush-mounted on the surface of the floor panels.

**Ramp** - To facilitate equipment transportation, a strong ramp with landing areas at both ends is recommended at the server/computer room. The ramp surface should be built with anti-static, non-combustible and non-slippery materials.

**False Ceiling** - The requirement of finished headroom is different from one vendor to another. In general, the headroom should not be less than 2.4m. False ceiling provides tidiness and aesthetic effect to the computer room. It also serves as a plenum for lighting fixtures. The ceiling plate is preferred to be of easy remove and install type for the access of utilities in the ceiling void. Non-combustible and dust-free plates are required. If false ceiling is infeasible, the structural ceiling should be dustproof, waterproof and heat insulated.

**Windows and Doors** - All windows of the computer room are walled up to avoid direct sunlight and to provide better security and weather protection.

**Main Entrance Door** - 5-foot wide double-leaf steel door having a 2-hour fireproof rating and secure bolted hinge is recommended. An air lock composed of 2 sets of outward opening and self-closing doors prevents the loss of conditioned air and reduces the influx of dust.

**Emergency Exit** - The emergency exit requires an outward opening and self-closing steel door. It is also equipped with the same fireproof rating and secure bolted hinge as the main entrance.

**Other Doors in the Computer Room** - Double-leaf doors are preferred for ancillary machine room and printer room to ease printout movements.

**Normal Lighting** - Evenly distributed lighting is recommended for the computer room. It is necessary to align the distribution of lights with floor and equipment layouts to avoid shadowy areas caused by tall equipment, cabinets or racks. The lighting, sectional controlled by switches, should be able to switch off when they are not required.

**Emergency Lighting** The lighting inside computer room should be connected to essential power supply and 50% of them should be supported by battery. The battery supported lights may be located at the console area, mains control panel areas and passages leading to the main entrance and emergency exit.

**Conduit and Trunk** - Grounded metal trunks are required to house signal cables from computer room to terminal locations between floors of the same building.

Vertical conduit for signal cable of individual terminal equipment is usually connected to the horizontal trunk and ended at skirting level on wall at which termination box is required for cable termination. The termination boxes can be at desk-top level in a terminal room environment. To avoid electromagnetic interference being induced to the signal cables, it is recommended to house the power and signal cables in separate conduits and trunks. If they have to cross each other, they should be crossed in right angle.

**Central Control and Monitoring System** The Central Control and Monitoring System is a PC-based integrated system controls and monitors facilities for computer room. With necessary devices to connect various facilities such as air conditioning system, power supply system, fire services system, access control system and CCTV system etc. to the system, real time information on the performance from these facilities can be collected. This system enables central monitoring of computer centre environmental facility systems remotely.

#### 4. Equipment Layout Planning

A properly designed equipment layout has the following benefits:

- easy equipment installation and maintenance;
- efficient computer operation;
- efficient air circulation;
- tidy environment; and
- feasibility and flexibility of future expansion

**Floor Layout Inside Computer Room** - A separate room should be provided for comfortable and silent working environment for computer and data entry operators

**Printer Room** - Printers together with a small stationery store area should be in a separate room inside the computer room to reduce dust contamination and noise disturbances to other areas.

**Air-conditioning Equipment** - There are sufficient spaces for maintenance service for the AHUs. They are, as far as possible, to be located at corners or closed to wall partitions to enable more spaces for computer equipment.

**Emergency Exit** - The emergency exit is always located at the opposite end of the main entrance.

**Technical Manpower Room** – A room is required for IT personnel to perform on-site repairing work and to store spare parts of the equipment. It equips with work bench and storage cabinets and power points on the bench or any convenient point. If space is available, the engineer room may be located inside computer room.

**Store Room** - Store room, preferably on the same floor, provides storage area for computer stationery, consumable, reports and other accessories.

**Locker and Changing Room** - Computer operators are not allowed to bring their personal belongings into the computer room. In addition, eating and drinking are prohibited in the computer room. It is therefore necessary to provide an accommodation outside the room.

#### Equipment Layout

1. Cable limitation, equipment operating requirement and operating convenience should be considered when placements of computer equipment is to be designed.
2. An expansion allowance of about 30% of the required area is suggested.
3. The equipment is preferably arranged in parallel rows to smooth the air-flow of the ventilation.
4. The computer equipment is to be aligned with the floor grid.



## 5. Electrical Requirements

**Power Source** - Computer equipment require a "CLEAN" and dedicated power source in conjunction with the use of electrical noise protection device or power conditioner to prevent electrical noise disturbance. For maximum reliability, the independent feeder for the computer equipment must not be shared with other electrical devices.

**Basic Power Requirements** The power requirements of different computer equipment may vary. Specifications in the planning manual of the computer equipment should therefore be referred to before the requirements are finalised. The following aspects are to be specified:

- **Capacity** - Sufficient capacity is required for computer loads and future expansions of computer equipment. The capacity of an equipment is expressed in terms of KVA or KW, where  
$$\text{KVA} = \text{Voltage} \times \text{Current in Ampere} / 1000$$
$$\text{KW} = \text{KVA} \times \text{Power Factor of that equipment}$$
*Always consult computer vendor(s) for the power factors of computer equipment*
- **Voltage Standard** The nominal voltage for a three-phase and single-phase power supply is 380V and 220V respectively. However, some equipment may require different voltage. Detailed permissible tolerance of the voltage requirement can be referred to the hardware manuals or computer vendors.
- **Phase** - In most computer installations, a three-phase, four wire and five conductor power supply is provided to the computer equipment power panel. Such a supply consists of three phase wires, one neutral wire and one insulated equipment ground conductor.

**Grounding** - For personnel safety and protection of equipment from damages and electromagnetic interference, a separated and insulated ground wire is necessary for the computer equipment. Computer vendors should be consulted for detailed specifications of the ground wire.

**Power Protection Device** - Poor quality of power can seriously affect the performance and reliability of the computer system and may cause damage. Before selecting the power protection device, the load characteristics of the equipment, computer service requirements and reliability must be known.

**Uninterruptible Power Supply (UPS)** - It employs a means for charging a bank of batteries as a backup for the city mains during a short-term power interruption or to allow the computer system to be closed down. Its requirements depend on the computer power loads to be supported, the lead times to start up the backup emergency diesel generator or a tidy close down of the computer system. Using an UPS containing an isolation transformer and a harmonic reduction filter would be the best alternative possible because it may resolve all power line noise problems and provides a continuous power supply during power interruption.

**Emergency Power Supply** - A generator is to support the UPS in providing emergency power supply to the computer equipment in a prolonged power outage. The need of generator depends on the service requirements of the computer system. However, the

generator should also be able to support other essential facilities and equipment such as the air-conditioning system, security and access control system and lighting.

**Circuit Breaker** - Besides the normal operating current, the circuit breaker of computer equipment handles the in-rush and surge current. Each computer equipment requires a separate circuit and a circuit breaker. Circuit breaker and its related power point/socket should be properly labeled to identify the branch circuit it is controlling.

**Power Connector** - Power connectors for the computer equipment should conform to the local standard. Their placements are to be planned so that they are always located within about 2m of the machine they supply.

**Emergency Power Cutoff Switch** - It is an emergency power cutoff switch to disconnect the power of all computer equipment in the computer room. The switch is reset by key once it is activated and controlled from locations readily accessible to operators, such as console area and main entrance. The emergency switch is to be properly protected from accidental operation by mistake. Same switch is also required for the air-conditioning system.

**Service Power Socket** - Sufficient numbers of single-phase square prong service power points with ON/OFF switches are required at appropriate locations in computer room for use by maintenance and service personnel. These power points should be installed at skirting level and separated from the computer panel or feeder.

Automatic Transfer Switch (ATS) is a high availability redundant switch that has two input power cords, one for each AC line, providing redundant power supply to connected equipment. It is designed to supply power to the connected load from a primary AC source. If the primary source becomes unavailable, it will automatically switch the power supply to the secondary source.

**Cables** - Cable trays and steel-wire-armored cables are recommended for all underfloor power cables. Power cables have to be laid separately from signal cables in order to avoid any interference. If crossing each other is unavoidable, crossing is suggested at right angle.

## 6. Air-Conditioning System

Computer equipment is operated in an environment of controlled temperature and relative humidity. The air-conditioning system in the computer room must be able to control the temperature and relative humidity within the specific ranges automatically and independently.

**Basic Requirements** - An independent air-conditioning system with full backup are required. Spare capacity of 50% is recommended for anticipated expansion. Power source of the system should be separated from those for computer equipment and connected to emergency power supply. The system can be either water-cooled or air-cooled depending on the equipment specifications.

**Cooling Capacity** - Determination of the cooling capacity of a computer room mainly depends on the following factors: -

1. total heat dissipation of the equipment (always consult vendor for specifications)
2. volume of the location
3. room and equipment layouts
4. anticipated expansion
5. heat gains and losses through walls, floor and ceiling
6. personnel working inside
- 7.

**Temperature and Relative Humidity Ranges** - The operating ranges of temperature and relative humidity for computer equipment are usually  $20^{\circ}\text{C} \pm 3^{\circ}\text{C}$  and  $50\% \pm 10\%$  respectively with the maximum rate of changes at  $3^{\circ}\text{C}$  and 6% per hour.

**Air Distribution Method** - Air distribution in computer room is usually classified into "Raised Floor" and "Non-raised Floor" distributions. **Raised Floor Distribution system** distributes the conditioned air through the floor void to the computer equipment via air grilles or perforated floor panels. The heat dissipate vents of most computer equipment are designed to suit such distribution as it is efficient in air circulation. In **Non-raised Floor Distribution**, air is distributed either from ceiling via diffusers or simply across the floor. Since air circulation of such distribution is not efficient, it is only recommended for small setups.

**Air Cleanliness and Fresh Air Intake** - The intake of adequate amount of filtered and pre-treated fresh air to the computer room is required. The location of the fresh air inlet should be carefully planned so that the intake of polluted air into the computer room can be avoided. Dust contamination inside the computer room can be minimized by using high efficiency filters. Detail requirement on dust level can be referred to vendor's documentation.

**Inter-switchability** - In addition to its capability of simultaneous operation, manual and automatic switching between the normal and standby units of the entire air-conditioning system is preferred.

**Water Supply** - If the computer room is operated with water-cooled chiller plant, an automatic filled water tank which is not affected by water supply suspension or ration is required.

**Power Supply** - Power supply of air-conditioning units must not be connected to the computer loads.

**Emergency Supply** - It is essential to provide emergency power supply to the air-conditioning system as long as the emergency power supply is provided to computer equipment.

**Emergency Power Cutoff** - Power supply of the entire system, including the fresh air intake unit is cutoff automatically when fire extinguishing system is actuated. The installation of manual emergency power cutoff switch is to shut down the system in case of emergency. It is preferred to be installed near the console area and duplicated at the main entrance.

**System Monitoring** - The audible and visual alarm panels of the air-conditioning system for the computer system and its ancillary machines (i.e. UPS Room) are to be installed in computer room at master console area to report the operating status and faults of all system components. The alarm/indicators include high/low temperature and relative humidity, filter status and chiller plant status.

**Perforated Floor Panel** - Perforated floor panel, equipped with air-flow control feature, is recommended for distribution of conditioned air in raised floor distribution system. It is more advantageous than air grille because it enables free placement for heavy computer equipment and has no frame protrusion.

**Temperature/Humidity Recorder** - Electrical temperature/humidity recorders are required in the computer room to provide 7-day continuous recording of the environmental conditions. They are wall-mounted at the locations near the computer equipment or other appropriate spots and must have visual and/or audible alarms.

**Automatic Power Cutoff Facility to Computer Equipment** - An adjustable temperature sensing system with audible and visual alarms is required for computer room and power conditioner room. If the threshold limit is exceeded, a facility is required to cut the power supply to the computer equipment automatically. This facility is capable to be operated manually. Reset switch of the automatic power tripped equipment is required to stop the equipment from "un-controlled" power ON/OFF due to changes of temperature.

**Store Room** - A normal office air-conditioning system is required for the store room of computer consumable such as magnetic media, printer ribbons and continuous stationery etc. Acclimatization to the computer store is necessary before they are put into use.

**Power Conditioner Room** - Power conditioner, such as UPS, is a heat generating device and is usually housed in a separate room away from the computer equipment. A reliable air-conditioning system with backup is required.

## 7. Fire Prevention, Detection, and Suppression

In order to minimise fire damages to computer equipment, the equipment and furniture used inside the computer room should, as far as possible, be made of non-combustible material or at least having minimal fire propagation or smoke generating properties.

**Storage of Stationery** - The storage of bulky volume of continuous stationery must be fire protected and be kept away from computer room. Amount of continuous stationery stored in computer room must not exceed the consumption of a shift.

**Ancillary Equipment** - The accommodation for power conditioner, emergency diesel generator and its fuel storage must be away from computer room.

**Ducts** - The air ducts should be equipped with automatic fusible-link fire dampers.

### Detecting Device and System

**Detector** - A two-stage detection system, consisting of two sets of detectors and alarm signals in cross-zone operation, is required. Detectors should be located at the headroom, inside the ceiling void and floor void of the computer room. Detectors can be smoke detectors or together with heat detectors.

**Detecting System** - First fire alarm will cut power to air-conditioning system and be transmitted to the building management office and the nearest fire station. Second alarm cuts all power supply to the computer room and the fire suppression system will be triggered off after a pre-set time interval.

**Fire Suppression System** – Various options include

- Gas Flooding System
- Portable Gas Fire Extinguisher

### Design Criteria

- The system should always be put to 'AUTO' mode under normal circumstances to fully protect the computer room against fire hazards and to cope with Fire Authority's practice. 'MANUAL' mode is only switched on when the system is under repair. Manual mode – In case of fire the system will have to be triggered off manually after all operation staff are evacuated. Automatic mode – In case of fire the system will be controlled by the detection system. System will be triggered off after a pre-set time interval when detectors of both zones sense a fire and activate detection system.
- No matter the system is in manual or automatic mode, an elapse time of at least 30 seconds is required for personnel evacuation before the gas is released. To facilitate evacuation, all emergency exits should be labeled with battery supported illumination. Furthermore, design of the door should be such that it can only be opened from the inside. The use of "push bar" or similar latch is preferred so that the door can be opened easily. However, to avoid the door from being used at times other than emergency, the door should be fitted with a burglar alarm.
- All duct work, doors, windows and any other air passages must be sealed off and exhaust air fans should then be installed. This is because if the protected area is not airtight, the pressurized extinguishing gas may dissipate, thus reducing the effectiveness of the system.

- The system is capable to be operated under all circumstances, including power failure. Regular maintenance and cleaning are necessary for the fire detection system and corresponding accessories.
- Portable gas fire extinguishers should be installed at various locations. The locations should be clearly marked to enable easy fetching of the extinguishers. All portable fire extinguishers should be periodically inspected and refilled by the supplier. The next inspection date should be clearly marked on the extinguishers.

**Monitoring** - The master alarm/indicator panel(s) of the system is/are to be installed inside the computer room. Audible and visual alarms are required to indicate the detection of fire. Fire alarms of the building must be provided inside computer room to alert operators of fire on other floors. Diagrams showing the locations of hose reels, fire exits, fire extinguishers and evacuation paths should be posted inside computer room. The fire extinguishing system is required to be accommodated in a separate room or compartment near the computer room.

## 8. Prevention of Water Leakage

- Concrete kerb is required along the perimeter of the computer room and power conditioner room.
- All unnecessary plumbing is to be removed away from computer room.
- Waterproof power connectors are to be used for underfloor power connections.
- All ducts, trunks and pipes for cables should be water-tight and be able to stop the water being led by them.
- All underfloor fixtures should be away from the floor drains.
- Waterproof treatment is required for internal wall surfaces, concrete ceiling and structural floor.
- Water detection system in the floor void with audible and visual alarm panel showing one or more locations of water threats is required in computer room. If the system is not a linear detection type, mimic diagram showing the locations of the water detectors is necessary.

## 9. Physical Security

**Access Control System - Installation of Lock** If the main entrance has 2 sets of door, the first set (outer) may be equipped with a cipher lock only. This lock is operated by entering a correct cipher code. The second (inner) set can be controlled by a cipher/cardkey lock. Both locks may be door-mounted or wall-mounted but the control circuit units are housed in locked metal cases inside computer room.

**Cipher Code Operation** - The cipher locks at both entrances must allow operations made by common code and individual codes. Changes of cipher codes are performed locally at the master control units of the locking system. The change of cipher code does not affect the information encoded in the magnetic cardkeys.

**Power Supply to the Lock** - A 24-hour battery power backup is required for the access control system including the electric door lock(s). The access control system should also be connected to the UPS if it is installed.

**Door Lock** - Heavy-duty electric lock is recommended for the main entrance doors. With time delay setting, the lock would effect after time is over. The lock must be fail-safe type. Panic bolt is recommended at emergency exits.

### Surveillance System

**Closed Circuit Television System (CCTV)** - CCTV is used to monitor the security as well as operating environment of the computer room. The monitor unit is capable of programmable switching for selection of pictures for a multi-camera CCTV system. The requirement of the CCTV system depends on the system security level and mode of operation of the computer system.

**Digital Video Recording System** - It is a triplex (real time, playback and record) video recording system, which allows video monitoring, recording and playback simultaneously over the computer network or other telecommunications channels like phone line or mobile network.

**Intercommunication System (INTERCOM)** - The master unit of the intercommunication system is placed at console area and the slave units are placed at the outer main entrance and other necessary places to provide a direct and clear communication between all functional areas.

**Burglar Alarm System** - To protect the computer room and other external restricted premises from unauthorised access or break-in, a burglar alarm system may be installed at the main entrances and all exits. The alarm system may also provide "Door-Remains-Open" warnings to operators. 24 hours standby battery supply to the operation of the burglar alarm is necessary to cater for power outage. The system should allow each protected door to have both ACCESS and PROTECT modes. Mode setting should be done on the master panel inside computer room. An alarm and indicating mimic panel showing every protected door is required in computer room. Every break-in of these doors will give audible and visual signals to the master panel inside computer room and the building management office or even the police station via professional security company.

**Security Review for Computer Room** - Physical security of a computer room is the most vital aspect for the expensive computer hardware and invaluable computer data being stored.

Data communication trunks are trunks for data communication cables and telephone lines of the network. Special care is required to secure the access of the data communication



cables and telephone lines in order to prevent malicious damage, interception and attachment of the cables and lines. Escort of computer vendors or telecommunication service provider is required in the course of the installation work.