# Security-Camera Proposal for the Dynamy Youth Center in Worcester, MA.

An Interactive Qualifying Project (IQP) Report

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by

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# Abstract

Dynamy is a non-profit educational program in Worcester, MA that sponsors a Youth Center for high schools students. The Youth Center provides mentoring, tutoring, and activities for the students after school. Because of the large number of students in the program, many people easily pass through Dynamy each day, including parents, internship students, maintenance crews, and friends of the youth center students. Recently, Dynamy officials have considered security cameras as a way to secure the building from unwanted outsiders. To assess Dynamy's Security Camera (CCTV) needs, I went to the University of Pennsylvania in Philadelphia to learn from the most secure educational facility in America, according to Security Magazine. I also met with professional CCTV installers from ADT Security, who even gave a free on-site estimate. From first-hand research and meetings with experts, I was able to draft a security camera proposal for the Dynamy Youth Center. The proposal asks for 8 cameras to be installed by Dynamy officials to secure the facility's computer labs, conference rooms, office areas, and entrance ways. The security camera proposal explains how to buy a CCTV system, where to place cameras, and how to route cabling. The "Do-It-Yourself" recommendation costs about $2000, while a professional system with installation costs between $10,000-$15,000. Dynamy officials were appreciative of my efforts.

# Acknowledgements

Thanks to my advisor Daniel Gibson, the Dynamy Youth Center, the ADT and the University of Pennsylvania Security Teams. This project enabled me to learn a lot about CCTV security camera systems. I appreciate camera security more after doing this project.

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*European CCTV*

Europe has a history of CCTV in public and private areas that stretches back to the 1950s. During this time, traffic cameras became popular. In 1956, the VCR was developed and made commercial CCTV expand. In the 70s and 80s CCTV began to spread across Europe. It was primarily used in "semi-private" space until the mid-80s. However, it was also used in urban public areas during this time. In the 90s, CCTV became a popular tool with European police to help fight street crime (in the public setting). Regulations for CCTV were issued during this time. Today, Britain has the largest CCTV network of any country in Europe and London is the CCTV center of the world.

CCTV is viewed as "an essential part of daily life" in Europe according to a 2004 European CCTV research study. In 2002, estimates of CCTV use in the capitals of six European nations showed that 29% of all premises (shops, stations, institutions) use CCTV. CCTV use was found to be most common in areas associated with transportation, government, hospitals, museums, and petrol stations. Learning centers and religious facilities were found to have the lowest use of CCTV in Europe.

Several purposes of European CCTV use are cited. CCTV is used to monitor traffic, fire, accidents, crime, and suspicious behavior. According to a 2002 survey, 86% of CCTV users cite the deterrence of theft as the primary reason for using CCTV. 39% cite deterrence of violence.

A 1997 market estimate indicates that the European CCTV industry generates 1.1 Billion Euro each year, with between 10 and 15 percent growth.

Nations in Europe have very different acceptance levels for CCTV. The British regularly report news stories about CCTV and how it helps in criminal investigations. Hungary also uses CCTV to solve social problems. On the other hand, the Germans strongly resist the idea of CCTV. Denmark is another nation that is resisting CCTV. One survey indicates that Britons have the highest opinion of CCTV, while Austrians and Germans have the lowest opinion in Europe. A different study showed that France, Belgium, Germany, and Italy had the strongest anti-surveillance organizations as of 2001.

Surveys show that most CCTV operators tend to use CCTV as a symbol to deter crime. These cameras are made clearly visible to the public rather than used to obtain the best vision of an area.

CCTV cameras are used in two ways. Most operators say they primarily use CCTV as a symbol to deter crime. A smaller group primarily uses CCTV cameras for active surveillance.

Most European CCTV systems are small, independent, and technologically simple. More than two-thirds of CCTV systems use fewer than 5 cameras. These "island" systems are most commonly analogue. Large CCTV systems of 20 or more cameras are uncommon. These systems are becoming digital and now being linked (or integrated) with other

agencies. These cameras are often linked to police and fire departments. This enables the retail shop to communicate effectively with police and fire officials.

European CCTV systems are mostly regulated by European and national governments. Several European councils have addressed the topic of video surveillance: Article 8 of the European Human Rights Convention, European Convention on the Automated Processing of Personal Data of the Council of Europe, and the Data Protection Directive of the Europe Union. National laws regulate data protection for public CCTV schemes. However, most operating regulations tend to be violated. One study showed that 51% of all cameras failed to notify the public with a sign that CCTV cameras were in use. In most cases, the data controller and their contact information was also omitted.

As a whole, Europe has a supportive attitude of CCTV. (Britons are the most supportive, while Germans and Austrians are least supportive.) A minority are against CCTV because they feel it violates privacy and civil liberties. According to one survey 50% of the public are concerned about CCTV "misuse" and 40% feel CCTV is invasive of privacy. The public is divided about "open street" CCTV which many people feel is a semi-private environment. While Britain commonly uses CCTV in "open street" areas, other countries, like Denmark, have no "open street" CCTV cameras.

CCTV is commonly evaluated and justified using crime statistics that say CCTV lowers the crime rate. These reports are often made by the CCTV operators and may be biased in favor of CCTV. CCTV operators' ability to measure and evaluate crime statistics is seen as questionable and may not be scientific. In addition, crime rate alone is seen as too narrow in scope to justify CCTV use. Several scientific reports to evaluate the correlation between CCTV and the crime rate have not proven CCTV lowers the crime rate. This is troubling because these crime statistics have a tremendous impact on political and social opinions and policy.

Many recommendations to improve CCTV in Europe have been made. Experts suggest making CCTV transparent by making registration of CCTV systems a law. Also, experts suggest operators be held legally accountable for following CCTV operation guidelines. Experts also suggest periodic inspections of systems to ensure compliance with CCTV operational guidelines. The European Parliament and the Council of Europe also recommend more regulation of CCTV, especially to address discrimination and CCTV. These two groups have also supported automated surveillance (facial recognition and scene monitoring).

*British CCTV*

The UK is the world leader in Closed Circuit Television (CCTV). The UK uses CCTV to (1) promote safety, (2) aid in criminal investigations, and (3) to protect against terrorist attacks and aid in investigations. CCTV was fist introduced in the UK in the 1970s and dramatically grew in the 1990s. Closed Circuit TV differs from broadcast TV in that only those directly connected to fire optic cable network can receive a video picture.

Although the British government owns many CCTV schemes, most are owned and operated by the commercial sector.

Cameras connected to CCTV schemes can vary considerably. They can either (1) remain motionless (static), (2) pan, tilt, and zoom, or (3) be placed on 'tours' to scout an area automatically. Cameras can be (1) stationary, (2) partially mobile (within a zone) or (3) freely mobile to be moved anywhere. Cameras can either use digital or analog information. They can be wireless or use cables.

There are a number of theoretical ways in which CCTV could reduce the crime rate. People exhibiting suspicious behavior could result in police being called into an area, deterring potential criminals. Criminals could be caught in the act on CCTV and immediately arrested. Arrested criminals could be deterred from committing further crimes. The presence of CCTV could attract more people to an area, which would cause the number of police monitoring an area to increase. The presence of more police could deter potential criminals. Publicity about CCTV or specific cases solved by CCTV could deter potential criminals. The publicity about crime and CCTV could encourage citizens to take safeguards against criminal activity. Crimes that take a long time would be deterred because of the increased likelihood that a camera operator would see the guilty party. In addition, experience with monitoring crime could help police better predict the conditions under which a criminal act is brewing.

Control rooms, where CCTV images are monitored, can also vary significantly. For example, some control-rooms have full-time workers, but many are controlled part-time. Sometimes the employees have responsibilities other than monitoring the CCTV cameras. Control rooms monitor different areas. And, their methods of alerting or communicating the police when crimes are committed vary considerably.

Many studies have evaluated the role CCTV plays in reducing crime. However, major studies have concluded CCTV is associated with crime reduction (NACRO, 2002), no changes in crime (Phillips, 1999), or increases in crime (Welsh and Farrington, 2002).

British CCTV has recently captured images of major incidents. These incidents include the IRA terrorist attacks in the 1990s, the Brixton nail bomber in 1999, and the July 2005 terrorist attacks in London.

One of the most memorable uses of CCTV came in the 1990s with the case of missing 2-year-old Jamie (also known as James) Bulger. In 1993, CCTV captured images of 2 pre-teens leading Jaime out of Bootle shopping center in Liverpool. The footage led the police to finding the dead body of Jaime a few days later. The police said that footage gave them a clue as to who to look for. Without the footage police said they would have been looking for characters

with a different profile than juveniles. Two ten year old boys, Jon Venables and Robert Thompson, were arrested in the murder. They led Jamie 2.5 miles from the shopping center, killed him, and left the body on railroad tracks. The body was discovered two days after Jamie's disappearance.

Another memorable use of CCTV came in April of 1999 when British authorities used CCTV to arrest the London Nailbomber. David Copeland bombed 3 separate locations in a span of 2 weeks. The bombs were aimed at blacks, Asians, and gays around London. The first bomb exploded in Brixton (a black neighborhood) on April 17, 1999, injuring 39 people. A second bombed exploded on April 24 on Brick Lane (a Bangladeshi community), injuring 6 people. On April 29, police release footage from the Brixton bombing showing a white man in a white cap walking around before the explosion. The next day, a bomb explodes in a Duncan pub, a gay night club, injuring 65 and killing 3. On May 2, police arrest David Copeland.

Public space cameras began receiving government funding in the early 1980s. During this time, public space CCTV was funded by Safer Cities Initiatives (or City Challenge). Beginning in 1994 and continuing through 1999, the funding was known as CCTV Challenge Competition. Approximately 38.5 million pounds were used to develop 585 public space CCTV schemes across the nation. From 1999 through 2003, the funding came from the Home Office through the Crime Reduction Program (CRP), the largest single investment in British CCTV. From this, approximately 170 million pounds were used to produce 684 public space schemes across the nation. Today, funding for public CCTV schemes in the UK comes from Home Office grants, Safe Communities Fund, Department for Communities and Local Government, and other sources.

In order to maintain the flow of funding, the Home Office recommends promoting the success of CCTV at the local level. This will (1) improve public support for CCTV and (2) keep a steady stream of cash flow to CCTV, and (3) deter criminals.

As of the result of implementation of CCTV schemes across a period of more 25 years, the nationwide CCTV system is a mixture of different schemes. These different schemes are now managed and funded by local authorities.

The British people overwhelmingly view CCTV as a protective rather than invasive. And, surveys reveal that the British feel "safer" because of CCTV.

With the advance of CCTV imaging technology, the UK hopes to use the technology for advanced automated analysis of footage. Automatic Number Plate Recognition (ANPR) and facial recognition are two cost-saving methods of computer analysis currently being

developed. Currently license plates for half a mile away can be read by high-tech cameras. Some analysis programs developed can even attempt to analyze behavior with intelligent scene monitoring.

The legality issues surrounding CCTV were first discussed by the Data Protection Act (DPA) of 1998. The regulations outlined in this act were implemented over public areas beginning in March 1, 2000. One of the most ignored rules in the DPA of 1998 is the need for CCTV cameras to be visible with signs indicating their presence (Telegraph.co.uk). Another rule that is often neglected is that CCTV footage cannot be seen by unauthorized third parties. Some argue that CCTV footage is not secured well enough, which could allow third parties to obtain access.

One current concern of the British deals with CCTV system compatibility. When analog CCTV systems ruled, compatibility issues were minor because of international standards used to make electronic equipment. However, with the rise of digital CCTV systems and the IT and television technology, issues of compatibility are becoming more difficult to deal with. This is because of a lack of industry standards for making equipment. Specifically, the British are concerned about "the ability to pick and choose different system components without being tied to one manufacturer." Currently the British Criminal Justice System (CJS) faces the challenge of playing back taped footage (termed 'playback issues'). The CJS has had to employ special technology employees to convert these files to standard formats (commonly VHS), which often results in deterioration of footage.

Another issue associated with British CCTV involves picture quality. At the start of the 1990s, recommendations for minimum "performance guidelines" were issued by the Home Office. The recommendations spoke of a tool that could be used to ensure that minimum picture quality guidelines were met. This test is known as the Rotakin test. And, the October 2007 National CCTV Strategy Report recommends updating the test for new digital CCTV equipment.

The British are currently attempting to find balance in using CCTV for (1) crime prevention (2) traffic law enforcement. Although the initial purpose of CCTV was for crime prevention, CCTV systems are currently being used to monitor traffic lanes for speeders and number plates (license plates). The British do not believe that installed cameras can monitor both crime and traffic at the same time. They believe that "cameras installed for crime and disorder" should not be "diverted to other uses."

CCTV systems can either be used for either "pro-active" or "post-incident" investigations. Sometimes the monitor of a CCTV scheme may miss an incident that is currently unfolding. In these cases, use of recorded footage can be used in the investigation. However, sometimes the blind-spot of surveillance camera systems can result in complete lack of documentation of an incident. In these cases, police often use footage taped by local commercial businesses.

In 2002 a research study by Michael McCahill and Clive Norris estimated the number of surveillance cameras in the UK at 4.2 million. This number is in agreement with a 2004 BBC news article's claim of more than 4 million cameras in Britain, which would be 1 camera for every 14 people. It is estimated that a person in the UK is caught on CCTV cameras approximately 300 times a day. These cameras are found in town centers, transportation systems, banks, residential and commercial areas, churches, bars, and restaurants (Christian Science Monitor). As of 2004, CCTV schemes were found in 500 towns. In 1990, only three towns had CCTV schemes. This vast improvement was the result of more than 250 million pounds or 460 million dollars of government funding.

However, these cameras may not be found in the highest crime locations or be used in the most effective manner. Because high-crime areas are always changing, CCTV cameras may find themselves in low crime areas. The British believe that the current locations of surveillance cameras should better reflect crime maps produced by the National Intelligence Model (NIM). In other words, cameras should be easily repositionable so that they can stay in high crime areas. Also, the British believe that current CCTV schemes should be linked together for extended monitoring services.

The British admit several mistakes in their implementation of a national CCTV system. One regret involves not thinking about how videos could be played back by police or courts. Another regret involves not considering storage or archiving of material. The British also regret not thinking of ways to lower the cost of the national CCTV system. Factors that should have been evaluated include how building design and national infrastructure plans could lower the cost of CCTV. Another regret involves not updating their operational guidelines (published in 1994) to address legal and technological changes.

With the arrival of digital CCTV systems, the British now believe that training, especially for police, is essential. Analog CCTV was simple enough that police and associated organizations of the Criminal Justice System (CJS) did not require special training to use a VHS. The British believe that digital CCTV training will ensure that all processes from video capture through court presentation will run smoothly.

The British also believe that a standardized training program is essential. Before the issue of SIA minimum training requirements, CCTV operators had a wide range of skill levels. Some operators knew so little that equipment was not used because operators did not know how to use it. This situation was the result of a lack of standardized training programs. To address this issue, minimum skill requirements were recommended by the Security Industry Authority (SIA) License in March of 2006. Under the new training conditions, CCTV operators in the control room must have a license before being allowed to operate at their stations. Police and CCTV installers are not required to have the license.

The digital conversion of CCTV equipment is causing problems for CCTV operators and the Criminal Justice System. Lack of a standard downloadable format and unique

software are two problems cited by the 2007 National UK CCTV Strategy. Often unique download formats are converted to old-fashioned VHS (which results in reduction in image quality). The initial expensive cost associated with storing digital CCTV footage resulted in reductions in how long footage was stored.

The British are currently considering placing cameras in areas other than those linked to local crime. For example, the British are considering moving cameras to areas that could be involved with organized crime and terrorist activities. Cameras could be placed in high-risk areas as determined by National Threat Assessments. Currently the British are have a small CCTV division dedicated for counter terrorism, within the Counter Terrorist Command. Also of note, the British would like to have their anti-terrorism CCTV system up before the 2012 Olympics in the UK.

Currently, the British keep video camera footage between 14 and 31 days before recording over the footage. However, the British Home Office recommends keeping the footage for between 28 and 31 days. The British believe that a period as long as 31 days is important to enable investigations after the incidents have occurred. The British also reason that terrorist attacks take prolonged periods of time to investigate, requiring a period of around 31 days of footage to be kept.

Storage of digital recordings is much easier to manage than storage of VHS recordings. Old-fashioned VHS storage requires large amounts of space and temperature and humidity regulations. Digital recordings, on the other hand, require hard disk storage space on either CD or DVD.

The British are currently dealing with nation-wide variations in what CCTV footage is (1) stored, (2) how it is stored, and (3) the length of time it is stored. The British believe standards must be adopted nation-wide. The length of storage for camera footage will be decided by the opinion of the police investigators. The storage conditions to ensure degradation does not occur will also be discussed.

Currently, non-police authorities monitor CCTV in Town Center Control Rooms and police rarely receive footage. Occasionally, Live CCTV footage is streamed to the police BCU control rooms. These feeds can help police respond to incidents as they happen. Even fewer police agencies are provided with feeds of stored footage from the Town Center Control Rooms. In order for police to get access to camera footage, they must go to Town Center Control Rooms and either watch the footage there or convert it to VHS for keeping. Most of the time, police cannot watch the film before copying it. In this case, the footage they record may not contain any evidence from the incident. To address this issue, the British would like to create a networked CCTV system to make the footage easily available to police and other organizations of the Criminal Justice System.

The British are currently working to connect their CCTV systems using IT technology. This issue is only now being addressed due to technological breakthroughs enabling the transmission of huge amounts of information. Also, costs have fallen recently, making this technology more affordable. Many commercial organizations have added IT

technology to their CCTV systems. This enables companies to request a remote monitoring service from another corporation.

Currently the British face the challenge of ensuring the maximal video playback systems for the Criminal Justice System and court trials. Although CCTV has successfully been used for prosecution of daily crimes and terrorist attacks, CCTV use has not been maximized. To help CCTV succeed in the courtroom, the CCTV Audio/Visual Strategy Group was developed to address issues of video playback compatibility in the courtroom. The main problem with courtrooms is that they lack up-to-date digital equipment needed for video cameras footage playback in court rooms.

Courts also face the problem of not knowing how to use digital equipment needed for video playback. A recent study by the National Audit Office revealed that some of the unsuccessful court cases were the result of a lack of digital playback equipment in courts. Instead of unsuccessful court cases, Britain hopes to use CCTV footage before court hearing occur in order to get early dismissals and guilty pleas, which could save the country money.

In order to evaluate CCTV, performance indicators are often used. Performance indicators can evaluate the number of (1) incidents captured, (2) requests for footage by police, (3) resulting arrests, (4) resulting court cases, (5) and how important the information was in a courtroom. Currently, there is a lack of information about these performance indicators from police and the Criminal Justice System.

*2005 London Terrorist Bombings*

On July 7, 2005, 56 people, including 4 terrorists, were killed in bombings in the London transport system during the morning commute. More than 770 people were injured. Three bombs were detonated on underground subway trains at 8:50 AM. Almost one hour later, a fourth bomb exploded on a double-decker bus. Of the 52 victims, 26 died at Russell Square, 13 on the bus at Tavistock P lace, 7 at Aldgate, and 6 at Edgware Road.

According to the BBC, over 6000 hours of CCTV were reviewed during the police investigation. According to the police and CCTV evidence, a training run of 3 of the terrorists took place on June 28, 2005, just nine days before the real attacks. The CCTV images show the men arriving at Luton Station, buying subway tickets, and waiting for the train or "tube," as it is known.

Investigators were interested in where the three men went from 9AM to noon, when they left the range of CCTV. The investigators were especially interested in knowing if the three men met anyone during this three hour period. In total, over 80,000 CCTV VHS tapes were examined.

London Terrorist Practice Run Schedule:

8:10 AM Arrival at Luton Station

8:55 AM Arrival at King's Cross Station
9:00 – noon Out of Range of Surveillance
12:00 PM Arrival at Baker's Street Station
12:50 PM Return to King's Cross Station


**Figure 1 shows the CCTV images of the practice run of the 4 terrorists 9 days before the London Bombings took place.**


**Figure 2 shows a CCTV photograph of the 4-member group responsible for the July 7, 2005 London Bombings as they enter the Luton railway station. This photo captures the terrorists the morning of the bombings.**

In March of 2002, the Police Scientific Development Branch in England released a report detailing procedures for managing digital CCTV images. This report was written with the hope that CCTV images will be handled in a standardized way at all stages through the Criminal Justice System.

Compression is a tool to reduce how many information is in an image but can cause harm. Compression can affect the replay of video because image data is lost. In addition, artifacts can be introduced which cause artificial pattern, movements, and outlines. Compression algorithms should be tested to ensure image quality meets minimum requirements. According to the British police, compression can be used effectively.

The British have several standard procedures that should take place before any CCTV images are captured. First, authorization of CCTV use and capture must be obtained in order to comply with restrictions known as "Intrusive Surveillance." Rules of use can be found in new legislation and ACPO guidelines. Second, a written or digital audit trail should begin before images are captured. Audits should include descriptions of the images, descriptions of the investigation, the storage of the original files, access rights to the original files, who viewed the original files, and disposal of files. Thirdly, a check of the equipment is necessary. This involves verifying correct date settings, sufficient supplies of recording materials, and correct recordings settings.

In rare cases, police have their own CCTV systems, however, in most cases, preparation and capture of images takes place at by third parties. Third parties include Town Centers with CCTV monitor and commercial businesses with CCTV. The point at which police

receive CCTV footage is called the "point of transfer". The audit trail produced by the third party should be collected and made continuous with the police audit trail.

To help the police, standards for third-party CCTV centers have been established. Many third party centers allow police to remove CCTV recordings as evidence. These centers also allow police to replay the footage and make any copies they need to. The centers often provide viewing facilities so that police can original footage.

CCTV images should not be deleted without proper authority. Accidental or intentional deletion of images could become the subject of legal debate during a trial. If images are to be deleted, they must receive the proper authorization and their deletion must be part of the audit trail.

Digital CCTV footage should be recorded onto back-up tapes. Most digital CCTV schemes have automatic recordings which rerecord over themselves after a set period of time. However, creating back-up copies is important for use in investigations as evidence.

Numerous different methods for recording digital files exist. Magnetic tape enables digital recordings to be placed on video tape. CD-R and DVD-R recording devices also exist. Memory cards are a removable memory. And, computer hard disk space can also be used for digital images.

Copies of digital images and video can be made in different ways. A copy can be made simultaneously with the master copy. Or, a copy can be made immediately after the master file has been created. Or, copies could be made only when copies are necessary.

Currently, there are many file formats available for still images and video. The main file formats for still images are TIFF and JPEG. However, some of the best resolution images belong to their own proprietary formats. Video from camcorders is commonly saved as Mini-DV or Digital8 Tape.

*University of Pennsylvania Campus CCTV System*

Profile of PENN

The University of Pennsylvania is a 280-acre urban-campus Ivy League School located in west Philadelphia, Pennsylvania. The school has an undergraduate class of more than 10,000 students. Another 10,000 students belong to Penn's 12 graduate and professional schools. These schools include a business school (Wharton), law school, nursing school, medical school, veterinary school, and others. All of the schools within in University of Pennsylvania educational system are on the west Philadelphia campus. As of 2008, Penn declared a student body of 23,980 students and a faculty membership of 4,607.

The University of Pennsylvania campus CCTV system consists of hundreds of fixed-position cameras along with 83 cameras with pan, tilt, and zoom capabilities. The system

was designed in 1999 for the purpose of "crime prevention and crime abatement." Three groups were involved in the process: (1) Division of Public Safety, (2) University of Pennsylvania, and (3) community members from West Philadelphia. Penn designed a 7-member committee before any CCTV cameras with installed to ensure compliance with CCTV regulations. Rotating members continue to approve proposals for new cameras in new sites.

**Figure 3 shows the University of Pennsylvania Control Room for CCTV.**

Penn cites several examples of where in public CCTV can be used for monitoring. "Open street" CCTV is appropriate for monitoring (1) buildings and property, (2) restricted-access areas, (3) security alarms, (4) vehicular and pedestrian traffic areas, and (5) theft protection.

Penn's security system, including CCTV, has worked very well. In November of 2007, Security Magazine released the Security 500 list of most secure places, with Penn's campus ranked at number 6.

The Penn Division of Public Safety outlines several key principles of its CCTV security system. The purpose of the CCTV system is to deter crime and assist the police in protecting the community. CCTV monitors are trained and supervised to ensure proper use of the technology. A monitoring Code of Procedures was developed with disciplinary actions including in the manual. Only the Vice President of the Public Safety Division has the right to release footage. The locations of all outdoor cameras are published by the school for the public.

The Penn CCTV monitoring panel ensures that CCTV policies are followed correctly. The 7-member panel consists of chairperson, two faculty members, one member appointed by the President, one student member, one staff member, and a member from the Office of Audit & Compliance & Privacy. These members serve for one year. They review where cameras are located and where cameras should be. Semi-annually, a list of camera locations is published. Temporary camera locations are published before special events. The capabilities of the cameras are also published in the reports.

Te CCTV Monitoring Committee allows for appeals to reject proposed locations for CCTV cameras. Some locations, where increased privacy might be desired, could have a

"chilled effect" if people stop using these locations. To avoid the "chilling effect," appeals are allowed. Because of the strong desire for privacy in hallways and lounges of residential facilities, CCTV cameras are not allowed in these areas unless special approval is given by the VP of Public Safety.

In order to release CCTV footage, the VP of Public Safety must give approval for the release. The CCTV Monitoring Panel may also approval release of footage with 5 of the 7 votes supporting the release. All releases are documented on a log.


The Penn report of CCTV use of campus outlines key information on CCTV use. Signs reading "THIS AREA IS SUBJECT TO VIDEO MONITORING BY THE UNIVERSITY OF PENNSYLVANIA POLICE DEPARTMENT" must be posted in locations with CCTV cameras. Residential housing cameras have very strict guidelines to protect "reasonable expectations of privacy." Video footage will be stored for no more than 30 days unless needed for a criminal investigation. Video footage is stored in a secure location with access allowed only to individuals with authorization. Camera operators receive training. Training teachers the operators only to view individuals based on suspicious behavior and not based on sexuality, religion, or disability.

The Penn report also outlines important information about hidden cameras. Hidden camera surveillance will only take place with the authorization by the President of the Division of Public Safety and the Open Expression Committee. Hidden cameras are primarily used in criminal investigations or special instances.

University of Pennsylvania obtained their security and CCTV equipment from Security Services and Technologies (SST). This company provides security and CCTV to companies, campuses, and governments. SST employees are responsible for 24/7 monitoring and management of the security and CCTV systems. SST buys equipment from Sony, BOSCH, PELCO, Tyco, and Panasonic.

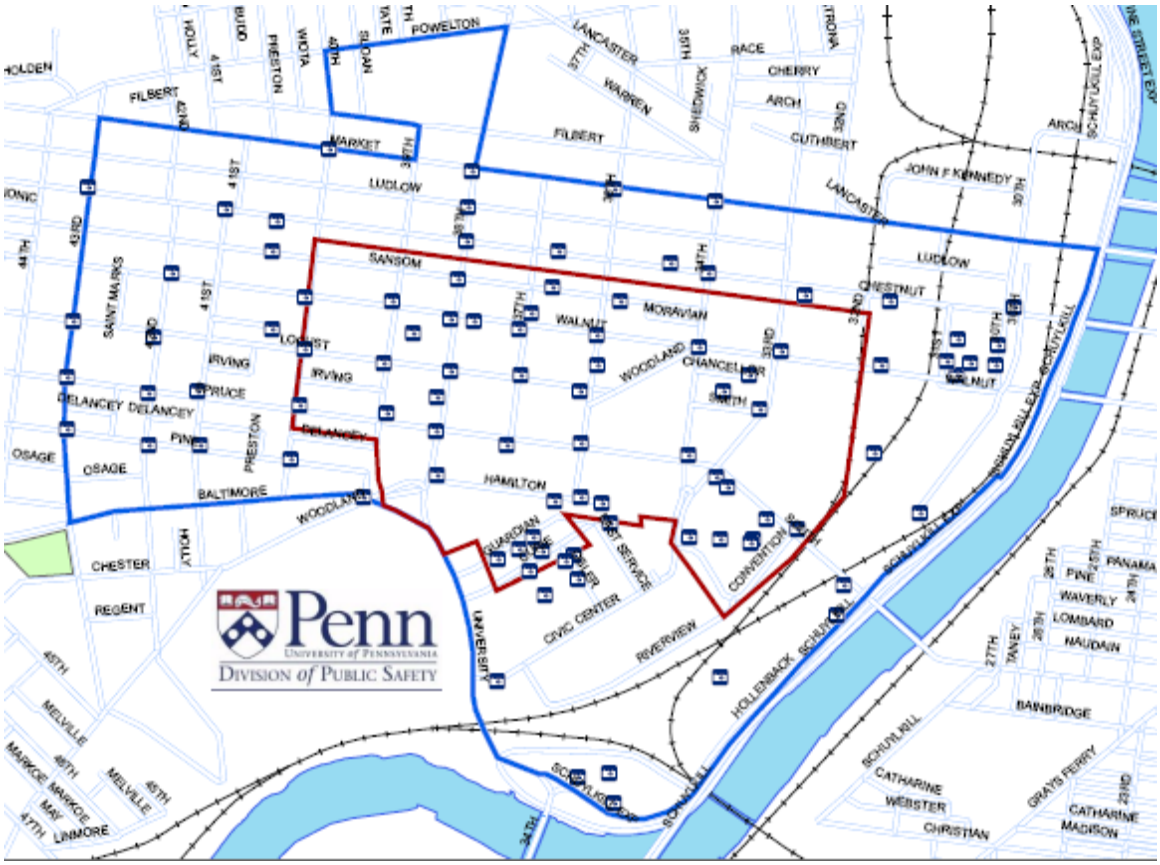



**Figure 4 shows the University of Pennsylvania school campus in western Philadelphia with locations of Cameras marked.**

1. 4040 Chestnut Street (Front)
2. 4040 Sansom Street (Rear)
3. 41st. & Chestnut Sts.
4. 40th & Locust Walk
5. 40th & Spruce Sts.
6. 41st & Spruce Sts.
7. 39th & Spruce Sts.
8. 39th & Walnut Sts.
9. 38th & Walnut Sts.
10. 38th & Spruce Sts.
11. FELS Center For Government
12. 36th & Walnut Sts.
13. 37th & Spruce Sts.
14. 36th & Spruce Sts.
15. 33rd & Smith Walk
16. 34th & Walnut Sts.
17. 100 Block Of So. 37th Street
18. Steve Murray Way & Sansom Sts.
19. 37th And Walnut Sts.
20. Towne Loading Dock
21. Steve Murray Way & Chestnut Sts.
22. 40th & Walnut Sts.
23. 33rd & Chestnut Sts.
24. 36th & Sansom Sts. (Franklin Bldg.)
25. Bennett Hall (Overseeing Levine Bldg.)
26. 1920 Commons (Garage 14 Rooftop)
27. 33rd & Walnut Sts.
28. 42nd & Locust Sts.
29. 36th & Locust Walk
30. 38th & Hamilton Walk
31. 31st & Chestnut Sts. (Left Bank)
32. 31st & Walnut Sts. (Left Bank)
33. 43rd & Locust Sts.
34. Shatner Coffee Shop Area
35. Bridge Cinema
36. 4119 Walnut St.
37. Franklin Field
38. 40th & Market Sts.
39. Levy Dental Loading Dock
40. Left Bank Loading Dock
41. 34th & Chestnut Sts. (Garage # 37
42. 39th & Locust Walk
43. 38th & Locust Walk
44. 37th & Locust Walk
45. 38th & Sansom Sts.
46. Penn Tower Hotel (Rooftop)
47. Huntsman Hall N/e Corner
48. 34th & Spruce Sts.
49. WXPN/world Cafe 31st & Walnut Sts.
50. WXPN/world Cafe Sw Side Lower Level
51. Transitional Research Labs 31st Street
52. Transitional Res. Labs 31st St.(Upper L)
53. Transitional Res. Labs 30th St.(Ll South)
54. Transitional Res. Labs 30th St.(Ll North)
55. Levy Tennis Pavilion
56. Mod 7 West
57. Mod 7 North
58. Mod 7 Southeast
59. Hollenback (Lower Level Rear Parking)
60. Hollenback (Rooftop)
61. 40th & Pine Sts.
62. 41st & Pine Sts
63. 42nd & Pine Sts.
64. 38th & Chestnut Sts.
65. 38th & Market Sts.
66. 34th & Market Sts.
67. 36th & Market Sts.
68. 39th St. & Baltimore Ave. Hill Pavilion
69. Stellar Chance Roof (Rear)
70. Stellar Chance Roof (Front)
71. Stellar Chance Loading Dock
72. Blockley Hall Roof
73. BRB II Loading Dock (Exterior)
74. Osler Circle Courtyard
75. BRB II Roof (Rear)
76. BRB II Roof (Front)
77. CRB Roof
78. CRB Bridge (Main Entrance Hall)
79. CRB Stemmler Hall (Main Entrance)
80. Loading Dock Exterior
81. 33rd Street Exterior
82. Kress Entrance Exterior
83. Interior Kress Entrance
84. Upper Loading Dock Exterior
85. Warden Garden
86. Stoner Courtyard


**Figure 5 shows the street locations of the CCTV Cameras on UPenn's Campus.**

*CCTV Basics*

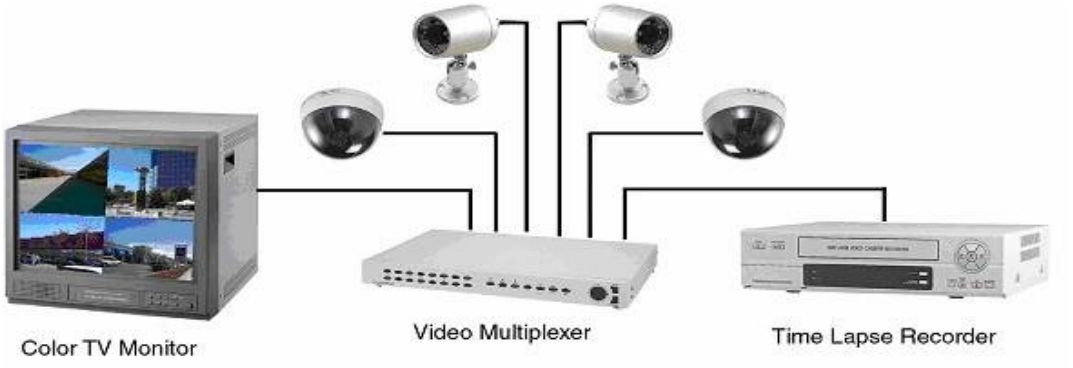



**Figure 6 shows an old-fashioned analog CCTV system. These systems required a multiplexer and Time Lapse Recorder to record multiple camera inputs onto one VHS tape. The video multiplexer consolidates multiple camera video inputs into one video out for the television and one video output for the Time Lapse Recorder. This enables the TV Monitor to have one video input of multiple camera videos to document multiple camera images at the same time.**

## Analog CCTV Systems

- Frequent VHS Changing – The standard 2-hour VHS tapes can record 1.5 frames per second for three days before the tape needs to be changed. 10-12 VHS tapes are recommended to be rotated in order to increase the life the recorder and tapes.
- Require Multiplexer for VHS tape playback.
- Require RG59 Coaxial Cable and BNC fittings. Each camera is connected to the Multiplexer with RG59. One RG59 goes from the Multiplexer to the Monitor. One RG59 goes from Multiplexer to the Time Lapse Recorder.


**Figure 7 shows two different PC-DVR systems. The system on the left shows a complete system. The system on the right shows a system with just a PCI Card which can be inserted into an existing computer tower.**

## Personal Computer CCTV Systems

- Two PC CCTV systems exist: One system consists of a PC-DVR (left image). The other system (right image) consists of a PCI capture card with 4-channel inputs for cameras. This system allows users to install the card into their *existing PC* to save money. If users have more than 4 cameras, multiple PCI cards will be needed.

- User-friendly interface and operating software – These systems are operated with keyboard and mouse. They use software, which is included as a CD. The software includes many features including: user-defined recording speed, alarms, motion-detection recording, recording schedules, remote access, and image snapshots.
- Weeks of Video Footage: Video compression allows a typical 4 camera CCTV system to store 30 days of footage with a 80 Gigabyte hard drive. (More memory can easily be installed to increase the amount of video storage.) These systems continuously and automatically record over the oldest footage when no new memory is available.
- Memory can be saved onto a CD, DVD, or USB flash drive on certain computers.
- Playback on Windows Media Player and other video playback software.
- Require RG59 Coaxial Cable (maximum length 600 feet) or RG6 Coaxial Cable (1000 feet). These systems use RCA or BNC cable terminators.


**Figure 8 shows a Standalone DVR CCTV system with a monitor. This system is operated with a remote. However, a mouse can be attached to the DVR.**

- Standalone DVRs function as PCs because simple computers that store video footage. The footage can be reviewed through the DVR and monitor. Memory transfer devices such as USB as used to transfer files to a computer to be printed.

Closed Circuit Television (CCTV) is different from broadcast television because CCTV uses direct circuits to transmit signals. No airwaves are used. Elements of CCTV include: cameras, lenses, cables, recording equipment, monitoring equipment, and illumination.

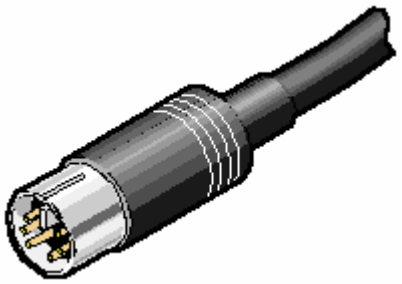
- ***Camera*** - All CCTV cameras use a lens to project reflected light onto an image sensor. However, CCTV cameras can have dramatically different features. Monochrome cameras record in black and white and are used in low light conditions. Monochrome cameras produce images at a higher quality than color cameras. Color cameras are good for tracking targets. Day-Night cameras are use color when enough light is present. When light levels are too low, they switch to black and white, which is more

sensitive in low light conditions. These cameras provide the best of monochrome and color. Dome cameras prevent monitored targets from knowing if the camera is being pointed at them. Infra red (IR) cameras use color in the day and switch to black and white in low light conditions. These cameras use IR light emitting diodes (LEDs) to illuminate the environment in low light conditions. The distance an IR camera can see at night depends on the number of IR LED lights built into the camera. As a general rule of thumb, 1 IR LED can help the camera see as far as one foot. Pan-Tilt-Zoom cameras (PTZ) have the ability to move right, left, up, down, and to zoom in and out. These cameras are more expensive that fixed cameras. However, these cameras have the ability to move around to get a 360 degree view.

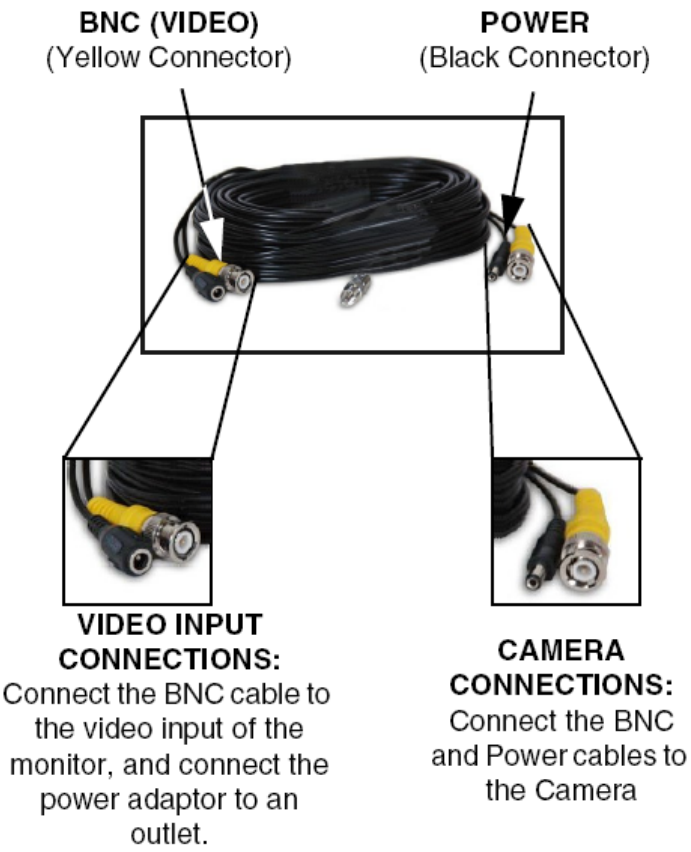
- ***Camera Sensors*** – Two types of camera sensors exist. The Complementary Metal-Oxide Semiconductor (CMOS) sensor produces low to medium quality images at a low cost. The Charged Coupled Device (CCD) sensor produces the higher quality footage compared with CMOS sensors. However, CCD sensors are more expensive. Most CCTV providers recommend image sensors between 1/3" and 1/4". The larger the sensor, the better the image quality.
- ***Camera Lenses*** – The lens helps direct light onto an image sensor. The most important concept relating to the lens is angle of view. The longer the focal length of the lens the narrower the angle of view. Two common types of lenses exist. Fixed focal length lenses are cheap are commonly found in CCTV cameras. Vari-focal lenses are more expensive and can be changed during installation of the camera.
- ***Camera Angle of View -*** The focal length of a camera determines the angle of view of the camera. Short focal lengths provide wide angles of view. Long focal lengths provide small angles of view.
- ***Light Levels*** – The iris of a camera is responsible for regulating how much light reaches the camera sensor. A manual iris lens is used when lighting in a particular environment remains constant. An auto iris lens is used when fluctuating light levels are present in an environment. An aspherical camera lens is used to achieve superior sensitivity in low light environments. An IR corrected lens is used to achieve superior images at night.
- ***Cables*** -
    - ***Coaxial Cable*** – Coaxial cable uses a shielded copper conductor to transmit video signals. Coaxial cable can be connected to CCTV equipment using a BNC connector.

- ***Cat5*** – Cat5 cable consists of 4 unshielded twisted pairs of wires and is used to transmit video signals. Cat5 cable can transmit signals further than coaxial cable.
- ***Power Cables***

- ***Cable Connections –***
  - ***DIN Connection*** – DIN connectors contain 6 pins for audio, video, alarm, and power. DIN connectors exist to simplify the wiring of CCTV systems. These cables run up to 300 feet. These cables can connect convert to BNC connections.

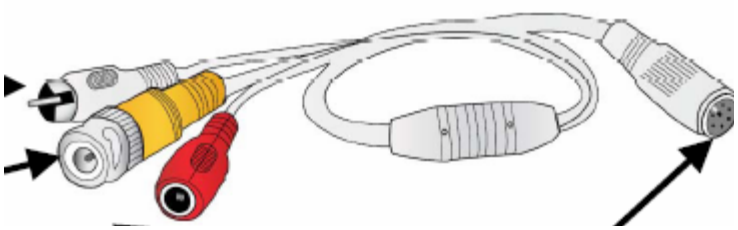


  - ***BNC Connection*** – BNC connectors are the industry standard. They consist of coaxial cable for transmitting video signal. They can transmit signals up to 300 feet.




- ***RCA Connection*** – RCA connections are used to transmit audio and video. Black and red cables are for audio, while yellow is for video. These cables can transmit for distances as long as 180 feet. However, these cables plug into systems without locking in.

- ***BNC-DIN Converters –*** This connector allows power (red), audio (white), and BNC video (yellow) to be converted to a single DIN cable.



- ***BNC-RCA Converter -***


- ***RCA-DIN Converter -***

- ***Digital Video Recorder (DVR) –*** DVRs consist of a hard-drive which stores CCTV video data. Cameras connect to the DVR and the DVR can then display the camera video on a monitor in split-screen mode.
- ***Illumination - Lighting*** is an important factor for When there is not enough natural light to illuminate an object, artificial illumination can be provided. There are several categories of illumination
  - ***Incandescent –*** Light produced from a filament. Either a normal filament or tungsten halogen can be used.
  - ***Fluorescent –*** Light produced from gas discharge. This option is considered to be more affordable than incandescent light.
  - ***High Intensity Discharge (HID) –*** Used as a long-term reliable light supply. Four types include (1) low pressure sodium, (2) high pressure sodium, (3) metal halide, and (4) high pressure mercury vapor.
  - ***LED -*** This is a long lasting and low-cost alternative with IR illumination capabilities.

    - ***Hidden Illumination –*** IR illumination cannot be seen by a human eye. This illumination can transmit as far as 10 meters.
- Hard Disk Drive (HDD) – This device stores the digital information.
- Digital Video Recorder (DVR) – Stores multiple video and audio signals in digital format on a hard disk drive. DVRs can offer motion-detection activated recording and remote viewing from anywhere in the world via internet access. CD, DVD, USB backup media can also be used. Standalone DVRs use the Linux operating system because of its reliability and stability. (Microsoft Windows often contains software glitches!) Some CCTV experts believe video surveillance should never be PC based because of the lack of reliability.
- Digital Video Recorder Card – Used to convert Computer to DVR
- Frames per Second (FPS) – One image is one frame. Real-time video is 30FPS with the standard NTSC video format (America). Real-time video is 25FPS with PAL standard video format (Europe and Asia).

*Digital Cameras*

A pixel is the fundamental unit of any image. Pixel, short for picture element, is a tiny square filled with one color. The color is designated by numerical values (0-255) for a red color, a green color, and a blue color. (For example, a color could be 44 red, 34 green, and 133 blue.) A single color can be represented by an 8 digit number, called a byte (or bit). An image made of pixels represented by 3, 8-digit numbers, is called a 24-bit color images. Other images can be 36-bit images or 48-bit images.

Total pixels are effective pixels are numbers used to evaluate cameras. Total pixels represent the number of pixels a camera's sensor contains. Effective pixels represent the number of pixels used to produce an image. This number excludes edge pixels on a camera's sensor.

The number of pixels determines the maximum image size that can be seen clearly. Kodak describes these conversions as follows:

| Resolution (Megapixels) | Image Size (Inches) |
|---|---|
| 1 | 5 by 7 |
| 2 | 8 by 10 |
| 3 | 11 by 14 |
| 4 | 20 by 30 |

**Obtained from Kodak.com**

Aspect ratio gives the ratio of image width to image height. Traditionally, aspect ratios were 3:2. Currently, most cameras and video cameras have aspect ratios of 4:3 to match computer monitors 4:3 aspect ratio.

Camera sensors have sizes on the scale of millimeters. Unlike 35mm film cameras, most digital camera sensors are much smaller. Digital camera sensor size is important because the larger the sensor, the more pixels the sensor can put into the image.

Card readers and connections help link computers and cameras. Current popular methods for connecting cameras include the USB 1.1 transfer at a rate of 11 megabits/second. USB 2.0 is an upgrade of USB 1.1 and can transfer 480 megabits/second. IEEE 1394 is another transfer method and has a maximum speed of 400 megabits/second.

Digital cameras use either a CCD or CMOS silicon chip to record pictures. The light-sensitive silicon chip replaces film used for older cameras. The benefit of a silicon chip is that it is reusable, unlike film.

Digital cameras frame shots using an optical viewfinder and LCD which displays the image to be photographed. Electronic viewfinders are sometimes used instead of LCDs.

Digital cameras store pictures on memory cards or discs using a variety of formats. JPEG memory enables image compression but could introduce artifacts during the process. TIFF images are large files but do not have compression artifacts. RAW is another file type, but using special software for reading the files.

Digital cameras display pictures in several ways. Images are saved in the camera memory and can be displayed on LCD. Images can be viewed on the computer using software or internet websites.

*Digital Image Review*

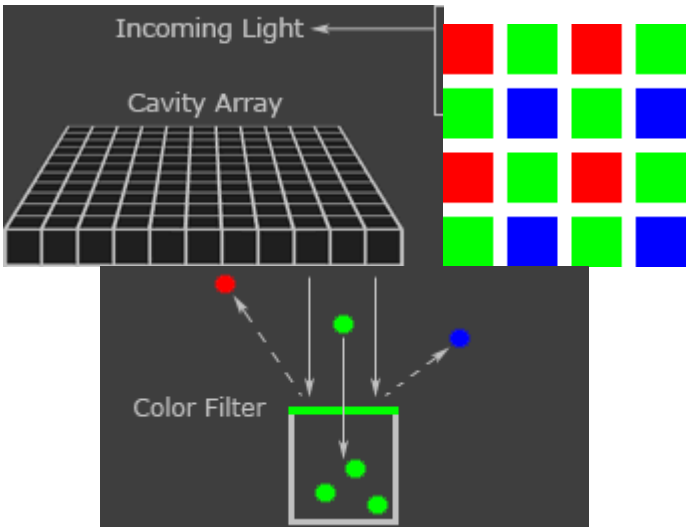



**Figure 6. Left image shows an array of photosites in a camera sensor. Center image shows the Bayer array, an arrangement of primary color filters that are placed over the array of photosites. Right**

**image shows how each photosite only measures the number of photons of one primary color (Red, Blue, Green). (FIGURES OBTAINED FROM CambridgeInColour.com)**

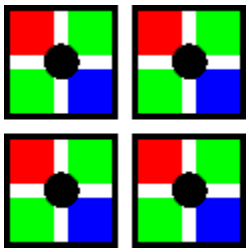


Figure 7. Demosaicing is a process where the color data from green, red, and blue sensors is used to approximate the true color of the object being photographed. (FIGURE OBTAINED FROM CambridgeInColour.com)

- Pixels - Pixels are tiny squares that make an image. Each pixel is made up of three color channels (Red, Green, Blue) with numerical values ranging from 0 to 255. The total number of pixels in an image determines how large a printed image can be without appearing blurry. Total pixels is equal to the number of pixels (photosites) on the camera sensor. Edge pixels are removed from the image that is produced from the total pixels of the sensor. Effective pixels equals the number of pixels used to produce the image.
- Bit Depth – Determines the number of possible colors available for each pixel. Each pixel color is determined by combining color data of red, blue, and green colors. Each primary color (red, blue, green) is specified by a number of "bits per channel." This number determines how many 0s and 1s will specify the color. The number of bits per pixel is equal to the total number of bits per channel.
- 
- For example, most primary color channels are specified by an 8-bit number. Because there are three primary colors within each pixel, the total number of bits per pixel is 8+8+8 or 24 bits/pixel. 24 bits/pixel is "true" color. This can also be expressed as a 24-bit color image.

| Bits/Pixel | Name |
|---|---|
| 1 | Monochrome |
| 2 | CGA |
| 4 | EGA |
| 8 | VGA |
| 16 | XGA "High Color" |
| 24 | SVGA "True Color" |

- Computer Display of Image – Pixel count and aspect ratio determine the size of an image on a computer screen.
- Print Display of Image –
- PPI – Pixels per Inch (PPI) determines how large an image will be when it is printed. PPI should range between 240 and 320.
- DPI – Dots per Inch describes how close the ink droplets should be spaced when printing an image. DPI is a measure of print quality and should be 360 or greater.
- Focal Length – A camera's focal length is dependent on the shape of the camera lens. A long focal length translates to a narrow view of an image. The shorter the focus, the wider the angle of a shot you will get. Websites like cambridgeincolour.com allow users to calculate the required focal length for a camera based on the distance, object size, and sensor size.
- Image Formats (JPEG, TIFF, RAW Files)
- JPEG – JPEG images are much smaller than TIFF files because of more compression.
- TIFF – TIFF images are significantly larger than JPEG because the original camera image is stored. TIFF files can use up to 16 bits per channel.
- RAW (or NEF) – RAW files contain the exact pixel information from the digital sensor. No editing has occurred within the digital camera. This allows professional photographers to have control over what the final image will look like.
- Depth of Field – Depth of field refers to the range of "acceptable" focus that a camera can achieve. Distances too close or too far away from the range of "acceptable" focus will appear blurry. Depth of field is controlled by …

- Aperture – Aperture size controls how much light is allowed into the lens. Aperture size is described by f-numbers. The smaller the f-number, the larger the aperture.
- Aspect Ratio – Ratio of the width to height. Cameras commonly use 3:2 aspect ratios. Video commonly uses 4:3 aspect ratio.
- Zoom:
- Digital Zoom – Magnification of an image
- Optical Zoom – Changing the focal length of the lens so that image quality does not decrease with magnification.
- Digital File Compression – Compression reduces the size of an image file. Compression can be achieved by discarding image information. Sometimes, "artifacts" can be produced, which result from the

*Computer Monitor Displays*

- Aspect Ratio – The aspect ratio of computer monitor or TV monitor cannot be changed. It is the ratio of width to height.
- Screen Resolution – This number can be changed by the computer user. However, the aspect ratio of screen resolution needs to match that of the computer monitor. Most monitors display at 72 dots per inch.

| **4:3 Aspect Ratio (pixels x pixels)** | **5:4 Aspect Ratio (pixels x pixels)** |
|---|---|
| 800 x 600 | 1280 x 1024 |
| 1024 x 768 | 1600 x 1280 |
| 1152 x 864 | |
| 1600 x 1200 | |

*Evolution of CCTV Network Technology*

The first type of CCTV system used analog and had several limitations. Traditional CCTV systems consisted of analog cameras, a multiplexer, analog video tape recorder, and television monitor. Cameras required and were limited by cabling. The multiplexer had strict limitations on the number of camera inputs. The video tape recorder required frequent changing of tapes, putting heavy demands on labor and materials. Another problem with traditional CCTV was the poor picture quality caused by the video tape recorder.

With the digital revolution, CCTV systems began incorporating digital technology into old analog systems, improving the system. Multiplexers, video tape recorders, and television monitors were replaced with digital components. "Backend Digital" systems continued to use analog cameras but linked them to digital video recorders (DVRs) and digital monitors. This change made recording easier, requiring no tape or labor to change

tape. However, the systems still (1) required cabling, (2) had limitations on the number of cameras inputs, and (3) had no direct camera access.

Today, complete digital CCTV systems with IP technology made CCTV very practical. These systems can produce JPEG images which can be connected to wireless Ethernet LAN networks. LAN infrastructure may already be present in a business or school, making it easy to connect cameras and add additional ones. This allows the surveillance images and cameras to be accessed from any location on Earth. One server and software can be used for all of the cameras in the system. RAID redundancy and SCSI connectivity can be used as insurance in case hard disk drives crash.

*Sample CCTV Installations:*

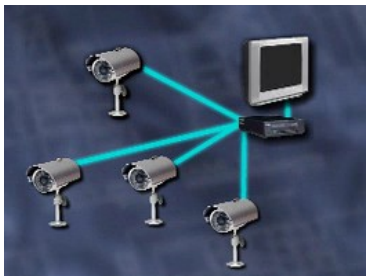
A CCTV system consists of cameras, cables, a digital video recorder, and a monitor. The monitor in the picture has a DVR embedded within it.

Mounting holes are marked and drilled above a 10' mark. Then, wall plugs are hammered in.

Screws are then inserted into the wall plugs to attach the mounting bracket.

Cable routing is easy with a dropped ceiling. Cables are often tied together to ensure connection.
Cables can be attached to baseboard with cable stapler.

Camera cables, network cables, and power cables are then connected to complete the installation.
**(Images obtained from LOREX CCTV Security Observation Systems Website).**
**http://lorexstore.lorextechnology.com/article.aspx?aid=3**



CCTV systems consist of cameras connected to digital video recorders, which are connected to monitors. Mounting bracket is screwed into place under the eve of the house.


Camera is attached to mounting bracket, angled properly, and connected to power and video cables. Cable clamps are hammered into place to attach the power and video cords to the side of the house.



Power and video cords are inserted into the basement of the house by drilling hole through the house siding. The hole where the cords were inserted is then sealed.

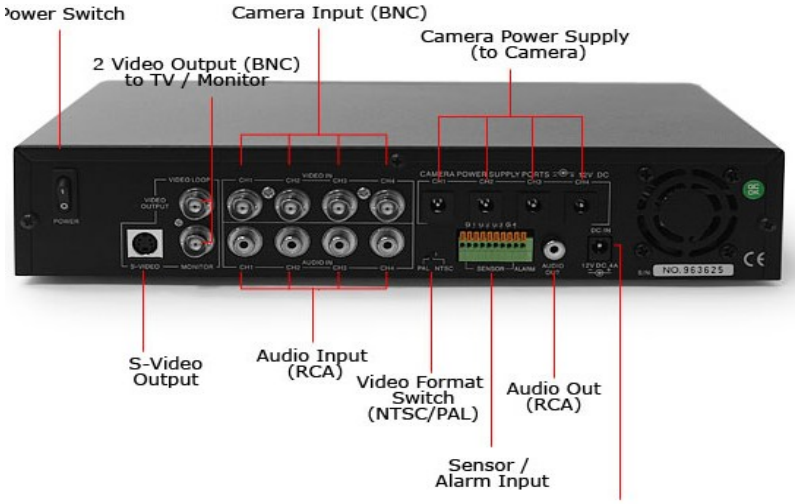


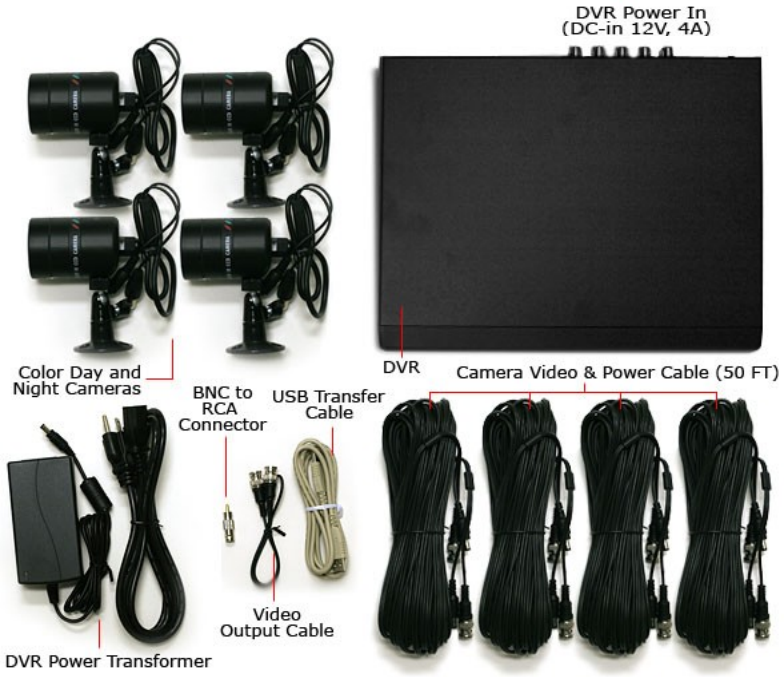
Cables are run through the basement and inserted into a room by creating a hole in the floor.



The power and video cords are pulled apart and attached to the power outlet and digital video recorder. The DVR is then connected to a TV or Computer monitor (Not Shown).
**(Obtained from Ron Hazelton's House Calls)**

*Sample CCTV Equipment:*

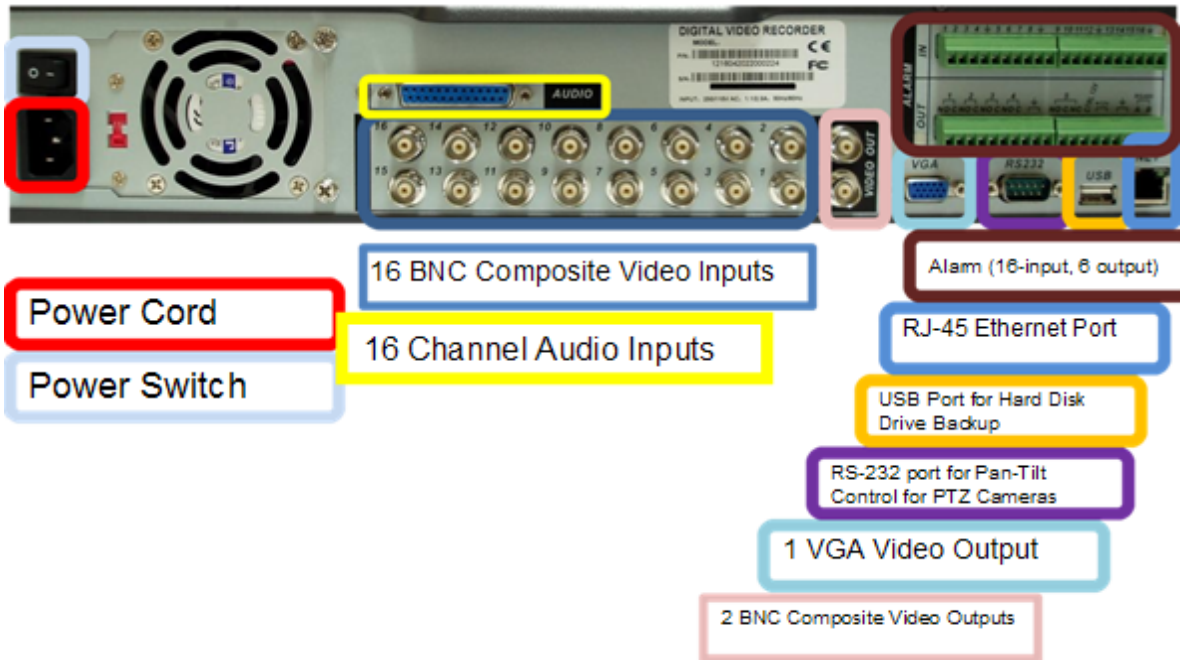

[Images Obtained from EBay]



[Images Obtained From EBay]

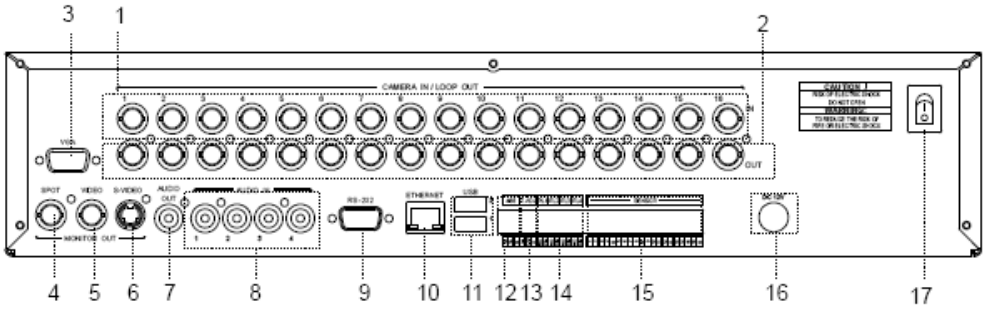


USB Port for Mouse




Images Obtained From EBay

## 3.2 REAR PANEL CONNECTORS




| Port Name | Description |
|---|---|
| 1 CAMERA IN | BNC input ports for cameras |
| 2 CAMERA OUT | BNC output(looping) ports for cameras |
| 3 VGA OUT (optional) | Output port for the VGA monitor<br>This DVR is compatible with TFT LCD monitor in PAL mode. |
| 4 SPOT OUT | BNC output port for spot monitor |
| 5 VIDEO OUT | BNC output port for the main monitor |
| 6 S-VIDEO OUT | Output port for the S-video output |
| 7 AUDIO OUT | RCA output port for an audio signal |
| 8 AUDIO IN | RCA input ports for an audio signal(4CH Line input) |
| 9 SERIAL | Connector for debugging. This DVR can be controlled by the other device through this connector(RS-232C). |
| 10 ETHERNET | Port for 10/ 100Mbps Ethernet/ XDSL |
| 11 USB1 / USB2 | USB 2.0 ports to use USB flash memory, Mouse or the external devices |
| 12 RS 485 | Terminal blocks of RS-485 |
| 13 T-ADJ | Input and output terminal blocks for time synchronization among DVR's |
| 14 RELAY OUT | 4 relay output terminal blocks |
| 15 ALARM IN | Input terminal blocks for alarm signals |
| 16 POWER IN | Socket for a DC 12V, 10A power cord |
| 17 POWER SWITCH | Switch to turn the power on / off |

*Dynamy*

Dyanmy, a non-profit educational organization, was created in 1969. Dynamy is both a (1) Youth Academy for high school students and an (2) internship program for high school graduates or college students between 17 and 22 years old.

The Dynamy Youth Academy accepts around 13 low-income, disadvantaged students entering Worcester public high schools each year. The Youth Academy is four years long and is designed to encourage students to complete high school and attend college. Students completing the four year program can receive full-tuition scholarships to Worcester Consortium colleges. Financial support is provided by donations from organizations and individuals. The Youth Academy also includes internships, outdoor activities, tutoring, mentoring, and group workshops. More than 92% of graduates attend college.

The Dynamy Internship Program mostly attracts high school graduates and first or second year college students. The program includes a 9-month full-time internship, wilderness trip, mentoring, community service, and potential college credits from Clark University. More than 80% of students completing the program continue on to college.


**Figure 8-9 Left picture shows the main Dynamy House at 27 Sever Street with the Carriage House. This building houses offices for administrators and advisors. The building is also used for Youth Academy students and Internship students. This building contains a kitchen, two computer labs, and a small and large conference room. Right image shows the proximity of WPI and Dynamy (.6miles).**

*Dynamy CCTV Recommendations*

| Factors | Recommendations |
|---|---|
| System | |
| • Remote Viewing over Internet | Not Necessary |
| | |
| Cameras | |
| • Weather Resistance | Not Necessary (Indoor Cameras Are Needed) |
| • Vandal Resistance | Not Affordable |
| • Color Picture | Necessary |
| • Night Time Picture | Not Necessary |
| • Angle of View | Wide angle lenses for rooms monitored by single camera. Narrow angle lenses for hallway cameras. |
| • Picture Quality | Facial Recognition, 1/3" CCD Sensors |
| • Wireless | Not Affordable. |
| | |
| Digital Video Recorder | |
| • Number of Camera Inputs | 8 (2 x 4 channel DVRs) |
| • Hard Drive | 80 GB minimum for each DVR |
| • Sound | Not Needed |
| • Compression | MPEG4 or MJPEG are both good |
| • Motion Detection Activation | Necessary to save memory |
| • Alarms | Not Needed |
| • Footage Transfer Mechanism | USB or CD writer or DVD writer |
| | |
| Monitor | |
| • Television | Not Owned by Dynamy |
| • CCTV Monitor | Not Affordable |
| • LCD | Recommended. Dynamy owns LCD computer monitors. They could also function for the CCTV system when the DVR footage is being reviewed. |
| | |
| Accessories | |
| • Warning Signs | Should be placed outside of the main entrances |
| • Dummy Cameras | Not Recommended |
| • Power Supply | Either a Power Box or Individual Power Supplies |

# Dynamy Youth Center
# Do-It-Yourself
# Security-Camera Proposal

**Ryan Philip Jajosky**
**"The Tutor"**
**April 2008**

## Dynamy Youth Center:
## Security Camera Options

### Option #1 (not recommended): Pay Professionals ($10-15K)

Pay ADT Security $10-15,000 for a Professional Security Camera System with Installation

### Option #2 (my recommendation): Do-It-Yourself (≈$2000)

- Buy 2 x 4-Camera Surveillance Kits online (easier to install cabling to 2 separate systems). The equipment, shipping costs, and installation equipment will cost about $2000.
- Install the 2 kits yourself!!! (Call it a Team-Building Activity)
- Each kit should include:
  - 4-Channel Digital Video Recorder (with at least 80 GB of Memory)
  - 4 Cameras (with 1/3" or larger Sony Super HAD CCD Sensors)
  - 4 Plug N Play (PNP) Cables at least 50-feet long
- Cable Routing Equipment (Separate from CCTV Security Camera Kit)
  - 120 feet of Cable Raceway Track (to safely run cables on the ceiling)
  - Cable Clips to secure cables to wallbase
- 2 Power Strips will be needed to manage the power to the 8 cameras and two DVRs.
- A Lock would need to be installed on the door where the basement DVR is stored. The 1st-floor DVR would need to be in a locked desk drawer. (A security camera on the first floor monitors the first-floor DVR.)

**This Presentation Explains how to "Do-It-Yourself"**

# Security Camera Systems

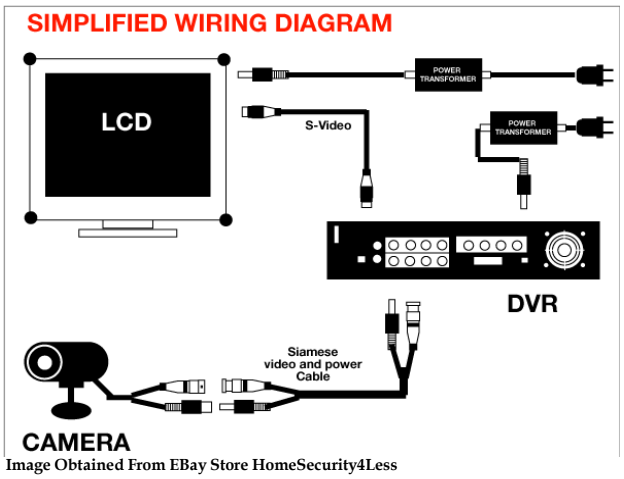



Image Obtained From EBay Store HomeSecurity4Less

Video Cables go from the Cameras to the DVR to the Monitor
Power Cables supply energy to each component

The Digital Video Recorder (DVR) records what the camera sees onto a hard drive. The DVR sends the video signal to a monitor to be displayed for a person to see. The DVR automatically records onto the oldest video data when it runs out of memory. The DVR also has special features, like motion-activated recording, to save memory.

Most DVR Connections are BNC!!!

# Camera Surveillance Components

## Cameras

Image quality is the most important feature. CCD sensors are better than CMOS. And, large 1/3" sensors are better than 1/4" sensors. TV Lines (TVL) measure image quality. 420 TVL and above is considered high-definition. 380 TVL is good.

## DVR

It is important to have at least 80GB of memory for each 4-CAM system. The DVR should have motion-activation so that it doesn't record when there is no movement. One of these backup methods should be present: USB, CD writer, or DVD writer. This way, video files can be transferred to a computer and printed.

## Cables

Plug and Play Cables are easy to install! They have RCA Connections. A small RCA to BNC connection is added (yellow) so that the cables can connect to a DVR

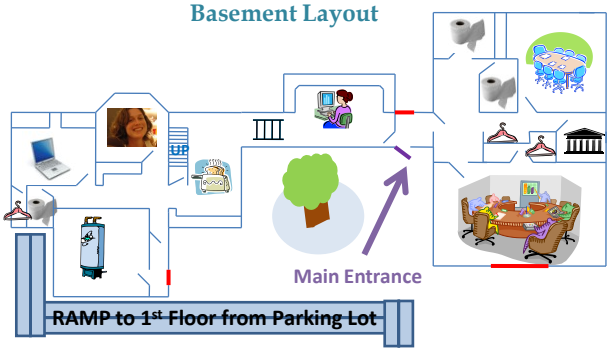
Image Obtained From CCTVCameraPros.Com

## Monitor

LCD PC Monitors connect to the VGA Port on the DVR. If there is no VGA Port, a BNC to VGA converter cable is needed.

# Dynamy Youth Center: Layout

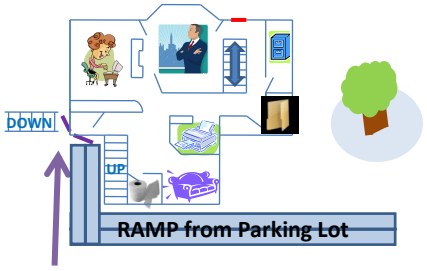
## Basement Layout




### LEGEND

| | | |
|---|---|---|
| Desktop Computer Lab | Sara's Office | Board Room (Intense!) |
| Laptop Computer Lab | College Counseling Room | Conference Room |
| Lavatory | Closet | Water Heater Room |
| | | Kitchen |

## 1st-Floor Layout

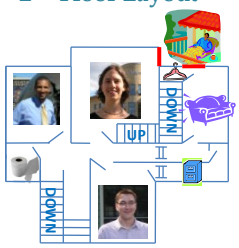



Main Entrances

### LEGEND

| | | |
|---|---|---|
| Secretary and Help Desk | Director's Office | Xerox Room |
| Lavatory | Sitting Room | Small Office |
| | | File Room |

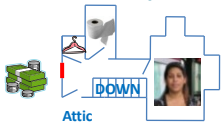
## 2nd-Floor Layout




### LEGEND

| | | | |
|---|---|---|---|
| Balcony & Fire Escape | Office of Executive Director | Joe's Office | Small Office |
| Lavatory | Allyson's Office | Sitting Room | Closet |

## 3rd-Floor Layout

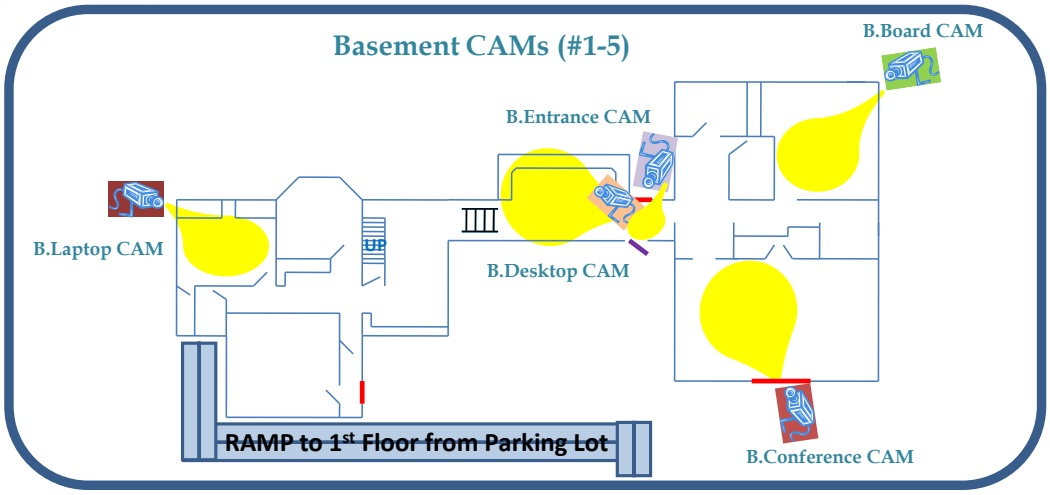



Attic Storage

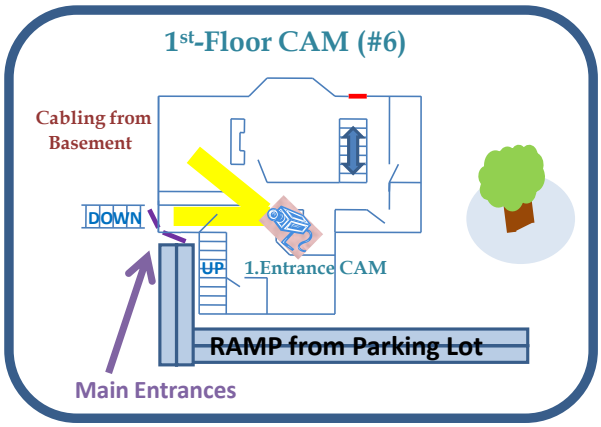
### LEGEND

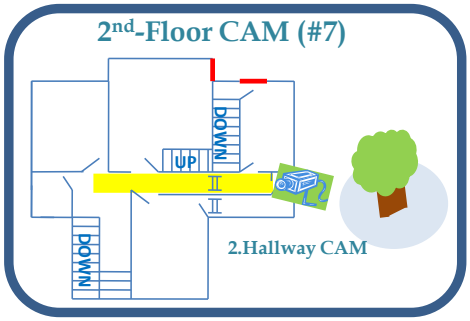
| | | | |
|---|---|---|---|
| Raquel's Office | Lavatory | Closet | The Bookkeeper |

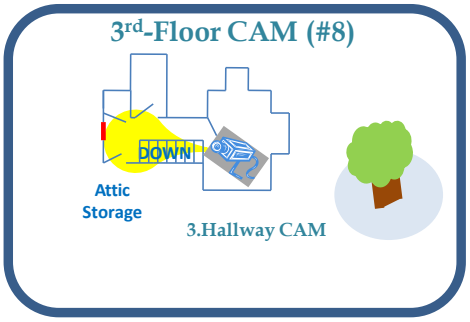
# Dynamy Youth Center: Camera Placement Recommendation




- B.Conference CAM – Overlooks entrance, equipment closet, and half of the total room
- B.Board CAM – Overlooks entrance and board room table
- B.Desktop CAM – Overlooks desktop computer area and printer
- B.Laptop CAM – Overlooks entrance and laptop computers
- B.Entrance CAM – Overlooks main basement entrance to Dynamy.




- 1.Entrance CAM – Overlooks first-floor entrances to Dynamy, stairwell to 2nd floor, part of the secretary area and the DVR.
- 2.Hallway CAM – Overlooks entrances to 5 offices, and stairwells.
- 3.Hallway CAM – Overlooks area leading to two offices and the attic storage area.

# Dynamy Youth Center:
# 8-Camera Kit or 2 x 4-Camera Kits

**$1260**

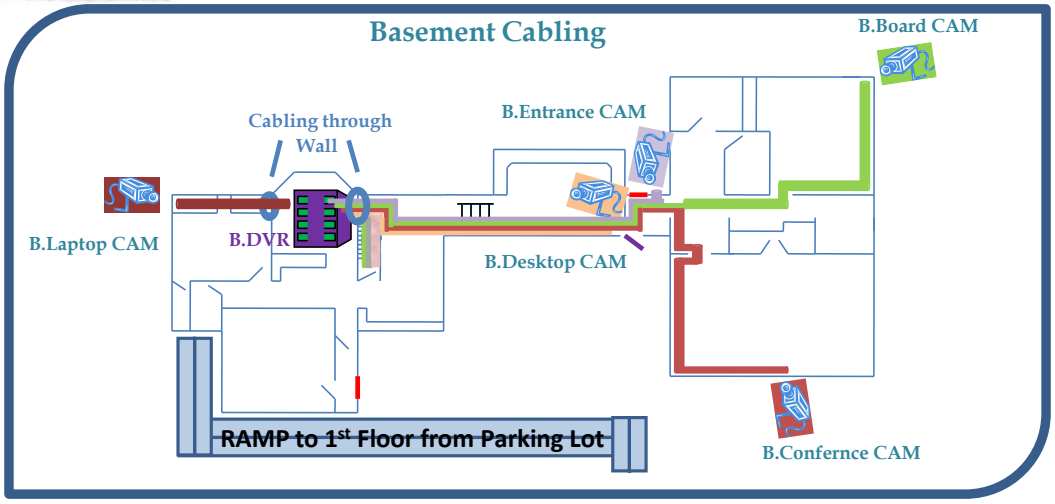
Images Obtained From CCTVFactory.com

or

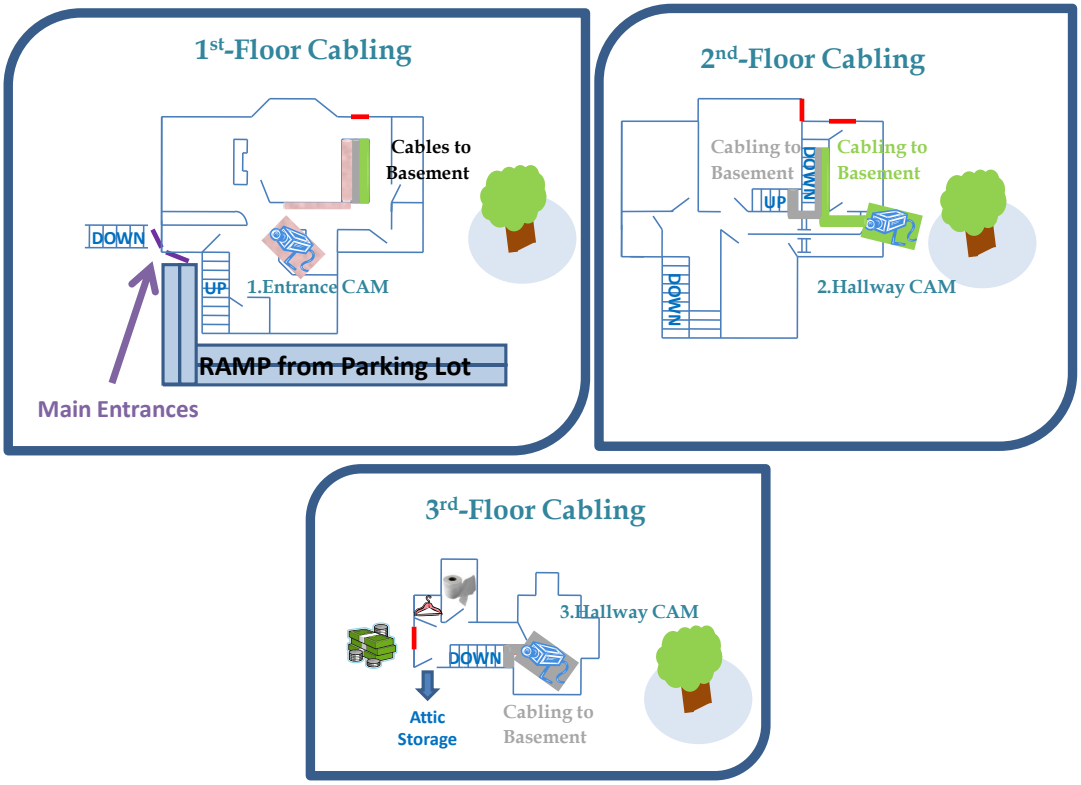
**$1400**

**The Cabling Diagrams for both Systems are Shown Next!**

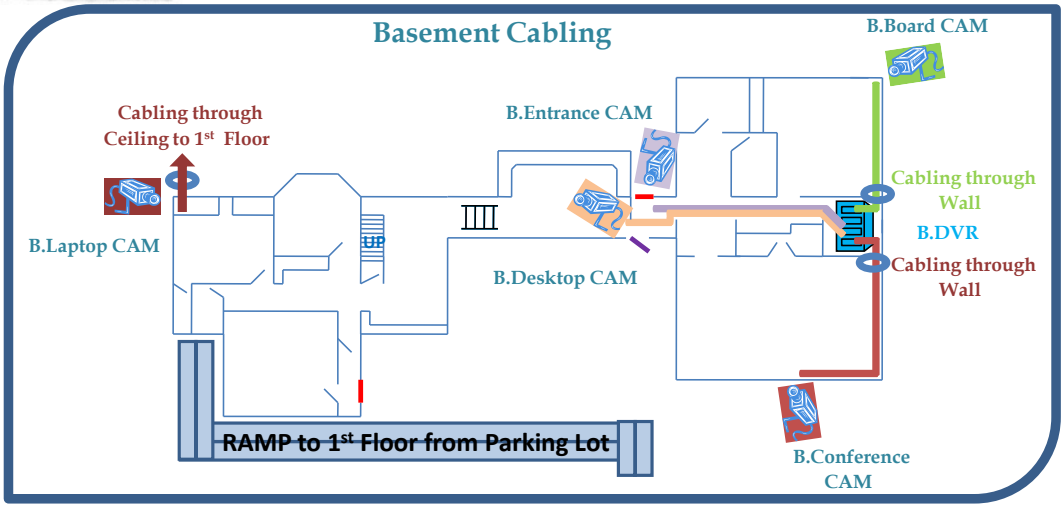
# Dynamy Youth Center:
# Cabling (1 DVR Setup)



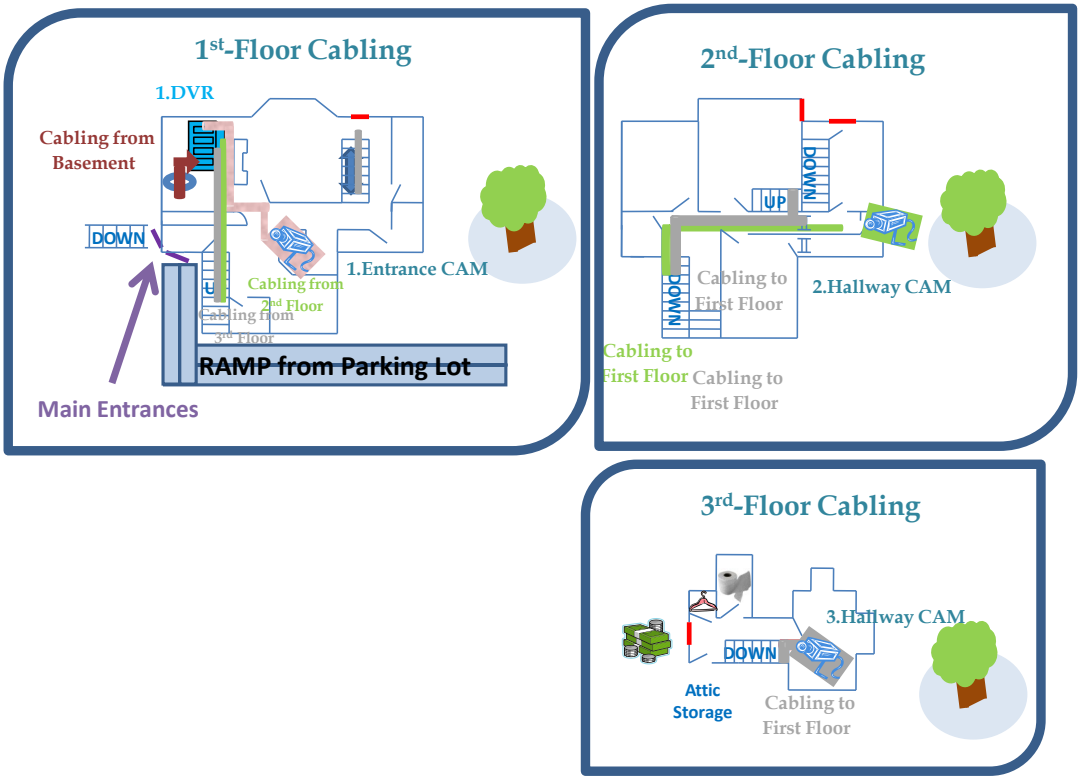

- Cable routes significantly longer than 50 feet.
- A "Cable-Cutter" could NOT be identified using camera footage and logic.
- Running 8 Cables to one location adds complexity and makes installation difficult.




# Dynamy Youth Center: Cabling (2 DVR Setup)




- Cable routes shorter than 50 feet.
- A "Cable-Cutter" could be identified using camera footage and logic.
- Cabling is much simpler with 2 DVRs compared to having just 1 DVR.




# 2-DVR "Simple Cabling" Setup Proposal

Images Obtained From CCTVFactory.com

• Buy 2 x 4-Camera CCTV Systems from *CCTVFactory.com*. *CCTVFactory.com* provides a rare feature that other discount Security companies do not provide – *the ability to customize the kit.*

• Each 4 Camera kit costs $750 (including a VGA port upgrade that is needed so that the two DVRs could be plugged into computer monitors that Dynamy owns). Dynamy would need two systems at a cost of $1500.

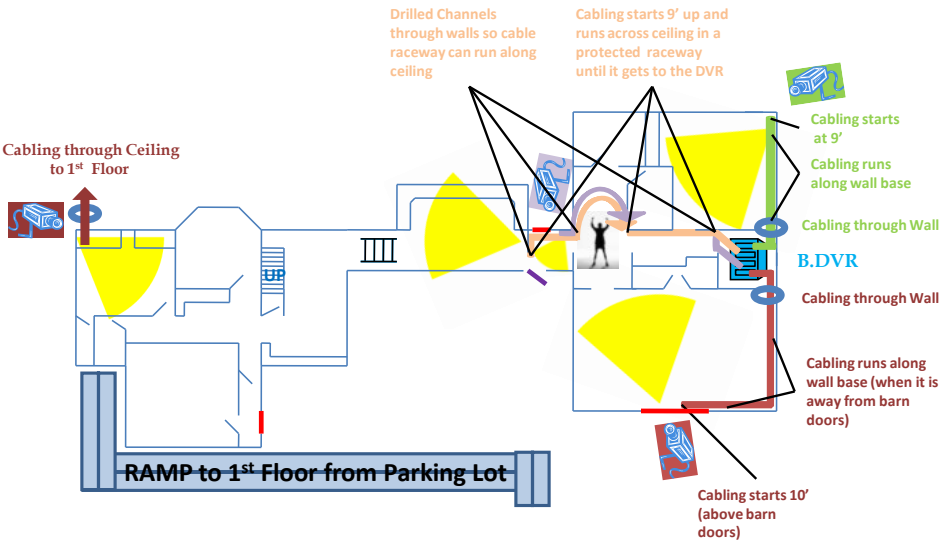
• The outdoor night-vision camera system is the same price as the indoor dome camera system. The benefit of weather-resistance and night-vision is tremendous. And, the night-vision systems allow you to change the size of the camera lens at no-expense. Dynamy will need the option to change lens size at no-expense because 2 of the cameras will need to view hallways (6mm lenses), while the other 6 cameras will need to view rooms (3.6mm lenses).

• Installation equipment, including a screwdriver, drill, and attachments are also needed. This equipment might be owned by Dynamy or Dynamy maintenance crews. Cable raceways would also be needed to route cabling. In addition 2 power strips would be needed to provide outlets for the eight cameras and DVR. A door lock would also be needed to protect the basement DVR. The first-floor DVR is monitored by a camera and can be placed in a locked desk drawer.

# Dynamy Youth Center: Detailed Proposal

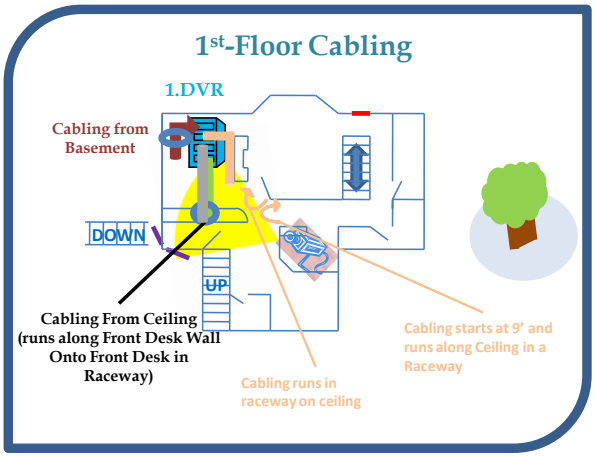
## 5 Basement Cameras with 3.6mm "Wide-Angle" Camera Lenses & 1/3" CCD Sensors (a.k.a. 68-74° of viewing)

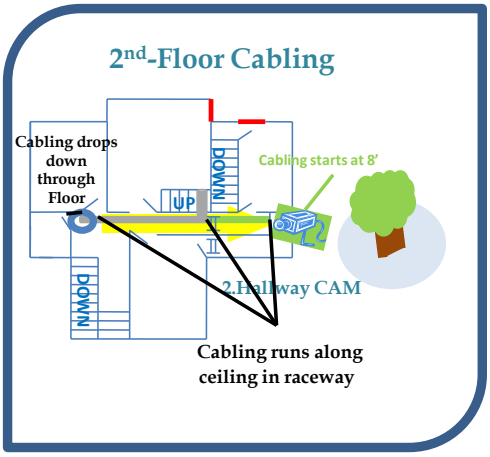
### Basement Diagram

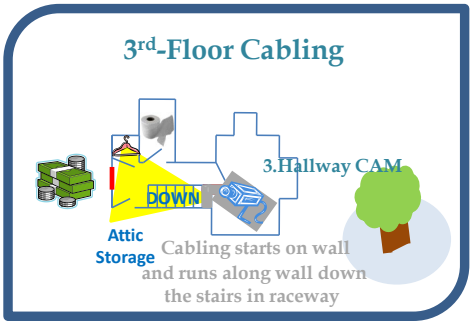



| | |
|---|---|
| **B.Laptop CAM** (attached to ceiling or wall in the comer of the room) | Camera views persons entering laptop computer room (so cable protection is not an issue). Low 7' ceiling does not present a problem because cabling goes through the ceiling to the secretary area (a secure location where the First-Floor DVR is found). |
| **B.Desktop CAM** (attached to ceiling) | Camera secures the desktop computer area. Camera is placed 9' up on the entrance-way wall. This camera has the most challenging cabling. Cabling begins 9' high on the wall and must drop down 1 foot because the ceiling of the entrance-way is 8'. A channel must be drilled through the top of the wall to allow the cable raceway to pass along the ceiling into the entrance-way. The cable raceway runs along the entrance-way ceiling and receives the cabling from the entrance-way camera. A second channel is drilled through a wall of the entrance-way to allow the cable raceway to exit this area. The raceway runs up the wall 1 foot so that it can run along the 9' ceiling. The raceway continues along the ceiling until it gets close to the DVR room. A final channel must be drilled in the wall of the DVR Room so that the cable raceway can enter the room with cables from the Desktop Camera and Entranceway Camera. (The raceway could be vandalized and the cables could be cut in an unmonitored area, footage could be used to determine who was in the area during the cutting of the cables.) |
| **B.Entrance CAM** (attached to ceiling or wall in the comer of the room) | Camera monitors the lone basement entrance. These cables run where the Desktop CAM cables run. |
| **B.Board CAM** (attached to ceiling or wall in the comer of the room) | Camera monitors the board room table and entrance (so cable protection is not an issue). Cables run along the wall base and then through the wall to the next room to the DVR. |
| **B.Conference CAM** (attached to wall) | Camera monitors the conference room entrance way, equipment closet, and one-half of the room. Cable protection is not an issue (because the entranceway is monitored). The cabling eventually runs through the wall to the next room where the DVR is located. |

## 3 Non-Basement Cameras, 1 Camera with a 3.6mm "Wide-Angle" Lens with 1/3" CCD Sensor (68-74° of viewing on 1st - Floor) and 2 Cameras with 6.0mm Lenses and 1/3" CCD Sensors (42-44° of viewing)



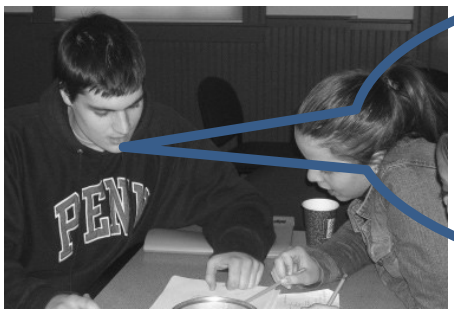

| | |
|---|---|
| **1.Entrance CAM** (Wall or Ceiling) | Camera monitors who enters the first-floor and who uses the stairwell between the 1st and 2nd floors. Camera also monitors the secretary area, where the DVR is found. Cabling starts at 9' and runs along ceiling in a raceway to the secretary area. |
| **2.Hallway CAM** (Wall or Ceiling) | Camera monitors 2nd-floor hallway, where 5 office doors are. Camera also monitors all camera cabling on the 2nd-floor in addition to the stairwells. Cable protection is not an issue because the camera monitors its cabling and the cabling from the 3rd-floor camera. However, cable routing is easiest by running the cables on the ceiling in a raceway down the 2nd-floor hallway. The cables fall through the 2nd-floor when they are above the 1st-floor secretary desk. The cables continue to run through a raceway down the wall and end at the secretary area where the DVR is. |
| **3.Hallway CAM** (Wall at Bannister Level) | Camera monitors all of the 3rd-floor hallway and stairwell area. Cabling runs down the wall of the stairwell to the 2nd-floor where it enters the cable raceway of the 2nd-floor camera. It runs in the raceway to the DVR. |

# Dynamy Youth Center: Estimated Costs

| ITEM | COST |
|---|---|
| 2 x 4 Camera Security Kits + Shipping | $1600 |
| 2 x PowerStrips | $30 |
| Cable Raceway (120FT) | $120 |
| Cable Clips (fasten cables to wallbase) | $20 |
| Door Lock (Basement) + Spare Keys | $40 |
| Memory Backup (USB or CDs or DVDs) | $40 |
| *TOTAL (Essential Items)* | *$1850* |
| | |
| Drill and Attachments | $100 |
| Screw Driver | $5 |
| Stud Finder | $25 |
| *TOTAL ( with Optional Items)* | *$1980* |

# Dynamy Youth Center: Security Camera Proposal Final Words

- **Dynamy should consider CCTV to deter crime, maintain a safe environment, and to catch criminals.**
- **CCTV can ONLY be affordable (under $2,000) if Dynamy personnel install the security system in a "Do-It-Yourself" fashion.**
- **CCTV installation (especially cabling) is easiest with 2 x 4-Camera Systems as opposed to 1 x 8-Camera system.**



*"I've been at Dynamy for the past 4 years and I still don't know half of the people I see coming and going. The Youth Center should remain open and welcoming – welcoming to anyone willing to smile at the cameras!"*

-The Tutor

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*CCTV in Britain*." Center for Criminology and Criminal Justice School of Comparative and Applied Social Sciences University of Hull. March 2002.

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# Dynamy Youth Center
# Do-It-Yourself
# Security-Camera Proposal

**Ryan Philip Jajosky**

**“The Tutor”**

**April 2008**

# Dynamy Youth Center: Security Camera Options

## Option #1 (not recommended): Pay Professionals ($10-15K)

Pay ADT Security $10-15,000 for a Professional Security Camera System with Installation

## Option #2 (my recommendation): Do-It-Yourself (≈$2000)

- Buy 2 x 4-Camera Surveillance Kits online (easier to install cabling to 2 separate systems). The equipment, shipping costs, and installation equipment will cost about $2000.
- Install the 2 kits yourself!!! (Call it a Team-Building Activity)
- Each kit should include:
    - 4-Channel Digital Video Recorder (with at least 80 GB of Memory)
    - 4 Cameras (with 1/3" or larger Sony Super HAD CCD Sensors)
    - 4 Plug N Play (PNP) Cables at least 50-feet long
- Cable Routing Equipment (Separate from CCTV Security Camera Kit)
    - 120 feet of Cable Raceway Track (to safely run cables on the ceiling)
    - Cable Clips to secure cables to wallbase
- 2 Power Strips will be needed to manage the power to the 8 cameras and two DVRs.
- A Lock would need to be installed on the door where the basement DVR is stored. The 1st-floor DVR would need to be in a locked desk drawer. (A security camera on the first floor monitors the first-floor DVR.)

**This Presentation Explains how to "Do-It-Yourself"**

# Security Camera Systems

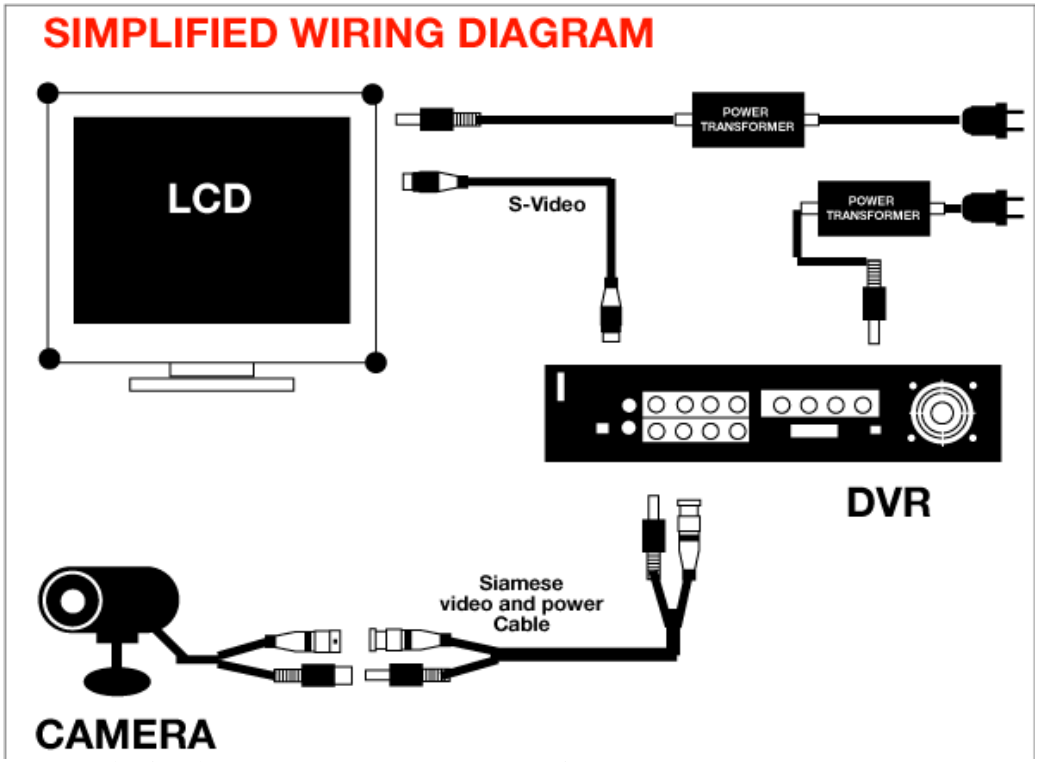



**Image Obtained From EBay Store HomeSecurity4Less**

**Video Cables go from the Cameras to the DVR to the Monitor**
**Power Cables supply energy to each component**

**The Digital Video Recorder (DVR) records what the camera sees onto a hard drive. The DVR sends the video signal to a monitor to be displayed for a person to see. The DVR automatically records onto the oldest video data when it runs out of memory. The DVR also has special features, like motion-activated recording, to save memory.**

**Most DVR Connections are BNC!!!**

# Camera Surveillance Components

## Cameras

Image quality is the most important feature. CCD sensors are better than CMOS. And, large 1/3" sensors are better than 1/4" sensors. TV Lines (TVL) measure image quality. 420 TVL is considered standard quality. (380 TVL is also good quality.)

## Cables

Plug and Play Cables are easy to install! They have RCA Connections. A small RCA to BNC connection is added (yellow) so that the cables can connect to a DVR

Image Obtained From CCTVCameraPros.Com

## DVR

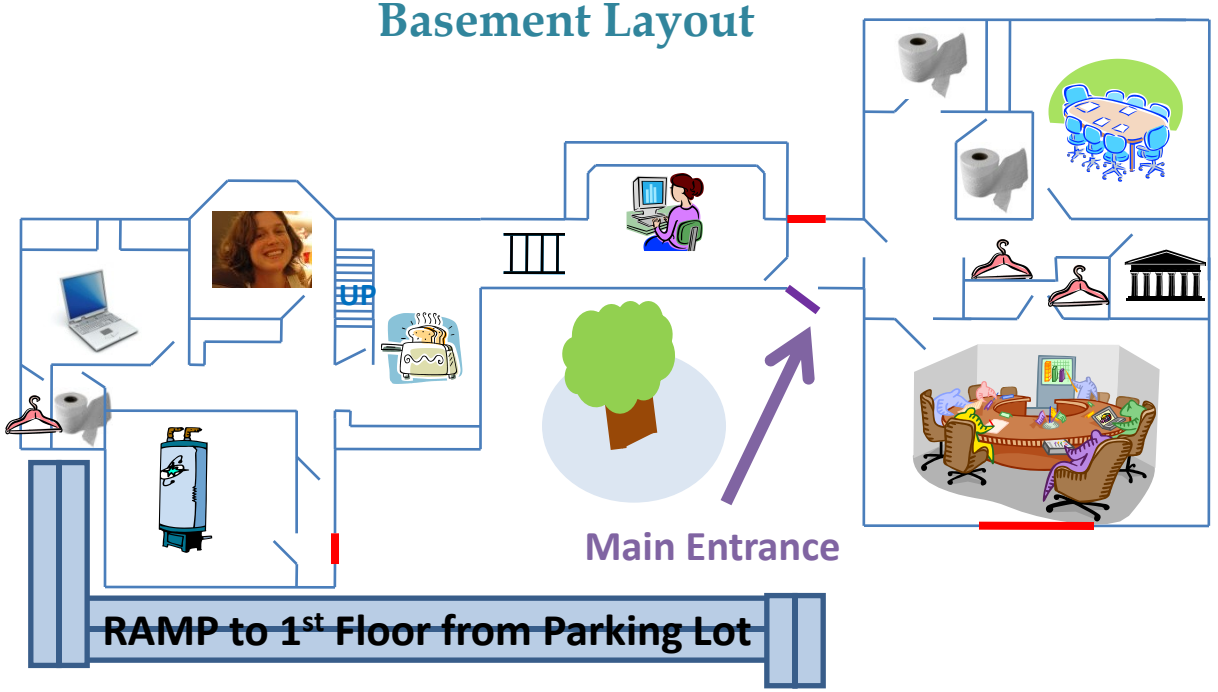
It is important to have at least 80GB of memory for each 4-CAM system. The DVR should have motion-activation so that it doesn't record when there is no movement. One of these backup methods should be present: USB, CD writer, or DVD writer. This way, video files can be transferred to a computer and printed.

## Monitor

LCD PC Monitors connect to the VGA Port on the DVR. If there is no VGA Port, a BNC to VGA converter cable is needed.

# Dynamy Youth Center: Layout

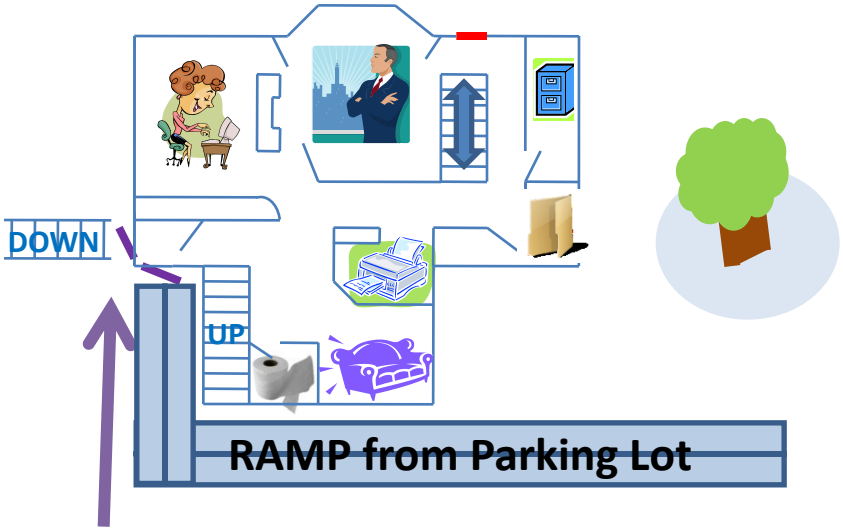
## Basement Layout




## LEGEND

| | | |
|---|---|---|
| Desktop Computer Lab | Sara's Office | Board Room (Intense!) |
| Laptop Computer Lab | College Counseling Room | Conference Room |
| Lavatory | Closet | Water Heater Room |
| | | Kitchen |

## 1st-Floor Layout

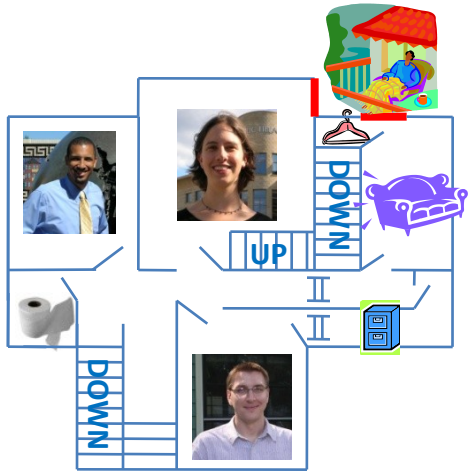



Main Entrances

## LEGEND

| | | | |
|---|---|---|---|
| Secretary and Help Desk | Director's Office | Xerox Room | |
| Lavatory | Sitting Room | Small Office | File Room |

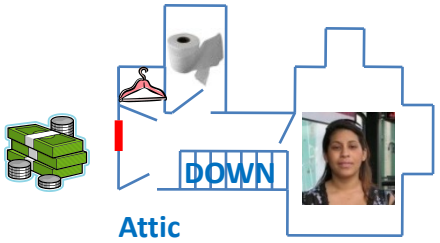
## 2nd-Floor Layout




## LEGEND

| | | | |
|---|---|---|---|
| Balcony & Fire Escape | Office of Executive Director | Joe's Office | Small Office |
| Lavatory | Allyson's Office | Sitting Room | Closet |

## 3rd-Floor Layout



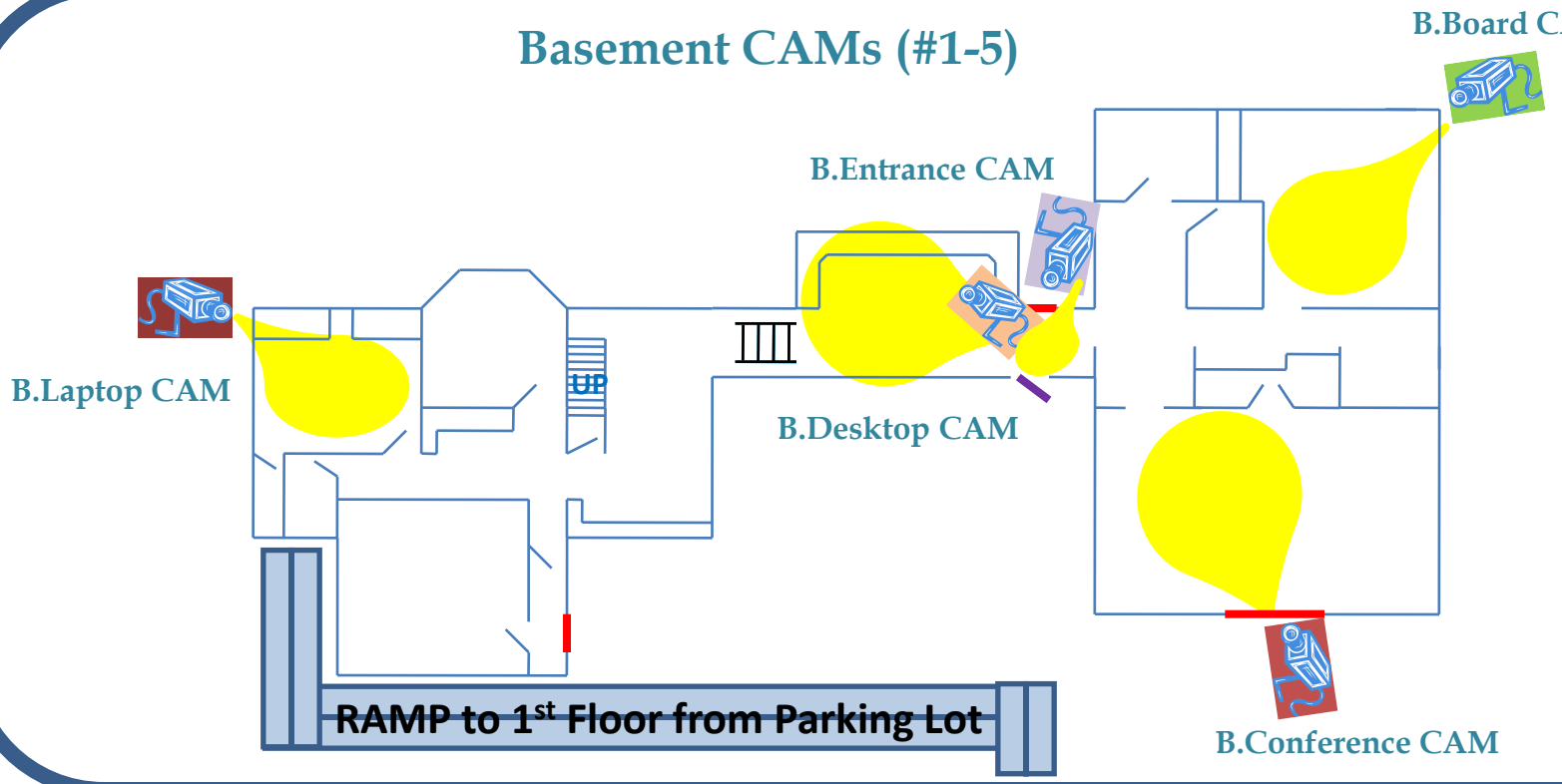

Attic Storage

## LEGEND

| | | | |
|---|---|---|---|
| Raquel's Office | Lavatory | Closet | The Bookkeeper |

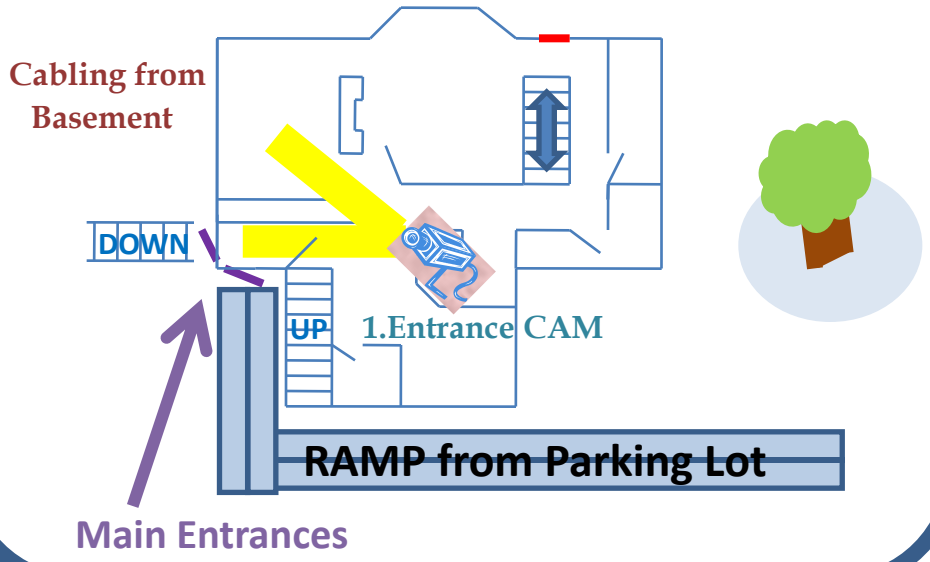
# Dynamy Youth Center: Camera Placement Recommendation

## Basement CAMs (#1-5)

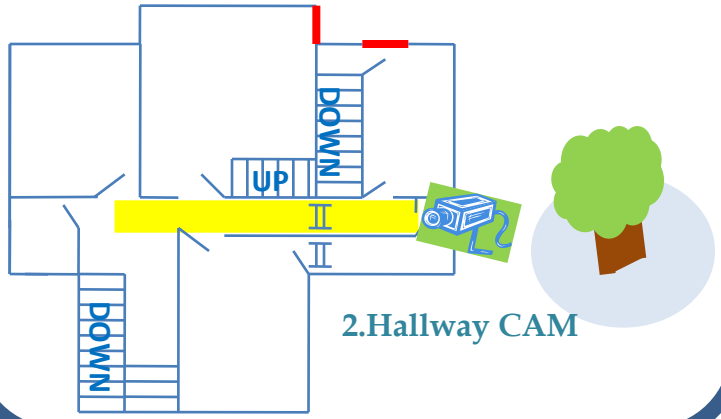



- B.Conference CAM – Overlooks entrance, equipment closet, and half of the total room
- B.Board CAM – Overlooks entrance and board room table
- B.Desktop CAM – Overlooks desktop computer area and printer
- B.Laptop CAM – Overlooks entrance and laptop computers
- B.Entrance CAM – Overlooks main basement entrance to Dynamy.

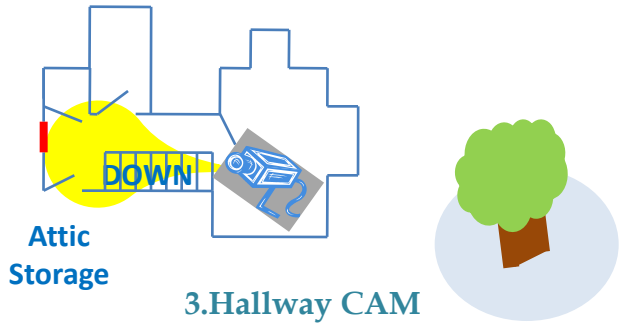
## 1st-Floor CAM (#6)




## 2nd-Floor CAM (#7)




## 3rd-Floor CAM (#8)




- 1.Entrance CAM – Overlooks first-floor entrances to Dynamy, stairwell to 2nd floor, part of the secretary area and the DVR.
- 2.Hallway CAM – Overlooks entrances to 5 offices, and stairwells.
- 3.Hallway CAM – Overlooks area leading to two offices and the attic storage area.

# Dynamy Youth Center:
# 8-Camera Kit or 2 x 4-Camera Kits

**$1260**

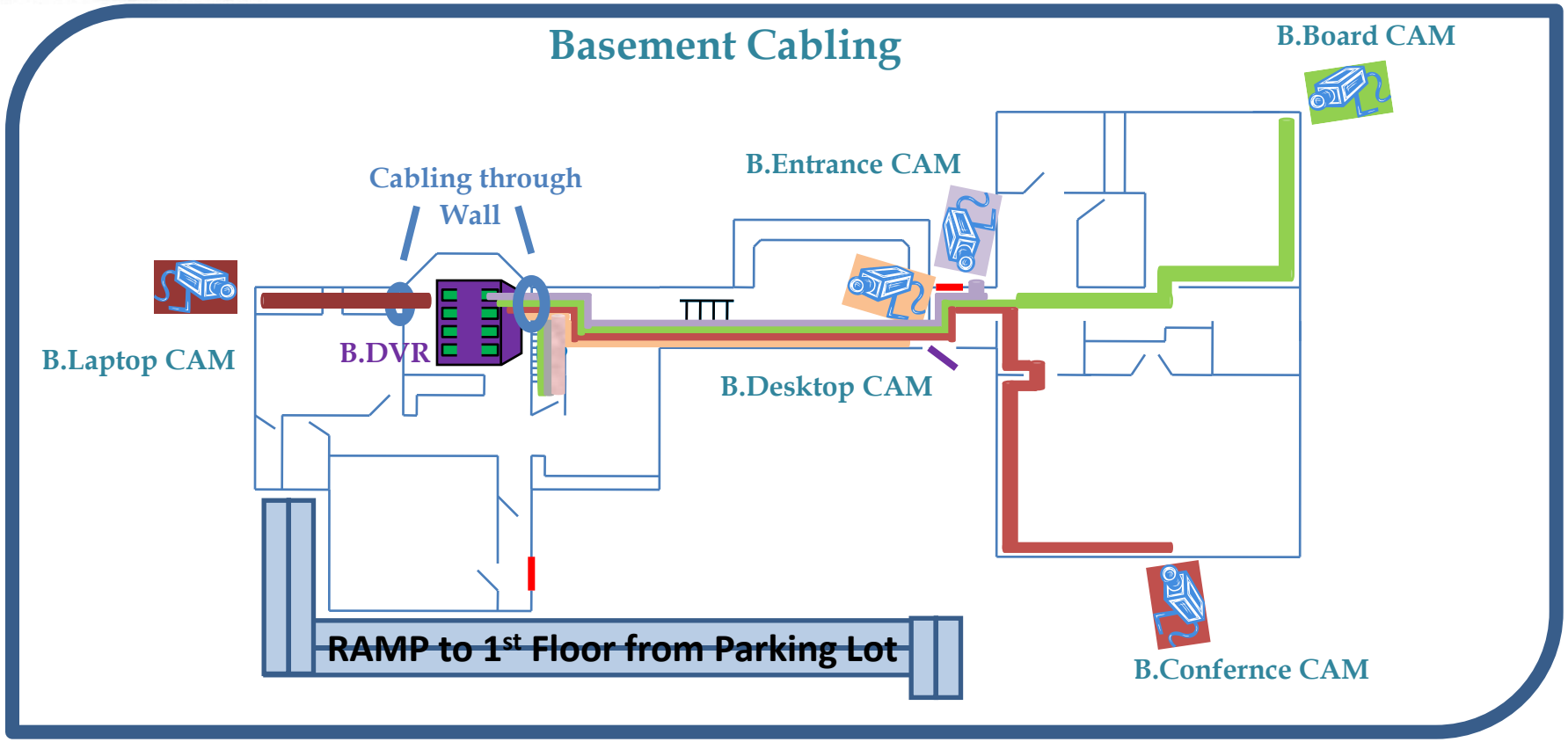
Images Obtained From CCTVFactory.com

or

**$1400**

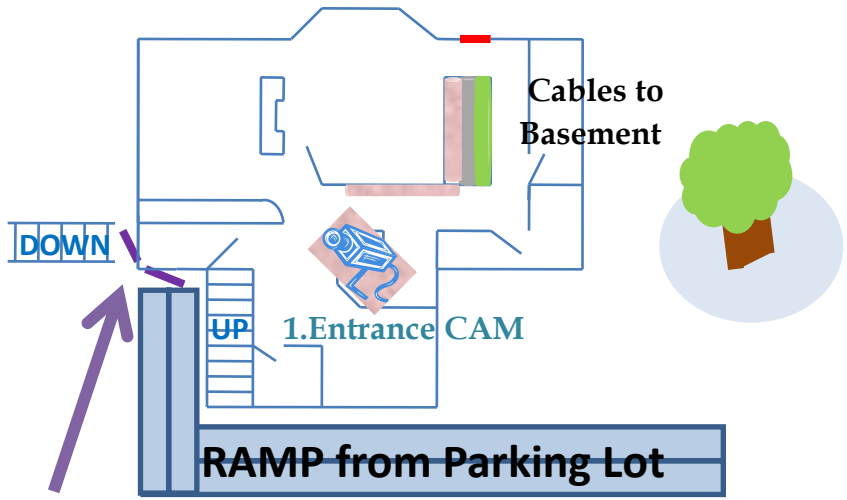
**The Cabling Diagrams for both Systems are Shown Next!**

# Dynamy Youth Center: Cabling (1 DVR Setup)

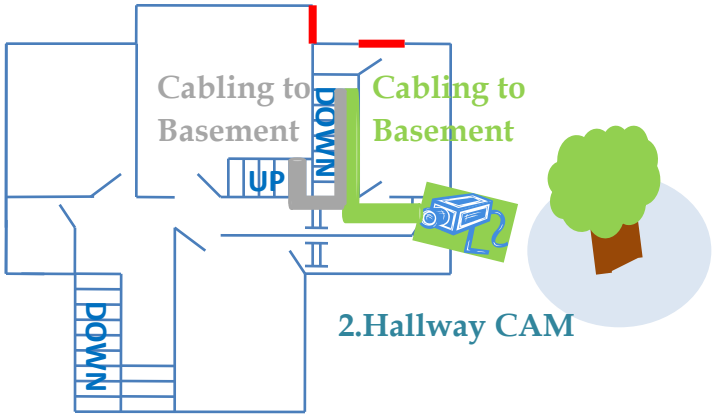



- Cable routes significantly longer than 50 feet.
- A "Cable-Cutter" could NOT be identified using camera footage and logic.
- Running 8 Cables to one location adds complexity and makes installation difficult.

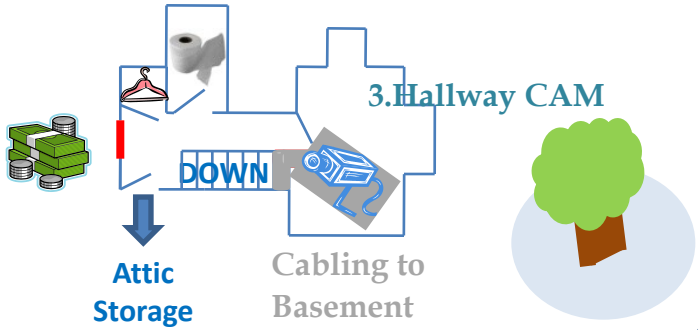
## 1st-Floor Cabling



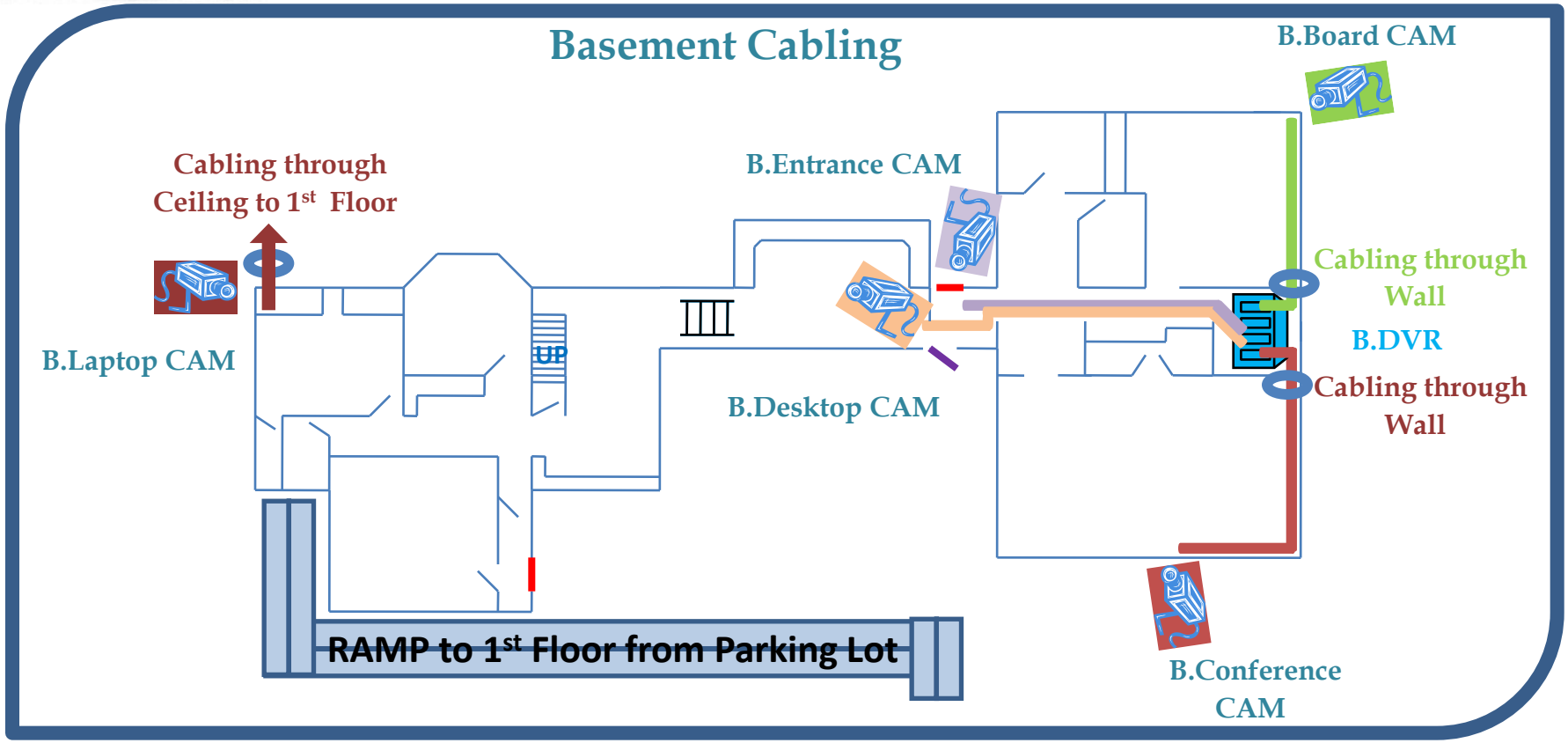

## 2nd-Floor Cabling




## 3rd-Floor Cabling

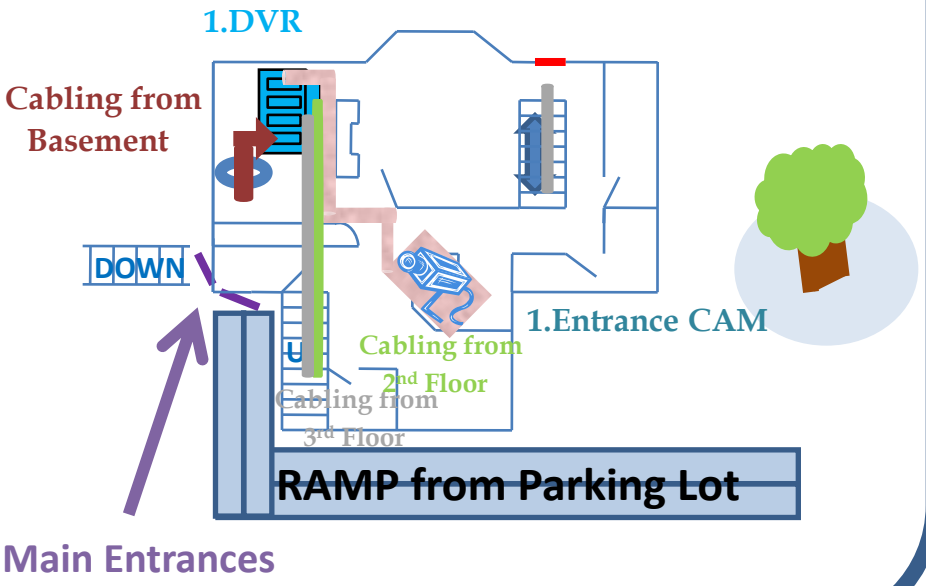


# Dynamy Youth Center: Cabling (2 DVR Setup)

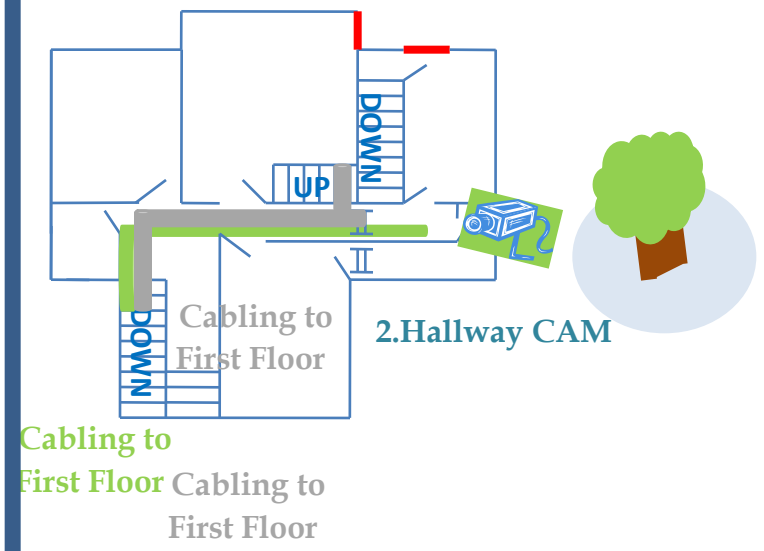



- Cable routes shorter than 50 feet.
- A "Cable-Cutter" could be identified using camera footage and logic.
- Cabling is much simpler with 2 DVRs compared to having just 1 DVR.

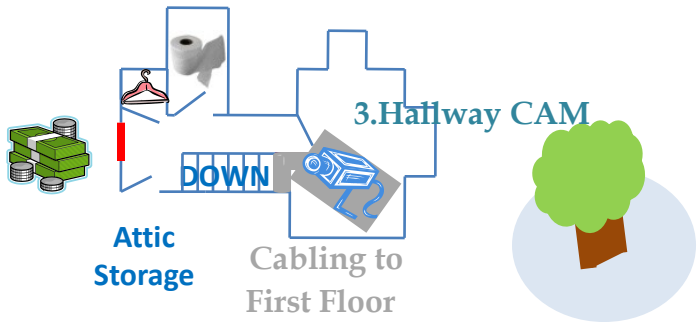
## 1st-Floor Cabling




## 2nd-Floor Cabling




## 3rd-Floor Cabling



# 2-DVR "Simple Cabling" Setup Proposal

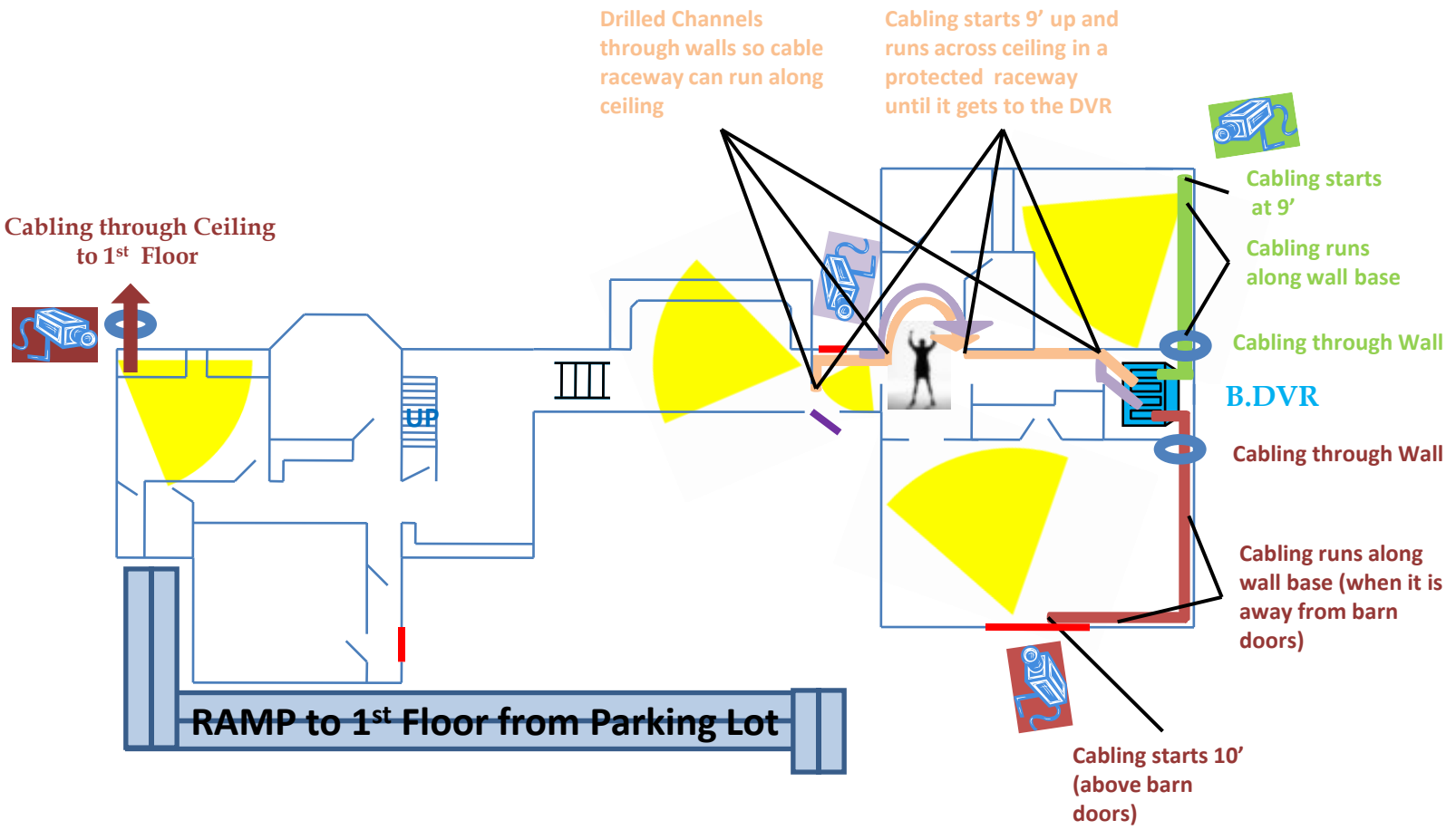
Images Obtained From CCTVFactory.com

- Buy 2 x 4-Camera CCTV Systems from *CCTVFactory.com*. *CCTVFactory.com* provides a rare feature that other discount Security companies do not provide – *the ability to customize the kit.*
- Each 4 Camera kit costs $750 (including a VGA port upgrade that is needed so that the two DVRs could be plugged into computer monitors that Dynamy owns). Dynamy would need two systems at a cost of $1500.
- The outdoor night-vision camera system is the same price as the indoor dome camera system. The benefit of weather-resistance and night-vision is tremendous. And, the night-vision systems allow you to change the size of the camera lens at no-expense. Dynamy will need the option to change lens size at no-expense because 2 of the cameras will need to view hallways (6mm lenses), while the other 6 cameras will need to view rooms (3.6mm lenses).
- Installation equipment, including a screwdriver, drill, and attachments are also needed. This equipment might be owned by Dynamy or Dynamy maintenance crews. Cable raceways would also be needed to route cabling. In addition 2 power strips would be needed to provide outlets for the eight cameras and DVR. A door lock would also be needed to protect the basement DVR. The first-floor DVR is monitored by a camera and can be placed in a locked desk drawer.

# Dynamy Youth Center: Detailed Proposal

## 5 Basement Cameras with 3.6mm "Wide-Angle" Camera Lenses & 1/3" CCD Sensors (a.k.a. 68-74º of viewing)

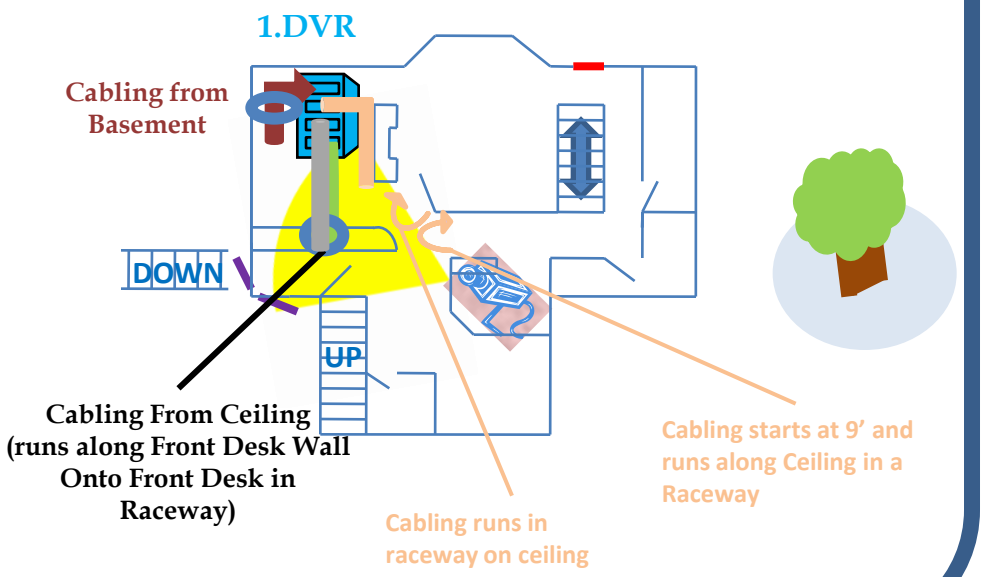
### Basement Diagram



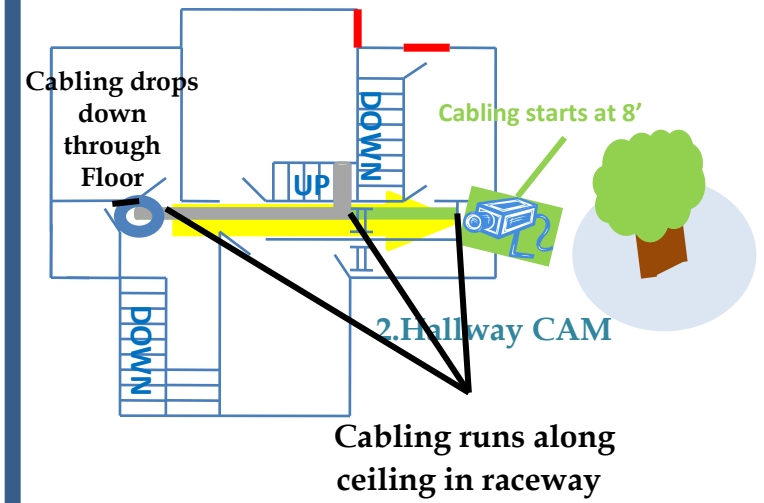
| | |
|---|---|
| **B.Laptop CAM** (attached to ceiling or wall in the comer of the room) | **Camera views persons entering laptop computer room (so cable protection is not an issue). Low 7' ceiling does not present a problem because cabling goes through the ceiling to the secretary area (a secure location where the First-Floor DVR is found).** |
| **B.Desktop CAM** (attached to ceiling) | **Camera secures the desktop computer area. Camera is placed 9' up on the entrance-way wall. This camera has the most challenging cabling. Cabling begins 9' high on the wall and must drop down 1 foot because the ceiling of the entrance-way is 8'. A channel must be drilled through the top of the wall to allow the cable raceway to pass along the ceiling into the entrance-way. The cable raceway runs along the entrance-way ceiling and receives the cabling from the entrance-way camera. A second channel is drilled through a wall of the entrance-way to allow the cable raceway to exit this area. The raceway runs up the wall 1 foot so that it can run along the 9' ceiling. The raceway continues along the ceiling until it gets close to the DVR room. A final channel must be drilled in the wall of the DVR Room so that the cable raceway can enter the room with cables from the Desktop Camera and Entranceway Camera. (The raceway could be vandalized and the cables could be cut in an unmonitored area, footage could be used to determine who was in the area during the cutting of the cables.)** |
| **B.Entrance CAM** (attached to ceiling or wall in the comer of the room) | **Camera monitors the lone basement entrance. These cables run where the Desktop CAM cables run.** |
| **B.Board CAM** (attached to ceiling or wall in the comer of the room) | **Camera monitors the board room table and entrance (so cable protection is not an issue). Cables run along the wall base and then through the wall to the next room to the DVR.** |
| **B.Conference CAM** (attached to wall) | **Camera monitors the conference room entrance way, equipment closet, and one-half of the room. Cable protection is not an issue (because the entranceway is monitored). The cabling eventually runs through the wall to the next room where the DVR is located.** |

# 3 Non-Basement Cameras, 1 Camera with a 3.6mm "Wide-Angle" Lens with 1/3" CCD Sensor (68-74° of viewing on 1st - Floor) and 2 Cameras with 6.0mm Lenses and 1/3" CCD Sensors (42-44° of viewing)

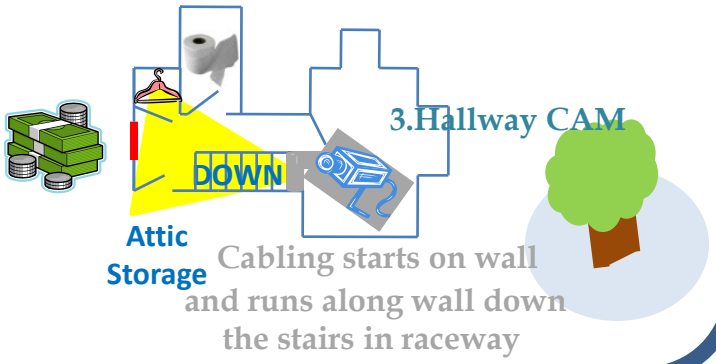
## 1st-Floor Cabling




## 2nd-Floor Cabling




## 3rd-Floor Cabling



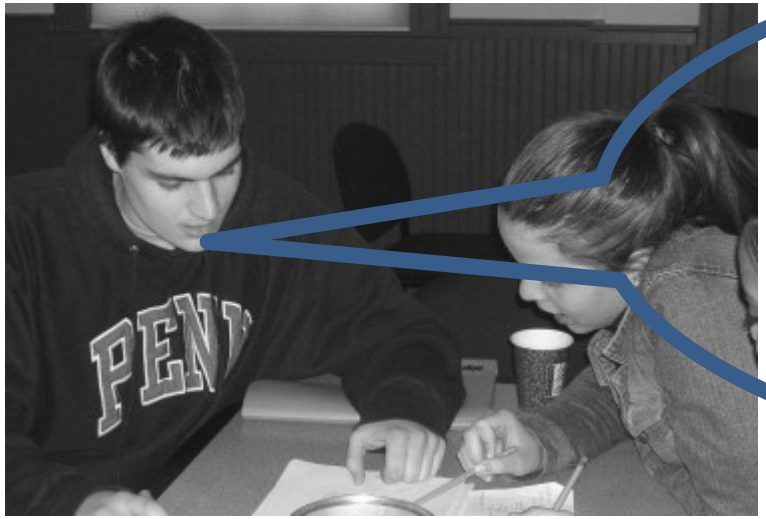
| | |
|---|---|
| **1.Entrance CAM** (Wall or Ceiling) | **Camera monitors who enters the first-floor and who uses the stairwell between the 1st and 2nd floors. Camera also monitors the secretary area, where the DVR is found. Cabling starts at 9' and runs along ceiling in a raceway to the secretary area.** |
| **2.Hallway CAM** (Wall or Ceiling) | **Camera monitors 2nd-floor hallway, where 5 office doors are. Camera also monitors all camera cabling on the 2nd-floor in addition to the stairwells. Cable protection is not an issue because the camera monitors its cabling and the cabling from the 3rd-floor camera. However, cable routing is easiest by running the cables on the ceiling in a raceway down the 2nd-floor hallway. The cables fall through the 2nd-floor when they are above the 1st-floor secretary desk. The cables continue to run through a raceway down the wall and end at the secretary area where the DVR is.** |
| **3.Hallway CAM** (Wall at Bannister Level) | **Camera monitors all of the 3rd-floor hallway and stairwell area. Cabling runs down the wall of the stairwell to the 2nd-floor where it enters the cable raceway of the 2nd-floor camera. It runs in the raceway to the DVR.** |

# Dynamy Youth Center: Estimated Costs

| ITEM | COST |
|---|---|
| 2 x 4 Camera Security Kits + Shipping | $1600 |
| 2 x PowerStrips | $30 |
| Cable Raceway (120FT) | $120 |
| Cable Clips (fasten cables to wallbase) | $20 |
| Door Lock (Basement) + Spare Keys | $40 |
| Memory Backup (USB or CDs or DVDs) | $40 |
| *TOTAL (Essential Items)* | *$1850* |
| | |
| Drill and Attachments | $100 |
| Screw Driver | $5 |
| Stud Finder | $25 |
| *TOTAL ( with Optional Items)* | *$1980* |

# Dynamy Youth Center: Security Camera Proposal Final Words

- ❑ **Dynamy should consider CCTV to deter crime, maintain a safe environment, and to catch criminals.**
- ❑ **CCTV can ONLY be affordable (under $2,000) if Dynamy personnel install the security system in a "Do-It-Yourself" fashion.**
- ❑ **CCTV installation (especially cabling) is easiest with 2 x 4-Camera Systems as opposed to 1 x 8-Camera system.**




*"I've been at Dynamy for the past 4 years and I still don't know half of the people I see coming and going. The Youth Center should remain open and welcoming – welcoming to anyone willing to smile at the cameras!"*

-The Tutor