

## **1. SCOPE**

Free TV Australia Operational Practice 33 is a guideline for the minimum requirements for live television coverage of Australian Football League (AFL) games. It provides an indication of infrastructure for an outside broadcast production using contemporary production techniques which meet commercial television presentation formats.

This Operational Practice has been developed by the Free TV Australia Project Group - Outside Broadcasts in the interests of maximising TV and Radio production potential and productivity at sports venues and avoidance of costly omissions at planning and construction stages.

TVOB coverage of AFL has progressed and expanded with the general availability of “super slo-mo” cameras, digital cable-less (wireless) cameras, and a range of special effects cameras. These developments have increased the venue space and infrastructure installation requirements for TV operations.

AFL TV rights are currently held by three separate TV networks, each with differing levels of coverage for Friday (night) matches, Saturday (day / night) matches and Sunday matches. Whilst “core” coverage is generally similar each network has its individual approach. The number of cameras may vary between 8 and 16 for regular round matches and camera positions and camera numbering may vary between networks.

The high level of coverage will be further augmented for feature matches (Anzac Day, Grand Final). Additional requirements for these matches will be negotiated with venue managements on a case by case basis.

## **2. TYPICAL COVERAGE**

### **2.1 CAMERAS**

The configuration of a typical AFL game at an approved venue will be:

Cameras covering the field of play	8 - 12
Cameras for O/B studio	2
Dressing Room POV cameras	2

### **2.2 CAMERA POSITIONS**

**Camera 1**                      **Above Centre Line**                      **OB Camera**                      **Tele zoom**

Positioned on the centre line of the ground at a height of 15 metres above the playing field and 25 metres back from the outer boundary of the playing field.

**Camera 2**                      **Above Centre Line**                      **OB Camera**                      **Tele zoom**

Positioned next to Camera 1 on the centre line of the ground at a height of 15 metres above the playing field and 25 metres back from the outer boundary of the playing field.

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## TV COVERAGE PLAN FOR AFL MATCHES

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<b><u>Camera 3</u></b>	<b>Cam left low 25/50</b>	<b>Slo Mo Camera</b>	<b>Tele zoom</b>
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Positioned on the edge of the playing surface behind the boundary fence, adjacent to the camera left 50 metre line on the same side of the ground as Cameras 1 and 2.

<b><u>Camera 4</u></b>	<b>Cam right low 25/50</b>	<b>Slo Mo Camera</b>	<b>Tele zoom</b>
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Positioned on the edge of the playing surface behind the boundary fence, adjacent to the camera right 50 metre line on the same side of the ground as Cameras 1 and 2.

<b><u>Camera 5</u></b>	<b>Cam left behind goal</b>	<b>OB Camera</b>	<b>Tele zoom</b>
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Positioned directly behind the centre of the camera left goalposts at a height of 15 metres above the playing field and 25 metres back from the outer boundary of the playing field.

<b><u>Camera 6</u></b>	<b>Cam right behind goal</b>	<b>OB Camera</b>	<b>Tele zoom</b>
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Positioned directly behind the centre of the camera right goalposts at a height of 15 metres above the playing field and 25 metres back from the outer boundary of the playing field.

<b><u>Camera 7</u></b>	<b>Field portable</b>	<b>20/1 zoom</b>	<b>(possible RF)</b>
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Portable camera operating on the sideline beside the interchange benches as defined by the AFL. On the same side of the ground as Cams 1 and 2. Allow for extension cabling to the opposite side of the ground. The camera works with a 100 metre head cable and can be used for dressing room interviews.

<b><u>Camera 8</u></b>	<b>Field portable</b>	<b>20/1 zoom</b>	<b>(possible RF)</b>
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Portable camera operating on the sideline beside the interchange benches as defined by the AFL. On the same side of the ground as Cams 1 and 2. Allow for extension cabling to the opposite side of the ground. The camera works with a 100 metre head cable and can be used for dressing room interviews.

<b><u>Camera 9</u></b>	<b>High 50</b>	<b>OB Camera</b>	<b>Tele zoom</b>
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Positioned on the camera left 50 metre line 10 to 15 metres above the field of play and 25 metres back from the outer boundary line.

<b><u>Camera 10</u></b>	<b>High 50</b>	<b>OB Camera</b>	<b>Tele zoom</b>
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Positioned on the camera left 50 metre line 10 to 15 metres above the field of play and 25 metres back from the outer boundary line.

<b><u>Camera 11</u></b>	<b>Reverse angle</b>	<b>Slo Mo Camera</b>	<b>Tele zoom</b>
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Positioned on centre line on the opposite side of the ground to Cameras 1 and 2, 10 to 15 metres above the field of play and 25 metres back from the outer boundary line.

<b><u>Camera 12</u></b>	<b>Player cam (Spy cam)</b>	<b>OB Camera</b>	<b>Tele zoom</b>
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To be positioned alongside Cameras 1 and 2 where possible.

**Camera 13      Dressing room POV**

Miniature (unmanned) camera mounted on wall of home dressing room with remote controlled PTH, zoom, focus and iris.

**Camera 14      Dressing room POV**

Miniature (unmanned) camera mounted on the wall of the visitors dressing room with remote controlled PTH, zoom, focus and iris.

**Camera 15      Studio host camera**

Portable camera on tripod 20/1 zoom, positioned in commentary box (or studio) for hostings.

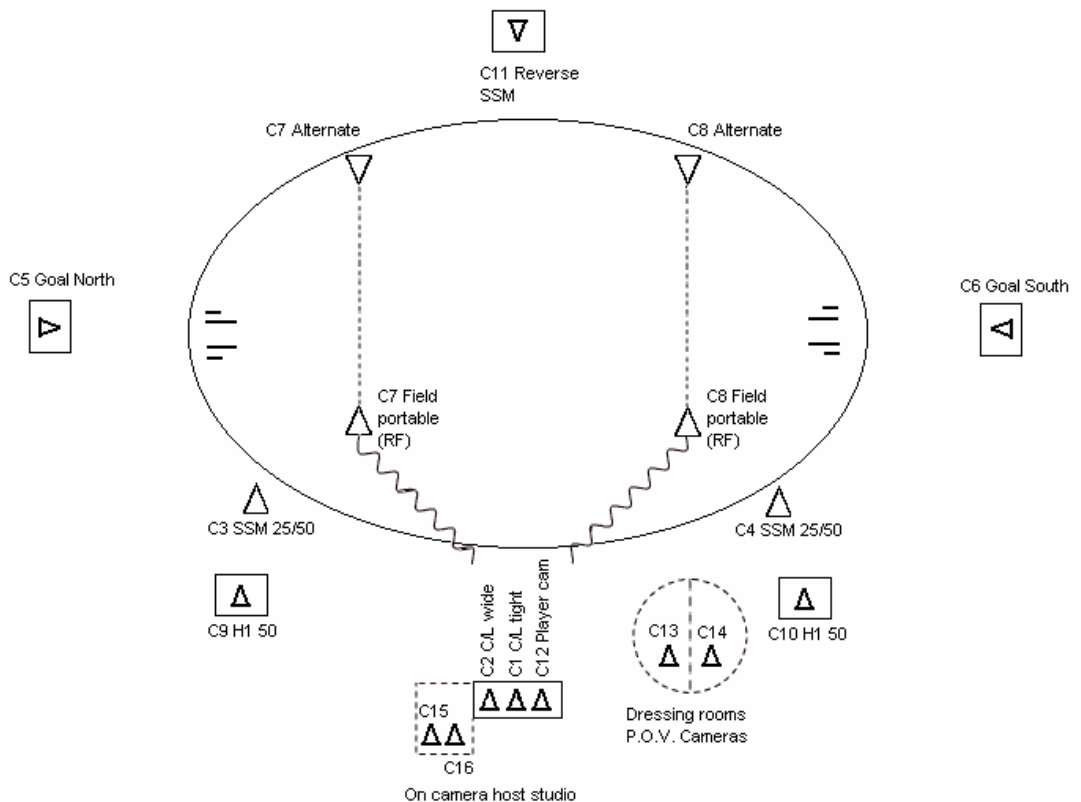
**Camera 16      Studio host camera**

Portable camera on tripod 20/1 zoom, positioned in commentary box (or studio) for hostings.

**Special Cameras**

Special cameras additional to above may be used at major event matches. These can include camera cranes, rail cameras, helicopters, blimps etc. Special camera requirements shall be negotiated in the lead up to major matches.

**Fig 1:      Nominal Camera Positions**



**2.2.1 Camera Configurations**

C1	OB Camera	50:1 Zoom
C2	OB Camera	50:1 Zoom
C3	OB Super slo-mo	70:1 Zoom
C4	OB Super slo-mo	70:1 zoom
C5	OB Camera	50:1 Zoom
C6	OB Camera	50:1 Zoom
C7	Portable Camera (possible RF)	20:1 Zoom
C8	Portable Camera (possible RF)	20:1 Zoom
C9	OB Camera	50:1 Zoom
C10	OB Camera	50:1 Zoom
C11	OB Super slo-mo	70:1 zoom
C12	OB Camera on roof	50:1 Zoom
C13	POV	WA Zoom
C14	POV	WA Zoom
C15	Portable camera on tripod	20:1 Zoom
C16	Portable camera on tripod	20:1 Zoom

**2.2.2 Final camera placement**

The above camera positions are typical of an AFL coverage but final camera placement will always be at the prerogative of the program producer and director.

**2.3 COMMENTARY BOXES****2.3.1 Commentary Box Position**

The main TV commentary box should be on centre line, nominally at a height of 15 metres above the playing field and 25 metres back from the boundary, with a clear view of the entire field, including the 'players bench' and should not be obstructed by the camera platform. The TV commentary box is required to accommodate up to 4 x commentators, TV producer, Associate Producer and Statistician, with commentators seated at the front of the box, and production staff on a raised platform to the rear of the commentators.

Provision is required for cable installation from the OB compound.  
(See CABLING)

**2.3.2 Commentary Box Dimensions**

Typical size for the main commentary box is in the order of 6 metres frontage x 6 metres deep.

**2.3.3 Studio**

A TV Studio area is required adjacent to the TV commentary box for hosting of the TV program. Typical dimensions for TV studio are 6metres x 6metres preferably with 3.6 metres (minimum) ceiling height and (background) view to the field of play.

The commentary box / studio area needs to be air conditioned with capacity to cope with up to a 12 person heat load plus studio lighting load. Evaporator fans need to be low noise units (Not to exceed NR 35) with local control for optional shut down during studio on air segments.

Lighting Bars are to be installed in the studio / on camera area for mounting of TV lights. Location and load capacity of the bars is to be decided in consultation between venue management and TV Technical representatives.

A 30 Ampere three phase interconnect cable is required from the OB compound for lighting power.

#### **2.3.4 Combined Facility**

At some venues, due to architectural restrictions, the main camera deck, commentary box and on-camera area share a common space. Typical dimensions for a shared area are in the order of 14 metres frontage x 6 metres deep. The on-camera area needs to be acoustically isolated from the commentary / camera area. Air conditioning requirements are as above.

#### **2.3.5 Change Area**

An area adjacent to the commentary box/studio area is required for off camera preparations including make-up, wardrobe etc. The change area should include kitchen facilities, and male and female toilet facilities. Typical room size would be in the order of 4metres x 4 metres.

#### **2.3.6 Unilateral Commentary Box**

A unilateral TV commentary box should be provided for international/interstate unilateral commentaries. The unilateral commentary box should be sited similarly to the main TV Commentary Box, similarly equipped and fitted out.

Dimensions for the unilateral commentary box are in the order of 4 metres x 4 metres.

#### **2.3.7 Radio Commentary Boxes**

Provision needs to be made for Radio broadcast boxes adjacent to the TV box area.

Nominal area for a Radio box is 3.5m x 3.5m with clear sight line to the field of play and to the main scoreboard.

Coax, Telco and screened audio cables need to be installed between the TV OB area and radio commentary boxes to provide for video replays, sound splits and communications circuits between radio and TV services.

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**2.3.8 Sideline Commentary position**

On field space is to be allocated to TV operations at centre line, western side, for sideline commentator/s. Personnel requiring sideline space, additional to commentator/s are: producer, floor manager, audio assistant.

Space provision also needs to be made for a half equipment rack to house wireless microphones and associated equipment.

**2.3.9 Arena lights**

Arena lights should remain ON following end of play until end of telecast as the field of play is the hostings backdrop. Arena lights should be switched to training level following the telecast until “bump out” is completed for crew safety.

**2.3.10 Wireless microphones**

Wireless microphones are extensively used for umpire calls and TV / radio interviews. Wireless microphone frequency co-ordination is required on a venue by venue basis to avoid interference with TV operations, radio broadcasters, umpires and linesmen, ground announcers, entertainment, and other legitimate users of wireless microphone equipment.

**2.3.11 Radio Frequency (RF) Spectrum Management**

Extensive use of the RF spectrum is necessary for comprehensive TVOB cover of AFL games.

Allocation of frequency bands is generally as follows:

- 2.5 GHz microwave band: Portable wireless cameras  
In-car camera uplinks  
Relay helicopter down links  
Camera helicopter down links
- 7 / 8 GHz microwave band Medium haul point to point back haul links
- 13 GHz microwave band Short haul point to point back haul and local interconnect links
- 470 – 520 MHz band Duplex Radio Telephone (RT) voice communications  
Telemetry and data communications
- 520 – 820 MHz band Wireless microphone operations
- Aggregate RF systems requirements can be in the order of 12 x 2.5 GHz channels, 4 to 6 x 7 / 8 GHz channels, 4 to 6 x 13 GHz channels
- 10 x UHF duplex RT frequencies and 4 to 6 x wireless microphone frequencies

RF spectrum usage is strictly controlled, and specific channel allocations are generally licensed to individual commercial entities. Temporary use of multiple frequencies as is required for operations on the major event scale require frequency co-ordination with established license holders and special licensing for the complete RF requirements for the period of the event.

It is essential that a rigid frequency management procedure be implemented on a venue by venue basis to ensure non interference between services within the precinct involved in TVOB origination, including authorised unilateral operators, and for other licensed users (ENG etc.) operating in near proximity to the OB precinct.

Wireless microphone frequency management is the prerogative of the event promoter and venue management, but TVOB operators need to be fully involved in channel allocations from the early planning stage of the project.

Microwave and UHF frequencies are licensed but may be subject to frequency sharing arrangements. Co-ordination between users, including news services not directly involved in the event telecast, but licensed to operate in proximity of the event precinct is an essential pre-requisite for event RF spectrum planning.

Major events involving multiple operators of RF services require overall coordination to be under statutory authority control of use / misuse of RF spectrum assets.

### **3. OUTSIDE BROADCAST COMPOUND**

#### **3.1 General**

A level hardstand area for outside broadcast control units (OB Units) parking is required convenient to the camera platform / TV commentary box area.

The OB van compound should be fenced off from public access for security of TV operations, and for public safety.

Major outside broadcast vehicles are semi trailer units built to Australian road transport regulations. Venue vehicle access and load bearing capacity needs to comply with maximum vehicle dimension and weight specifications. Typical requirements are 17.5 metres combined trailer and prime mover length, maximum height of 4.3 metres, and 8.5 tonne per axle loading.

Typical hardstand area is in the order of 500 square metres either 25 metres x 20 metres or 50 metres x 10 metres, rectangular.

Access to and egress from the OB compound needs to cater for the turning circle and overhead clearance requirements of maximum dimension articulated vehicles.

Special attention to overhead obstructions is necessary where ramps or uneven road surfaces are involved.

Generator hardstand should be incorporated in the OB compound (see below).

Provision is to be made to site a satellite uplink vehicle within the compound, or adjacent to the compound with clear line of sight to the North-East sky.

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An additional area of nominal 300 square metres should be available for international unilateral operators.

### **3.2 Personnel Amenities**

Adequate personnel services need to be provided in the OB compound. These amenities should include:

- Toilet facilities, separate male and female facilities
- Sewer or self contained connection, town water connection
- Drainage contours such as to minimise “ponding” during heavy rainfalls
- Food preparation area and catering area
- First Aid facility
- Regular cleaning and rubbish removal services

## **4. POWER**

### **4.1 Typical Requirements**

Typical power requirement is for 150 Ampere per phase three phase supply adjacent to the outside broadcast vehicles hardstand area. Power should be available over 4xthree phase outlets or via ‘Power-lock’ bulk connectors. Industry standard power connections are Cutler Hammer DS63 outlets, Wilco 5 pin 3 phase (40 amp/50 amp) connectors and outlets, and / or “Power Lock” bulk supply connectors.

### **4.2 Heavy Neutral Currents**

The high level of use of switch mode power supplies in TVOB technical equipment has resulted in high neutral current drain in three phase mains supplies. High current neutral connections should be specified for mains power installations planned for TVOB compounds.

### **4.3 Circuit Breakers and Safety**

Where mains power supplies are protected by residual current devices (RCDs) trip current of the source RCD should be adjustable, to be set to a higher trip current level than the main OB van circuit breaker, such that the OB van main circuit breaker serves as the prime safety switch for the TVOB operation.

TVOB mains supplies are to be separately protected from other electrical supplies servicing the entertainment venue.

Power reticulation ex the OB van to operational areas is to be RCD protected in accordance with Work Safety requirements.

#### **4.4 Local and Standby Emergency Generators**

Generator hardstand should be incorporated in the OB compound and should be adjacent to the mains power connect point.

Sourcing of generators is a TVOB responsibility. Generators are to be silenced to EPA requirements and are to be sited to obviate exhaust fume exposure to TVOB staff and patrons.

Where generator hardstand cannot be within the OB van compound interconnect cabling specified to full electrical load (150 Amps / phase, three phase) is required to be installed between the generator site and the OB Compound.

Three phase 30 Ampere rated interconnect cables (Wilco 5 pin connectors) are to be installed between the OB Compound and Commentary box / Studio area, and between the OB Compound and sideline for extension of OB van power to main operational areas.

### **5. AUDIO / VIDEO (A/V) CONNECTIVITY**

#### **5.1 General**

TV program material may be required to be fed to and occasionally returned from other locations. Full quality feeds from the OB unit to another location such as a broadcast station should be over a “Contribution” quality circuit.

Both Standard Definition (SD) and High Definition (HD) picture formats are now expected to be in 16x9 wide screen. For SD, the preferable video connection is component serial digital video (SDI) with at least stereo audio. The alternative for SD and necessary for HD are digital link connections that use MPEG compression systems. However, the degree and type of compression, and as a consequence, the quality loss on such “contribution” circuits, need to be pre-confirmed. In certain circumstances if no other connection is possible, if agreed, an analog video link may be used for SD program material.

Audio requirements may include enhancements such as “Pro-logic” surround stereo encoding or discrete multichannel surround (eg. 5.1 surround). Multichannel audio may be carried in digital AES/EBU circuits in “Dolby-E” format. Additional audio channels may be required if separate music and/or effects channels are required.

In all cases, care is required to ensure that picture-sound delay offsets (lip-sync) are within limits.

#### **5.2 Venue Audio / Video (A/V) Connections**

The connect panel for venue A/V services should be located in the OB compound, co sited with TVOB cable terminations and Telco services.

TV signals emanating from the OB unit will generally be 16x9 wide screen digital video, and at least stereo audio.

The venue A/V service provider would need to provide a format converter for reticulation to any 4x3 in house monitors.

Interface connectors for off-air TV distribution, venue A/V distribution, Foxtel cable and venue phone should be available at the connect panel.

(Refer to Addendum # 1 Cable Installations).

## **6. CABLING**

### **6.1 General**

Simple access is required for cabling from the outside broadcast vehicle hardstand to the main camera platform, roof camera platform, main commentary box, unilateral commentary box, on camera position and field, and to all other operations areas, and to the nominated post match presentation area.

TV cable installations are site specific and need to be planned on an individual basis, but provision needs to be made for cable routes which provide ease of access, do not compromise venue aesthetics and do not present risk to workers or public.

Cable routes within the venue should allow for obstacle free installation and removal of cables.

Wherever possible, ground level cable paths clear of public traffic areas are preferred.

As a general rule provision for day cabling allows for full cable install within a 20 man hour rig time, and de-rig within 12 man hours.

Where this cannot be achieved due to either stadium access problems or to the scale of the OB operation, installation of "SEASON CABLING" is a preferred option.

Cable conduits are not recommended for temporary cable installs, but where there is no other option conduits should be a minimum 150mm diameter with draw wire installed. A minimum of 3x conduits should be available in order to separate signal cables from power cables, and to allow for (inevitable) future expansion.

### **6.2 Permanent Cable Install**

Cable routes in major stadium complexes may be such as to preclude both DAY and SEASON cable installs.

In such cases permanent installations become the only option.

It should be recognised that TV production techniques change, particularly with equipment innovations, and that cable installations are subjected to continuing upgrades.

Implementation of HDTV equipment is impacting on cable installation with increased demand for Fibre optic camera cables, precision digital video coaxial cable, and (multi way) fibre optic cables for utility use.

Co-axial video cable is to be specified for end to end delivery of uncompressed digital video over the installed length of cable.

Cable types and cable technical specifications alter with advances in technology so cable schedules need to be updated prior to planning any permanent installation.

Permanent cable installations should be planned in consultation with venue management and TV Rights holders, with emphasis on specifications for cables, connectors and locations of outlets.

For multi-purpose venues, the total installation should encompass the highest common requirements of all possible event cabling.

Provision needs to be made for replacement and upgrade of such installations.

Preference is for cantilevered cable trays exclusive to TV cabling. Conduits – if provided – should be free of turns no less than 120 degrees from any change of direction. Where conduits are the only option, 150mm diameter is the minimum specification, and multiple conduits should be available to all operations areas with provision for upgrade and expansion.

(See Addendum #1 TVOB Cable Installation requirements for AFL grounds).

## **7. BACKHAUL**

### **7.1 General**

TVOB transmission to studio base can be via Telco circuits, satellite uplink or local microwave radio transmission.

The Telco access point should be adjacent to the OB compound.

Space provision for a satellite uplink vehicle with clear view to North-East sky is required within or adjacent to the OB compound.

### **7.2 Microwave Link Platform**

A 2.0 m x 2.0 m platform is typically required for TVOB backhaul microwave link installation.

The platform is to be sited to allow clear line of sight radio transmission to the TV studios or to a suitable intermediate relay site.

A microwave platform may also be required within the stadium for mounting of (manned or unmanned) wireless camera microwave receivers.

The provision of microwave link platforms at the stadium will depend on the surrounding topography and available link paths in and out of the stadium.

Any structures need to comply with relevant Occupational Health & Safety (OH&S) regulations.

## **8. LIGHTING**

(Reference should be made to FREE TV AUSTRALIA OP 31: *Lighting Requirements for Colour Television.*)

### **8.1 International Standard for Colour TV Lighting at Sports venues**

Design criteria for development projects should meet an international standard with mechanical and electrical specifications to provide for upgrade to (future) HDTV standards.

Lighting level (EV) toward cameras	1400 lux
Colour temperature (TK)	4000 Kelvin to 5600 Kelvin within 500 Kelvin at individual venues
Colour rendering index (Ra)	>90

### **8.2 Local Standards**

Existing stadiums that do not meet international standards are classified as follows:

#### **8.2.1 Professional Standard** (Minimum standard for TV cover)

EV toward cameras	1000 lux
Colour temperature	As above
Colour rendering index (Ra)	Minimum 65, > 90 preferred

Whilst satisfactory picture quality can be achieved at the minimum lighting levels stated (1000 lux), restrictions are placed on full usage of tele zoom lenses and focusing becomes quite difficult for camera operators on BCU (big close up) camera angles. Super Slo Mo cameras cannot perform satisfactorily below PROFESSIONAL standard lighting.

## **9. SAFETY**

All personnel working on TVOBs are to be familiar with and to comply with relevant OH&S regulations.

A site specific risk assessment is to be undertaken by venue management and TVOB operations management during planning stages of the event.

TVOB personnel are to be inducted as to venue and TVOB safety requirements prior to commencement of duties.

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Scaffolding, camera tracks, aerial cabling and other constructions are to be installed by suitably licensed persons.

Camera cranes, scissor lifts, fork lifts and other mobile work platforms are to be operated by licensed persons.

Electrical installations are to be undertaken by licensed persons, and tested and tagged in compliance with statutory regulations.

Temporary TV cable installations are to comply with site hazard reduction policies.

As safety regulations can vary subject to individual state government regulations, applicable requirements need to be determined on a site by site basis.

**ADDENDUM # 1**

**CABLE INSTALLATIONS AT AFL STADIUMS**

**NOTE:**

- Implementation of HDTV equipment is impacting on cable installation with increased demand for Fibre optic camera cables, precision digital video coaxial cable, and (multi way) fibre optic cables for utility use.
- Co-axial video cable is to be specified for end to end delivery of uncompressed digital video over the installed length of cable.

The following cable listings are typical of requirements for AFL telecasts but intended only for guideline reference. Cable types and cable technical specifications alter with advances in technology so cable schedules need to be updated prior to planning any permanent installation.

Permanent cable installations should be planned in consultation with venue management and TV Rights holders, with emphasis on specifications for cables, connectors and locations of outlets.

**Outside Broadcast compound to Main Camera Platform**

- 4x Fibre optic camera cables
- 4 x triaxial<sup>1</sup> camera cables
- 2 x digital coaxial video
- 1x single phase power

**Outside Broadcast compound to TV Commentary Box Number 1**

(Possibly integrated with main camera platform and on-camera hosting position / studio)

- Cabling additional to above
- 2 x triaxial<sup>1</sup> camera
- 6 x digital coaxial video
- 2x 12 way audio multi-mic cable (typical suppliers, Burndy, Gepco)
- 1 x 20 pair Telco (Audio)
- 1 x 20 pair Telco (Data)
- 1 x 32 Amp Wilco 3 phase power interconnect cable
- 4 x CAT 6 computer cable
- 1x 8 way multi Fibre optic cable.

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<sup>1</sup> Installed Triax cables are to be 11mm or 14mm diameter as required to meet HDTV performance requirements over the installed length of the cable (including any “day cable” extensions to the installed cable. Maximum working lengths are 1000 metres for 14 mm cable and 500 metres for 11 mm cable.

**Outside Broadcast compound to Commentary Box 2**

- 1 x triaxial<sup>2</sup> camera
- 4 x digital coaxial video
- 1x 12 way audio multi-mic cable (typical suppliers, Burndy, Gepco)
- 1 x 20 pair Telco (Audio)
- 1 x 20 pair Telco (Data)
- 1 x single phase power interconnect cable
- 2x CAT 6 computer cable

**Outside Broadcast compound to Field (Players Race) for extension to perimeter camera positions**

- 8x Fibre optic camera cable
- 8 x triaxial<sup>2</sup> camera
- 4 x coaxial video
- 2x 12 way audio multi-mic cables
- 1 x 20 pair Telco (Audio)
- 1 x 20 pair Telco (Data)
- 1 x 32 Amp Wilco 3 phase interconnect cable
- 2 x Cat 6 computer cable

**Outside Broadcast compound to Dressing Room(s)**

- TV cabling is required to each player activity area of both “home” and “visitors” dressing room as follows:
- 1 x triaxial<sup>2</sup> camera
  - 1 or 2 coax (subject to layout)
  - 1x single phase power interconnect cable
  - 2 x Cat 6 computer cable
  - 4 x audio

**Outside Broadcast compound to wireless camera Microwave Platform**

- 2 x Microwave Triax
- 1x Single phase power interconnect cable
- 1x RF coax
- 2x digital coax
- 4x audio
- 2 x Cat 6 computer cable

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<sup>2</sup> Installed Triax cables are to be 11mm or 14mm diameter as required to meet HDTV performance requirements over the installed length of the cable (including any “day cable” extensions to the installed cable. Maximum working lengths are 1000 metres for 14 mm cable and 500 metres for 11 mm cable.

**Outside Broadcast compound to Backhaul microwave platform**

- 2 x Microwave Triax
- 1x Single phase power interconnect cable
- 2x RF coax
- 2x digital coax
- 4x audio
- 2 x Cat 6 computer cable