1. SCOPE

Free TV Australia Operational Practice 50 is a guideline to the minimum requirements for industry standard coverage of motor sport competition. It outlines infrastructure requirements for a television outside broadcast production using contemporary production techniques, which will meet current broadcast television presentation requirements as well as catering for future developments. The following description of facilities is based on those for an outside broadcast by one facilitator, with mention being made to events that may see multinational coverages involving numerous OB facilitators in a "unilateral mode" being present.

This Operational Practice has been developed by the Free TV Australia Project Group - Outside Broadcast its intention being to maximise TV and Radio production potential and productivity at venues and the avoidance of costly omissions at planning and construction stages.

TV coverage of motor sports events have been, and are still expanding. The increased use of ultra slo-mo, super slo-mo, wireless, "in-car" and other specialty cameras, computer generated graphics, "second screen" applications and the requirement to interface these in an on site hosting environment along with the associated audio facilities, require certain space and infrastructure installation requirements.

2. TYPICAL COVERAGE

Camera coverage for Motorsport events is planned on a venue by venue basis to meet the particular requirements of individual circuits.

2.1 Cameras

The typical configuration for motorsport "race" coverage is "sequential":

Cameras covering circuit and pit area	8 - 30
Cameras for studio	2 - 3
Other cameras including aerials, POV	event/location dependent
In-Car / On-Board	event/location dependent

2.2 Camera positions

This is venue specific, but could include the following:-

- Helicopter mounted cameras
- Wireless cameras
- Crane cameras
- Tracks for crane cameras
- Travel Towers
- "Wire/cable" cameras
- POV cameras
- In-car cameras
- Motorised portable cameras

Camera. 1 Main Overview of main straight

Positioned with start / finish in view usually at height – variations on 3 – 6metre scaffold above ground. Preference is for an angle of view 30-40m from start / finish.

Camera 2 Generally first corner approach and departing shots

Camera 3 – 30>> As dictated by track layout and production criteria

Camera 31 – 32>> Portable wireless pit cameras

Special Cameras

Special cameras additional to those used above may be used at certain venues. These include POV cameras within Race Control to monitor activity, helicopters, blimps etc. Specialised cameras shall be negotiated in the lead up and planning of a major event.

Final camera placement

The above camera positions are typical of a motorsport event but final camera placement will always be at the prerogative of the program producer/s and director. Camera positions, scaffolds barriers etc. are to comply with Confederation of Australia Motor Sport (CAMS), Fédération Internationale de l'Automobile (FIA) and other relevant state or federal safety requirements. *See Clause 9: Safety.*

2.2 Commentary boxes and studios

2.3.1 Commentary box

The TV commentary box should be close to pit garages and preferably oversee the start/finish line. Height should be approximately 15m above track level, a distance of 5 -10m back from the track with a clear and unobstructed view. The box should be able to easily accommodate 4 x commentators, 2 x statisticians, and 2 x producers. Commentators would ideally be seated at the front of the box with others at the rear on a raised platform. The commentary box needs to be air conditioned with capacity to cope with 12 personnel heat loading. Evaporator fans need to be low noise units (not to exceed NR 35) with local control for optional shut down during program segments.

Commentary boxes are to be acoustically treated in order to minimise external noise and to reduce internal reflectivity.

2.3.2 Studio

A TV Studio area is required for hosting the TV program. Typical dimensions for TV studio are 6 metres x 6 metres with 3.6 metres (minimum) ceiling height and have a (background) view to the track, pits or other location landmark dependent on venue layout. The window of the studio is to be as “mullion free” as possible and sloped inwards at an angle between 14-17 degrees to the vertical at the sill (inwards at the head/top of the window) to minimise reflections from studio lights.

The studio 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 controls for the operation of the unit providing the ability to turn the unit “off” during studio on air segments. PA speakers are not required.

The walls of the studio should be constructed of a material that reduces sound reverberations within the space along with providing sound isolation from adjacent areas. A dark matte finish surface is required to reduce reflections in the background window.

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 but is typically located 300mm in from the window with the second bar being 4 metres from the window (in a 6m studio space), each rated to carry in the order of 40Kg.

2.3.3 Unilateral commentary boxes

Unilateral TV commentary boxes should be provided to house international clientele. Boxes as required are to be sited similarly to the main TV commentary box and similarly equipped and fitted out. These units are not shared. Nominal floor area for unilateral commentary boxes is 3.5 metres x 3.5 metres with clear line of sight to the track.

2.3.4 Radio commentary boxes

Provision needs to be made for radio broadcast boxes adjacent to the TV box area. Nominal area for a radio commentary box is 3.5 metres x 3.5 metres with clear sight to track activity.

Coaxial video, telecommunications and screened audio cables need to be installed between TV OB compound and radio commentary boxes to provide video replays, sound splits and communication circuits between radio and TV services. Connectivity and proximity to local telecommunications infrastructure is also a consideration.

2.3.5 Pit Lane commentary position

Pit Lane roaming for up to 3 x camera operators, 3 x “spotters” (safety look-out guides), and 3 x pit reporters. Other personnel requiring access are 2 x producers, 1 x floor manager and 3 x audio assistants. All are to be clothed in fire-retardant overalls.

TVOB personnel operating in or in the vicinity of pit lane are to comply with CAMS, FIA and other relevant safety regulations.

See Clause 9: Safety.

2.3.6 Wireless microphones

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

See Clause 2.3.7: Radio Frequency (RF) Spectrum management.

2.3.7 Radio Frequency (RF) spectrum management

Extensive use of the RF spectrum is necessary for comprehensive TVOB cover of motor sport.

Allocation of frequency bands is generally as follows:

- 2.0 & 2.2 GHz microwave bands:

  Portable wireless cameras
  Specialty POV cameras
  Camera helicopter down links in 2GHz band ONLY

For specific information on use and coordination of ENG / TOB in the 2 and 2.2GHz bands refer to:

OP63 Spectrum usage for ENG and TVOB Operations in the Brisbane / Gold Coast / Sunshine Coast Area

OP64 Spectrum usage for ENG and TVOB Operations in the Sydney / Canberra / Newcastle / Illawarra Area

OP65 Spectrum usage for ENG and TVOB Operations in the Melbourne Area

OP66 Spectrum usage for ENG and TVOB Operations in the Adelaide Area

OP67 Spectrum usage for ENG and TVOB Operations in the Hobart Area

OP68 Spectrum usage for ENG and TVOB Operations in the Darwin Area

OP69 Spectrum usage for ENG and TVOB Operations in the Rural and Remote Areas

- 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, telemetry and data communications.
- Aggregate RF systems requirements can be in the order of 12 x 2.0 & 2.5GHz channels, 4 to 6 x 7 / 8 GHz channels, 4 to 6 x 13 GHz channels, 10 x UHF duplex RT frequencies and 20 to 30 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 vans) parking is required, it should be situated as close as possible to the camera platform/ TV commentary box area.

This area (OB compound) should be securely fenced so as to provide security for television equipment, personnel, TV operations and the safety of the public. This is particularly important on large scale television operations where facilities are setup for many days, weeks and there is the need for only accredited personnel to have access to the compound.

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 22.0 metres combined trailer and prime mover length, maximum height of 4.3 metres, and 8.5 tonne per axle loading. 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 along with adequate clearance on the underside of the OB vans.

Motorsport coverage in particular has a requirement for several site sheds/portable buildings and auxiliary vans that house specialty equipment facilitators and their associated workshops. These site sheds are typically 6m x 3 m in size.

Typical hardstand area is in the order of 500 square metres either 25 metres x 20 metres or 50 metres x 10 metres, rectangular. This area would cater for up to two OB facilitators with more space co-sited with it for site sheds and unilateral broadcasters.

The hardstand area is required to be level to accommodate OB vans with expanding sides with any slope for drainage being kept to a minimum.

Should the OB compound be situated within an enclosed space (underground or under a grandstand for instance) adequate ventilation is to be provided so as to comply with relevant safe work practice regulations as outlined by each State's regulatory body Code of Practice.

Air conditioning units on OB vans and portable sheds give off a considerable amount of heat which needs to be removed from the area and this along with any exhaust fumes from generators and vehicles (buses, delivery vehicles, fork lift trucks etc), needs to be taken into account when designing ventilation systems.

Provision is to be made to site satellite uplink vehicles within or adjacent to the compound with clear line of sight to the North-East sky for the majority of Australian broadcasters and to the western sky for a number of international broadcasters.

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
- Lighting for personnel movement
- 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 250 Amps per phase three phase (415Volt) supply adjacent to the outside broadcast vehicles hardstand area. Power should be available via powerlock connectors with OB facilitators providing their own distribution boxes as required. If supply becomes inadequate due to the number of facilitators being on site, generators will be used to supplement the local power, however major venues likely to be hosting major international or nationally significant events should specify 400 Amps per phase in construction and rebuilding planning.

3 x 15A single phase outlets should be provided adjacent to the connectors for overnight use.

Three phase 30 Ampere rated interconnect cables (5 pin connectors) are to be installed between the OB Compound and commentary box / studio area, and other operational areas.

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 rest of the venue.

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

4.4 Local and standby 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.

For indoor/undercover OB compounds provision needs to be made to extract exhaust fumes. If this is not possible, interconnect cabling specified to full electrical load is required to be installed between the generator site and the OB compound.

5. AUDIO / VIDEO (A/V) CONNECTIVITY

5.1 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 be HDSDI with embedded audio (minimum stereo audio) supplied on BNC connectors.

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

5.2 Telecommunications services connections.

An area within the compound is required for the location of various circuit provider's equipment and services, (fibre interfaces, PSTN, data etc.) This area to have local power as required by the service providers and adequate space for their equipment. Modern equipment has seen the need for small air conditioning plants being used on the equipment housings so facility for water runoff needs to be considered.

6. CABLING

6.1 General

Simple access is required for cabling from the outside broadcast vehicle hardstand to the all camera and TV operational areas, along with pre/post event presentation areas, media press conference area/s and race officials, timing and co-ordination areas.

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.

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.

Where cables need to be routed below ground level open cable troughs with easily removable and replaceable cover plates are the preferred option where possible.

Where cables need to be routed above traffic areas, open cable trays with cantilever mounting from below allowing for simple cable runs with "lift in" installation without the need for mechanical aids— ladders, scaffolds, elevated work platform/scissor lifts.

Cable conduits are not recommended for temporary cable installs, but where there is no other option conduits should be a minimum 150mm diameter and curves/bends no greater than 30 degrees with draw wire installed. A minimum of 3 x 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 at Motorsport venues 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 sees an increased demand for Fibre optic camera cables, precision digital video coaxial cable, and multi way fibre optic cables for utility use.

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 the maintenance, 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.

7. BACKHAUL

7.1 General

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

The Telco access point should be adjacent to the OB compound and no more than 25 metres away.

Space provision for satellite uplink vehicles with clear view to the North-Eastern and Western skies is required within or adjacent to the OB compound.

Space allocation within TV compound to cater for increased International clientele or unilateral service providers for future expansion also needs to be considered.

7.2 Microwave link platform

A 2.4 m x 2.4 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 venue for mounting of wireless camera microwave receivers.

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

Any structures need to comply with relevant WH&S regulations.

8. LIGHTING

Television standard lighting is to be provided at start and finish areas of each event along with tunnels and undercover areas that are encountered on the circuit.

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

A brief summary of lighting standards is as follows:-

8.1 International standard for TV venues

Lighting level (Ev) toward main cameras	1400 lux (average
Lighting level toward other directions:	1000 lux
Lighting level toward USM / SSM cameras	1800 lux within defined zones- slo mo replay zones (SRZ)
Colour temperature (TK):	4000K to 6500K, but within 500K at individual venues: preferred value 5600K.
Colouring rendering index R_a	$\geq$ 90
Maximum GR for main TV cameras	<40
50 Hz mains flicker:	minimise flicker by cross aiming and spreading floodlights equally over the three phases: ≤10% flicker for ≤600fps ≤3% flicker for ≤1,000fps.

8.2 Professional standard

E_V toward main cameras	1000 lux (average)
E_V toward other directions	800 lux
Colour temperature	4000K to 6500K, but within 500K at individual venues
Colour rendering index R_a	Minimum requirement Ra 85, Ra > 90 preferred
Maximum GR for main TV cameras:	<40
50 Hz mains flicker	minimise flicker by cross aiming and spreading floodlights equally over the three phases

Note: Whilst satisfactory picture quality can be achieved at the minimum lighting levels stated, restrictions are placed on full usage of 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.

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

Camera cranes, scissor lifts, forklifts 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.

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