



Bat Conservation Ireland
Wind Turbine/Wind Farm Development
Bat Survey Guidelines



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Bat Conservation Ireland

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These guidelines were prepared by *Bat Conservation Ireland* to provide advice to the wind energy industry, ecologists, local planning authorities and other competent authorities on the survey work required to understand and assess the use by bats of an area proposed for a wind energy development.

Bat Conservation Ireland recognises the importance of both protecting bat populations and the development of a sustainable renewable energy industry in Ireland. For this reason, *Bat Conservation Ireland* has developed these guidelines in consultation with industry stakeholders to actively encourage renewable energy developments that are compatible with the needs of wildlife and biodiversity conservation and are in line with the *UNEP/EUROBATS Secretariat Guidelines* and other national guidance such as that offered by the *Northern Ireland Environment Agency*, *The Bat Conservation Trust* and *Natural England*.

The overall aim of these guidelines is to ensure that bats, their roosts, feeding areas and flight paths are protected from any potentially adverse impacts posed by proposed wind turbine/farm development through avoidance, mitigation and/or compensation measures as required by survey findings based on a standardised assessment methodology.

These recommendations should be interpreted on a case-by-case basis by an ecologist with bat expertise when considering proposed development sites. The level of survey effort and the survey techniques employed must be designed by the surveyor to allow a comprehensive understanding of the use of the site by bats. Examples given in these guidelines are descriptive rather than prescriptive and the onus lies on a qualified bat worker to determine the ultimate level of effort that is necessary. *Bat Conservation Ireland*, based on current national survey experience, does not however envisage any site where a bat activity survey would be unnecessary.

Note that these guidelines do not apply to micro-turbines, as for such developments other survey methods are required. Micro-turbines may also potentially have significant impacts on bats if they are erected in close proximity to a roost or commuting route of these animals.



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1. Introduction

Wind turbines and bats

Wind turbines are a known risk to bats (Arnett *et al.* 2008, Baerwald *et al.* 2008, Betts 2006, Cryan and Brown 2007, Johnson *et al.* 2003, Johnson and Strickland 2004, Zagamajster *et al.* 2007) and the *UNEP/EUROBATS Secretariat* published guidelines on bats and wind farm projects (Rodrigues *et al.* 2008) to ensure bats are considered as part of development proposals.

Although further worldwide research on bat/turbine interactions needs to be undertaken, studies to date in Europe and the U.S.A. (Kunz *et al.* 2007, Arnett *et al.* 2008, Horn *et al.* 2008, Rydell *et al.* 2010), have shown that bat mortality due to wind turbines is a serious issue. Bats are known to be killed either through a fatal change in pressure within the lungs (Baerwald *et al.* 2008) or through collision with rotor blades (Rollins *et al.* 2012). There is no evidence to suggest that the Irish context is unique in avoiding such a conflict.

To date, ten bat species have been recorded in Ireland and all, apart from one, Leisler's bat *Nyctalus leisleri*, are normally low fliers e.g. <10m above ground level and as such are considered to be at a lower risk from turbine impacts. However, pipistrelle species have been observed to investigate new landscape structures such as turbine masts. Data from European wind turbine related mortality includes high numbers of pipistrelle species of which approximately 50% occur outside the migratory season.

Leisler's bat is classified as a *high risk* species in relation to wind turbines as it is a high flier (Carlin and Mitchell-Jones 2009) which travels considerable distances (up to 13.4km has been recorded in Ireland, Shiel *et al.* 1999) between roosts and foraging areas. The species has evolved for fast flight in excess of 40km/h (Dietz *et al.* 2007) and is less manoeuvrable as a consequence. It therefore avoids cluttered environments by keeping above the tree canopy normally flying between 10m and 70m above the ground (Russ 1999) but the species has been known to reach heights of 500m (Bruderer and Popa-Lisseanu 2005). Flying at such heights potentially brings it into direct risk of collision with wind turbines.

Although, to date, there are no published results of a study of bat mortality from Irish wind turbines, considering recent research from mainland Europe and North America, there is an increasing amount of detailed published evidence that wind turbines cause bat fatalities. However, many of these overseas turbine/bat mortality studies are at wind farms, with significantly larger numbers of turbines, sited along known bat migration routes where many hundreds or even thousands of bats commute seasonally resulting in numerous deaths and injuries. We currently have no evidence that mortality of bats occurs on the same scale in Ireland where seasonal migration within the island occurs.

Although it is known that Nathusius' pipistrelle *Pipistrellus nathusii* migrates seasonally from Scandinavia to Scotland and to the north of Ireland and back again (Russ *et al.* 2001), there is currently no evidence of bat migration elsewhere in Ireland as no research has been undertaken. However research has shown that bats migrate up to 60km to swarming sites in the UK and it is likely that similar migration occurs in Ireland. Therefore risks to bats from wind turbines have to be acknowledged and it is possible that some bat mortality may occur in this country as a result of wind developments.

Legislation and bats

All Irish bat species are protected under the Wildlife Act (1976) and Wildlife Amendment Acts (2000 and 2010). Also, the EC Directive on The Conservation of Natural habitats and of Wild Fauna and Flora (Habitats Directive 1992), seeks to protect rare species, including bats, and their habitats and requires that appropriate monitoring of populations be undertaken. All Irish bats are listed in Annex IV of the Habitats Directive and the lesser horseshoe bat *Rhinolophus hipposideros* is further listed under Annex II requiring designation of Special Area of Conservation for the species. Across Europe, bats are further protected under the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1982), which, in relation to bats, exists to conserve all species and their habitats. The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention

1979, enacted 1983) was instigated to protect migrant species across all European boundaries. The Irish government has ratified both these conventions.

Also, under existing legislation, the destruction, alteration or evacuation of a known bat roost is a notifiable action and a derogation licence has to be obtained from the *National Parks and Wildlife Service* (NPWS) before works can commence.

It should also be noted that any works interfering with bats and especially their roosts, including for instance, the installation of lighting in the vicinity of the latter, may only be carried out under a licence to derogate from Regulation 23 of the Habitats Regulations 1997, (which transposed the EU Habitats Directive into Irish law) issued by NPWS. The details with regards to appropriate assessments, the strict parameters within which derogation licences may be issued and the procedures by which and the order in relation to the planning and development regulations such licences should be obtained, are set out in Circular Letter NPWS 2/07 "*Guidance on Compliance with Regulation 23 of the Habitats Regulations 1997 - strict protection of certain species/applications for derogation licences*" issued on behalf of the Minister of the Environment, Heritage and Local Government on the 16th of May 2007.

Furthermore, on 21st September 2011, the Irish Government published the European Communities (Birds and Natural Habitats) Regulations 2011 which include the protection of the Irish bat fauna and further outline derogation licensing requirements regarding European Protected Species.

2. Qualifications/Experience of surveyors

- The surveyor contracted to undertake this work must have a demonstrable track record of experience in surveying bats and preferably be a member of an appropriate professional body such as the *Institute of Ecology and Environmental Management* (IEEM). For example, an acceptable minimal standard would be a bat specialist with experience of similar types of bat surveys in the Republic of Ireland or the UK in a variety of habitats and locations, who is competent in the use of bat detectors and identification of bat species.
- In the event that the planning application goes to appeal or oral hearing, the person contracted to do the survey and assessment should be prepared to appear at, or give evidence to, the inquiry and defend their work based on scientific evidence. This should include defending the extent of survey undertaken, the methodology, interpretation of results and mitigation proposed.

3. Health and Safety considerations

- Lone working during bat surveys on both existing and proposed wind energy development sites should be avoided where a pre-survey risk assessment has found potential high risk hazards. Many turbine developments are located on open exposed hillsides and in areas of bog in which terrain is uneven and potentially hazardous, unless there are pre-existing trackways.
- Given the difficult terrain in which many wind turbine developments are located it may not be possible for workers to survey the entire site on foot at night. In such cases consideration could be given to the use of automatic static recording devices set and retrieved during daylight hours at these and other locations and depending on the accessibility of the site consideration could also be given to the use of driven car transects.
- Surveyors should be suitably equipped for the survey work both in terms of personal safety (e.g. high visibility reflective jacket, walking pole, torch(es), whistle, fully charged mobile phone, personal locator beacon, navigational aids including site maps, compass and GPS etc.) and with the necessary survey tools (broadband bat detectors, digital recording devices, spare batteries, handheld anemometer, thermometer etc.).

- Survey work should be subject to a site-specific risk assessment to review hazards such as lone working, remote sites, difficult terrain, adverse weather conditions, presence of livestock, presence of members of the public, lack of telecommunications, presence of water bodies, night-time work, presence of excavations or derelict structures *etc.* Mitigation for and management of such risks is necessary for each individual site and a daylight assessment is recommended in advance of any nocturnal survey works.
- Surveyors should prepare a risk assessment/safety plan for each site location and establish procedures for reporting back. This will depend on a reliable communication system being in place and it should be recognized that there is often little or no mobile telephone reception in remote areas.

4. Bat assessment

Desktop study

- An initial review of aerial photography and mapping of the area within c.10km radius of the proposed wind turbine/farm location should be undertaken to determine those habitats/features likely to be of high significance for bats in the general landscape surrounding the proposed development. Such sources may also point to potential maternity roosts, swarming or hibernation sites in over ground structures and in subterranean sites such as caves, souterrains, icehouses, tunnels *etc.* however, as all such features may not be apparent in photographs or maps, a review of these sources should not substitute for fieldwork.
- Prior to designing the survey it would be appropriate to consult either with the *National Parks and Wildlife Service (NPWS)* through the Development Applications Unit or the *Northern Ireland Environment Agency (NIEA)* through the Development Management Team to discuss the scope of work proposed. It is also recommended that contact is made with the local NPWS Conservation Ranger and/or regional staff or with the Wildlife Liaison Officer of the *Police Service of Northern Ireland* who may have records of bat activity or roosts in the area and may also be able to advise on any local issues regarding the site. The NPWS website (www.npws.ie/mapsanddata) and the *National Biodiversity Data Centre* online map viewer are useful reference points for aerial photographs and habitat and faunal data.
- *Bat Conservation Ireland*, local bat groups/bat workers and the local authorities' Heritage and/or Biodiversity Officers should also be consulted to acquire further records of bat activity or known roosts from the area. Other reports by *Bat Conservation Ireland* will also assist in understanding the considerations of bats and the surrounding landscape in an Irish context e.g. www.batconservationireland.org/pubs/reports/Landscape_Conservation_Irish_Bats.pdf
- The desktop study should include all details of known bat roosts, bat activity and other records of these animals from within a 10km radius of the proposed wind turbine development. It must be recognised however that data on bats may not exist in certain areas and even where data is available it is unlikely to be complete and the whereabouts of some bat species and roosts will not be known.
- Building on existing guidance, an assessment should be made of the quality of the habitat at the site and in the wider landscape, and the potential for these areas to support bats, taking into account:
 - the extent and quality of foraging and commuting habitat within and surrounding the site e.g. woodland, well-connected and structured hedgerows, waterways and water bodies,
 - the proximity of the proposed site to areas designated for bats (Natural Heritage Areas or Special Areas of Conservation), and
 - the presence of buildings or other features or structures that may support or are known to support bat roosts.
- The factors outlined above provide indications of some of the features to consider when assessing the need for a survey for both wind farms and single wind turbines.

Pre-planning surveys

The overall aim of surveying at wind turbine/farm sites is to identify and assess the potential impacts the proposed development is likely to have on local populations of bat species present on and around the site and hence on national bat populations. A pre-planning field survey is one that is carried out in advance of the proposed development applying for consent and is therefore part of the design stage for the development.

It is recommended that all aspects of the yearly life cycle of bats and their associated movements are considered in any field studies and a decision on the most site appropriate survey methodology to be employed be based on the recommendations of the appointed bat surveyor.. A four-season approach allows the confirmation of potential hibernation sites, where these are present in the locality, to be made during the winter months.

The surveys should determine whether bats have established roosts (active or inactive) and/or use the area for commuting, foraging, migrating or for breeding purposes, e.g. advertising posts of individual males. Swarming sites or significant hibernation sites should also be investigated and recorded and the potential for movement of bats between same should be recognised.

- The surveys should attempt to provide an understanding of how bats are using the landscape surrounding the proposed wind development site in relation to known roosts in the area and to determine variations in seasonal activity.
- The site should be walked during daylight hours to assess the potential for and to inspect any bat roost found. The nocturnal fieldwork element should also be planned at this time.
- A site specific risk assessment should be completed and used to identify hazards for each individual site.
- Should a meteorological mast be present on the site it may offer a means of collecting baseline data of bat activity in relation to weather conditions as periods of high winds, low temperatures and/or heavy rain may negatively affect the ability of surveyors to manually observe bat activity. It may be possible to erect two static bat detector microphones on the mast - one at the base and one at the equivalent height of the proposed turbine nacelle.
- Surveys of turbine positions at turbine nacelle height have been conducted in some countries using helium balloons carrying broadband detectors/recorders. Although this method has not yet been used in Ireland, it should be considered if deemed necessary by the appointed bat surveyor and both the opportunity exists and local regulations permit. Such activity may be subject to H&S restrictions.
- Bat activity surveys should be carried out over several months from March/April to October/November inclusive, during optimum weather conditions. Survey during very heavy rain, strong winds (> Beaufort Force 5), mists and dusk temperatures below 7°C is not recommended. Should unsuitable weather conditions be encountered, surveys can proceed but subsequent additional surveys may be required. The number of survey nights required per visit will depend on the size of the site, number of proposed turbines *etc.* It is recommended that a minimum of five months across the active bat season are surveyed.
- An increased number of survey periods (*i.e.* in excess of 5) may be necessary in some circumstances where there are features of the landscape that are of high importance in bat ecology (e.g. mountain ridges or passes that may serve as potential migratory paths, caves or other sites with swarming potential) and further survey should be at the discretion of the project ecologist.
- Potential swarming sites should be inspected and monitored during the autumn months and, as these rare sites can attract thousands of bats, their identification by

night survey is vital. The use of broadband detectors/recorders and static automatic recording devices is particularly recommended for survey of potential swarming sites.

- Potential hibernation sites should be inspected and, if bats are present, monitored during the winter months (November-February). Such monitoring may require a derogation licence.
- Surveys should be conducted on-site at the earliest possible opportunity. This should help decide the location of turbines, define exclusion zones and ensure that turbines are positioned outside areas of highest bat activity. Site surveys at an early stage will give developers a good overview of bats on-site and this may also negate the need to resurvey the site if the turbine locations change during the design process. However such surveys will require more survey effort to ensure that all areas within the site are covered and this will depend on the complexity of the landscape in terms of linear features, field boundaries, woodlands, wetlands, etc.

Survey methodology

- A combination of survey methods can be used – these could include manual activity surveys, driven transects, static detector surveys of activity both at ground level and at height, the identification of potential roosts, surveys of known roosts *etc.* In some situations, depending on the species present, more detailed survey work such as radio-tracking, infra-red monitoring *etc.* may be required.
- On-site bat activity surveys should include a combination of both post emergence activity surveys (from approximately thirty minutes before sunset for a minimum of 120 minutes) and dawn surveys (from a minimum of 90 minutes prior to sunrise). These surveys should determine the approximate numbers and species of bats present within the site, areas used for foraging, commuting routes to and from roosts and any changes in mid to late summer activity levels. The approximate flying height and direction taken by bats should be estimated and detailed if possible.
- Manual detector surveys should be designed as timed walked transects to ensure that all areas and main features of the site are sampled within the time period of 30 minutes before dusk to 2-3 hours after sunset. Pre-dawn to dawn surveys commencing a minimum of 90 minutes before sunrise should also be carried out. Transects should be walked in different directions and at different starting points across the bat season so that variations in emergence times of different species of bats and bat activity across the site are recorded. Pre-dawn surveys can assist in determining if any roosts are present on or within a 200 metre radius of the site. Environmental conditions across the transect should be recorded at regular intervals to determine if there is a change in bat activity attributable to temperature/rainfall/wind speed *etc.*
- Should a potential roost (tree/underground structure/building *etc.*) be present on-site it should be adequately inspected to determine its use by bats. If the structure or tree contains a *known* roost, a derogation licence may be required to allow internal inspection.
- Any roosts within the site boundary and the roost origins of bats using the site for significant commuting/large scale foraging activity should be determined.
- Once a roost has been identified two dusk and dawn surveys per roost should be carried out as a minimum per season. Depending on the proximity of the roost to turbines, the species present and the significance of the roost, further surveys focusing on this location may be required.
- The survey area should not only focus on the turbine locations but should encompass the entire site area and extend well beyond the site boundary if significant bat movements or features are observed. Surveys well outside the site boundaries may also be required if significant features occur. During the surveys, features such as structures, hedgerows and tree lines and topographical features such as valleys and watercourses should be observed for potential roost sites, foraging areas and commuting routes. Such a survey can take place early in the planned development and its findings can be considered when determining the turbine locations at a pre-application stage.
- Static bat detectors/recorders can be set up to record for longer periods *e.g.* over several nights and for prolonged duration. They can also be used for comparison

purposes as they can be situated at proposed turbine locations and at other features/appropriate locations on and around the site as decided by the project ecologist and used to determine bat activity across the site. This is especially useful for comparing bat activity over open ground and adjoining vegetated sites e.g. forestry, scrub, hedgerow and tree lines.

- Driven transects can provide useful information on the wider landscape, from the perspective of bats, in the vicinity of the proposed development site.
- Additional aspects of the wind farm/turbine development such as access tracks/haul roads, transmission stations, construction compounds, transmission lines, towers *etc.* should also be assessed for potential negative impacts on bats.
- Any opportunity to survey at height and over extended periods of time using unattended detectors should be taken although it should be noted that the use of such detectors alone is not satisfactory and these should be combined with walked transects, car-based transects, point counts *etc.*

5. Existing wind turbine development surveys

- Where an extension/alteration to a wind farm is proposed it is recommended that the existing turbines are surveyed to determine any associated bat activity. This measure would apply to most operational wind farms/turbines in Ireland given that the majority of existing wind developments have had no baseline bat surveys conducted either as part of the planning process or for post-construction monitoring of potential operational impacts. Where a baseline bat activity survey has already been carried out for an operational site these results should be assessed by the site ecologist and a decision taken as to whether further assessments are needed.
- Should an extension to the wind farm or alteration of the nacelle height of a wind turbine be proposed then an appropriate survey should include long term detector monitoring of those turbines closest to the proposed extension/for which a hub height alteration is proposed.
- Any opportunity to survey at height at these existing turbines should be taken where appropriate.
- Searches for, and recovery of, bat corpses at the base of these turbines and within turbine blade throw areas should also be conducted (see post-construction monitoring).
- Monitoring of existing wind farms and the collation of data on bat fatalities would assist in determining the significance or otherwise of the impacts of wind turbines on Irish bat populations (this is currently unknown). The results of any such surveys will be considered in future revisions to these guidelines.

6. Further considerations

As part of wind turbine/farm construction, existing on-site and/or off-site bridges may require strengthening to increase load-bearing capacity. Such works may impact bats as these animals often choose to roost beneath these structures and may be present throughout the year. All bridges scheduled for strengthening works should be surveyed for bats prior to works commencing. Surveys should be undertaken as early as possible in the development planning as, should bats be found, a derogation licence will be required to allow works to legally commence.

Wind turbine/farm developments may also require the removal of hedgerows and/or other vegetation along haul roads and access tracks to allow for the transport of turbines to the site/other works. Such habitat loss can affect bat feeding areas and flight paths and these potential impacts should also be considered and assessed.

- There may be potential impacts to bats arising from grid connections and associated power lines through vegetation/habitat loss, structure removal *etc.*
- Construction of borrow pits may result in habitat loss or potentially impact roosts.

- Lighting at wind farm sites may impact local bat populations and any such impacts need to be considered as part of the assessment. In general, where a minimum level of lighting is necessary, the lighting should be of a design that mitigates potential negative impacts.
- Works e.g. involving the removal of roadside vegetation or engineering works on bridges and culverts to allow access for machinery and delivery of turbines pre-construction, can cause impacts off-site and these should also be considered.

The removal of mature trees and buildings identified as potential/confirmed bat roosts should be treated in line with best practice under the supervision of a qualified bat worker.

7. Reporting

The initial desktop study should include a review of aerial photography and mapping of the turbine development site and environs (c. 10km radius) to determine areas of bat-favourable habitat and this information should be detailed in the final report to allow the context of the site to be understood by the reader. The following information should also be included in the report:

- The size, number and location of proposed turbines.
- The number of surveyors involved in the assessment and their qualifications.
- The equipment used in conducting the bat surveys should be specified.
- The date and time of the surveys.
- Temperature, weather conditions (precipitation, cloud cover *etc.*) and approximate wind speed and direction (at 2 metres above ground level) encountered during each survey. *For existing operational turbines, records of wind speed at height during surveys should be sought.*
- Any constraints to surveys due to restrictions of access to land, restrictions on survey design *etc.*
- The survey findings should be presented in the text with appropriately scaled maps, tables and diagrams detailing the exact location of roosts, roost entrances, flight movements, foraging areas, advertising posts *etc.*
- Where possible, an index of activity should be provided at turbine sites where activity surveys have been completed e.g. remote recordings by bat detectors/recorders could provide an hour-by-hour activity level of each species recorded.
- Information should be presented in a clear way which shows seasonal use of the site.
- All evidence of site use by bats such as acoustic recordings, droppings, dead specimens *etc.* should be detailed in the report.
- The approximate numbers of bats using the site or exiting from a roost must be specified.
- The species of bats encountered must be specified.

Further survey effort or revision to the proposed numbers, layout and design of wind turbines may be required if the proposed turbine/wind farm poses a high risk to local bat populations.

If necessary, the survey should recommend the most appropriate ways in which bats can be protected during the construction and operational phases.

In assessing potential impacts consideration should be given to future land changes on-site during the lifespan of the wind turbine development that might increase or decrease its suitability for bats. The local and regional status of different bat species also needs to be taken into consideration to assess any likely effect on population levels.

Survey data should be sent to *Bat Conservation Ireland* who submits all records of bat activity and roosts on an annual basis to the *National Biodiversity Data Centre* and in Northern Ireland to the *Northern Ireland Bat Group* who share records with the *Centre for Environmental Data and Recording (CEDaR)*.

8. Post-construction monitoring

- Post-construction monitoring is an important measure of the detectable impacts of wind turbines and is fully endorsed and encouraged by *Bat Conservation Ireland*.
- Under the *UNEP/EUROBATS Secretariat* guidelines (Rodrigues *et al.* 2008) it is recommended that monitoring of bat populations is conducted for a minimum of three years once the wind turbine/farm becomes operational. We recommend that monitoring effort should be assessed on a site-by-site basis and be dependent on the predicted risk to and scale of impacts on bat populations. The period over which monitoring is undertaken is likely to be a function of the planning conditions set by the NPWS or NIEA through the planning process.
- Monitoring should include detector surveys of bat activity near turbines and the continuing status of any nearby roosts, combined with a properly designed corpse-search regime at all turbine locations.
- This corpse-search regime should be calibrated to take account of corpse finding difficulty, habitat visibility and removal of corpses by scavengers. A search for bat corpses could be done in conjunction with a bird corpse-search and should take place over a number of consecutive days.
- Surveyors should be competent in the identification of bat corpses to species level but, if not, corpses should be retained and sent to a bat specialist for identification.
- Mitigation measures should be reviewed based on the results of monitoring of their effectiveness.
- The results of any monitoring should be provided to the statutory agencies with the understanding that this data will be made available to other parties to give further guidance on wind turbines/farms and their impacts or otherwise on bats in Ireland and Europe in terms of future Environmental Impact Assessment, Ecological Impact Assessment, Appropriate Assessment, development of mitigation measures *etc.* taking into account data protection requirements.
- The results from post-construction monitoring will assist the industry in designing and planning wind farms in the future. These results will also inform future survey design and requirements for the industry.

9. Review of guidelines

- An examination of the issues pertaining to bat mortality and ecology at existing operational wind farms/turbines through a programme of monitoring or through specific projects would be welcomed by *Bat Conservation Ireland*. This would allow for further revisions of these guidelines.
- These guidelines will be reviewed annually and updated as new information becomes available from studies here in Ireland and elsewhere within the EUROBATS area.

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National and international wind turbine survey guidelines

The Bat Conservation Trust:

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