



CHIEF OF COURSE – ALPINE SEASON 2022

STUDY GUIDE

This Study Guide is intended to be used as an educational and review aid for individuals interested in alpine officiating. Downloading, printing, and reading the Study Guide must not be substituted for actual attendance at an Alpine Officials' approved clinic or used as a replacement for actual instruction at any Alpine Officials' approved clinic.*

**Alpine Officials' Manual, Chapter VII. "THE RACECOURSE" may be printed and used in conjunction with this Study Guide.*

REFERENCE RESOURCES:

1. U.S. Ski & Snowboard Alpine Competition Regulations (ACR)*
2. ICR of the FIS, Current Edition
3. Precisions to both ACR and ICR, if published
4. U.S. Ski & Snowboard Alpine Officials' Manual

PowerPoint presentation, “Clean Hill Initiative” is required viewing at any U.S. Ski & Snowboard Chief of Course Clinic. Additional presentations which are recommended viewing, are: “Courses” and “B-Net”.

***NOTE:** ACR mirrors, when possible, ICR numbering. U.S. Ski & Snowboard exceptions have a “U” preceding the rule number; the “U” is a part of the number.

CERTIFICATION EXAMINATION:

Chief of Course Certification Examination will be available at Alpine Officials' approved clinics. Allowed time limit is 2.5 hours. The examination is an open book and familiarity with available resources is required. Examination must be administered only at scheduled Clinics. It is NOT A TAKE HOME EXAM! Allowing the use of computers to “search” rule books is strongly discouraged. Completed examinations must be retained by the clinic examiners; they are not returned to individuals taking them. Please refer to Region/Division publications for schedules. *The Study Guide is not intended as a replacement for taking notes for use during an open-book examination at any Alpine Officials' approved Clinic.*

NOTE: In addition to Competition Official (CO) certification requirement in place for all Alpine Officials, Level 1 Chief of Course (CC) certification requirements include:

- Attendance at a level 1 Chief of Course (CC) Clinic*
- Successful completion of Chief of Course (CC) Examination

** On-snow clinics are acceptable for Chief of Course (CC) certification; successful completion of Chief of Course written examination is still required.*

If you have problems with this Study Guide or have suggestions for improvements, please contact the Chair of the Alpine Officials' Education Working Group: aoewgchair@gmail.com. Thank you.

U.S. SKI & SNOWBOARD

CHIEF OF COURSE - ALPINE SEASON 2022

PLEASE NOTE: Local health authority restrictions may require ski area management to implement procedures to protect the wellbeing of their employees and guests. These procedures may vary from venue to venue, county to county, and state to state. Procedures which impact your event operations and programs must be relayed to all event officials, Team Captains, and competitors. The procedures must – without question – be respected and observed.

U.S. Ski & Snowboard will maintain a COVID-19 resource page with recommended protocols (usskiandsnowboard.org/covid-19).

“COVID-19 Best Practices Guidelines” (PowerPoint presentation) must be reviewed at all U.S. Ski & Snowboard Alpine Officials’ Clinics.

I. PERSONNEL:

A. Membership Requirements

1. **U.S. Ski & Snowboard SANCTIONED NON-FIS EVENTS:** Jury members, Jury Advisors (Start & Finish Referees), Chief of Course, Course Setters, Chief of Timing and Calculations, and Race Administrator are required to be *current, appropriately certified, U.S. Ski & Snowboard Coach or Official members*. With the exception of the Technical Delegate, these officials must have also attended a bi-seasonal Continuing Education (Update) Clinic; Technical Delegates are required to attend a seasonal Technical Delegates’ Workshop. *Qualified members of foreign federations recognized by FIS must hold a valid U.S. Ski & Snowboard membership in order to serve in the above positions at U.S. Ski & Snowboard sanctioned non-FIS events.*
 2. **U.S. Ski & Snowboard SANCTIONED FIS EVENTS:** Jury members, Jury Advisors (Start & Finish Referees), Chief of Course, Course Setters, Chief of Timing and Calculations, and Race Administrator are required to be *current, appropriately certified Coach or Official U.S. Ski & Snowboard members; update requirements also apply*. If a foreign FIS Federation lists a foreign coach on their FIS entry form, the Federation is certifying that the coach has the knowledge and ability to fulfill the duties of a Team Captain: e.g., serve as a Jury member or set a course; *this satisfies the “qualified member of foreign federation” requirement for FIS events.*
 3. **U.S. Ski & Snowboard** Coach or Officials members whose membership status is marked “PENDING,” may not have completed membership requirements, e.g., SafeSport Training, Introduction to Avalanches Course, Coaching Fundamentals Course and/or background screening, and they must not be granted venue access or appointed to serve as Jury members, Jury Advisors, Chief of Course, or Course Setters.
- NOTE:** Competitors who are 18 years of age and older who have not completed SafeSport Training, Introduction to Avalanches Course *, and/or background screening will also be designated as “PENDING.” These athletes must not be allowed to participate in any U.S. Ski & Snowboard event until “ACTIVE” status is achieved.
- * All members, including those who turn 18 years of age during the competition season, must complete the Introduction to Avalanches Course.
4. Failure to comply with membership requirements will invalidate event liability insurance.

5. Learning the responsibilities and applications of the Chief of Course in the classroom setting is a bit like teaching swimming without a body of water. It is important that those wishing to become proficient in the task, seek multiple opportunities to work under “experts” on the race hill and gain knowledge that may be applicable to the ski area where an individual may serve as Chief of Course.

NOTE: *Except in specific instances where the event has been pre-approved (CAN-AM events), all coaches must have a current Coach membership in order to participate in any capacity at any U.S. Ski & Snowboard sanctioned event; e.g., on-hill coaching.*

- B. **Chief of Course** acquires required knowledge and skills through both education and experience. They must be familiar with local snow conditions on the terrain concerned. The Chief of Course is responsible for the preparation of the event arena in accordance with the directives and decisions of the Jury and as indicated on the homologation report. The Chief of Course is often affiliated with the resort and should be the “local authority” regarding area weather patterns, availability of resources, and existing snow conditions.

As the Referee provides the connection between the coaches and the Jury, the Chief of Course is the connection between the resort’s mountain operations department and the Jury.

1. Chief of Course needs to establish advance communication with ski area management, including Mountain Operations (grooming), Lift Operations, Race Department, and Ski Patrol. *An important facet of communication with ski area management and the Ski Patrol is clarification of those areas for which the Jury has jurisdiction (Race Arena) and which areas ski area management and Ski Patrol are under the supervision of the ski area (Race Venue). It is critical that any operational procedures adopted by the resort which could affect the event are also clarified.*
2. Chief of Course needs to know the racecourse and snow preparation and should be able to evaluate the racecourses set under their jurisdiction. Their responsibilities include the start and finish areas and the timing installations – as well as the actual race trail.
3. Chief of Course must work with Course Setters and have ample help to assist the Course Setters for all runs. This includes supervising the cleanup immediately following the event.
4. Successful completion of these responsibilities requires organization, leadership, personnel, and equipment.
5. Chief of Course should know, understand, and abide by the rules. The Chief of Course should participate in Team Captains’ Meetings, Jury inspections, and Jury meetings.
6. Chief of Course must be a current Coach or Official member of U.S. Ski & Snowboard and must be a certified official in one (or more) of the following: Chief of Course, Chief of Race, Referee, or Technical Delegate.
7. Chief of Course must attend a bi-seasonal Alpine Officials’ Continuing Education Clinic (Update), in order to serve in the position and retain certification; *annual attendance is recommended.*

- C. **Course Setters** answer to the Jury for the particular competition. The Course Setters and the Chief of Course need to follow the directives of the Jury, and if the racecourse has been set prior to the Team Captains' Meeting, they are required to provide a report for the Team Captains concerning the course set.

Course Setters must follow the rules governing course setting for the event being contested. They are obliged to set in accordance with the course protection plan set forth by the Homologation Report, as well as any additional request from the Jury and Chief of Course. *It is strongly suggested that Course Setters take the time to familiarize themselves with the documented requirements contained in the respective Homologation Report prior to setting a course.*

D. **Course Workers/Volunteers**

1. Properly trained and are equipped for their tasks.
2. Reasonable skiing skills to perform required tasks with the ability to maneuver competently on steep slopes while carrying equipment and materials, including heavy loads.
3. Supervised by trained, experienced crew leaders.
4. Trained in the proper use of racecourse maintenance equipment.
5. Trained in proper radio communication procedures.
6. Aware of details for improved margin of racecourse security:
 - a. Daily Program (schedule), including training, and forerunner and racer start times
 - b. Course inspection techniques authorized for competitors
 - c. Start intervals – time planned between the consecutive forerunner and competitor starts; critical for course workers and officials to know when it is clear to work or communicate between starts.
 - 1.) DHT, DH, SG: Regular (fixed) with a minimum of 40 seconds
 - 2.) GS: Regular (fixed) with a minimum of 30 seconds
 - 3.) SL: Irregular (non-fixed) as determined by the Jury
 - d. Location of staging areas, e.g., replacement poles and/or equipment
 - e. List of course positions and related terminology
7. Aware of “Start Stop” and its procedures which are applicable at all levels of competition. *ANY Jury member, Eyes of the Jury, or Jury Advisor MAY call a “Start Stop” when necessary, to address critical situations. No other official is authorized to call a “Start Stop”! Failure to comply may result in a “walk over,” effectively impairing the Start Referee’s ability to receive the transmission.*
 - a. The command “Start Stop.” is called via radio by a Jury member, Eyes of the Jury (a coach positioned at a yellow flag zone), or Jury Advisor when it is necessary to control the departure of the next racer – usually because the preceding racer has fallen and the racer or racer’s equipment is blocking the course. When this command is issued, the Start Referee must immediately close the start.
 - b. The command “Start Stop, Yellow Flag Stop.” is called via radio by the Jury member, Eyes of the Jury, or Jury Advisor who called the “Start Stop” when it is necessary to control the departure of the next racer and also to “Yellow Flag”

(stop) a racer who is already on course – again, because the preceding racer may have fallen, and the course may be blocked. When this command is issued, the Start Referee must immediately close the start.

- c. The Start Referee must immediately, and in a concise manner, respond via radio:
 - 1.) That the start is closed, and
 - 2.) Must state the start number of the last competitor to have started as well as
 - 3.) The start number of the competitor held at the start.
Example: “start stop confirmed, number 23 on course, number 24 at the start.”
- d. When “Start Stop” or “Start Stop/Yellow Flag Stop” is called, Ski Patrol assigned to the event and in radio contact with the Jury, is on alert medical assistance may be required.
- e. If the Jury/Eyes of the Jury/Jury Advisor call for medical assistance:
 - 1.) Ski Patrol assigned to the event first verifies that the course is clear, e.g., no racer is on course!
 - 2.) Once Ski Patrol assigned to the event has verified that it has a clear course, it responds to the call for medical assistance.

SKI PATROL ASSIGNED TO THE EVENT - NOT COACHES/TRAINERS/ OFFICIALS/PARENTS / OTHER COMPETITORS - ARE THE FIRST RESPONDERS!

- f. The individual (Jury member, eyes of the Jury or Jury Advisor) who called the “Start Stop” or “Start Stop, Yellow Flag Stop” is responsible for releasing the course hold.
- g. The course is reopened at the direction of the Jury: either from top to bottom, bottom to top or from the position where the incident requiring the “Start Stop” occurred.

NOTE: Only the members of the Jury, Jury Advisors and Eyes of the Jury (Connection Coaches) are authorized to call a “START STOP.” The Chief of Course may call for a “course hold” as required for maintenance of course. Chief of Timing & Calculations may call for a “timing hold”, if required.

II. THE RACECOURSE AND THE TRACK

- A. Racecourse or the *piste* is the trail or slope, where the competition is to be contested
 - 1. The ideal racecourse should be maintained so that all competitors have equal opportunities regardless of their start position.
 - 2. Proper preparation is essential for a good race! It is important to cooperate with the Organizing Committee (OC), ski area management, and the personal in charge of slope maintenance and grooming regarding procedures regarding the following areas:
 - a. Course preparation:
 - 1.) Pre-season by clearing of brush, obstacles, and if available early season snowmaking.
 - 2.) Mixing snow types is critical in establishing consistent piste
 - 3.) Manage grooming throughout race season
 - a. Apply proper grooming techniques immediately prior to race day
 - 1.) Slow track speed
 - 2.) Tiller bar control

- 3.) Reverse till
 - 4.) Down pressure
 - b. Managing snow depth
 - 1.) For adequate track condition
 - 2.) For adequate depth for fence installation
 - c. Adequate, trained staffing for piste preparation and maintenance
 - 1.) Fence Crews
 - 2.) Section Chiefs
 - 3.) Course Workers
 - 4.) Slip Crews: (Figuring the #'s (lift time, intervals, sections, travel time) # of slippers per group X Lap time (to include# of slipper pullouts + time to lift base + time on lift) X Slipping interval + minimum reserve = # of slippers)
 - 5.) Snow Plan (If required by changing weather/course conditions)
 - d. Course Materials
 - 1.) Gates and panels
 - 2.) Fencing and protection devices
 - 3.) Drills
 - 4.) Snow hardening agents
 - 5.) Course coloring agents and sprayers
 - 6.) Shovels and rakes
 - 7.) Timing installations and security/protection
 - 8.) Additional equipment as needed
2. Clean up: After the race, the hill should be left clean of equipment and debris. [Refer to “Venue Dismantling Recommendations” in MPF]
3. On-hill security/protection installations require specific knowledge and experience and should follow this creed: **ADA**
- **Avoid** the obstacle
 - **Deflect** a fallen competitor away from an obstacle
 - **Absorb** the energy to stop a fallen competitor before the competitor reaches the obstacle.
4. Sources for security/protection installation information are as follows
- a. Homologation requirements
 - b. Jury inspection requests
 - c. Manufacturers’ recommendations
 - d. Historical knowledge of the piste
 - e. Technical Advisors are named by FIS or U.S. Ski & Snowboard for upper-level competitions, e.g., World Cup, Continental Cup, and National Championships, to work with the organizers in advance of the competition to prepare the racecourse and verify the availability of necessary competitor security/protection equipment.
- B. The race *Track* is a sequence of gates through which the competitor passes. The gates are set in accordance with specifications stipulated by U.S Ski and Snowboard and/or FIS and are particular to the event being contested, DH, SG, GS, SL, or P. The following resources will assist the Chief of Race to understand these specifications:
1. Setting of the Gates (**Refer to USA Course Setting Specifications: Scored and Non-Scored; 2022 Alpine Competition Guide**).

- a. U.S. Ski & Snowboard non-FIS events use current edition of course setting specifications available on the website and in 2022 Alpine Competition Guide. Gate count is decided by the distance between gates (turning poles); specific gate combinations may also be required.
- b. FIS event SG, GS and SL gate counts are based on direction changes. The required number is calculated on a percentage of vertical drop. FIS DH gate count is based on what is required.
3. Width between the poles of each gate.
4. Distance between turning poles of two successive gates.
5. What restrictions applied to vertical combinations (SL flushes, hairpins, and delays)?
6. Track should:
 - a. Be set to the appropriate level of competition
 - b. Have a variety of turns that involve a skillful use of the terrain.
 - c. Difficult sections should not be set right at the beginning or at the end of course
 - d. Be technically challenging
 - e. Should require complete turns
 - f. Have rhythm and the preferred line should be obvious
 - g. Should lead competitor through the center of the finish
 - h. Be legal but also fair and appropriate for all competitors
 - i. Be set in agreement with the Homologation security plan
 - j. Situations that may increase the inherent risk of the sport should be avoided

III. RACECOURSE, THE “TRACK” AND THE RULES

- A. Dimensions
 1. Minimum and maximum vertical drop per U.S. Ski & Snowboard ACR and FIS ICR.
 2. Minimum width of the racecourse per U.S. Ski & Snowboard ACR and FIS ICR.
 3. Width and separation of the gates per U.S. Ski & Snowboard ACR and FIS ICR.
 4. Timing requirements (Manual and Electronic) per U.S. Ski & Snowboard ACR, “FIS Timing Booklet” and FIS ICR.
- B. Some applicable rules for review
 1. Single Pole Slalom and Single Gate Giant Slalom (Refer to current U.S. Ski & Snowboard ACR and FIS ICR).
 - a. In what situations must you install both outside poles/gates and turning poles/gates?
 - b. What is the definition of “gate line” for Single Pole Slalom and Single Gate Giant Slalom?
 - c. In which event, and under what circumstances, is a competitor allowed to “hike”?
 - d. How far does a competitor have to hike (step back) in order to complete “clear passage” when they miss a single-pole gate?
 - e. How far does a competitor have to hike (step back) in order to complete “clear passage” when they miss a gate comprised of two poles?

2. Course setting rules regarding events with mixed age groups.
 3. Differences between gate counts/setting for non-FIS and FIS events.
 4. Start/Finish preparation and course setting for Parallel events (**Refer to current edition of Parallel rules (Art. U1220) in 2022 Alpine Competition Guide and its Precisions; FIS ICR (Art. 1220) and its Precisions**).
- C. Supervision of the Training
 - D. Rights of the Jury During Competition: Race Arena
 - E. The Start Area
 - F. The Finish Area
 - G. Homologations: Course, Gate Panels, Poles, Timing Equipment
 - H. Preparing the Downhill racecourse, and its “dimensions”
 - I. Preparing the Slalom racecourse, and its “dimensions”
 - J. Preparing the Giant Slalom racecourse, and its “dimensions”
 - K. Preparing the Super G racecourse, and its “dimensions”
 - L. Preparing the Parallel racecourse, and “dimensions”
 - M. Inspection and Training (on the racecourse)

IV.

RACECOURSE HOMOLOGATION

- A. U.S. Ski & Snowboard Course Approval (Inventory available on U.S. Ski & Snowboard /FIS websites)
 1. Required for all U.S. Ski & Snowboard Downhill (DH), Super G (SG), Giant Slalom (GS), Slalom (SL), and Parallel (P) events, both scored and non-scored.
 2. Required for U.S. Ski & Snowboard Masters events.
 3. Course setting needs to conform to the inspection report and U.S. Ski & Snowboard/FIS requirements.
 4. FIS homologated trails are automatically accepted by U.S. Ski & Snowboard.
- B. FIS Racecourse Homologation (Inventory on FIS website)
 1. U.S. Ski & Snowboard and FIS calendared events are to be held on racecourses that are homologated (approved) in advance by the FIS.
 2. Homologation requests are directed to the U.S. Ski & Snowboard representative of the FIS Alpine Racecourses Subcommittee; *they are not sent to FIS Office.*

3. Downhill (DH) and Super G (SG) courses must be re-homologated every 5 years. Downhill (DH) and Super G (SG) events must be held on currently homologated hills.
4. Slalom (SL) and Giant Slalom (GS) courses must be re-homologated every 10 years. In cases of *force majeure*, Slalom (SL) and Giant Slalom (GS) events may be staged on replacement hills. These hills are required to meet standards of original homologation, and Jury Minutes must be generated to document the need for the replacement.
5. All courses – DH, SG, GS, and SL – must be re-homologated whenever there have been major modifications to the hill including, but not limited to:
 - a. Erosion, landslides of overgrowth
 - b. Construction of buildings or lifts
 - c. Construction of shelters, parks, roads, tracks, etc.
 - d. Installation of snowmaking hydrants, snow retention fences, additional hardware

NOTE: Homologation files are available for review on the following websites; these are the only valid sources for verification of a course homologation:

media.ussa.org/Public/Athletics/CompServices/Homologation/

(Login is required: User ID = homologation; Password = Allout2018!)

fis-ski.com/DB/alpine-skiing/homologations.html

(Maps, photos, reports, etc. are not accessible at this site.)

A new inspection of an existing course (FIS or National) voids the previous homologation of an existing course.

NOTE: An Organizer should not depend entirely on the homologation of a racecourse by the FIS and ignore exceptional snow and weather conditions. Natural conditions like insufficient snow depth, unfavorable surface snow conditions, dense fog, heavy snowfall, or rain may make the trail unsuitable for holding a specified competition.

V.

RACECOURSE MATERIALS

- A. Suggested List of Supplies – Have extra of everything available!

Poles:	Wrenches (if screw-in gates being used)
GS racecourse: adequate numbers	Wedges, hammers
SL racecourse: adequate numbers	Shovels and rakes
Tool kit (pliers, screwdriver, etc.)	Communication equipment
Water, if required for course preparation	Extra radio batteries and chargers
Barriers: As needed	Signs (“Closed”, etc.)
Drills/Auger for hard snow/ice	Snow hardening agents for snow treatment
Drill battery chargers/extr batteries	Buckets and spreaders
“Willy bags” & filling	System for crowd control
Air fences and inflating devices	Course coloring agent & sprayers
Tags/stickers for numbering gates	Plastic garbage bags
Heavy twine/baling wire	Tape - duct, electrical, friction, etc.
“Zip” ties	Gate panels/banners DH/GS/SG
Support for banners	Timing equipment: electronic & manual/hand
Banners: Start, Finish, Sponsors	Finish sensor protection devices
Score Board / Official Notice Board	Public address system
- B. Factors to Consider for appropriate venue construction
 - a. Type of event

- b. Number, age, size, speed, and ability level of competitors
- c. Nature of racecourse
- d. Available personnel
- e. Snow conditions
- f. Anticipated weather

VI. START AREA, START LINE AND THE FINISH AREA

- A. Start Area
 - 1. Integral and important part of the racecourse carefully planned and prepared.
 - 2. Closed off from public.
 - 3. Sheltered or near the shelter.
 - 4. Sufficient area for competitors, coaches, service personnel, extra clothing/equipment.
 - 5. Exit other than through start gate.
- B. Start Line and Start Gate
 - 1. Location should be well considered.
 - 2. Level start platform and start area with restricted access.
 - 3. Start gate preparation and equipment in accordance with rules.
 - 4. Proper surface preparation to limit deterioration (Pads).
 - 5. Start gate leads competitors onto the racecourse through the first gates.
 - 6. Track from start line to first gate prepared and maintained as well as the rest of racecourse.
- C. Finish Area and Finish Line
 - 1. Conforms to current requirements of U.S. Ski & Snowboard and/or FIS.
 - 2. Enough length and width to allow competitors to stop.
 - 3. Access and egress for officials and competitors.
 - 4. Adjacent areas to accommodate timing, scoreboard, media, and spectators.
 - 5. The last gate directs competitors to the middle of the finish line.
 - 6. Vertical poles or banners may be installed to identify location; horizontal banner may be attached to vertical posts.
 - 7. Finish line clearly marked with a coloring substance.
 - 8. All finish installations located and secured to protect competitors.

9. Prepared and maintained as well as rest of racecourse.

VII. RACECOURSE PREPARATION SUGGESTIONS

- A. Advance work is a key element
 1. Organizing Committee should consider the recommendations of the area management and the consideration of the skiing public.
 2. Keep area management and mountain operations informed, involved, and committed.
- B. Actual Preparation
 1. Clear obstacles from slope and course – prior to first snowfall.
 2. Slopes used by recreational skiers groomed on a regular basis; supply input on scheduling to provide good density.
 3. Surface as firm and smooth as possible prior to race day.
 - a. Mogul cutting, use grooming machines well in advance of event
 - b. 12 hours required for reworked snow to properly “set”; *air temperature is an important consideration when estimating required setting time*
 - c. Keep in mind it is often better to “wait” for conditions/temperatures to stabilize
 4. Mechanical preparations are dependent on the ski area “rolling stock,” the snow conditions, and anticipated weather. The ski area employee in charge of grooming is generally the most knowledgeable source of information relative to the needs of the slope. Event personnel should discuss preparation of the racecourse well in advance of the event. This will help establish that the grooming staff is aware of current snow preparation requirements and how these requirements differ between preparation for competition and preparation for recreation.
 - a. **Track Packing** can be used early in the season to develop a base. This provides initial compaction and provides a rough surface to which future snow can adhere. This may also help in consolidating deep, dry snowfalls until they can be worked more intensely. With care, track packing may provide enough consolidation and adhesion for new snow to adhere to a frozen base.
 - b. **Tiller Bar** is hydraulic powered to apply significant down pressure and tilling of the snowpack. It is the standard grooming device for most ski areas with modern grooming equipment. It leaves a smooth or slightly rippled surface, but if worked in very deep snowfalls, it may leave layers of compacted snow. Continuous packing is necessary during heavy storms or a sufficient period of time must be allowed after grooming to allow top layers to “set.”
 - c. **Cutter Bar or Blade** is used to “cut” moguls and move snow and should be followed up by finish grooming to leave a skiable surface. This type of grooming requires skilled operators.
 - d. Certain level of events requires that racecourses be prepared with the use of a **Water Injection Bar or by spraying water on the track in conjunction with grooming**. These techniques add water to the racecourse and, when set, provides a firmer racing surface.
 5. Mechanical Preparation Issues. Mechanical preparation is quick and usually effective, but machines do have their limitations.
 - a. Compacting power is diminished on very steep slopes

- b. Control of the machine may be difficult in some conditions
 - c. Some machines do not maneuver or pack well on a side-hill
 - d. Under some circumstances, can damage the prepared track
 - e. If insufficient time for the surface to be slipped by skis after working, machinery is best kept off the racecourse until the depth of new snow can no longer be handled by working on skis.
6. Manual Preparation. If machines are not available or their use would be ineffective.
- a. Snow cover is very thin
 - b. The slope is too steep for effective machine use
 - c. Crust layer will support skis but break under machines,
 - d. Racecourse is covered with old unpacked snow
 - e. Great depth of new snow on top of a prepared surface
7. Types of Manual Preparation
- a. **Boot Packing** should be done several days in advance to be as effective as possible. When boot packing, several passes over the slope are usually needed. Boot holes should be left open and not packed or slipped over until two days before the event or beginning of training. The racecourse should then be ski packed on the day before the event, and the ridges should not be slipped.
 - b. **Ski Packing** is necessary when there is very thin snow cover, a racecourse needs smoothing after being boot packed, there are isolated areas that cannot be reached by machinery or machinery is not available.
 - c. **Side Slipping** is used for final smoothing of the racecourse and/or removing loose snow from the track.

As may be apparent, the Chief of Course must be able to evaluate conditions and react appropriately. This is a critical piece for a successful event.

VIII. SPECIAL SITUATIONS

- A. If New Snow Is Expected Overnight
 - 1. Defer course setting until morning.
 - 2. Cat crews should constantly be packing new snow as it falls. Racecourse maintenance crews should be prepared to begin work on the racecourse as early as possible to move new snow off to the sides of the actual track - if it is not too deep or heavy.
 - 3. Consider use of the designed “SNOW PLAN” – **Excess Snow Fall**. With more than a very light coating of new, very dry snow, it is recommended that the first slipping crews clear a wide area away from and on both sides of the track. This will create an area for placement of snow removed from the actual track. *Starting from the center of the track will create “berms” which can then, “set up,” and create removal difficulties.*
 - 4. Inspection: The same “setting up” can also occur if snow is allowed to pile up at the gate bases. Solutions include course workers using grain scoops to remove the excess snow or a course crew worker/official instructing the competitors to flatly sideslip when moving through the course as wedging will create piles of loose snow (duff).
 - 5. During the race: The goal is to maintain a course that is equitable for all competitors, and course slippers should be reminded of this goal. As competitors pass through the

course, berms may develop either at the base of the gates or in the track. *Note that the track will not require as much “grinding off” of roughness (berms) as it will smooth out of loose snow. One recommendation is to have “spotters” who, keeping competitors’ start intervals in mind, can be positioned along the course so they can easily either move to or call for required course repair.*

6. While smoothing the track makes it erode more evenly, remember that smoothing the berm or “The Low Line” is an important task and should be performed by the Chief of Course and their crew.
- B. Consider use of the designed **“SNOW PLAN” – Thin Snow Cover.** Dry snow/thinly covered areas can be sprayed with water, so the available snow becomes more resistant to ski traffic. The air temperature should be considered before using water as a preparation agent because in order to be efficient, it must refreeze either by contact with air below 32 degrees F, reaction with a snow hardening agent or by contact with a lower and colder portion of the snowpack. When applying water, it is suggested to apply less than what you think may be required.

In specific situations, the application of snow hardening agents to loose snow will create a more durable racing surface. In other situations, a shovel, some loose snow, application of a snow hardening agent, and a propane torch (weed burner) can suffice. The loose snow is “cooked” with a periodic sprinkling of the snow hardening agent into the heated area, and as the melting of snow crystals creates free water, crystals beneath are percolated and refreeze. *Such a patch is useful in cases of rock that cannot be physically moved.* This process takes time and it is suggested that these areas be cordoned off prior to competitor’s course inspection in order to protect them during the actual inspection.

- C. Ice Patches can either be:
 1. Tilled or aggressively raked to add “texture” to the ice.
 2. Industrial-type propane torches can be used to partially melt relatively large areas to allow loose snow to adhere.
- D. Snow hardening agents may be recommended. Snow hardening agents can be used when:
 1. Adequate moisture exists in the snowpack and/or:
 2. Melting of ice is sufficient for new snow to adhere in a variety of situations including:
 - a. When snow is sticky
 - b. Snow is too soft or wet due to mild weather and/or rain. Snow hardening agents can only be effective in the presence of free water occurring due to melting snow crystals.

Sunshine is a great source of energy to create the water needed. Overcast skies, low humidity, and evaporative wind on the piste can create conditions where snow hardening agents are effective to only a shallow depth, even with temperatures well above freezing. Snow hardening agents can “run out” of free water, resulting in a breakable crust which can then lead to holes in the course. It is important to prepare the snow hardening agent test patches to verify there is enough depth of penetration for a structurally solid surface.

NOTE: Organizers should work with ski area management regarding types of snow hardening agents allowed by the area/local environmental agencies/regulations.

E. Application of Snow Hardening Agents

1. Upper layer of snow is ski packed and then smoothed with skis or rakes and shovels.
2. The section to be prepared is “salted” by hand or with a spreader.
3. Snow hardening agent is scattered on the surface and then covered with a thin layer of snow by side slipping or shoveling.
4. The treated area should extend beyond (outside) the track itself.
5. Start and finish areas should also be prepared in the same manner as the racecourse.

A treated racecourse may become smooth only after several skiers use it so advance preparation for an adequate number of forerunners will assist in providing an even surface for all competitors.

6. Warmup/training areas, if available, should be treated in the same manner as the racecourse.

F. Snow Hardening Agent Preparation Issues. Preparation of the run with snow hardening agents, if done in due time, is more effective than applying water because it allows the snow to become moist and even. However, the following should be noted:

1. Granular spring snow may be hardened by the use of additives.
2. With new snowfall, the snow needs to be treated and compressed during, or immediately after the snowfall to take advantage of the humidity in the new snow.
3. When using snow hardening agents, **prepare several test patches** adjacent to the course in order to evaluate the effectiveness of the snow hardening agents.
4. Snow hardening agents are generally not recommended for use with dry snow at low temperatures.
5. When snow hardening agents are used, snow hardens differently at varying depths and lasts for differing amounts of time. Refer to historical reactions of snow hardening agents and test patches.
6. When time is short, or if a run needs overnight preparation with cold and loose snow, water and snow hardening agents may be used in combination. In this case, the *piste*:
 - a. Should be boot packed or track packed, windrowed, or other means of “opening” the surface of the snowpack
 - b. Water should be applied to “open” surface of the snowpack
 - c. Run should be worked in small areas; mixture of water should be immediately boot packed or tilled into the snow and then ski packed to make it smooth
7. Although snow hardening agents may be used in varying amounts on certain sections of GS, SG and DH racecourses, it is best to prepare an entire SL racecourse evenly.

8. When there is damp or wet snow that does not freeze because of mild temperatures, compact snow may be obtained with snow hardening agents. Such products may also be effective because of rain and/or a rise in temperature.
9. Very wet, rippled snow is usually found in the spring when there is warm, rainy weather or when rainfall mixes with snow. The same substances used for wet snow are effective, but much deeper preparation is needed before snow hardening agents are spread and must be repeated after spreading. If the snow is very humid, it may be necessary to use a different snow hardening agent.
10. A racecourse may need to be softened when rainfall is followed by a sudden freeze - a difficult situation that generally requires machine work by experienced operators.

NOTE: *Prior to “setting,” some “snow hardening agents” can damage equipment. In addition, traces of some “snow hardening agents” can be transferred from on-hill clothing/equipment to travel clothing/equipment and may cause airport security alerts.*

IX.

RACECOURSE MAINTENANCE SUGGESTIONS

- A. Racecourse maintenance begins with the preparation of the slope that is to be used and ends after the last competitor has crossed the finish line and all race-required installations have been removed.
- B. Potential problem areas should be anticipated and proper planning should be undertaken to avoid problems.
- C. Constant racecourse maintenance work is necessary during the race to slip or shove out ruts, holes, and “chatter marks” from the turning areas. If properly prepared and undisturbed, snow density should be consistent within the snowpack. Even and predictable erosion will develop in the turns. An area of snowpack that has set, subsequently been disturbed by machine and is not yet well “glued together,” may require course crew’s efforts to maintain a smooth racing surface.

Uneven erosion caused by slight variances in snowpack density are generally quite manageable with skis and/or tools. In some cases, it may be more damaging to attempt erosion guidance as the area may be fragile due to lack of bonding. It is important to catch deterioration in such areas early as bonding may be possible with packing in new/wet snow or in colder temperatures, sprinkling with water and adding snow.

- D. Objective is to make the racecourse as equitable for the last competitor out of the start gate as it was for the first competitor.
- E. Keep in mind maintenance of the start and finish areas is as important as that of the actual racecourse.
- F. If pre-race preparation has been successful, maintaining the racecourse during the race itself will be easier. Part of maintenance will be preparation for the next day's training or race.
- G. As with other race operations, racecourse maintenance is easier and more effective if:
 1. It is properly organized.
 2. The workers are shown leadership, coordination, and are properly trained.

3. Communication is in place to lessen delay in response or error in assigned tasks.
 4. Racecourse maintenance work is done by several crews under the direction of an experienced leader and staffed by skiers with the ability and skill for the job.
 5. Crews are assigned a section of the racecourse that they will work continuously, or they rotate down the racecourse and move from one section to another.
 6. If a rotation system is used, one crew should always be either already at the start or on the lift headed for the start.
- H. The security of all competition participants – Coaches, Competitors, Officials, and Volunteers, as well as the efficiency of a racecourse crew, are core concerns.

Generally, the more qualified racecourse crew members who have access to radio communication, the better. However, every racecourse crew member, regardless of whether or not they have a radio, should be familiar with the race program/schedule.

Familiarity with the race program/schedule includes but is not limited to the intervals between forerunners' and competitors' consecutive starts. *Fixed start interval competitions (GS, SG, and DH) require that this information be published on the race program.* Knowing the amount of available time between starts can permit the racecourse crew to make better use of their time and preserve the margin of their security in the performance of their duties during the event.

1. Chief of Course should always be aware of actual start intervals: published and Jury-approved changes.
 2. All racecourse crew members should be aware of changes to published/announced start intervals and must communicate that to other competition workers, e.g., Gate Judges, if they do not have radios.
 3. It is common to have a longer start interval for the first group (usually 15 competitors); if the event is televised, this interval is lengthened.
 4. During the main portion of the competition field, the start interval is often shortened; e.g., the minimum as dictated by the type of event: DH, SG, and GS.
 5. It is common and recommended that the start interval for a final group of competitors (usually five), be lengthened to reduce the possibility of a rerun required by issues beyond the control of the competitor on course, e.g., obstruction created by a fallen competitor, and/or required gate repair/replacement, and/or required course repairs.
- I. Repairing damage. With sufficient organization, it should not be necessary to interrupt the race for maintenance for more than brief intervals. Should an interruption be needed, the delay must be approved by the Jury and announced to all officials, competitors and coaches.
1. Competitors' course inspections may damage a racecourse more than race or training runs will and may necessitate repair before the race or training run can start.
 2. Establish a communication system to make sure racecourse is clear of all competitors so that maintenance work can start.

3. Turns, landing areas after jumps, flats, and traverses are all areas that require regular maintenance. Some sections will only need side slipping, but others may require major work with shovels, torches, water, and snow hardening agents.
 4. Weather permitting, maintenance work should be done as soon as possible so a developing problem is not aggravated, and all major repair work should be completed after the last run of the day so the racecourse may “set” overnight.
- J. Recent challenges due to extremes in weather/climate change have caused alterations to slope use, vertical drop, and location of start and timing installations. The Chief of Course should be aware of alternate racecourses, and the range of the track within the Homologation.
1. Anticipating future challenges may include consideration of higher start locations, and higher finish/timing installations.
 2. Having additional timing/communication cables to allow greater range of timing/finish line locations.
 3. Other considerations can include alternate courses, even moving events to alternate nearby resorts. (Moving to an alternate resort will require a new Schedule Agreement.)
 4. Off-season construction/availability of mobile timing buildings should be considered.
 5. Coordination within the Organizing Committee can result in successful completion of events/schedule due to being prepared and knowing your alternatives.
- K. Venue dismantling is the responsibility of the Organizing Club and Ski Area and is outside the jurisdiction of the Jury. However, unless a venue is being kept intact for future competitions/training, dismantling is required, and the assistance of Team Captains/Teams may be requested.

When a run is left in a condition that it can easily be returned to use by the public, ski area management is more likely to be receptive to future event scheduling.

Dismantling requires the presence of many individuals and inasmuch as their focus is directed towards proper dismantling, transport, and storage of required course materials, the following process is strongly recommended:

- Entrance to start area should be controlled so only those assisting in venue dismantling are able to access the venue
- Crossings that would allow individuals to enter the venue at a place below the start should be controlled in an effort to eliminate entrance
- Finish arena should be controlled so only those assisting in venue dismantling are able to gain access to the venue
- Finish arena, crossings, and start area should be dismantled last and in the listed order

The above process should be fully explained at the Team Captains’ Meeting and such discussion should be referenced in applicable Team Captains’ Meeting Minutes. The process should also be posted on the event’s Official Notice Board.

A good Chief of Course will anticipate problem areas and organize crews accordingly!