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A Radio Communications Protocol for Resource Roads in B.C.: Pilot Project Results and Recommendations for Implementation

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Table of Contents

Introduction

There is an urgent need to improve safety and reduce collisions on resource roads in British Columbia. One way to improve safety is to clarify and standardize VHF radio communication procedures for the wide range of users that now travel on resource roads. To address the radio issue the B.C. Radio Communications Working Group developed a proposal for a new radio communications protocol. The new protocol consists of a block of dedicated resource road radio channels along with standardized call procedures and road signage.

The new protocol has been tested in two pilot projects. One pilot project covered the Campbell River, South Island and Sunshine Coast Forest Districts and the other project was located near Tumbler Ridge in the Peace Forest District. The pilots were introduced in a series of stages. BCTS' Strait of Georgia (SoG) Business Area finalized project specifications for the Tsitika network, north of Campbell River, and put the new protocol into effect in January 2008. Various road systems on the South Island and Sunshine Coast were brought into the program in March, April, and May 2008. The pilot project in the Peace District was initiated on the Ojay road network in June 2008.

The objectives of this report are to: a) summarize protocol development, b) present results from the pilot projects, and c) provide recommendations for implementation. The report is divided into several sections to meet these objectives. First, the Working Group is introduced and elements of the proposed protocol are briefly described. Second, communications activities carried out during the pilot projects are summarized. Third, supporting documents for radio protocol implementation are presented. The documents provide the rationale for some aspects the proposal. They were also designed to guide local road managers in potential future implementation efforts. Fourth, the results from FPInnovations' on-site interviews with road users during the pilot projects are presented. And finally, recommendations for protocol implementation are offered based on FPInnovations' observations during the pilot projects and on feedback gathered from road users and the Working Group.

The B.C. Radio Communications Working Group

In 2006, a working group was formed to develop a proposal for a new radio communications protocol. The group, now known as the B.C. Radio Communications Working Group, is currently comprised of the individuals and organizations listed in Table 1. To date, the group has focused on investigating the feasibility of adopting a communications protocol on FSRs.

The Working Group collaborated extensively with local road user committees, industrial operators from all sectors, and public stakeholders in the development of a common radio use protocol. The proposed protocol has been tested in two regional pilot projects. Public information meetings and ongoing consultation with road users have been key parts of the process to date. The goal is straightforward and shared by all; to improve safety on B.C.'s resource roads.

Table 1. The B.C. Radio Communications Working Group

Participants	Affiliation
Brian Chow	B.C. Ministry of Forests and Range (MFR), Resource Tenures and Engineering Branch
MaryAnne Arcand[1]	B.C. Forest Safety Council, Forestry Trucksafe Program
Doug Erickson	B.C. Timber Sales (BCTS)
Morris Bodnar Jim Laursen Brad Davis	Industry Canada, Spectrum Management and Telecommunications
David Miller	MFR, Information Management Group, Radio Operations
Rob Kopecky Steve Amonson	MFR Peace Forest District
Mark Vieweg	MFR Operations Division
Steve Kozuki	Council of Forest Industries (COFI)
Doug Bennett Craig Evans Ed Proteau	FPInnovations, Feric Division.

[1] Affiliated with the Central Interior Logging Association (CILA), as of July 15, 2009.

Elements of the Proposed Radio Communications Protocol

The number of collisions and near misses on B.C.'s resource roads appears to be increasing and many of these incidents can be attributed to poor radio communications. Some examples of communications-related safety issues are:

- Increasing traffic volumes on resource roads and more frequent occurrences of simultaneous radio transmission.
- Increasing numbers of road users from a variety of resource sectors and the public.
- Too many radio channels in use and confusion about the correct frequencies and call procedures.
- Greater mobility of forest workers between different regions of the province and the associated problem of drivers obtaining the correct local radio channels in a timely manner.
- Interference between several licensed radio users and other operations.
- Excessive chatter on radio channels and drivers "forgetting" to announce their position at regular intervals.
- Increasing number of resource roads supporting two-way travel of loaded log trucks and other payload-carrying vehicles.

The Working Group believes that including three elements in a standardized radio communications protocol would provide the greatest likelihood of reducing road user confusion and overcrowding on the airwaves. The three elements of the proposed protocol are: 1) a block of dedicated resource road radio channels, 2) standardized call procedures and 3) standardized signage for resource roads. As a first step, and in consultation with industry and government-affiliated road users, the Working Group developed some proposed specifications for the three radio protocol elements.

The next stage in protocol development was field testing. Two pilot projects were deemed necessary to cover a range of operating conditions and multi-sector road users. The Working Group was looking for feedback from a variety of road users to evaluate the new procedures. As a result, the pilot projects were located on B.C.'s south coast and northeastern regions. A series of public information meetings were held in each region to introduce the pilot projects and prepare road users for the trials. These meetings also proved to be good venues for receiving constructive input into protocol development.

The proposed radio communications protocol was refined based on the findings from the pilot projects. The Working Group believes that the prototype system is ready for a broader process of consultation with stakeholders. Further, the group believes that implementation of a new radio protocol, in a staged process on priority roads within Forest Districts, is warranted and would improve safety for road users.

A brief description of the basic elements of the proposed radio communications protocol follows.

Dedicated Bank of Radio Channels for Resource Roads

A dedicated bank of VHF radio channels has been established for resource roads. Within the block of new radio channels there are:

- 18 resource road channels configured for 30-watts of output power,
- 15 resource road channels configured for 5-watts of output power, and
- 9 loading channels configured for 5-watts of output power.

The road channels are designated for communications on resource roads and are only to be used for the purposes of transmitting traffic control information. Drivers use the road channels to announce their positions at regular intervals when traveling a road. Loading channels are reserved for communications between vehicles and/or heavy equipment within a harvesting area or other confined industrial operation.

The goal of the dedicated channel bank is to ensure that road users will be prepared for travel on any resource road in the province. All users will be able to load the complete bank into their radios. They can then travel anywhere in the province and simply switch to the channel posted at a roads point of commencement (PoC).

The road channels are not intended to replace regular working channels used by industrial operations. Operations will retain their required working channels at their own discretion. The new road channels are reserved for communication between vehicles on resource roads and for any emergency communications. Extraneous chatter must move to separate working channels.

Standardized Call Procedures

A standard radio call procedure is proposed. The procedure should apply to all radio-equipped vehicles travelling on resource roads. The proposed provincial standard includes specifications for: a) the order in which descriptors for vehicle position are announced, b) frequency of calling, and c) convoy calling. There are provisions for flexibility within the proposed procedure. However, any variation from the standard provincial protocol must be authorized by the District Manager. Preferably, a deviation from the default provincial standard will be developed and endorsed by a local road user group.

Further, any variations from the standard provincial protocol must be posted at the beginning of a road or at the point where the variation occurs along the road. In the absence of an authorized variation, the standard provincial procedure will apply. The following specifications are proposed for the standard call procedure:

Call Order

Drivers are to announce their position in the following order: *Road Name – Kilometer – Direction (Up or Down)*. The "Up" direction is defined as travel in the direction of increasing km marker boards. "Down" is in the direction of decreasing km marker boards.

The fourth and final part of a driver's radio call may be *vehicle type*. However, adding a description of vehicle type to a radio call will depend on local road conditions and the predominant type of traffic. It might not be necessary or desirable for a vehicle description to be included in all radio calls and a strict requirement to announce vehicle type is not proposed.

The decision to include vehicle type in a call requires some judgment. For example, if the predominant type of industrial traffic is log trucks then it likely makes sense for truck drivers to forego the vehicle description. Other road users, however, should be required to identify themselves. Some examples of descriptors for other vehicles include: lowbed, fuel truck, explosives truck, grader, shop truck, service truck, pickup, ambulance, etc. Any slow-moving vehicles or trucks carrying wide-loads should include vehicle type in their radio calls.

Alternative rules for announcing vehicle type may be warranted on resource roads supporting a mix of traffic from other industrial sectors and the public. There is a good opportunity for local road user groups to determine the appropriate rule for announcing vehicle type on a particular road system.

Call Frequency

The default call frequency is every km in the "Up" and "Down" directions. The frequency of calling may be adapted to local conditions however it is suggested that any deviation from the default provincial standard must be developed and authorized through a local road user group recognized by the District Manager. The maximum interval between radio calls will be two kms. The call frequency should be posted at the roads point of commencement. If the call interval is modified at some point along a road then a sign must be posted advising drivers of the change in the call interval.

Convoy Calling

A convoy is a series of two or more vehicles with the trailing vehicle positioned no more than 1 km behind the lead vehicle. If a vehicle is more than 1 km behind the lead vehicle it is responsible for calling its own position. Other specifications for convoy calling are:

- Lead vehicle must agree to call for all vehicles in the convoy.
- Lead vehicle shall call for all vehicles in the convoy.
- Vehicles joining or leaving the convoy must notify and receive confirmation from the lead vehicle.
- The lead vehicle should be equipped with a mobile radio — a hand-held unit should not be used.

Other Requirements

Must calls. Many points on resource roads, other than km marker boards, warrant a site-specific radio call to alert other road users about a vehicle's position. These locations are described as "must calls". All vehicles are required to transmit a radio message at must call points. If possible a sign specifying information for the radio call should be posted at must call locations. Some examples of reasons for must calls are:

- Near junctions of branch roads and mainlines prior to entering onto the mainline or proceeding up a branch road.
- When a vehicle stops or parks on the road, and again when the vehicle resumes travel.
- When a radio-equipped vehicle encounters a vehicle traveling without a radio.

Emergency situations. Immediately upon encountering an accident on a resource road, road users should identify and broadcast the accident location on the designated resource road channel. Active emergency vehicles (e.g. ambulance, RCMP) will have priority over radio airtime during emergency situations.

Roads within posted work sites. Occasionally a resource road will traverse through a work site, for example, roads that pass through an active timber harvesting unit. Travelling through a posted work site may mean that road users will have to switch from the resource road channel to the loading channel designated for the work site. The following steps should be taken when travelling though a posted work site:

- Make a radio call when leaving the road channel and entering the work site.
- Switch to the posted loading (worksite) channel and gain permission to enter and traverse the work site.
- Using the loading channel, make a call when you have cleared through the area and reached the end of the posted work site.
- Switch back to the road channel and make a radio call to announce your position.

Resource Road Signage

A properly installed and maintained network of road signs is an important component of a communications protocol. Signs must clearly show the information that road users require when making radio contact with other travelers. A set of standard road signs is proposed as part of the new communications protocol. A new sign standard has the added advantage of alerting road users that a new communications system is in effect.

After testing several configurations during the pilot projects, a final sign layout was developed. The proposed road sign specifications are shown in Appendix 1.

Four basic sign types were developed with standard formats for "Km" signs, "Road Channel" signs, "Must Call" signs, and "Caution" signs. Standard sign formats are proposed because they provide clarity and continuity for road users, help control manufacturing costs, and provide flexibility for road managers to tailor text to their local needs. Note that "Km" sign layout facilitates correct announcement because the "call order" elements are listed on the sign from top to bottom. Drivers can simply read the sign and make the correct call.

"Must Call" signs can be placed near junctions of branch roads and mainlines prior to entering onto the mainline or proceeding up the branch road. "Caution" signs can be applied to a variety of situations. For example, they can be posted to identify areas of reduced radio reception or points where drivers must switch to another radio channel. "Must Call" and "Caution" signs have a standard header format and the road manager can tailor the accompanying message to meet the specific needs of a site.

Examples of road signs developed for the radio pilot projects.

Communications Activities

Several communications initiatives were undertaken by the Working Group to: a) introduce the concept of a new radio communications protocol to stakeholders, b) solicit feedback to help specify elements of the proposed protocol, and c) prepare road users for the pilot projects. Communications activities included:

- **An online survey conducted by the B.C. Forest Safety Council, Forestry TruckSafe.** The survey was used to gather feedback on specific attributes of the proposed radio protocol. End users such as truck drivers and road managers were targeted in this poll. Of the 900 responses, the majority of poll participants supported the proposed standardized procedures.
- **A series of public information meetings held in 2008.** Public meetings were led by Working Group members from the B.C. Forest Safety Council and BCTS with support from FPInnovations and Industry Canada. Attendees included truck drivers, industry and agency road managers, radio equipment suppliers, and Provincial Emergency Program representatives. The radio pilot projects were introduced and road users were engaged in a dialogue about implementing improved radio communications. The public meetings are listed in Table 2.
- **Road user interviews conducted by FPInnovations.** Roadside interviews formed part of the pilot project evaluation process. Interview results are summarized in a separate section in this report.
- **FM transmitters installed near Port Alberni and Tumbler Ridge.** FM transmitters were used to inform road users in the vicinity of the pilot projects about the new procedures. Two messages were continuously broadcast; one message provided information about general road safety awareness, and another message introduced the radio pilot projects.
- **Presentations by Working Group members at conferences and resource sector meetings.** Working Group members provided overviews of the pilot projects and radio protocol elements at numerous conferences and meetings. A PowerPoint presentation, prepared by FPInnovations, was distributed during these meetings. Regular updates were also provided in Forestry TruckSafe's *Rumblings* newsletter.

Table 2. Public information meetings held in 2008

Location	Date	Venue	Time
Duncan	May 13	Steelworkers Union Hall	7 pm
Campbell River	May 14	Anchor Inn	9 am and 6 pm
Nanaimo	May 15	Best Western Dorchester	9 am and 6 pm
Port Alberni	May 15	Best Western Barclay	1 pm
Dawson Creek	May 20	George Dawson Inn	9 am and 6 pm
Chetwynd	May 21	Recreation Centre	9 am and 6 pm

Supporting Documents for Radio Protocol Implementation

Several supporting documents were prepared as the protocol was developed and the pilot projects progressed. Three documents, subtitled *Proposed Approach for Implementation*, *Assigning Radio Channels to Road Networks*, and *Identifying Zones of Reduced Radio Reception*, were prepared by FPInnovations. A fourth document outlining a radio reception field testing procedure was prepared by Industry Canada. The documents were reviewed by the Working Group. The purpose of these documents was to provide a rationale and explanation for technical aspects of the protocol. Other objectives were to help guide local road managers in their efforts to implement the pilot projects and to provide a source of information in case of future broader implementation. The four supporting documents, included as Appendices in this report, are introduced below.

Proposed Approach for Implementation

The document titled, *A Radio Communications Protocol for Resource Roads in B.C.: Proposed Approach for Implementation*, lays out the general tasks required should a decision be made to initiate a new communications protocol on provincial road systems (Appendix 2). The tasks are presented in two ways. First, the steps leading to implementation on a selected road system are summarized in a Gantt chart. Second, the steps required for implementation, accompanied by additional detail describing each step, are presented in a table. Each step is accompanied by a suggested period of lead time preceding the selected start date. The roles and responsibilities for each task are also specified. This document was developed in the context of protocol implementation on FSRs.

Assigning Radio Channels to Road Networks

Within the block of new radio channels there are thirty-three resource road channels available for allocation throughout the province. It is important to think strategically and provide for logical assignment of channels over the landscape. Two tasks must be completed before assigning new road channels to road networks. First, road systems should be reviewed to identify opportunities for rationalizing the number of road names. This is also the time to examine road naming conventions and determine if there is a need to streamline any local practices. Second, the landscape must be partitioned into map polygons that enable logical assignment of radio channels The purpose of the document about assigning radio channels is to provide guidance on reviewing road systems and partitioning the landscape (Appendix 3).

Identifying Zones of Reduced Radio Reception

Within the block of new radio channels there are 18 resource road channels with 30 watts of output power and 15 resource road channels with 5 watts of output power. Five-watt road channels are just one of several protocol elements designed to reduce radio interference for road users. The supporting document sub-titled, *Identifying Zones of Reduced Radio Reception*, explains the rationale for the 5-watt resource road channels and presents a procedure for identifying zones of reduced reception when five watt channels are planned for a road system (Appendix 4).

Five-watt road channels are proposed because their transmission range, or reception distance, is less than the range achieved by 30-watt channels. Therefore, on a busy road with a steady stream of radio calls, 5-watt channel assignments may be one option that could reduce the likelihood of interference for users.

Radio Reception Field Testing Procedure

Five-watt channels offer an opportunity to reduce the amount radio traffic and the likelihood of simultaneous radio transmission on busy roads. However, prior to assigning a 5-watt channel, the Working Group recommends testing radio reception to try and detect any areas where reception falls below an acceptable threshold distance between oncoming vehicles. If a zone of reduced reception can be identified it should be marked in the field. The document titled, *Recommended Field Testing Procedure for the Selection and Implementation of 5-Watt Resource Road Channels*, provides a procedure for field testing radio reception (Appendix 5).

It is important to keep in mind that the relationship between output power and reception distance is not linear. Impacts on radio reception are extremely site-specific and sometimes the additional acceptable transmission range gained by a 30-watt channel compared to a 5-watt channel may only be a few kilometers. Road authorities should be aware that testing radio reception on roads is not an exact science. Testing reception of 5-watt channels is simply suggested as a good practice. It is very difficult, if not impossible, to ensure that road users will always experience acceptable reception distance on roads regardless of whether 5 or 30-watt channels are assigned.

Road User Interviews

FPInnovations conducted roadside interviews with road users at several pilot project sites. The objective was to gather direct feedback about the protocol and to learn about opportunities for improvement. The feedback from the interviews was used by the Working Group to refine the proposal. This section provides a summary of results from the on-site interviews. It is divided into two parts. First, some statistics are presented to describe the types of road users interviewed. Second, some recurring comments were drawn from all the interviews and listed. Detailed summaries from each interview field visit are included in Appendix 6 followed by the questionnaire used to guide the interviews.

Road User Interview Statistics

Tables 3, 4 and 5 provide information about dates and locations of interviews, road user vehicle type, and the employment sector for interviewees, respectively.

Table 3. Road user interview locations

Date	Location	No. of interviews
January 28, 2009	Sunshine Coast	9
January 12, 2009	Tumbler Ridge	14
October 27-30, 2008	Vancouver Island	30
October 15-17, 2008	Tumbler Ridge	41
July 15-17, 2008	Tumbler Ridge	35
June 20; July 16-17, 2008	Vancouver Island	20
Total		149

Table 4. Road user vehicle type

Vehicle type	No. of interviews
Heavy trucks	73
Service vehicles (3-5 ton)	14
Light vehicles (pick-ups)	59
Other	3
Total	149

Table 5. Road user employment sector

Employment sector	No. of interviews
Oil & Gas	88
Forestry	56
Other	5
Total	149

Recurring Comments from Road Users

This section presents a series of recurring comments from the interview process and lists them under the categories of Road Signage, Calling procedure, Radios and Channels, and Communicating to Road Users. See Appendix 6 for a complete list of comments received during the interviews at each site.

Road Signage

- The Tsitika and Ojay-style "Km" boards were highly regarded and should be adopted as the standard – retain the sign layout, however consider removing the "km" suffix and show the number only.
- The font size for the frequency designation is too small on FSR PofC signs (however the Working Group needs to consider Industry Canada's remarks about the need to minimize the prominence of the frequency designation).
- Make sure signs are installed high enough to avoid snow cover, especially when they are installed on the lower side of the road.
- More "Must Call" signs are needed in hazardous areas.
- Suggest placing "Must Calls" far enough in advance of road junctions so that a call can be made in advance of the junction between a branch and main road.
- More speed limit signs are needed.

Calling Procedure

- There should be provision to allow the calling frequency to be determined at the road user group level, or even at the individual road user level. Calling every Km was thought to be too frequent for many roads.

- 5 – 10 km was the most common opinion regarding safe minimum distance for hearing calls; 10 km was the second most common.
- Not enough comments were made about the "call order" to warrant any recommendations for an alternative order based on user feedback. The order shown on the signs is the best practice.
- Vehicles traveling in the "Up" direction should clear for vehicles traveling "Down". This procedure was mentioned in each survey.
- Calling "Down", for vehicle direction, while physically traveling up an adverse grade was initially confusing for some road users. Generally, calling "Up/Down" for travel direction was acceptable to most users. Of those who encountered the "Up/Down" procedure for the first time, most thought they could adapt to it over time.

Radios and Channels

- The dedicated bank of Resource Road Channels is a concept that was consistently cited as being a very positive development.
- Not all radio shops were installing the complete channel bank in their client's radios.
- On average, 55% of road users on the Ojay road network had the complete 42-channel bank installed in their radios; 78% of road users interviewed in January 2009 had the complete bank installed.
- On average, 12.5% of road users interviewed on the B.C. Coast had the complete 42-channel bank installed.
- The radios used in the B.C. coastal region were often limited in their capacity to hold large numbers of radio channels. Many users did not have adequate capacity to install the complete bank of 42 radio channels.
- Radios used by B.C. Interior road users generally held more channels and could usually accommodate the required resource road channel bank.
- ⅝-wave and ½-wave antennas were the most common antenna configuration used.
- Most road users were using mobile-type radios; only two respondents in all surveys were using handheld radios.

Communicating to Road Users

- Posting the road information and call procedures at the beginning of the road was the preferred method for transferring knowledge about the radio protocol to road users.
- Local newspapers and advertisements in journals were also cited as effective ways to inform road users.
- Employers have an important role in educating workers about new radio procedures.
- Many road users favoured the idea of increasing protocol enforcement activities if communication efforts do not achieve desired results with road users in a particular area.
- The level of support for the protocol and uptake by road users was directly related to the prior communication efforts in a particular locality. In areas where road users were not informed about the impending pilot project, confusion and misconceptions about the radio protocol quickly became evident. Conversely, when road users were engaged in discussion about radio protocol objectives and informed in advance about an impending pilot project, there was good support for the initiative.

Recommendations

The following recommendations are based on FPInnovations' observations during the pilot projects and on feedback gathered from road users and the Working Group.

Resource Road Signage

- Adopt the Tsitika and Ojay-style Km signs as the standard; consider dropping the Km suffix.
- Adopt a standard layout for "Must Call" signs and adapt it to serve several purposes. For example, "Must Calls" can be used to alert other drivers that a vehicle will be entering onto a main road, or leaving a mainline and heading up a branch road. Use the same style of sign, with the word "Caution" replacing "Must Call" in the header, to inform drivers about areas of reduced radio reception or local road hazards. A common style will enable production of batch orders of base sign templates and will generate savings in sign costs. Local operations can add site-specific text to the sign template as needed.
- Place "Must Call" signs far enough in advance of road junctions so that a call can be made in a timely manner as a vehicle travels down a branch road and approaches the mainline.

Call Procedures

- Allow for flexibility in the frequency of radio calls to suit a particular road system. Consult with local road user groups to determine the most appropriate call frequency for "Up" and "Down" calls at Km markers. The default call frequency, in the absence of considered input from local road user groups, should be every Km in the "Up" and "Down" directions.
- Adopt the "call order" as proposed in the current protocol, that is, drivers announce: *Road Name – Kilometer – Direction (Up or Down)*. Note that "Km" sign layout facilitates correct announcement by drivers because the "call order" elements are listed on the sign from top to bottom.

Radio Channels and Reception Testing

- Retain a selection of 5-watt channels within the resource road channel bank. (Currently, there are eighteen 30-watt channels and fifteen 5-watt channels available for use on resource roads under the new protocol). Five-watt channels offer an opportunity to reduce the amount radio traffic and the likelihood of simultaneous radio transmission on busy roads. However, prior to assigning a 5-watt channel, local road authorities should test radio reception to try and detect any areas where reception falls below an acceptable threshold distance between oncoming vehicles. If a zone of reduced reception can be identified it should be marked in the field. For guidance on radio testing, refer to a document prepared by Industry Canada for the B.C. Radio Communications Working Group titled, *"A Radio Communications Protocol for Resource Roads in B.C.: Recommended Field Testing Procedure for the Selection and Implementation of 5-Watt Resource Road Channels"*. For a discussion about identifying and marking zones of reduced reception, see a document prepared by FPInnovations titled, *"A Radio Communications Protocol for Resource Roads in B.C.: Identifying Zones of Reduced Radio Reception"*.
- Think strategically about assigning radio channels over the landscape and take into account a) traffic volumes on key roads, b) topography, c) distribution of distinct landscape units, and d) the requirements of licensees and road users in neighbouring jurisdictions. When selecting channels consider the full range of available five and 30-watt channels. The document titled, "*A Radio*

Communications Protocol for Resource Roads in B.C.: Assigning Radio Channels to Road Networks", provides some specific recommendations on this topic.

At the Ojay pilot project, a 30-watt channel was assigned to the mainline. During the winter months, when oil & gas traffic volumes were high, there was considerable demand for radio time. There were some instances of radio interference between road users, a situation also encountered in previous years. Subsequently, the mainline was partitioned into two sections, each with a separate radio channel, in an attempt to clear up radio communications. A better strategy may have been to assign a 5-watt channel to the mainline as a first step. A 5-watt channel may have prevented the need to partition the road and assign extra channels. The opportunity to test the effectiveness of reducing radio interference through the use of 5-watt channels was not realized on the Ojay.

- Wherever possible assign the resource road radio channels to a defined geographic area as opposed to assigning separate channels to a mainline and each tributary branch road.[2] The latter situation can lead to an excessive number of radio channels over one road network. Exceptions may be warranted on extremely busy mainlines where road users have been accustomed to having a stand-alone channel for a particular road. For guidance on assigning radio channels, refer to a document prepared by FPInnovations for the B.C. Radio Communications Working Group titled, "*A Radio Communications Protocol for Resource Roads in B.C.: Assigning Radio Channels to Road Networks".*
- Road authorities should be aware that testing radio reception on roads is not an exact science. Testing reception of 5-watt channels is simply suggested as a good practice to gain more information about radio performance under local conditions. It is very difficult, if not impossible, to ensure that road users will always experience acceptable reception distance on roads regardless of whether 5 or 30-watt channels are assigned. The premise for testing is not to guarantee that radio reception will always be acceptable and road users should not be given the impression that a tested road means that radio reception will be optimal.

  Further, to provide some context for the discussion around 5-watt channels the following points are presented. First, many factors influence radio signal propagation and reception distance on forest roads other than output power, for example, topography, surrounding forest vegetation, weather conditions, antenna configuration and cable connections. Sometimes these factors will cause reliable reception distance to fall below a minimum acceptable level. Second, the relationship between output power and reception distance is not linear. Impacts are extremely site-specific and sometimes the additional acceptable transmission range gained by a 30-watt channel compared to a 5-watt channel may only be a few kilometers. Third, zones of reduced coverage are not anchored spatially over the landscape — they depend on the relative positions of oncoming vehicles. The results from field testing are not definitive and can only be used to help bracket a zone of potentially reduced reception. Note that there may be areas where acceptable radio reception will be compromised for both five and 30-watt channels. Finally, consider that there are some jurisdictions in Canada where relatively low-power radio systems such as Citizen Band (CB) radios are used for communication on resource roads. CB systems are limited to 4 watts of output power by law.

[2] Different methods were used to assign radio channels for the pilot projects. The SoG project covered a large portion of Vancouver Island and the Sunshine Coast, and the landscape was partitioned into geographic units for channel assignment. The Ojay pilot project was confined to one road network, comprised of a mainline and several tributary branch roads. Separate channels were assigned to the roads within the Ojay network.

In summary, the guiding principle should be that roads are not "radio-controlled" but rather they may have procedures in place to warrant being described as "radio-assisted". Radios are one aid to safe travel but can not take the place of ongoing defensive driving practices.

Radio Equipment

- In the interests of expediting protocol implementation, be prepared to offer some flexibility to operators who do not have radios with the capacity for the full resource road channel bank. This factor is especially pertinent to the coastal region. Some coastal operators may be confined to areas with only one or two FSRs and may only need a small number of Resource Road channels for an interim period. Insisting that large fleets purchase new radios may create undue hardship for operators trying to survive under current economic conditions.

  There is, however, another overriding factor that must be considered when determining radio compliance. The Resource Road channels have a narrow-band specification and therefore radios must be capable of being configured for narrow-band channels. Operators using older wide-band radios must be aware of this issue and encouraged to upgrade at their earliest convenience. It should be noted that narrow-band VHF radios were first stipulated as the standard by Industry Canada effective December 15, 1998. In January 2002, all radio licensees with non-standard land mobile equipment in the VHF and UHF bands received notification of the change in status of their radio equipment to a non-protected basis effective January 1, 2004.[3] Non-protected means that radio licensees can now be required to conform to the new standard. In effect, wide-band VHF radios have been out-of-compliance with Canada's national Radio Standards Specification (RSS-119) for at least five years.
- Permit the use of handheld radios on resource roads but strongly recommend that users equip their handhelds with external antennas. External magnetic-mount antennas, in ⅝-wave or ½-wave configurations, are good alternatives for use in conjunction with a handheld radio. These antennas can approximately double the effective radiated power of a typical 5-watt handheld radio. Although handheld radios are not as effective as mobile radios for communication, there are many occasional users of public resource roads that have no choice other than a handheld radio. Because radio use is not a strict requirement on public roads, retaining some communication capability for special situations and occasional road users is better than leading them to travel without a radio.
- Consider producing a simple pamphlet that provides basic information about best practices for setting up mobile and handheld radios and antennas. A pamphlet, made widely-available, would be a valuable tool to educate road users about radio system technology and proper configuration of their equipment to optimize its effectiveness.

Communications

- Prepare a communication plan and ensure that road users are consulted and informed prior to implementing the protocol at the local level. When users are informed and engaged in the process, the likelihood of successful implementation is much greater. It is important to achieve contact on-the-road with actual drivers. An effective method for transferring information to drivers was instituted at the Ojay pilot. The local road user group established an information booth at the road's PoC to inform drivers and ensure that they complied with the new procedures. Other successful

[3] Source: *Regional Policy and Procedures Circular 2-1-08,* Industry Canada, Pacific Region.

elements of a communication plan include information letters to licensees and public meetings to explain the radio protocol.

- Consult with road user groups. Seek input from road user groups especially in areas where multiple resource sectors operate. Discuss the implementation of the new communications protocol at user group meetings. Take the opportunity to present road network maps at group meetings and solicit suggestions for rationalizing the current system of road names.
- Post information about the radio protocol at the point of commencement (PoC) of FSRs or other common initiation points for road networks. Explain the elements of the protocol on the sign including descriptions of the new radio channels, call procedures and signage.
- Communicate with road managers in neighbouring jurisdictions when reviewing road systems. Inform other tenure holders and road management jurisdictions about your road review. Ensure that one road spanning several jurisdictions will have a consistent name. Discussions with other managers may produce new knowledge about development plans and help in the design of a road naming system for the long-term benefit of all users.

Implementation Process

- Review road systems in a Forest District, or other resource road jurisdiction, and identify opportunities to: a) rationalize road names, and b) streamline road naming conventions. This is an important step because a standard format for road kilometer signs has been proposed. The new format specifies the road name on each kilometer sign. A review before new road signs are ordered and installed could prevent the need for sign changes and additional costs in the future. Another potential benefit of a review is that fewer road names and a clear naming convention for branch roads should make it easier for users to adopt the new protocol.

  An efficient process for renaming road networks was demonstrated in the Ojay pilot project. The local road user group, with representatives from oil & gas firms, forest companies and government agencies, gathered around maps and upgraded road network names in 1½ hours. Such a process of consultation with road user groups has the added benefit of promoting cooperation and generating good ideas for implementation. For more information about conducting road system reviews refer to the document prepared by FPInnovations for the B.C. Radio Communications Working Group titled, "*A Radio Communications Protocol for Resource Roads in B.C.: Assigning Radio Channels to Road Networks".*
- Designate a person in each MFR District and/or BCTS Business Area to lead radio protocol implementation at the local level. This is a critical role to fill before attempting to move forward with implementation. Regional implementation leaders should be experienced and knowledgeable about local road systems and road users. They must be prepared to liaise with stakeholders within their local area and ensure that a communication plan is in place. Further, they must relate to the broad spectrum of industrial and recreational users and their road use patterns. Designating a local leader will also help to ensure that two important steps are completed prior to initiating the protocol, that is, review road names and assign channels in a logical manner over the landscape.

  For guidance on the required steps and tasks leading to radio protocol implementation, refer to the draft provincial implementation guide, titled, *"A Radio Communications Protocol for Resource Roads in B.C.: Proposed Approach for Implementation".* The guide was compiled by FPInnovations in consultation with the B.C. Radio Communications Working Group. The document lays out the tasks and timelines, in a 24-week process, that must be completed prior to implementing the protocol on a selected road system.

- Carry out provincial implementation of the radio protocol in a staged process. MFR Forest Districts should identify roads where improved radio communication is most needed and prioritize their selected FSRs for implementation accordingly. The amount of staff time and resources dedicated to protocol implementation will have an impact on the scope of work undertaken in a particular region. Note that the steps leading up to implementation, outlined in the document subtitled *Proposed Approach for Implementation*, show essential tasks and timelines that must be followed before the new protocol can be adopted. These tasks require some allocation of resources.

Appendix 1. Resource Road Signage

- **Proposed Road Sign Specifications**
- **Sign Materials and Manufacturing Processes**
- **Estimated Unit Costs for Road Sign Materials**

A Radio Communications Protocol for Resource Roads in B.C.

Proposed Road Sign Specifications

July 2009

"Km" Signs

Type: Two-sided (1 sign/km)

Backing material: 0.08" aluminum, Coroplast, or wood

Dimensions: 600mm X 400mm

Lettering: 7 yr Vinyl

Reflective sheeting: 3M Engineering Grade

Text colour: Black

Font: Arial bold

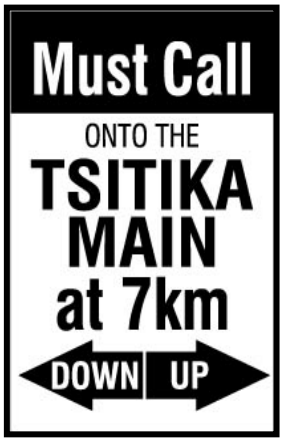
Mounting: side mount on U-Post

Sign cost: $57.00 (0.08" aluminum)

“Road Channel” Signs

	
Style 1	**Style 2**
Type: Single-sided Backing material: 10mm Coroplast Dimensions: 1200mm X 200mm (48” X 8”) Reflective: Yes Background colour: 3M Yellow Lettering: Vinyl Black Font: Arial Bold Mounting: Below FSR PoC sign, spanning two posts Sign cost : $12.00	Type: Single-sided Backing material: 4mm Coroplast Dimensions: 400mm X 200mm Reflective: Yes Background colour: 3M Yellow Lettering: Vinyl Black Font: Arial Bold Mounting: on FSR sign, top-right corner Sign cost: $5.00

“Must Call” Signs



Example 1

Example 2

Type: Single-sided

Backing material: 0.08” aluminum, Coroplast, or wood

Dimensions: 600mm X 400mm

Lettering: 7yr Vinyl

Reflective sheeting: 3M Engineering Grade

Header colour: Black

Text colour: Black

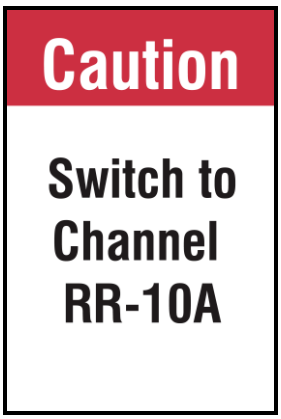
Font: Arial Bold

Mounting: U-Post

Suggested sign locations: Near junctions of branch roads and mainlines prior to entering onto a mainline or proceeding up a branch road. Sign text can be tailored to other needs and locations as deemed necessary by road managers.

Sign cost : $43.00 (0.08” aluminum)

"Caution" Signs

Example 1	Example 2	Example 3
		

Type: Single-sided

Backing material: 0.08" aluminum, Coroplast, or wood

Dimensions: 600mm X 400mm

Lettering: 7yr Vinyl

Reflective sheeting: 3M Engineering Grade

Header colour: Red

Text colour: Black

Font: Arial bold

Mounting: U-Post

Suggested sign locations: Areas of reduced radio reception; points where drivers must switch to another radio channel; etc. Sign text can be tailored to other needs and locations as deemed necessary by road managers.

Sign cost : $47.00 (0.08" aluminum)

Other examples of potential "Caution" sign text could include:

- Caution – Steep Grades (> 20%) Ahead
- Caution – Powerline Clearance 10 m
- Caution – Narrow Road
- Caution – Wildlife Crossing
- Caution – Gate Ahead
- Caution – Traffic Entering From Left
- Caution – Active Logging
- Caution – Slide Area No Stopping For 300 m

Sign Materials and Manufacturing Processes

This section presents additional information about sign materials and sign making processes. Signs are generally comprised of three parts: backing material, reflective sheeting and lettering.

1. Backing Material

Two different backing materials were used for the Km signs in the Radio Pilot Projects, Coroplast and aluminum. Each material has its advantages and disadvantages. Aluminum is more durable, and more expensive, than Coroplast. Wood falls somewhere in between these two material types in terms of cost and durability. The following table presents some of the attributes for alternative road sign backing materials.

Aluminum	Coroplast	Wood
• Well-suited to long-term projects. • Best durability; strong. • Raw material cost of $5.00/ft2. • Must be reflective and accepts reflective material more readily than Coroplast. • Accepts higher grade vinyl lettering, i.e., a lettering material that will not shrink with age. • Clear protective scratch-resistant material can be applied on top of the final sign if desired.	• Better suited to short-term projects – a less permanent solution with a 3-5 year maximum life expectancy. • Raw material cost of $0.40/ft2. • Weakens, distorts (bends), and fades with age. • Applying long-life non-shrink vinyl lettering on this material is not cost-effective. • Requires wood bracing for larger signs resulting in additional costs (purchase, cutting, fitting, etc.) • Can accept reflective sheeting. However, the reflective overlay generally will not adhere reliably for more than three years due to the deterioration of the coroplast material over time.	• Suited to long-term projects • ½" MDO plywood (medium density overlay) commonly used. • 10 yr life expectancy. • The additional labour required for wood sign-making increases costs by 20% compared to aluminum. • Safety issues have been cited by sign shops with respect to cutting the material. • Can apply thermal printed graphics. • Does not always perform reliably as a base for adherence of materials. • Wood must be well sealed around sign edges to prevent warping and eventual distortion of graphics.

2. Reflective Sheeting

Reflective sheeting is spread over the backing material before lettering is applied regardless of the process used for lettering.

Reflective backing is available in several different grades. Engineering grade 3M is the least expensive and most effective for resource road use and is therefore recommended. Reflective backing has a peel-off film that exposes the adhesive before being applied to the backing material. As long as the mating surface is clean it should not separate or shrink. Note: B.C.'s Ministry of Transportation and Infrastructure specifies 3M Diamond Grade reflective sheeting for highway signage. This material has a greater degree of reflectivity but is more expensive than the Engineering Grade.

3. Lettering

Three lettering processes can be used for road signs. Sign text may be vinyl applicated, screen printed, or thermal printed. Some attributes of the three lettering processes are presented in the following table.

Vinyl letters	Screen Printing	Thermal Printing
• Individual letters, logos, shapes are applied to the sign. • Preferred process for signs with unique text requirements, e.g. "Km" signs that have different numbers on each sign. • Less suitable for high volume production due to the labour required. • More durable than screen printing if good quality lettering is used. • Letters have adhesive backing and are available in different service lives e.g., 3-5 yr and 7-10 yr. • 3 yr vinyl will shrink over time whereas 7yr high performance vinyl will not shrink. • Vinyl letters with a 3 yr estimated service life are the most cost effective for Coroplast signs because will not outlive the backing material. • 7 yr vinyl letters are preferred for aluminum signs.	• Ink is applied directly to the sign to produce the letter or pattern. • The most cost effective alternative for high volume sign production where the same lettering configuration is repeated on many signs. • Many different makes and qualities of ink are available. • An expensive alternative if individual signs have different text requirements. • Ink can fade or be scraped off the sign. Fading is a relatively common issue and leads to reduced sign service life.	• Graphics are printed directly on the reflective backing material. • Cost effective for signs with different lettering requirements. • Letters are not applied to the sign individually. • Long life span when printed on appropriate backing material.

4. Colour Selection

Some considerations and alternative ways of achieving multiple colours on signs are listed below:

- Vinyl letters can be applied to sign blanks. For example, batch orders of “Must Call” and “Caution” signs can be made with the headers applied by screen or thermal printing. Site specific vinyl text can be applied locally as required. Further, batch orders of “Km” signs can be made with the UP/DOWN graphic and possibly the road name. The actual “Km” number could be applied using vinyl letters at a later date.
- Many Caution or Must Call sign blanks can be produced at a relatively low cost.
- There are labour costs associated with applying individual vinyl letters on sign blanks that need to be considered. For example, if a sign shop is asked to print and apply labels onto sign blanks, or screen letters onto blanks, there will likely be a minimum charge that could equal or exceed the cost of producing a complete graphic. Further, if sign text is applied at the field operational level, quality control must be assured.
- Specifying two sign colours, i.e. different colours for the header and text, generally increases sign printing costs by approximately 10% over single-colour signs.

Estimated Unit Costs for Road Sign Materials[4]

An estimated unit cost for sign materials is presented below for aluminum and Coroplast backing materials.

Aluminum sign material

Item	Cost ($)	Signs/km (no.)	Cost/km ($)
Km signs	57.00	1	57.00
Road channel signs	25.00	0.025	0.63
Must Call signs	43.00	0.1	8.00
Steel U-posts (2.4 m)	55.00		60.50
- c/w hardware kit & stub posts (1 m)			
Total cost/km			**126.13**

Coroplast sign material (c/w 3-year vinyl decals)

Item	Cost ($)	Signs/km (no.)	Cost/km ($)
Km signs	11.50	2	23.00
Road channel signs	12.00	0.025	0.30
Must Call signs	23.00	0.1	2.30
Steel U-posts (2.4 m)	55.00		60.50
- c/w hardware kit & stub posts (1 m)			
Total cost/km			**86.10**

[4] Does not include "Caution" signs.

Appendix 2. Proposed Approach for Implementation

➢ Steps to Implement the Proposed Radio Communications Protocol on FSRs

A Radio Communications Protocol for Resource Roads in B.C.: Proposed Approach for Implementation

B.C. Radio Communications Working Group

Revised July 2009

Background

In 2006, a working group was formed to develop a proposal for a new radio communications protocol and improve the safety of B.C.'s resource roads. The group, now known as the B.C. Radio Communications Working Group, is currently comprised of individuals from the following organizations:

- BC Ministry of Forests and Range (MFR), Resource Tenures and Engineering Branch
- B.C. Timber Sales (BCTS)
- BCMoFR, Information Management Group, Radio Operations
- B.C. Forest Safety Council, Forestry Trucksafe Program
- Industry Canada, Spectrum Information Technologies and Telecommunications
- Council of Forest Industries
- FPInnovations, Feric Division.

The group is committed to collaborating with local road user committees, industrial operators from all sectors, and public stakeholders in the development of a common radio use protocol. Public information meetings and ongoing consultation with road users are key elements of the process. The goal is straightforward and shared by all; to improve safety and reduce collisions on resource roads. To meet this goal, a block of dedicated resource road radio channels along with standardized call procedures and road signage has been proposed. The proposed protocol has been tested during two pilot projects. One pilot project covered the Campbell River, South Island and Sunshine Coast Forest Districts and the other project was located near Tumbler Ridge in the Peace Forest District.

The pilots were initiated in a series of stages. The BCTS Strait of Georgia Business Area finalized the project specifications for one area, the Tsitika network north of Campbell River, and put the new protocol into effect on January 1, 2008. Various road systems on the South Island and Sunshine Coast were brought into the program on March 1, April 1, and May 1, 2008. The pilot project in the Peace District was initiated on the Ojay road network on June 1, 2008. Findings from the pilot projects were used to revise the proposal and prepare for potential broader provincial implementation.

This document lays out the general tasks required to initiate a new communications protocol on provincial road systems. The tasks are presented in two ways. First, the steps leading to provincial implementation are summarized in a Gantt chart. Second, the steps required for implementation, accompanied by additional detail describing each step, are presented in a table. Each step is accompanied by a suggested period of lead time preceding the selected start date. The roles and responsibilities for each task are also specified. Target dates accompany the objectives identified for each stage of implementation.

Scheduling the implementation of a new communications protocol throughout the province requires care and due diligence. There must be enough lead time to educate road permit holders and other road users, and to avoid creating confusion and unsafe conditions. One way to achieve this goal is to develop the implementation timetable around the seasonal logging cycles in each region of the province. This means that the typical "Spring break-up" or "shutdown" periods should be used to hold meetings and to complete signage and other groundwork. For example, in the B.C. Interior the best time to implement the protocol may be in the late spring, after break-up. In the northeastern part of the

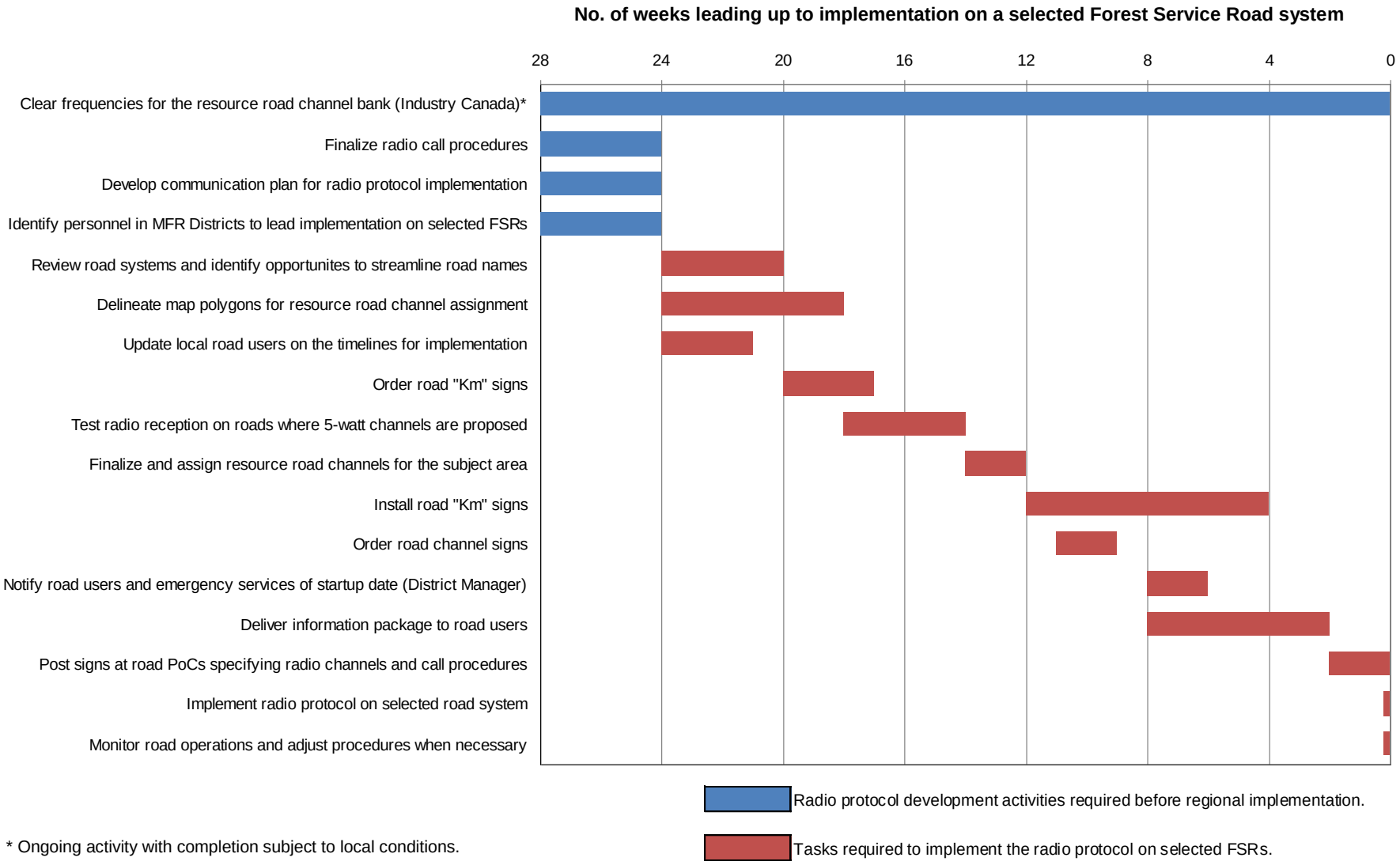
province, it will might be the Fall, before the start of winter activities. On Vancouver Island, the preferred time will be after the winter shutdown, likely in February. Synchronizing implementation with a region's logging season will provide time to prepare and educate road users, and increase the program's likelihood of success.

Several supporting documents have been prepared to provide guidance on the various steps required to implement the protocol. Some of the action items in the following table refer to these supporting documents. These documents, also included as Appendices in this report, are titled:

- *Assigning radio channels to road networks.*
- *Identifying zones of reduced radio reception.*
- *Recommended field testing procedure for the selection and implementation of 5-watt resource road channels.*

The Gantt chart and table are guides for implementing a new radio communications protocol on resource roads in B.C. Currently, the focus is on Forest Service Roads but user safety would be enhanced by expanding the program to all resource roads regardless of jurisdiction. The Working Group encourages other forest road managers and other industrial sectors to adopt the new protocol so that improved practices and signage will be consistent throughout the province's resource road networks.

Steps to Implement the Proposed Radio Communications Protocol on FSRs



* Ongoing activity with completion subject to local conditions.

Steps to Implement the Proposed Radio Communications Protocol on FSRs

Revised July 2009

	Action item	Responsibility	Comments	Lead time
A	Review road systems and identify opportunities for streamlining road naming conventions.	MFR District staff BCTS Business Area staff	Carry out mapping exercises to rationalize road systems and names. Seek input from road user groups especially in areas with overlapping jurisdictions. For guidance on this task refer to the supporting document titled, *Assigning radio channels to road networks*.	6 months lead time
B	Delineate map polygons suitable for resource road channel assignment.	MFR District staff BCTS Business Area staff	MFR District and BCTS Business Area engineering staff to partition geography and identify map polygons for logical assignment of radio channels. For guidance on this task refer to the supporting document titled, *Assigning radio channels to road networks*.	6 months lead time
C	Continue to clear frequencies to free up the entire channel bank for resource roads.	Industry Canada	Identify frequencies for the Resource Road channel bank Move current users and/or reassign Update available channels list as needed.	On-going Phase-in
D	Update local road users and pertinent road management groups on the status and timelines for radio protocol implementation.	B.C. Forest Safety Council, Trucksafe MFR District staff BCTS Business Area staff	Discuss project at meetings of local road management groups. Initiate road user information session(s). Distribute emails and other media notifications of the intent to proceed.	6 months lead time
E	Order road "Km" signs. Supporting documentation with detailed specifications for road signage will be finalized following the pilot projects.	MFR District staff BCTS Business Area staff	Source suppliers and provide with appropriate sign examples to use as templates. Include examples for kilometer and must call signs. NB. Lead time depends on the region and selected date for implementation. For example, if March 1st is the target date for an area in the B.C. Interior, the signs should be ordered in time for installation prior to freeze-up.	4 months before start in each area

	Action item	Responsibility	Comments	Lead time
F	Field testing of radio reception for 5-watt channels.	MFR District staff BCTS Business Area staff MFR: IMG, Radio Operations Ministry contractor	Schedule field tests to investigate 5W-channel performance on a particular road. For guidance with this task, refer to two supporting documents: a) *Recommended field testing procedure for the selection and implementation of 5-watt resource road channels.* b) *Identifying zones of reduced radio reception.*	4 months
G	Finalize and assign resource road channels for the subject area. Request road users to install resource road and loading channels.	Industry Canada, Spectrum Operations MFR District staff BCTS Business Area staff	MFR Forest District and BCTS Business Area staff in conjunction with Industry Canada, Spectrum Control, select appropriate Resource Road channels. Recommend that users install the complete block of Loading and Resource Road Channels. Channels assigned in coordination with Industry Canada and local users. Radios must be programmed by implementation date. Disseminate information to radio shops. For guidance on assigning channels, refer to the supporting document titled: *Assigning radio channels to road networks.*	3 months
H	Install road "Km" signs.	MFR District staff BCTS Business Area staff	Obtain quotes and retain contractor to install Km and "Must Call" signs. NB. Lead time depends on the region and selected date for implementation. For example, if March 1st is the target date for an area in the B.C. Interior, the signs should be installed prior to freeze-up.	2 ½ months
I	Order road channel (frequency) signs.	MFR District staff BCTS Business Area staff	Order road channel signs so they are available for posting prior to implementation date.	2 months
J	Letter from District Manager to road users, RCMP, PEP, Ambulance, Regional Districts, Search and Rescue advising of radio standards implementation.	MFR District Managers	For a letter template, refer to the supporting document titled, *Example letter notifying road users of pilot project implementation*.	2 months

	Action item	Responsibility	Comments	Lead time
K	Finalize radio call procedures and communicate to users.	B.C. Forest Safety Council, Trucksafe (Lead) MFR District staff BCTS Business Area staff	The provincial standard for call procedures specifies the order of announcement (i.e. road name, km, direction, type of vehicle), the frequency of calling, and a procedure for convoys. The frequency of calling may be adapted to local conditions however any deviation from the default provincial standard must be developed and authorized through a local road management committee.	2 months
L	Develop a comprehensive communication plan for provincial radio protocol implementation	B.C. Forest Safety Council, Trucksafe (Lead) MFR District staff BCTS Business Area staff FPInnovations	Utilize industry communications sources, e.g. TLA, ILA, CILA, Silviculture, Rumblings, Forests West, SAFE Companies. Provide the media with information about the resulting significant strides in safety. Website postings.	2 months
M	Deliver information package to road users.	MFR District staff BCTS Business Area staff B.C. Forest Safety Council, Trucksafe	Notify road users of implementation accompanied by information package containing: • Radio call procedures • Industry Canada Information Circular 07-1 • Industry Canada Notice to Radio Equipment Supplier. User groups include forest licensees, road management committees, BCTS registrants, service industries, and other stakeholders.	2 months prior to implementing in an area
N	Post sign(s) at PoC identifying radio channels and call procedures.	MFR District staff BCTS Business Area staff		1 week prior to implementing in an area
O	Implement new radio communications protocol on selected road system.		A schedule for regional implementation will be developed to accommodate any required regional variances.	

Appendix 3. Assigning Radio Channels to Road Networks

- **Road System Review**
- **Partitioning the Landscape**

B.C. Radio Communications Working Group
A Radio Communications Protocol for Resource Roads in B.C.: Assigning Radio Channels to Road Networks

July 2008

The B.C. Radio Communications Working Group is proposing a new radio communications protocol for resource roads in B.C. The protocol consists of dedicated VHF radio channels, standardized call procedures and new signage for resource roads. Within the block of new radio channels there are thirty-three (33) resource road channels and nine (9) loading channels. The road channels are designated for communications on resource roads. Drivers use the road channels to announce their positions at regular intervals when traveling a road. Loading channels are reserved for communications between vehicles and/or heavy equipment within a harvesting area or other confined industrial operation.

Two tasks must be completed before assigning new road channels to road networks. First, road systems should be reviewed to identify opportunities for rationalizing the number of road names. This is also the time to examine road naming conventions and determine if there is a need to streamline any local practices. Second, the landscape must be partitioned into map polygons that enable logical assignment of radio channels.

These tasks should be completed at least six months prior to implementing the new communications protocol in a particular area. Six months lead time is needed because other duties are contingent upon completion of a review, including preparation of sign orders, installation of road signs, and communication activities.

The purpose of this document is to provide guidance for reviewing road systems and partitioning the landscape.

Road System Review

Resource road systems gradually expand over time to meet the needs of natural resource development. Sometimes a road system evolves in a piecemeal fashion resulting in a confusing and disjointed set of road names. For example, several roads may eventually link up to form one mainline. However, the original road names may be retained resulting in a new mainline with several different names along its length. Further, there may be different road naming conventions used for branch and spur roads in a region. The result of inconsistent road names is a confusing patchwork especially for new road users unfamiliar with the local jargon.

A first step in implementing the new radio communications protocol is to review the road systems in a Forest District, or other resource road jurisdiction, and identify opportunities to: a) rationalize road names, and b) streamline road naming conventions. This is an important step because a standard format for road kilometer signs has been established for the province. The new format specifies inclusion of the road name on each kilometer sign. A review before new road signs are ordered and installed could prevent the need for sign changes and additional costs in the future. Another potential benefit of a

review is that fewer road names and a clear system for branch roads should make it easier for users to adopt the new protocol.

Other points to consider in a road system review are:

- **Communicate with road managers in neighbouring jurisdictions**. Inform other tenure holders and road management jurisdictions about your road review. Ensure that one road spanning several jurisdictions will have a consistent name. Discussions with other managers may produce new knowledge about development plans and help in the design of a road naming system for the long-term benefit of all users.
- **Consult with road user groups**. Seek input from road user groups especially in areas where multiple resource sectors operate. Discuss the implementation of the new communications protocol at user group meetings. Take the opportunity to present road network maps at group meetings and solicit suggestions for rationalizing the current system of road names.

Partitioning the Landscape

After road names have been reviewed and finalized, radio channels must be assigned to road systems throughout a region. This requires partitioning of the landscape into logical units suitable for resource road channel assignment. After creating the geographic units, road channels are selected and assigned to individual map polygons. The channels need to be distributed over the landscape so that the likelihood of interference is minimized. The following points provide additional guidance for partitioning the landscape and assigning road channels.

- The goal is to assign one radio channel to a network of resource roads in a defined geographic area. As a first step, partition the landscape into relatively large geographic units such as watersheds. One approach may be to focus on a main Forest Service Road and capture all roads tributary to the FSR when delineating a map polygon for a particular drainage. Remember that there are a limited number of road channels available for assignment. If too many small geographic units are created, the thirty-three road channels will be used up before adequate spacing and distribution of channels is achieved.
- Some mainline roads, with very high traffic volumes, experience a heavy demand for radio airtime. Users struggle for an opportunity to make their calls in a timely manner. To reduce the likelihood of interference, one channel could be assigned to a mainline and separate channels could be assigned to the adjacent branch roads. However, there are some pitfalls to this approach. First, if widely adopted, it would significantly increase the number of radio channels required to service a region. Second, when users are traveling on a branch road, and approaching a mainline junction, they will be unaware of the upcoming traffic patterns until they switch over to the mainline road channel. Drivers will have to make additional radio calls to ask if there are vehicles in the vicinity or wait at the junction until they understand traffic flow before entering onto the mainline.
- In some cases, land tenure arrangements may dictate that a map polygon take the form of a linear corridor along a major Forest Service Road.
- Of the thirty-three channels designated for roads, eighteen are configured for 30 watts output power and fifteen are configured for 5 watts. The difference in reception distance for the 5W and 30W channels is another factor to keep in mind when assigning channels to map polygons. The relationship between output power and reliable reception distance is not linear, for example, to

double reception distance, the power level needs to increase four times. This means that if reliable reception distance is 15 km with a 5-watt channel, a range of approximately 37 km could be experienced with a 30 watt channel.

- Consider maintaining a minimum separation distance of approximately 200 km between map polygons before reassigning the same channel.
- Actual reception range experienced in the field is hard to predict and varies greatly with local conditions. Radio waves can be reflected, diffracted, scattered and absorbed by terrain features and vegetation. Steep terrain does not necessarily dictate partitioning the geography into smaller units. Sometimes radio waves are propagated readily along narrow valleys while low rolling topography and tall vegetation may cause significant radio signal attenuation and therefore be more troublesome for reception.
- VHF radio waves propagate as a line-of-sight phenomenon and can travel long distances over bodies of water compared to forested environments. Special attention should be paid to map polygons bordering coastlines and large lakes. Avoid assigning the same channel to polygons on opposite sides of water bodies, even if they are separated by long distances.
- Consult road managers in neighbouring jurisdictions about the mapping process, and discuss your proposed landscape units and selected channels with them. Managers need to be informed about the process in a neighbouring region so that they can avoid creating any channel assignment conflicts in the future.

Appendix 4. Identifying Zones of Reduced Radio Reception

- **Rationale for 5-Watt Channels**
- **Identifying Zones of Reduced Reception**
- **Estimates of time and distance between oncoming trucks**

B.C. Radio Communications Working Group
A Radio Communications Protocol for Resource Roads in B.C.: Identifying Zones of Reduced Radio Reception

July 2008

The B.C. Radio Communications Working Group is a proposing a new radio communications protocol for resource roads in B.C. The protocol consists of dedicated VHF radio channels, standardized call procedures and new signage for resource roads. Within the block of new radio channels there are:

- 18 resource road channels with 30-watt output power,
- 15 resource road channels with 5-watt output power, and
- 9 loading channels with 5-watt output power.

This document explains the rationale for the 5-watt resource road channels and presents a procedure for identifying zones of reduced reception when five watt channels are planned for a road system.

Rationale for 5 Watt Channels

The number of accidents on resource roads in B.C. is increasing and many of these incidents can be attributed to radio communications. Some examples of communications-related safety issues are:

- Increasing traffic volumes on Forest Service Roads and more frequent occurrences of simultaneous radio transmission.
- Too many radio channels in use and confusion about the correct frequencies and call procedures.
- Interference with other licensed radio users and other operations.
- Excessive chatter on radio channels and drivers "forgetting" to announce their position at regular intervals.

The Working Group proposed several initiatives to reduce confusion and crowding on the airwaves. Five-watt road channels are just one of several elements designed to reduce radio interference for road users. Other elements are:

- The resource road channels themselves, that is, a dedicated block of standard frequencies complete with tone codes.
- Standard call procedures, with the option to adjust frequency of calling to suit local conditions.
- Logical assignment of channels over the landscape.
- Dedicated loading channels.
- A properly installed and maintained network of road signs.
- Extraneous chatter moved to separate working channels.
- Recommended best practices for specifying the complete radio system; including the transceiver, antenna and cable connections.

Five-watt road channels are proposed because their transmission range, or reception distance, is less than the range achieved by 30-watt channels. Therefore, on a busy road with a steady stream of radio calls, 5-watt channel assignments may be one option that could reduce the likelihood of interference for users.

There are two points to consider about the relationship between output power and reception distance. First, the relationship is not linear — as output power increases, reliable reception distance increases by a square-root effect. For example, to double reception distance, the power level needs to be increased four times. This means that if reliable reception distance is 10 km with a 5 watt channel, a range of approximately 24 km could be experienced with a 30-watt channel under constant conditions. Second, the actual reception distance experienced with a VHF radio is greatly influenced by local conditions and their effect on radio signal propagation.

Identifying Zones of Reduced Reception

Some of the factors that influence radio signal propagation and reception distance on a forest road are: topography, surrounding forest vegetation, weather conditions, antenna configuration and cable connections, and output power. Sometimes these factors will cause reliable reception distance to fall below a minimum acceptable level. For the purposes of implementing the new radio protocol, the minimum acceptable level has been set at 10 km. The rationale for selecting the 10 km threshold is set out in Table 1.

Roads with 5-watt channel assignments must be tested to determine if five watts of output power will provide the required 10 km of reception distance between oncoming vehicles. The B.C. Radio Communications Working Group's field test procedure should be used to conduct the road tests[5]. The test procedure includes a standard spreadsheet form for field data entry. Note that zones of reduced reception may also occur when 30-watt channels are used. However, 30 watts is the maximum output power allowed on resource roads in B.C. and road users should follow established precautionary driving practices. The guiding principle is that roads are not "radio-controlled". Radios are one aid to safe travel and should not take the place of ongoing defensive driving practices.

Road testing may show zones where reliable radio reception is below the 10 km threshold. An example is when a road winds around a ridge and oncoming vehicles positioned on either side of the ridge lose radio contact. These zones of reduced coverage are not anchored spatially over the landscape — they depend on the relative positions of oncoming vehicles. The results from field testing will bracket a zone of potentially reduced reception.

When a zone of reduced reception has been identified it should be marked in the field. Two road signs will accomplish this task. One sign should be positioned at each end of the zone so that vehicles travelling in the UP and DOWN directions will be alerted to the situation. An example phrase for a sign is, "Caution — Reduced radio reception for next 12 km".

[5] For guidance on conducting radio reception road tests, refer to the B.C. Radio Communications Working Group supporting document titled, *Recommended field testing procedure for the selection and implementation of 5-watt resource road channels.*

Estimates of time and distance between oncoming trucks

The table below was developed to serve as background information for discussions about a minimum safe distance for radio communications on resource roads. Examples of "worst case" scenarios are estimated for situations where: a) every call is clearly heard and, b) the loaded truck misses or confuses one call.

Assumptions used to develop the table:

- Radio call frequency: Loaded truck calls every 2 km on the even km and the empty truck stays quiet.
- Trucks come into radio contact range just after the loaded truck passes an even numbered km sign.

Table 1. Time and distance between oncoming trucks

		No missed calls			One missed call	
Speed of oncoming trucks	Radio range	Minimum vehicle spacing at initial radio contact	Time to meet after initial radio contact		Minimum vehicle spacing at initial radio contact	Time to meet after initial radio contact
(km/h)	(km)	(km)	(min:sec)		(km)	(min:sec)
70	1	0	0:00		0	0:00
70	2	0	0:00		0	0:00
70	3	0	0:00		0	0:00
70	4	0	0:00		0	0:00
70	5	1	0:26		0	0:00
70	6	2	0:51		0	0:00
70	7	3	1:17		0	0:00
70	8	4	1:43		0	0:00
70	9	5	2:09		1	0:26
70	10	6	2:34		2	0:51
70	11	7	3:00		3	1:17
70	12	8	3:26		4	1:43
70	13	9	3:51		5	2:09
70	14	10	4:17		6	2:34
70	15	11	4:43		7	3:00

Other factors to consider:

- Allow 16 sec for "time to stop" including reaction & braking time.
- Allow 200 m for "stopping distance".

N.B. These are only suggested allowances for "time to stop" and "stopping distance" to provide context when reviewing the table, not to the exclusion of others that may actually be experienced under a given set of vehicle and road conditions.

Appendix 5. Radio Reception Field Testing Procedure

- **Background and Purpose**
- **Equipment**
- **Setup**
- **Procedure**
- **Evaluation of Results**

B.C. Radio Communications Working Group
A Radio Communications Protocol for Resource Roads in B.C.: Recommended Field Testing Procedure for the Selection and Implementation of 5-Watt Resource Road Channels[6]

July 2008

Background and Purpose

The Resource Road Initiative Pilots have several channels specified for a maximum of 5 watts. These low power channels are expected to reduce co-channel interference from distant vehicles. The remaining resource road pilot channels are specified for a maximum of 30 watts. This testing procedure is recommended to be used to assess if a 5 watt channel provides suitable coverage on a particular resource road and if there is a requirement for 'must call' signs in areas that are found to have reduced radio reception on five watt channels. For the purpose of this testing procedure, any area where a 5 watt channel cannot achieve good (readable) reception up to, and including 10 KM away, is considered to have poor radio coverage and 'must call' signs will need to be posted. If testing reveals that there are an excessive number of poor reception areas, a 30 watt channel will need to be used.

For additional information regarding the Resource Road Pilots, PRC 07-1 'Information For Radio Equipment Suppliers on Resource Industry Channel Pilots', can be found at the following URL: http://www.for.gov.bc.ca/bcts/areas/TSG/IndustryCanadaPRC07-1.pdf

Equipment

Transmitter (TX) Kenwood TK-7180, or equivalent VHF two way radio capable of the technical specifications specified in PRC 07-1[1]. Specifically, the transmitting radio must be approved for 5 watt Transmit power. The radio must also be narrow band capable, ie 11K0.

Receiver (RX) The TK-7180 is specifically recommended because when loaded with the correct software, it displays the receive signal strength level in dBm. The software is available from Kenwood Electronics Canada Inc.

Antenna's 5/8 whip tuned to 151 MHz are recommended as 5/8 whip antenna's are the most common antenna used by resource road radio users. The antenna should be mounted at approximately 1 meter above ground level as this is the typical height of an antenna mounted on a pickup truck.

Laptop Computer A laptop computer with Microsoft Excel installed. A power inverter or 12 volt adaptor is also recommended.

GPS A GPS is needed to record the locations of the KM signs on the road. The GPS should be set to NAD 83.

[6] Author: Brad Davis, A/Manager, Spectrum Operations, Industry Canada, Prince George, B.C.

Setup

Both the transmitting and receiving radios that are to be used for the tests must be programmed in accordance with Table 1. Each of these radios will be installed in a vehicle for the duration of the testing.

Before conducting radio coverage tests on resource roads, the transmitting and receiving radios must be tested to ensure that they are operating properly. The following measurements must be made and recorded in Table 2. The information recorded in Table 2 must be retained:

- Low power setting of the transmitting radio
- Sensitivity of the receiving radio
- Standing wave ratio of both the transmitting and receiving radios
- The resonant frequency of both antenna's must be measured and adjusted if necessary.

Procedure

The tests will be conducted using a receiving radio and a transmitting radio which will both be installed in vehicles. The receiving mobile will remain stationary during all testing. The transmitting mobile will be traversing the road during the testing; this is intended to simulate real life conditions as resource road users typically call kilometers while they are moving. It has been determined that the maximum distance that required for testing is 10 KM's.

The receiving mobile will park at the start of the resource road, or KM 0. At that time the transmitting mobile will begin to travel down the road. As the transmitting mobile approaches a KM marker on the road, a test transmission will be made. The test transmission should be a standard phrase such as, "This is a 5 watt radio test at KM___, testing testing one two three, testing testing one two three, over." Ideally this transmission should be made just as the transmitting mobile passes the KM marker.

The Transmitting mobile will travel down the road making the test transmissions until it is 10 KM away from the location of the receiving mobile. At that time the receiving mobile will move to the next KM marker, ie KM 1, and will call the transmitting mobile once it is in place. The transmitting mobile will also have to move to the next KM marker, ie KM 11, turn around in a safe location, and wait. Once both the transmitting and receiving mobiles are ready the transmitting mobile will travel back down the road towards the receiving mobile and will make test transmissions at every KM marker until it is just one KM away from the other mobile. At that time both mobiles will move up the road one KM and continue the tests.

During each transmission, the receiving mobile will record the signal strength in dBm as it is displayed on the Kenwood TK-7180 radio. Also the perceived signal quality will be rated on a scale of 1 – 5 using the following criteria found in Table 3. When a test transmission is received, the receiving mobile should reply, "Test transmission from KM___ received." If the transmitting mobile does not hear a response from the receiving mobile, contact will have to be re-established before continuing and communication between both mobiles to determine what area of the road has poor radio coverage characteristics will have to take place.

All test data should be recorded in the Microsoft Excel spreadsheet, named '5 Watt Power Test Data'. The perceived signal strength should be entered into the spreadsheet using the 1 – 5 scale and the signal strength as displayed on the Kenwood TK-7180 should be recorded using the absolute value which is in dBm. You should have received a copy of this spreadsheet. If you are testing a particularly long road, additional columns may be added to the spreadsheet. The coordinates of the KM markers must also be recorded in the spreadsheet.

Evaluation of Results

The testing procedure will determine if VHF radios using 5 watt channels cannot reliably communicate. It is important to understand that the poor coverage area is not at just one location, poor reception is occurring at both locations. Must call signs will need to be posted in between the poor reception locations at intervals of 1 Km.

Table 1

Loading/Unloading Pilot Channels			
Channel	Frequency	Power	Tone
LD-1A	150.590	5 Watts	114.8
LD-1B	150.590	5 Watts	123.0
LD-1C	150.590	5 Watts	131.8
LD-2A	150.680	5 Watts	114.8
LD-2B	150.680	5 Watts	123.0
LD-2C	150.680	5 Watts	131.8
LD-3A	151.670	5 Watts	114.8
LD-3B	151.670	5 Watts	123.0
LD-3C	151.670	5 Watts	131.8

Resource Road Pilot Channels				
Channel	Frequency	Power	Tone	Restrictions
RR-10A	150.200	30 Watts	114.8	
RR-10B	150.200	30 Watts	123.0	
RR-10C	150.200	30 Watts	131.8	
RR-11A	150.365	5 Watts	114.8	Not to be used within 100 Kms of Abbotsford BC
RR-11B	150.365	5 Watts	123.0	Not to be used within 100 Kms of Abbotsford BC
RR-11C	150.365	5 Watts	131.8	Not to be used within 100 Kms of Abbotsford BC
RR-12A	151.520	5 Watts	114.8	
RR-12B	151.520	5 Watts	123.0	
RR-12C	151.520	5 Watts	131.8	
RR-13A	150.560	30 Watts	114.8	Not to be used within 100 Kms of Prince George BC
RR-13B	150.560	30 Watts	123.0	Not to be used within 100 Kms of Prince George BC
RR-13C	150.560	30 Watts	131.8	Not to be used within 100 Kms of Prince George BC
RR-14A	151.700	5 Watts	114.8	
RR-14B	151.700	5 Watts	123.0	
RR-14C	151.700	5 Watts	131.8	
RR-15A	150.545	30 Watts	114.8	
RR-15B	150.545	30 Watts	123.0	
RR-15C	150.545	30 Watts	131.8	
RR-16A	150.500	30 Watts	114.8	
RR-16B	150.500	30 Watts	123.0	
RR-16C	150.500	30 Watts	131.8	
RR-17A	151.370	5 Watts	114.8	
RR-17B	151.370	5 Watts	123.0	
RR-17C	151.370	5 Watts	131.8	
RR-18A	150.185	30 Watts	114.8	
RR-18B	150.185	30 Watts	123.0	
RR-18C	150.185	30 Watts	131.8	
RR-19A	150.530	30 Watts	114.8	
RR-19B	150.530	30 Watts	123.0	
RR-19C	150.530	30 Watts	131.8	
RR-20A	151.190	5 Watts	114.8	Not to be used within 100 Kms of Comox BC
RR-20B	151.190	5 Watts	123.0	Not to be used within 100 Kms of Comox BC
RR-20C	151.190	5 Watts	131.8	Not to be used within 100 Kms of Comox BC

Table 2

Date:
Name:
Company:

Transmitter			
Radio Model:			
	Measured Level	Acceptable Range	Test Equipment used for Measurement
Low Power Level:		4.95 - 5.05 Watts	
Standing Wave Ratio (SWR):		1.0 - 1.2	
Antenna Resonant Frequency:		150 - 152 MHz	

Receiver			
Radio Model:			
	Measured Level	Acceptable Range	Test Equipment used for Measurement
Receiver Sensitivity Level:		0.2 - 0.4 µV	
Standing Wave Ratio (SWR):		1.0 - 1.2	
Antenna Resonant Frequency:		150 - 152 MHz	

Table 3

* The following signal readability scale should be used:

1. Bad (unreadable)
2. Poor (readable now and then)
3. Fair (readable but with difficulty)
4. Good (readable)
5. Excellent (perfectly readable)

Appendix 6. Results of Road User Interviews

- Sunshine Coast Road User Surveys – January 2009
- OJAY Road User Surveys – January 2009
- Vancouver Island Road User Surveys – October 2008
- OJAY Road User Surveys – October 2008
- OJAY Road User Surveys – July 2008
- Vancouver Island Road User Surveys – June & July 2008
- B.C. Radio Pilot Projects – Road User Questionnaire

Sunshine Coast Road User Surveys – January 2009

Date of Survey: Jan 28, 2009

Interviewers: Craig Evans, Ed Proteau
FPInnovations

Survey locations: Stillwater Main

Interview Statistics

Roadside Interviews:		9
Vehicle Breakdown:	**%**	**No.**
Semi trucks	66	6
Service vehicles (3 – 5 ton)	0	0
Pick-ups	0	0
Off-site	33	3
Industry primarily worked:		
Oil & Gas	0	0
Forestry	100	9
Recreational	0	0
Interviewed before by FPInnovations:		
Yes	0	0
No	100	9
Number of respondents who work in:		
Tumbler Ridge area only	0	0
Powell River area only	66	6
BC only	33	3
BC & Alberta	0	0
Number of respondents with no radio		0
Number of respondents with no RR channels installed in their radio		7

Survey Comments

Road Signage: (Lois Main, Duck Main)

- Signage is good compared to what we had before.
- Don't like radar signs and wonder what the province is thinking.
- Not enough lead time was given by the District about the new signage and especially the new radio channels.

Calling Procedure

- No negative comments regarding up/down calling as they use this already.
- 4 respondents said 4-5 Km was enough distance to hear on these roads.
- Call every Km already, roads are slow

Radios & Channels

- All respondents liked the idea of a permanent set of road channels but question the number they really need to have in their radios.
- 0% of users had all 42 RR channels installed in their radio.
- 11% (one user) had any of the channels at all (7 RR channels) installed.
- 50 % of radios held more than 200 channels, the other 50% held 20 channels or less, and as low as only 8 channel capacity. This is very common on the coast.
- 50% of respondents said they would need to upgrade equipment because of capacity. Most do not know what narrow/wide band means or care.
- One local contractor said he probably owns 25+ radios that would need to be replaced in pick-ups and logging trucks and equipment.
- Said they like the idea but who's going to pay or subsidize. Like the idea of a subsidy.
- 100% of users had a radio of some type in their vehicle.

Information to road users about changes

- Finding out about the changes from the radio was agreed to be a good way for most.
- Local paper and employer were also thought to be key sources for information.
- Nobody knew of the upcoming changes except one driver and personnel at the WFP office.

OJAY Road User Surveys – January 2009

Date of Surveys: Jan 12, 2009

Interviewers: Craig Evans, Albie Thomson
FPInnovations

Survey locations: Ojay Main

Interview Statistics

Roadside Interviews:		14
Vehicle Breakdown:	**%**	**No.**
Semi trucks	50	7
Service vehicles (3 – 5 ton)	0	0
Pick-ups	50	7
Industry primarily worked:		
Oil & Gas	100	14
Forestry	0	0
Recreational	0	0
Interviewed before by FPInnovations:		
Yes	7	1
No	93	13
Number of respondents who work in:		
Tumbler Ridge area only	0	0
BC only	14	2
BC & Alberta	86	12
Number of respondents with no radio		0
Number of respondents with no RR channels installed in their radio		0

Survey Comments

Road Signage:

- Night-time reflectivity is great.
- Need "Must call" signs near bridges and in windy road sections.
- Need large speed limit signs placed in several locations.

Calling Procedure

- No negative comments regarding Up/Down calling.
- Some would still prefer a right-of-way rule… i.e. Up's clear the Downs and only Downs call except at "must call" points.
- Some would still like to adjust calling frequency on their own depending on traffic levels.
- Still experiencing a lot of radio traffic.
- Security shack established at the road's PoC has helped greatly with the calling rules and other road issues. Two respondents said people are still not calling.

Radios & Channels

- All respondents liked the idea of a permanent set of road channels.
- 78% of users had all 42 RR channels installed in their radio.
- 22% of users had 5 or 6 RR channels installed (only the ones they needed).
- 45% of radios held more than 200 channels.
- 93% of respondents said they did not need to upgrade equipment because of narrow band channels. Capacity issues were the only reasons for upgrades mostly.
- 7% (1 person) said they had to upgrade their radio to accept the new channel standards. Cost was $800.
- 100% of users had a radio. This is due to the security shack checking.

Information to road users about changes

- Posting the information on a very large sign at the road PofC was still the most common comment regarding the best way of getting the information to the users.
- Oil & Gas journals were another way to transfer information.
- We were reminded that almost everybody out there uses Satellite Radio and were unlikely to hear a local station message unless they were in a major centre. If a large enough sign indicated an FM channel, then they would probably listen.
- Getting the information at the road was still a good way.
- Getting the info from the employer was still the best way.

General Issues specific to the Ojay

- Put a channel switch somewhere along the road (perhaps another RR channel).
- People are still driving too fast.
- Vehicles traveling in the "down" direction are not being cleared by the ones traveling in the "up" direction and drivers don't seem to care. Road is not wide enough for this practice.
- Still people are not adjusting the calling frequency according to the rule but the odd even calling seems to help.
- Km 56 to the back end (Km 92) has the worst channel walkover. Up front wasn't bad.
- New calling procedure came into effect recently. Up's call odd Km's, Down's call Even Km'.
- One person didn't like even/odd directional calling because it forces you to miss an important call if you are close to an oncoming vehicle.

Overall comments are that all users interviewed are open to change if the rules are followed and that the whole concept is great. Some things just need tweaking.

Vancouver Island Road User Surveys – October 2008

Date of Surveys:	October 27 – 30, 2008
Interviewers:	Craig Evans, Ed Proteau FPInnovations
Survey locations:	Cook Creek Mainline, Tsitika/Eve network, Stirling Main

Interview Statistics

Roadside Interviews:		30
Vehicle Breakdown:	**%**	**No.**
Semi trucks	70	21
Service vehicles (3 – 5 ton)	3	1
Pick-ups	27	8
Industry primarily worked:		
Oil & Gas	0	0
Forestry	97	29
Recreational	0	0
Other	3	1
Interviewed before by FPInnovations:		
Yes		1
No		29
Number of respondents who work in:		
BC Only (Vancouver Island)	90 (77)	27 (21)
BC & Alberta	8	3
Number of respondents with no radio	0	0
Number of respondents with no RR channels installed in their radio	10	3

Survey Comments

Road Signage Tsitika/Eve:

- All comments regarding the Km road signage were VERY positive with regard to the look, visibility, colour, font, size and placement.
- Frequency and tone is too small on the yellow "RR" sign. RR sign is also too small. Suggest a much larger individual RR sign at the road PoC.
- Need more must call signs near bridges and in winding road sections.
- One user who was colour-blind was able to distinguish the signage with no problems.

Road Signage South Island

- Most respondents said the must call signs are too small and should be moved back from the intersections they are associated with. Some indicated the size of the sign gives an idea to how much emphasis is placed on the action resulting from reading the sign. Larger means more important.
- A small number of respondents said the Km numbers could be larger on the Km marker signs, as well as the RR Channel signs.
- Many said that compared to what we had before, these signs are excellent.
- Many good comments about the signage in general.

Calling Procedure

- Up/down calling is generally being accepted in this area and most indicated that a procedure of some kind is a good idea.
- Some truckers are modifying the calling order indicating the down direction and whether they are loaded or not "LOADED-EVE-19-DOWN"
- Comments about physically driving uphill and calling a "down" direction is confusing to users in this area as well as the Ojay.
- Some prefer a right-of-way rule, i.e. Up's clear the Downs and stay quiet except at the PoC of the road and at "Must call" points.
- Most still want to use their judgment when it comes to frequency of calling (i.e. base the amount of calling on how busy the road is) instead of being forced to call every Km or every other Km. Other drivers said to stay to one rule and don't allow variation.
- Many comments regarding the calling frequency should depend on road conditions.
- 65% of users indicated 10 Km is adequate radio reception distance, 35% said somewhere between 5 Km & 10 Km.

Radios & Channels

- Resource road channel idea was liked by everybody surveyed and they can see why it's being done.
- Users who do not have high capacity radios do not like the idea.
- Users who have only ever worked in a certain area served by two or three of the RR channels do not see why they should have all RR channels installed.
- 12.5% of users had all 42 RR channels installed in their radio.
- 25% of users had 2 or 4 RR channels installed (only the ones they needed).
- 42% had 1 RR channel installed, 12.5% had none.
- 40% of radios held 40 channels or less (according to the user) – it was difficult to identify older radio models in a lot of cases as many were permanently mounted in the vehicle with the model number either against the floor or the cab ceiling)
- 50% of radios held 128 channels or more.
- 10% of radios held between 40 and 128 channels.
- 39% of respondents said they would have to upgrade their radios because of capacity issues in order to accept the entire bank of RR channels.
- One road user was using a handheld.
- Most respondents with low capacity radios had to have one frequency removed in order to put in one RR channel.
- ⅝ wave or ½ wave antennas are the most common; located on fender for pick-ups and mirrors on semi-trucks.
- No negative comments were reported with regard to radio transmission distance.
- A handful of users admitted to having a low capacity user programmable radio which was more than the 5 watt minimum (they wouldn't have known the required wattage).
- One angry contractor said that in his fleet of 40 radios, the majority were 16 channel units with several being 2 channel radios used in his loaders. With the industry in such change, he would hope for some kind of subsidized radio upgrade program.
- Questions arose about first-aid attendants monitoring too many channels at a time.

Information to road users about changes

- Posting the information on a very large sign at the road PofC was the most common comment regarding the best way of getting the information to the users.
- At Sproat Lake, the MFR FM radio information channel has been off-line a lot, so some have heard it others have not.
- 66% of users were informed ahead of time of the road changes, 33% were not.
- Of the 66% who were informed, 42% learned about the protocol at the public information meetings, 37% through their company.

General Issues specific to the Coast

- Communication while pushing loaded trucks is taking place on contractor channels in an "RR Channel Road". Contractors should be putting out signs in those areas to denote that a different channel is being used.
- Signage is confusing in some places where the top ends of FSR's meet, for example, where hook-up roads connect two differently-named roads. This represents an opportunity to streamline road names.
- Some users were concerned that there is intermittent enforcement occurring and that the rules have not been mandated in an Act. Some are getting warnings and fines and others get away with not following the rules.
- Road users on the coast were not as open to being interviewed as those in the interior and were generally more frustrated. We had a higher number of users drive past not wanting to stop despite our gestures.

OJAY Road User Surveys – October 2008

Date of Surveys: October 15 – 17, 2008

Interviewers: Craig Evans, Albie Thomson
FPInnovations

Survey locations: Ojay Main

Interview Statistics

Roadside Interviews:		41
Vehicle Breakdown:	**%**	**No.**
Semi trucks	29	12
Service vehicles (3 – 5 ton)	12	5
Pick-ups	59	24
Industry primarily worked:		
Oil & Gas	98	39
Forestry	1	1
Recreational	1	1
Interviewed before by FPInnovations:		
Yes	7	3
No	93	38
Number of respondents who work in:		
Tumbler Ridge area only	12	5
BC only	34	14
BC & Alberta	54	22
Number of respondents with no radio		1
Number of respondents with no RR channels installed in their radio		4

Survey Comments

Road Signage

- Nearly all comments regarding the road signage were positive with regard to the look, visibility, colour, font, size. One negative comment was recorded but this person had negative comments about the whole project.
- Some minor comments about the signs being obscured by wet snow sticking to the sign.
- Some minor complaints about signs blending in with fall colours.
- Comments regarding sign placement included, some too low….will be obscured by snow banks (this was most common comment), Km 37 on inside corner, Km 50 on blind corner. Some signs were easily missed by the driver due to their placement on one side of the road vs. the other….overall, very few negative comments about sign placement.
- Night-time reflectivity is great.
- Frequency and tone on small yellow "RR" sign is too small…many don't notice it when looking for the frequencies in their radio. Many users seem to have their radio display the actual frequency number and not the channel "name".
- Some confusion regarding the BP sign at the beginning of the road that shows the channels needed for the area. Some don't realize that "all" users must have the channels and think the BP sign that is there implies that only BP and its contractors need use the channels. Perhaps need a larger more generic yellow sign located 100 meters off the Heritage Highway.
- Need must call signs near bridges and in windy sections.
- Need large speed limit signs placed in several locations.

Calling Procedure

- Up/Down calling is catching on, some still using empty/loaded. Very few negative comments regarding up/down calling, anybody who was negative said they could get used to it and generally like it.
- Many comments about wanting other roads in the area standardized like this one in terms of up/down calling.
- Still comments about physically driving uphill and calling a "down" direction being confusing to some.
- Some would prefer a right-of-way rule…..i.e. up's clear the downs and only downs call except at must call points.
- Many respondents indicated they would prefer to use their own judgment when it comes to frequency of calling (i.e. base the amount of calling on how busy the road is) instead of calling every Km or every other Km. Some said to stay to one rule and don't allow variation.
- Very few were informed about the calling order, some naturally do it by reading the signs from top to bottom, others still call the Km first and cut it off by keying up the mic incorrectly either at the beginning of the call or at the end.
- A few comments were made regarding not making too many rules or things get too complicated.

Radios & Channels

- Resource road channel idea widely praised by all. All respondents like the idea of a permanent set of road channels.
- 34 % of users had all 42 RR channels installed in their radio.
- 39 % of users had 5 or 6 RR channels installed (only the ones they needed).
- 27 % had fewer than 5 RR channels installed, 10 % had none.
- 50 % of radios held more than 200 channels
- 99 % of respondents said they did not need to upgrade equipment because of narrow band channels. Capacity issues were usually the only reasons for upgrades.
- Low channel capacity radios were not necessarily the ones with less RR channels installed.
- ⅝-wave antennas are the most common; located on fender for pick-ups and mirrors on semi-trucks.
- Some users insist that since tone codes have been introduced on the channels, they don't have the transmission range that they previously had.

Information to road users about changes

- Posting the information on a very large sign at the road PofC was the most common comment regarding the best way of getting the information to the users.
- Local newspapers and radio stations in Grande Prairie, Tumbler Ridge, Fort St. John, Chetwynd and Dawson Creek were second. We were reminded that almost everybody out there uses Satellite Radio and were unlikely to hear a local station message unless they were in a major centre where FM was worth listening to.
- Advertising in "Roughneck" magazine, an oil & gas publication, was suggested. Also advertising in a magazine called "Patches" was also suggested.
- Only direct employees of BP, Spectra Energy, CNRL, Talisman and other majors knew about the changes to the Ojay. Contractors of these companies and other majors generally did not know and were among the ones who were the most uninformed.
- Some users suggested to hand out more fines and the word will get out.

General Issues specific to the Ojay

- One channel for the entire road is much too busy, should either lower wattage or put a channel switch in somewhere. (perhaps another RR channel).
- Better signage needed to direct all traffic over the connector until the A-road construction is completed. People are getting stuck following the Ojay signs into a soft area.
- People driving much too fast.
- Vehicles traveling in the "down" direction are not being cleared by the ones traveling in the "up" direction and drivers don't seem to care. Road is not wide enough for this practice.
- People not using their radios enough was a very common complaint.

Overall comments are that all users interviewed are open to change if the rules are followed and that the whole concept is great. Some things just need tweaking.

OJAY Road User Surveys – July 2008

Date of Surveys: July 15 – 17, 2008

Interviewers: Craig Evans, Albie Thomson
FPInnovations

Survey locations: Ojay Main

Interview Statistics

Roadside Interviews:		35
Vehicle Breakdown:	**%**	**No.**
Semi trucks	35	15
Service vehicles (3 – 5 ton)	22	8
Pick-ups	43	12
Industry primarily worked:		
Oil & Gas	100	35
Forestry	0	0
Recreational	0	0

Survey comments

Road Signage

- All comments so far regarding the road signage were VERY positive in terms of the look, visibility, colour, font size. None of the interviewed users had seen the signs at night yet.
- Minor comments about the frequency and tone lettering not being large enough on the RR 10A sign at the beginning of the road.
- There were some comments regarding installation of the signs in that some were positioned too low (this was only the case for signs that needed to be positioned too far down the road fill-slope in order to be far enough off the road) The road users thought that in the winter, the plowed snow could eventually obscure it. To correct this would involve adding one more piece of sign U-post between the portion of the post that is driven into the ground and the piece the Km sign is bolted to.
- Negative comments about general signage issues not related to the pilot.

Calling Procedure

- Numerous negative comments on up/down calling (at first) but once the project background was explained it's something most users said they could get used to. It was only the older guys who opposed the changes.
- Physically driving uphill (adverse) and calling a "down" direction is confusing to some, as is driving downhill and calling an "up" direction.
- Most respondents indicated that calling **every** Km "up" and **every** Km "down" or even every **other** Km in both directions of travel is too much if it's a quiet day and there is little traffic on the road. There should be a provision to let the amount of calling police itself depending on how busy the road is.
- Many respondents indicated that on a busy day, the channel is clogged with too much calling as RR10A covers up to 80Km of road where in the past the road was divided into two channels.
- 19% of respondents felt that 10 km is the minimum safe distance that they want to be able to hear in order to prepare for oncoming traffic.
- 48% of respondents felt that 5–10 km is all they needed to hear.
- 32% of respondents felt that 3-5 km was all they needed to hear.

Radios & Channels

- 45% of road users had the complete bank of 42 RR channels installed in their radios.
- 53% had only installed 6 of the 42 channels that were used in the OJAY system only.
- 2% had none of the channels in their radio.
- Radio shops are not always installing the entire bank.
- Radio shop technician had travelled to Tumbler Ridge from Ft. St. John and set-up in the parking lot of one of the hotels, and installed only the channels they needed for the interim period into many radios. The radios programmed at this time with 6 of 42 channels were not necessarily full.
- 40% of radios held 150 channels or less, 60% held 396 channels or more.
- Users which had only 6 RR channels in their radios were not necessarily informed by their supervisors about why only 6 were put in. Employees who did not own the radios generally knew nothing about the process to get them programmed and about other requirements.
- Some users insist that their radios are not transmitting as well on the RR10A channel due to the tone code and narrow-band configuration. We heard several complaints about not being able to contact the tow-tractor whereas before the changes there was no problem.
- ½ wave antennas are the most common on semi-trucks and pick-ups.

Information to users about changes

- Road users who did not directly work for BP or Spectra Energy, or have a tie with the road-user group, did not know the calling procedure ahead of time or have any knowledge of the new channels. Most figured it out when they got to the road PoC.
- Those who didn't have the channels continued on the road regardless.
- A large sign posted at the beginning of the road on Apr 1, 2008 by BP advised of the new radio channel assignments but according to some of the users, has been ignored until the last minute by many.
- Some say the information sign was in the wrong place and should be moved farther from the turn-off onto the OJAY….others say it is obvious enough.
- Road users felt the best medium to inform of the changes is in local newspapers at Tumbler Ridge, Chetwynd, Dawson Creek, Grande Prairie and Ft. St. John.
- Others felt that the best way to encourage information circulation is by handing out more fines.

Vancouver Island Road User Surveys – June & July 2008

Date of Surveys: June 20, 2008 and July 16-17, 2008

Interviewer: Ed Proteau
FPInnovations

Survey locations: Campbell River and Port Alberni; Eve River Mainline, Cook Creek Mainline, Stirling Mainline, Canal Mainline, Gracie Main.

Interview Statistics

Roadside Interviews:		20
Vehicle Breakdown:	**%**	**No.**
Highway log trucks	55	11
Lowbed	5	1
Light vehicles (pickups)	40	8
Industry primarily worked:		
Forestry	0	17
Fisheries and other agencies	0	3

Survey comments

- All of the people interviewed thought the signage was great, with a small exception that the Must Call signs in the South Island District were too small and not strategically placed.
- Many of the people interviewed thought that calling intervals should be every 2km on wide mainlines like Eve Main, Canal Main, Stirling Main.
- Many of the people interviewed believed that pickups should only announce when entering a road and should not call kms.
- Most of the people interviewed only added one or two Resource Road channels to their radios, not the complete bank. Some had to drop another channel because they did not have the required channel capacity in their radio.
- All of the highway log trucks had their antennas mounted on their mirrors, most were ½ or 5/8 wave. All but one truck were getting good reception with the RR channels, the one with problems was likely due to improper antenna length to match his dispatch channel.
- Most liked the standardization across the province
- Some interviewees thought that log trucks should call Loaded and Empty and others call Up and Down
- One person was against the idea of convoy calling in dusty summer conditions.
- Make the Gracie Main and Gracie hookup road one consistently-named route.

B.C. Radio Pilot Projects – Road User Questionnaire

Surveyors: ❑ Craig Evans ❑ Albie Thomson ❑ Ed Proteau Date _____

Location and road name: ❑ Ojay ❑ Tsitika ❑ Sproat Other _____

Radio channel used: ❑ RR10A ❑ RR17A ❑ Other _____

Type of vehicle: ❑ Pick-up ❑ Semi-truck ❑ Service Vehicle ❑ Car

Industry worked: ❑ Oil & Gas ❑ Forestry ❑ Other _____

Have you participated in a previous survey? ❑ Yes ❑ No

What areas do you work in? ❑ Tumbler Ridge ❑ BC Only ❑ BC & Alberta

What is the make and model of your radio? _____

How many channels does your radio hold? _____

How many Resource Road channels are in your radio? _____

Antenna mounted on: ❑ Roof ❑ Fender ❑ Mirror ❑ Other (specify) _____

Antenna: ❑ ¼ wave ❑ ½ wave ❑ ⅝ whip ❑ Other (specify) _____

Were you informed in advance of the new channel and call procedures for this road? ❑ Yes ❑ No

If Yes, How were you informed? Did you get enough information?

_____

What is the best way to inform road users about the new radio procedures?

❑ Local newspaper ❑ Oil & Gas journals ❑ Radio Stations ❑ Other: _____

What is your opinion of the signage on this road? _____

- Are the signs readily visible and legible? _____
- Are they large enough? _____
- Are the reflective properties appropriate? _____
- Is the colour scheme suitable? _____
- Are the signs well positioned? _____

What do you think about the calling procedure and the order of announcement?
(e.g. road name, km, direction, vehicle type)

_____

Is there a need for any local variations in the calling frequency?

_____

Did you have to acquire new radio equipment to adapt to the new channels?
If so, what were the costs?

_____

How is the radio reception on this road network? Are there any dead spots?

_____

What do you think is a safe minimum distance for radio reception? _____

Other comments: _____

_____

_____

_____

_____