



**MARTONI, CYR
& Associates Inc.**

STRUCTURAL AND
CIVIL CONSULTING
ENGINEERING
SERVICES FOR
TELECOMMUNICATIONS
TOWERS,
BUILDINGS AND
STRUCTURES

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POST CONSTRUCTION INSPECTION REPORT OF RADAR TOWERS

SITE: LANDRIENNE RADAR

PREPARED FOR

ENVIRONMENT CANADA

PREPARED BY

Marc Patry, Eng.



2001-03-12

MCA REFERENCE N°: 1642-100-1

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**POST CONSTRUCTION INSPECTION REPORT
OF RADAR TOWERS**

SITE	LANDRIENNE RADAR
SITE CODE OR NUMBER	-
LOCATION OR SITE COORDINATES	Road 386 Landrienne, Quebec
SITE ACCESS (VEHICLE)	automobile
TOWER HEIGHT	24.384 m
TOWER FACE WIDTH AT BASE	9.144 m
TOWER TYPE	
• guyed, self-supporting	self-supporting
• triangular, square, other	square
• construction (knock-down, all weld) & model	knock-down
CONTRACTOR(S)	
• foundations	Public works
• fabrication of structure	LeBlanc
• erection of structure	LeBlanc
• access road and compound area	Public works
DATE OF WORK	February 2001
INSPECTION DATE	2001-02-27
INSPECTOR(S)	Marc Patry, Eng.
WEATHER CONDITIONS	
• temperature (degrees C)	-15
• wind (speed and direction)	negligible
MCA REFERENCE N°	1642-100-1

REMARKS:

i) The first 6m of the tower is new as well as the tower foundation. The upper 18.3m of the tower were recycled from another site, Carp, Ontario.

ii) The present report prepared by Martoni, Cyr & Associates Inc. constitutes a visual inspection of the field work executed with respect to the drawings and specifications indicated hereinafter, with respect to the general requirements of CSA S37-94 and with respect to generally accepted good practices.

In no case, should this report be interpreted as a warranty of the structural integrity of the work inspected or as an implicit or explicit verification of the design of the work. The responsibility of the structural integrity of the designed work lies entirely with the design engineer.

iii) The drawings that we were supplied with for the inspection were not signed and sealed by an Engineer. Environment Canada should obtain as-built drawings signed and sealed by an Engineer ensuring that the stamp is valid in the Province of Quebec.

iv) In order to verify the corrections indicated in this report and to verify the unchecked items listed in this report, we recommend a final inspection at the end of the work including radar installation, transmission lines installation and ladder installation.

NOTE:

In this report, the legs and guy lines having the smallest azimuth are numbered respectively as leg 1 and line 1. The following legs and guy lines in the clockwise direction are numbered 2, 3 and 4 (if applicable). The tower face located between the legs 1 and 2 is face 1 the face located between legs 2 and 3 is face 2, etc.

The " ✓ " symbol indicates that the item has been verified and found to be adequate.

GENERAL:

Use this form of report for post-construction inspections of radar towers and related civil works for final approval after completion of work. The inspector was not present during the execution of the work.

LIST OF DRAWINGS used for inspection:

See Appendix A

TOWER ORIENTATION

Verify the azimuth of the guys for a guyed tower or the legs for a self-supporting tower. Compare the relative positions of the tower bridge, equipment shelter, access road and compound area with the drawings.

1. TREE CLEARING AND GRUBBING

Verify:	Acceptable	See Remarks
a) the minimum tree CLEARING limit of 4,5 m on each side of the guy lines and the 12 m radius limit around the guy anchors;	N/A	
b) the PRESENCE OF TREES that may fall and cause damage to the tower, guys, equipment shelter, electric lines and other installations;	✓	
c) CUTTING and REMOVAL of trees and other vegetation over a height of 150mm above the ground in cleared areas;	✓	
d) the presence of EXCESSIVE VEGETATION around the base of the tower and the guy anchors;	✓	
e) OTHER.		

REMARKS:

There are no remarks that apply to this section.

2. ACCESS ROADS AND COMPOUND AREA

Verify:		Acceptable	See Remarks
a)	that the ACCESS ROAD to the tower site is safe (width, slope, crown, curve radius, embankment, etc.);		2.1
b)	for EROSION of the road or POOR DRAINAGE;		2.1
c)	the ROAD CROWN (2% minimum) to allow for adequate drainage;		2.1
d)	the accumulation of ERODED MATERIAL inside the culverts and drainage ditches;		2.1
e)	the presence of DEPRESSIONS due to a poor quality of material AND/OR COMPACTION		2.1
f)	if the site is generally CLEAN and free of CONSTRUCTION DEBRIS;		2.1
g)	that an automobile is able to circulate in the PARKING AREA near the equipment shelter;	✓	
h)	OTHER.		

REMARKS:

2.1 Due to the snow accumulation these items were not verified.

3. FENCES**Verify:**

	Acceptable	See Remarks
a) that the FENCE POSTS are well anchored in the ground (shake post with hands);		3.1
b) that BARBED WIRE is present and not damaged (barbed wire required only on fence around compound area);		3.1
c) if there is a secure GATE at the access road entrance when the length of road is greater than 0,5 km;	✓	
d) the FENCES around the guy anchors* and the equipment shelter;		3.1
e) the presence of PADLOCKS at the entrance of each fenced area (compound area and guy anchors) and at the access road entrance gate if applicable;	✓	
f) OTHER.		

* Verify the fences around the guy anchors using the following criteria:

- no fence is required around anchors found in depressions, forested areas and where access is difficult or improbable;
- a fence is required on one or more sides of anchors subject to occasional vehicle traffic nearby (tractors, snowmobiles, etc.);
- a closed fence is required for anchors subject to heavier traffic or where farm animals have easy access.

REMARKS:

- 3.1 The fence around the compound area was not installed at the time of our inspection.

5. EQUIPMENT BUILDING**Verify the equipment shelter for the following:**

	Acceptable	See Remarks
a) the exterior WALLS and ROOF for visible damage;		4.1
b) the STEPS and BALCONY leading to the entrance door for being level and properly anchored;		4.1
c) OTHER		

REMARKS:

- 4.1 The equipment building was not installed at the time of our inspection.

5. TOWER, WAVE-GUIDE BRIDGE AND SHELTER FOUNDATIONS

Verify:		Acceptable	See Remarks
a)	the dimensions and locations of the ELEMENTS ABOVE GROUND;		5.1
b)	that FORM WORK and SONOTUBES were removed;		5.1
c)	the CONCRETE and GROUT above ground for movement, cracking, spalling and deterioration;		5.1
d)	for exposed REINFORCING BARS;		5.1
e)	the BASE PLATE contact surfaces;		5.2
f)	the ANCHOR BOLTS for bends and fractures. Anchor bolts to be double nutted;		5.3
g)	BACKFILL for surface compaction;		5.1
h)	that the EQUIPMENT SHELTER is well centred over the foundations and attached to each foundation;	N/A	
i)	the SURFACE DRAINAGE and ground slope around the foundations and in general in order to prevent water accumulation;		5.1
j)	OTHER.		

REMARKS:

- 5.1 Due to snow accumulation these items were not verified.
- 5.2 There is no grout under the tower base plates as specified on drawing no. 83TP1717_E01_02 (Photo no. 2). We recommend adding a non-shrink grout between the concrete pilasters and the underside of base plates.
- 5.3 The tower anchor bolts are not double nutted as specified on drawing no. 83TP1717_E01_02 (Photo no. 2). Since two out of three anchor bolts cannot be double nutted due to the poor anchor bolt layout detail (i.e. two out of three anchor bolts interfere with the diagonal gussets) and that there is not enough space to add a second nut on the third anchor bolt, the Contractor is to propose a method to lock the anchor bolts in place.

5. TOWER, WAVE-GUIDE BRIDGE AND SHELTER FOUNDATIONS
(cont'd)

REMARKS:

- 5.4 The base of the stair stringers does not rest on its foundation (i.e. a concrete step) (Photo no. 3). We recommend casting another foundation to adequately support the stair stringers to take into account the existing field condition.

6. GUY ANCHORS**Verify:**

	Acceptable	See Remarks
a) the dimensions and locations of the ELEMENTS ABOVE GROUND;	N/A	
b) that FORM WORK was removed;	N/A	
c) the dimensions and quality of welds and galvanizing of STEEL ELEMENTS ABOVE GROUND;	N/A	
d) the angle of inclination of ANCHOR ARMS in the vertical plane;	N/A	
e) that the ANCHOR ARMS are oriented within ± 3 degrees of the tower centre;	N/A	
f) if the TOTAL LENGTH OF THE ANCHOR ARMS is known, the anchor depth comparing the exposed part with the total anchor arm length indicated on the drawings;	N/A	
g) the CONCRETE and GROUT above ground for movement, cracking, spalling and deterioration;	N/A	
h) for exposed REINFORCING BARS;	N/A	
i) the above ground STEEL ELEMENTS of the anchors;	N/A	
j) the above ground components of the ROCK ANCHORS;	N/A	
k) that the GROUT has been well injected into the hollow core anchor bolts (Williams type). If bolts are exposed, verify with a steel wire if necessary;	N/A	
l) the bituminous COATING ON STEEL ELEMENTS in the soil (remove some of the backfill if necessary);	N/A	
m) BACKFILL for surface compaction;	N/A	
n) the SURFACE DRAINAGE and ground slope around the anchors and in general in order to prevent water accumulation;	N/A	
o) OTHER.		

REMARKS:

There are no remarks that apply to this section.

7. TOWER STRUCTURE AND ACCESSORIES - MEMBERS

Check the tower height, the guy levels, the position and the guy spread of the torsion resistor(s) and the members sizes.

Itemize the structural elements that are bent, fractured, loose, missing or where on-site modifications may have reduced their structural resistance (e.g. slotting, excessive reaming, bending, intermediate splicing, etc.)*.

Check for:

	Acceptable	See Remarks
a) the BASE PLATE(S) of the tower;	✓	
b) the STAR BASE or TAPERED BASE (guyed tower);	N/A	
c) that the underside of BASE PLATES are level and at the same elevation (self-supporting towers);		7.1
d) the LEGS, including splices;	✓	
e) the DIAGONALS;		7.2 7.3
f) the HORIZONTALS;		7.4
g) the INTERNAL BRACING;		7.5 7.6 7.11
h) the TORSION RESISTOR(S).	N/A	
i) the GUY ATTACHMENT PLATES at the tower;	N/A	
j) that TUBULAR ELEMENTS are sealed at the top or have a positive drainage at the lower end;	N/A	
k) the structural elements of the WAVE-GUIDE BRIDGE;	N/A	
l) the structural adequacy of ANTENNA SUPPORTS and if appropriate for antenna supported (take note of unused antenna supports);	N/A	
m) the TRANSMISSION LINE SUPPORTS on the tower;	N/A	
n) the condition of ICE SHIELD(S), if the antenna(s) is (are) completely protected, if support cables are taut;	N/A	
o) the condition of the REST PLATFORMS as well as their conformity with CSA S37-94;		7.7 7.8
p) the condition of the LADDER RUNGS and BRACKETS and their conformity to CSA S37-94;	N/A	
q) the conformity to CSA S37-94 and proper functioning of the FALL ARRESTING DEVICE with a stopper at its top;	N/A	
r) OTHER.		7.9 7.10

7. TOWER STRUCTURE AND ACCESSORIES - MEMBERS (cont'd)

*If a member is to be replaced or modified, take note of the mark number engraved on the member, its dimensions, pertinent details and its location. Measure, for any buckled member, the maximum deviation with respect to a straight line.

REMARKS:

- 7.1 This item was not inspected during this visit.
- 7.2 Due to the poor detail, the diagonal gussets interfere with the weld of the leg to base plate (Photo no. 4). We recommend to fabricate new gussets that would clear the weld, be in contact with the tower leg all the while maintaining minimum specified bolt edge distance.
- 7.3 Three diagonal members are missing under the catwalk at elevation 21 m (Photo no. 5). We recommend installing these members.
- 7.4 There are two damaged secondary horizontal members on the tower (Photo no. 6). We recommend replacing them.
- 7.5 The interior bracing members that connect near the tower leg are not attached as specified on drawing no. 83ER1717_E02_01. The L127X127X10 (piece # KSV12A) is attached further from the legs than indicated on the drawings (Photo no. 7). The Contractor's Engineer is to confirm along with signed and sealed drawings that the situation is acceptable, and if not, the Contractor must rectify the situation.
- 7.6 The interior bracing member parallel to face 4 at elevation 12.6 m is bent (Photo no. 8). We recommend replacing this member.
- 7.7 There are numerous openings in the steel wire woven mesh at the platform levels (Photo no. 9). We recommend rectifying the situation.
- 7.8 There is a slight step in the grating platform at elevation 10.5 m (Photo no. 10). The step is due to the fact that one of the stringers is slightly lower than the other one. We recommend adding shims on the entire length of the stringer supporting the grating.

7. TOWER STRUCTURE AND ACCESSORIES - MEMBERS (cont'd)

REMARKS:

- 7.9 The stair stringers between elevation 10.5 m and 6 m do not match the holes in the C200 x 21 at elevation 6 m (piece # KSV16G) as specified on the drawing 83ER1717_E03_04. Due to field conditions a L64X64X1/4 was welded to piece # KSV16F and KSV16A. Also, resulting from this field modification, the handrail was modified. The Contractor's Engineer is to confirm along with signed and sealed drawings that the situation is acceptable, and if not, the Contractor must rectify the situation.
- 7.10 On the last catwalk level, a section of the handrail is too low and one mid-span member is missing (Photo no. 13). We recommend rectifying the situation.
- 7.11 The interior bracing assembly at elevation 6m has a deflection of approximately 50mm due to the vertical loads from the stairs and the platform. This deflection could be partially created by the fact that the base section of the stairs does not rest on its foundation (see remark 5.4) The Contractor's Engineer is to confirm along with signed and sealed drawings that the situation is acceptable, and if not, the Contractor must rectify the situation.

8. TOWER STRUCTURE AND ACCESSORIES - BOLTS**Verify the bolts* of (note the size and grade of bolts (e.g. ASTM A325)):**

	Acceptable	See Remarks
a) the LEG SPLICES;	✓	
b) the DIAGONALS;		8.1
c) the HORIZONTALS;		8.1 8.2
d) the INTERIOR BRACING;		8.1 8.2
e) the TORSION RESISTOR(S);	N/A	
f) the STITCH BOLTS;		8.1 8.3
g) the WAVE-GUIDE BRIDGE;	N/A	
h) the ANTENNA SUPPORTS;	N/A	
i) the TRANSMISSION LINE SUPPORTS;	N/A	
j) the ICE SHIELD(S);	N/A	
k) the LADDER;	N/A	
l) the PLATFORM(S);		8.1
m) the SAFETY RAIL;	N/A	
n) OTHER.		8.4

* Verify the bolts using the following criteria;

- bolts too short (minimum of two threads to exceed the nut) or missing;
- ASTM A325 bolts have a maximum of two washers;
- bolts other than ASTM A325 have either two nuts or one nut and one lock washer. Check particularly bolts at antenna support connections;

8. TOWER STRUCTURE AND ACCESSORIES - BOLTS (cont'd)

- sample the ASTM A325 bolts at random for proper torque using a precalibrated torque wrench (sample 5% of bolts on knock-down towers and 10% on all-weld towers). Check particularly the bolts at guy levels for guyed towers and at the top of self-supporting towers.

REMARKS:

- 8.1 Approximately 30 % of the 5/8" dia. A325 bolts sampled were not tightened adequately. To verify if bolts are properly tightened, we use a conservatively low inspection torque value for gavanized 5/8" dia. A325 bolts of 130 lbs-ft. Also some of the bolts are visually loose (Photo no. 14, 15 and 16). We recommend verifying that all of the bolts are tightened properly.
- 8.2 Many bolts are missing on the back to back horizontal members and on the interior bracing back to back members at elevation 6 m \pm (Photo no. 17). We recommend rectifying the situation.
- 8.3 Some spacers are missing at stitch bolts locations at elevation 6 m \pm (Photo no. 18 and 19). We recommend rectifying the situation.
- 8.4 The stair section between the ground and elevation 6 m is not properly attached to the platform, two bolts are missing (Photo no. 20). We recommend rectifying the situation.
- 8.5 The stair section between elevation 6 m and 10.5 m is not attached at elevation 6 m (Photo no. 11). We recommend rectifying the situation.

9. TOWER STRUCTURE AND ACCESSORIES - WELDS

Verify the quality and continuity of the welds as well as surface cracks of:

	Acceptable	See Remarks
a) the BASE PLATE;	✓	
b) the STAR BASE;	N/A	
c) the LEG SPLICES;	✓	
d) the MEMBER CONNECTIONS;		9.1
e) the TORSION RESISTOR(S);	N/A	
f) the WAVE-GUIDE BRIDGE;	N/A	
g) the ANTENNA SUPPORTS;	N/A	
h) the TRANSMISSION LINE SUPPORTS;	N/A	
i) the ICE SHIELD(S);	N/A	
j) the LADDER;	N/A	
k) the PLATFORM(S);		9.1
l) OTHER.		9.1

REMARKS:

- 9.1 Due to field conditions, a few welds were done in the field. We believe that the galvanizing was not removed before proceeding with the welds. As a result, the weld metal was mixed with zinc producing poor weld quality. Also, these welds are not seal welds and are starting to rust (Photo no. 12, 21 and 22). The Contractor's Engineer is to certify that these welds are sufficient for the present loads, and if not, the Contractor must rectify the situation.

10. GUYS AND GUY HARDWARE

Verify the GUYS for:

	Acceptable	See Remarks
a) diameter, construction (e.g. 1x19), lay direction (left or right) and any deficiencies (e.g. broken strands, bird-caging, kinks). Inspect the guys using binoculars.	N/A	

Verify* if there are any poorly installed, loose, fractured, worn, bent or missing pieces in the GUY HARDWARE assemblies (if applicable) with respect to:

b) the FACTORY-INSTALLED COMPRESSION GRIPS;	N/A	
c) the SPELTER SOCKETS;	N/A	
d) the PREFORMED GUY GRIPS;	N/A	
e) the SHACKLES;	N/A	
f) the TURNBUCKLES for articulation and for minimal adjustment in each direction: (100 mm for guy diameters of 13 mm or less and 150 mm for guy diameters greater than 13 mm);	N/A	
g) the THIMBLES;	N/A	
h) the GUY CLIPS and their spacing;	N/A	
i) the COTTER PINS and if of stainless steel;	N/A	
j) the ANTI-ROTATION LOCKING CHAIN and PADLOCK;	N/A	
k) the guy tail STEEL WIRE TIES.	N/A	

Verify as well:

l) if the HARDWARE between two guys touch each other and if the relative ARTICULATION of the guys and hardware is possible;	N/A	
m) if there is any SLIPPAGE in the GUY CLIPS or PREFORMED GUY GRIPS;	N/A	
n) if the CABLE LAY DIRECTION of the preformed guy grips and the guys are the same;	N/A	
o) the GUY GUARDS (yellow plastic markers);	N/A	
p) OTHER.		

10. GUYS AND GUY HARDWARE (cont'd)

- * Check the dimensions and the trademarks of all elements (indicate if the hardware trademark is not "Crosby" and if the performed guy grips are not "Preformed Line Products, Ohio").

REMARKS:

There are no remarks that apply to this section.

11. GALVANIZING

Check the quality, the thickness (using a coating thickness gauge) and the finish of galvanizing.

Verify the quality of the galvanized surfaces and note the presence of any scratches, flaking, rust or bubbles on:		Acceptable	See Remarks
a) the ANCHOR BOLTS;		✓	
b) the BASE PLATE(S);		✓	
c) the TOWER MEMBERS;			11.1
d) the ASSEMBLY BOLTS;		✓	
e) the WAVE-GUIDE BRIDGE;		N/A	
f) the ANTENNA SUPPORTS;			11.2
g) the ICE SHIELD(S);		N/A	
h) the LADDER RUNGS and BRACKETS;			11.1
i) the GUY ANCHOR ASSEMBLIES;		N/A	
j) the GUYS;		N/A	
k) the GUY HARDWARE;		N/A	
l) OTHER.			

REMARKS:

- 11.1 The field welds are showing signs of rust (Photo no. 12, 21 and 22). We recommend removing the rust and treating each of these connections with "Galvazinc" brush applied, but only after the adequacy of the welds is ascertained (see remark 9.1)
- 11.2 The underside of the radar platform is showing signs of rust (Photo no. 23). We recommend removing the rust and treating the platform with "Galvazinc" brush applied.

12. DAYTIME OBSTRUCTION MARKINGS (PAINTING)

		Acceptable	See Remarks
Verify:			
a)	that the TOWER PAINTING (length and position of colour bands) is in accordance with the latest version TRANSPORT CANADA TP382;		12.1
b)	that the ALTERNATING COLOUR BANDS, international orange and white can be seen clearly from a distance of 600 m to 1 000 m;	✓	
c)	the PAINT QUALITY (flaking, blistering, fading, oxidation), indicate % of damaged paint;	✓	
d)	that the EXTERIOR and INTERIOR SURFACES of the tower members are painted;	✓	
e)	if the following SURFACES are NOT PAINTED: contact surfaces of leg splices, ladder rungs and rest platforms and antenna supports;	✓	
f)	OTHER.		

REMARKS:

- 12.1 The colour band scheme does not comply with the existing Transport Canada standard. There are nine paint bands instead of seven and the bottom section is not painted. Environment Canada should verify with Transport Canada if this site requires daytime obstruction marking.

13. NIGHT-TIME OBSTRUCTION MARKINGS (LIGHTING)**Verify*:**

	Acceptable	See Remarks
a) that the LIGHTING SYSTEM conforms with TRANSPORT CANADA TP382;		13.1
b) that the FLASHING RED BEACON(S) functions as per TP382;	N/A	
c) that the DOUBLE STEADY BURNING RED LIGHTS function;	N/A	
d) that the MEDIUM INTENSITY WHITE FLASHING LIGHT(S) function as per TP382;	N/A	
e) that the HIGH INTENSITY WHITE FLASHING LIGHTS function as per TP382;	N/A	
f) that the BEACONS and LIGHTS are not HIDDEN by antennas or any other obstacle;	N/A	
g) the water-tightness of CABLES and JUNCTION BOXES;	N/A	
h) with a steel wire that the DRAINAGE HOLES under the beacons and junction boxes are not plugged;	N/A	
i) that CABLE CONNECTIONS are solid;	N/A	
j) the INTENSITY CONTROL DEVICE of the white flashing light system (Cover the device to verify the change in intensity);	N/A	
k) the CONTROL and TERMINAL BOXES;	N/A	
l) OTHER.		

* Check if the lighting system, bulbs, cables (including wire gauges), control boxes and the intensity control devices are of the same type and brand as specified. If there is no specification, indicate the brand and model of all equipment.

REMARKS:

13.1 There is no night-time obstruction marking on this tower.
Environment Canada should verify with Transport Canada if this site requires night-time obstruction marking.

14. GROUNDING

Verify (note the grounding cable sizes (e.g. 2/0) and elements. The above ground portion of the cable must be tinned):		Acceptable	See Remarks
a)	that the LIGHTNING ROD is pointed, vertical and exceeds the top of the tower and antennas by at least 1,0 m or as specified;	N/A	
b)	the physical continuity of the CABLES DESCENDING THE TOWER for kinks and sudden changes in direction. The cables must have a well routed grounding path;	N/A	
c)	the grounding system at the BASE OF THE TOWER;		14.1
d)	that the grounding assembly at the GUY ANCHORS is above the guy hardware and on the active part of the guy;	N/A	
e)	the WAVE-GUIDE BRIDGE grounding;	N/A	
f)	the EQUIPMENT SHELTER grounding;		14.1
g)	the FENCE grounding;		14.1
h)	physically the individual TRANSMISSION LINE grounding near the antennas, at 60 m intervals, at the base of the tower and at the wave-guide bridge just before the entrance to the equipment shelter;	N/A	
i)	if there are any inappropriate, missing, or loose ASSEMBLIES (the make and model of the assemblies above ground are necessary if a replacement is required);	N/A	
j)	OTHER.		

REMARKS:

14.1 The grounding was not inspected during this visit.

15. ANTENNA LIST

No	Type	Elevation ()	Azimuth (deg.)	Direction	Transmission Line

PRESUMED MAGNETIC DECLINATION:

14°WEST

measure:

- the approximate azimuth of the micro-wave, directional cellular and directional mobile antennas.

16. ANTENNAS**Verify for each antenna:**

	Acceptable	See Remarks
a) if the STRUTS installed according to the micro-wave antenna manufacturer and if attached to adequate support elements;	N/A	
b) the DAMAGES to antennas due to falling ice and other causes ;	N/A	
c) if the antennas are protected by an ICE SHIELD where falling ice from the top of the tower, another ice shield or antenna at about the same azimuth exceeds the permitted height*;	N/A	
d) OTHER.		

* Maximum recommended ice fall:

Specified radial ice for the site	Maximum recommended ice fall without ice shield
40 mm and under	15,0 m
50 mm	12,0 m
65 mm	10,5 m
75 mm	7,5 m

REMARKS:

There are no remarks that apply to this section.

2001-02-27

17. TRANSMISSION LINES

Verify the transmission lines noting:		Acceptable	See Remarks
a)	any KINKS, if BEND RADII are less than specified radii, DAMAGE to EXTERNAL SHEATH due to rubbing against a structural member or other (note their location on the tower by referring to drawings);		17.1
b)	if all HORIZONTAL PORTIONS are PROTECTED against falling ice or objects (when more than 5 m below the top of the tower) and against workers or other;		17.1
c)	if they possess a HOISTING GRIP at the top most point of the line (and at every 60 m) attached to the tower to carry the line's self weight;		17.1
d)	if the LINES are attached to the tower with appropriate HANGER KITS spaced at the recommended distance and having an opening of 8 mm \pm 3 mm;		17.1
e)	if the lines are WATER-TIGHT at the JUMPER CONNECTORS and at the ENTRANCE to the EQUIPMENT SHELTER. Verify as well that the lines have DRIP LOOPS before entering the shelter;		17.1
f)	OTHER.		

REMARKS:

17.1 These items were not verified since the transmission lines were not installed at the time of our inspection.

18. INSULATORS

Verify the presence of dirt, cracks, faults, flaking and carbon streaks due to arc formations on:

	Acceptable	See Remarks
a) the ISULATORS AT THE TOWER BASE;	N/A	
b) the ARC GAP BALLS at the base of the tower. Note if they are intact and in good condition (smooth and without cavities);	N/A	
c) the PRIMARY ISULATORS at the top ends of the guys;	N/A	
d) the ISULATORS ALONG THE LENGTH OF THE GUYS (with the help of binoculars);	N/A	
e) OTHER.		

REMARKS:

There are no remarks that apply to this section.

SUMMARY OF OBSERVED DEFICIENCIES

- 0.3 The drawings that we were supplied with for the inspection were not signed and sealed by an Engineer. Environment Canada should obtain as-built drawings signed and sealed by an Engineer ensuring that the stamp is valid in the Province of Quebec.
- 0.4 In order to verify the corrections indicated in this report and to verify the unchecked items listed in this report, we recommend a final inspection at the end of the work including radar installation, transmission lines installation and ladder installation.
- 5.2 There is no grout under the tower base plates as specified on drawing no. 83TP1717_E01_02 (Photo no. 2). We recommend adding a non-shrink grout between the concrete pilasters and the underside of base plates.
- 5.3 The tower anchor bolts are not double nutted as specified on drawing no. 83TP1717_E01_02 (Photo no. 2). Since two out of three anchor bolts cannot be double nutted due to the poor anchor bolt layout detail (i.e. two out of three anchor bolts interfere with the diagonal gussets) and that there is not enough space to add a second nut on the third anchor bolt, the Contractor is to propose a method to lock the anchor bolts in place.
- 5.4 The base of the stair stringers does not rest on its foundation (i.e. a concrete step) (Photo no. 3). We recommend casting another foundation to adequately support the stair stringers to take into account the existing field condition.
- 7.2 Due to the poor detail, the diagonal gussets interfere with the weld of the leg to base plate (Photo no. 4). We recommend to fabricate new gussets that would clear the weld, be in contact with the tower leg all the while maintaining minimum specified bolt edge distance.
- 7.3 Three diagonal members are missing under the catwalk at elevation 21 m (Photo no. 5). We recommend installing these members.
- 7.4 There are two damaged secondary horizontal members on the tower (Photo no. 6). We recommend replacing them.
- 7.5 The interior bracing members that connect near the tower leg are not attached as specified on drawing no. 83ER1717_E02_01. The L127X127X10 (piece # KSV12A) is attached further from the legs than indicated on the drawings (Photo no. 7). The Contractor's Engineer is to confirm along with signed and sealed drawings that the situation is acceptable, and if not, the Contractor must rectify the situation.

SUMMARY OF OBSERVED DEFICIENCIES (cont'd)

- 7.6 The interior bracing member parallel to face 4 at elevation 12.6 m is bent (Photo no. 8). We recommend replacing this member.
- 7.7 There are numerous openings in the steel wire woven mesh at the platform levels (Photo no. 9). We recommend rectifying the situation.
- 7.8 There is a slight step in the grating platform at elevation 10.5 m (Photo no. 10). The step is due to the fact that one of the stringers is slightly lower than the other one. We recommend adding shims on the entire length of the stringer supporting the grating.
- 7.9 The stair stringers between elevation 10.5 m and 6 m do not match the holes in the C200 x 21 at elevation 6 m (piece # KSV16G) as specified on the drawing 83ER1717_E03_04. Due to field conditions a L64X64X1/4 was welded to piece # KSV16F and KSV16A. Also, resulting from this field modification, the handrail was modified. The Contractor's Engineer is to confirm along with signed and sealed drawings that the situation is acceptable, and if not, the Contractor must rectify the situation.
- 7.10 On the last catwalk level, a section of the handrail is too low and one mid-span member is missing (Photo no. 13). We recommend rectifying the situation.
- 7.11 The interior bracing assembly at elevation 6m has a deflection of approximately 50mm due to the vertical loads from the stairs and the platform. This deflection could be partially created by the fact that the base section of the stairs does not rest on its foundation (see remark 5.4) The Contractor's Engineer is to confirm along with signed and sealed drawings that the situation is acceptable, and if not, the Contractor must rectify the situation.
- 8.1 Approximately 30 % of the 5/8" dia. A325 bolts sampled were not tightened adequately. To verify if bolts are properly tightened, we use a conservatively low inspection torque value for galvanized 5/8" dia. A325 bolts of 130 lbs-ft. Also some of the bolts are visually loose (Photo no. 14, 15 and 16). We recommend verifying that all of the bolts are tightened properly.
- 8.2 Many bolts are missing on the back to back horizontal members and on the interior bracing back to back members at elevation 6 m ± (Photo no. 17). We recommend rectifying the situation.

SUMMARY OF OBSERVED DEFICIENCIES (cont'd)

- 8.3 Some spacers are missing at stitch bolts locations at elevation 6 m ± (Photo no. 18 and 19). We recommend rectifying the situation.
- 8.4 The stair section between the ground and elevation 6 m is not properly attached to the platform, two bolts are missing (Photo no. 20). We recommend rectifying the situation.
- 8.5 The stair section between elevation 6 m and 10.5 m is not attached at elevation 6 m (Photo no. 11). We recommend rectifying the situation.
- 9.1 Due to field conditions, a few welds were done in the field. We believe that the galvanizing was not removed before proceeding with the welds. As a result, the weld metal was mixed with zinc producing poor weld quality. Also, these welds are not seal welds and are starting to rust (Photo no. 12, 21 and 22). The Contractor's Engineer is to certify that these welds are sufficient for the present loads, and if not, the Contractor must rectify the situation.
- 11.1 The field welds are showing signs of rust (Photo no. 12, 21 and 22). We recommend removing the rust and treating each of these connections with "Galvazinc" brush applied, but only after the adequacy of the welds is ascertained (see remark 9.1).
- 11.2 The underside of the radar platform is showing signs of rust (Photo no. 23). We recommend removing the rust and treating the platform with "Galvazinc" brush applied.
- 12.1 The colour band scheme does not comply with the existing Transport Canada standard. There are nine paint bands instead of seven and the bottom section is not painted. Environment Canada should verify with Transport Canada if this site requires daytime obstruction marking.
- 13.1 There is no night-time obstruction marking on this tower. Environment Canada should verify with Transport Canada if this site requires night-time obstruction marking.

LIST OF PHOTOS

<u>Photo N°</u>	<u>Description</u>
1	Tower profile
2	Base of the tower leg
3	Foundation of the stairs
4	Diagonal gusset at the base of the tower
5	Missing diagonal under the top platform
6	Damaged secondary horizontal
7	New to recycled section connection
8	Bent interior bracing member
9	Opening at the platform level
10	Step in the grating platform
11	Stair stringer connection to platform at elevation 6m
12	Handrail post connection to platform at elevation 6m
13	Handrail at the top platform
14	Loose bolt
15	Loose bolt
16	Loose bolt
17	Missing bolt at the new interior bracing elevation
18	Missing spacer at elevation 6m
19	Missing spacer at elevation 6m
20	Missing bolts at elevation 6m
21	Handrail connection to leg at top platform elevation
22	Added member connection to channel
23	Rust under the radar platform

SITE: LANDRIENNE RADAR
2001-02-27

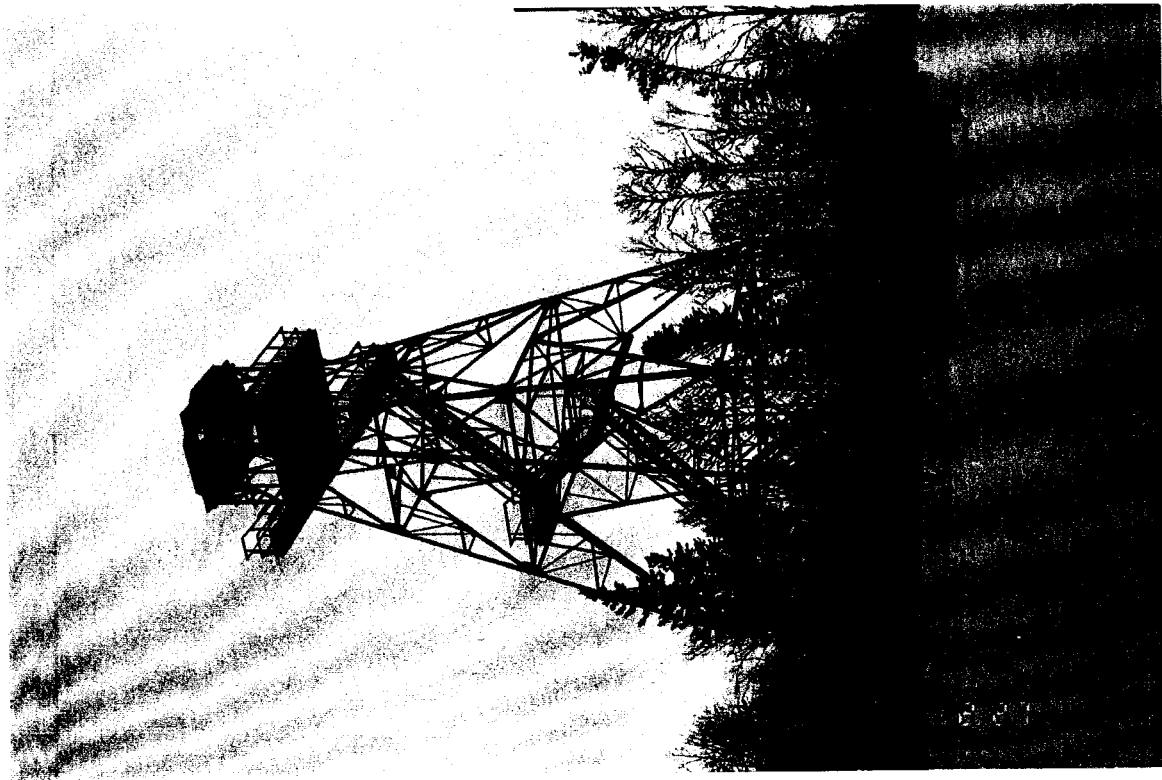


photo # 1



photo # 2

SITE: LANDRIENNE RADAR
2001-02-27



photo # 3



photo # 4

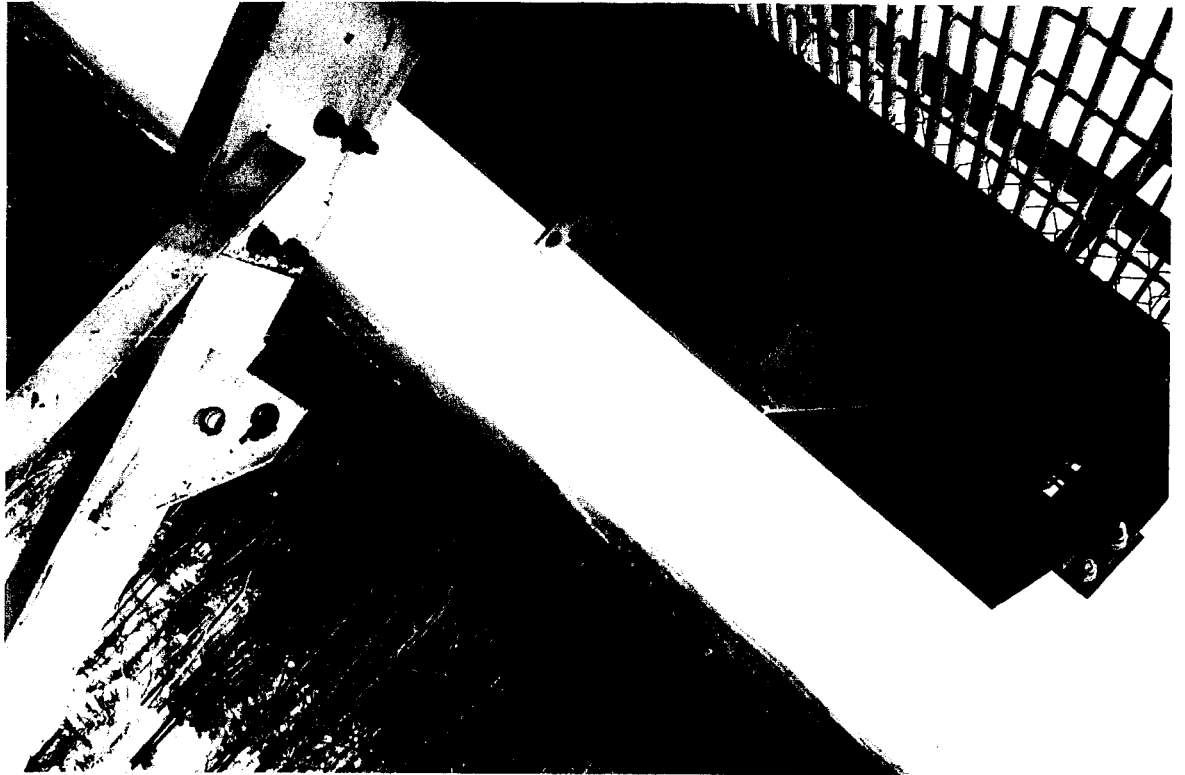


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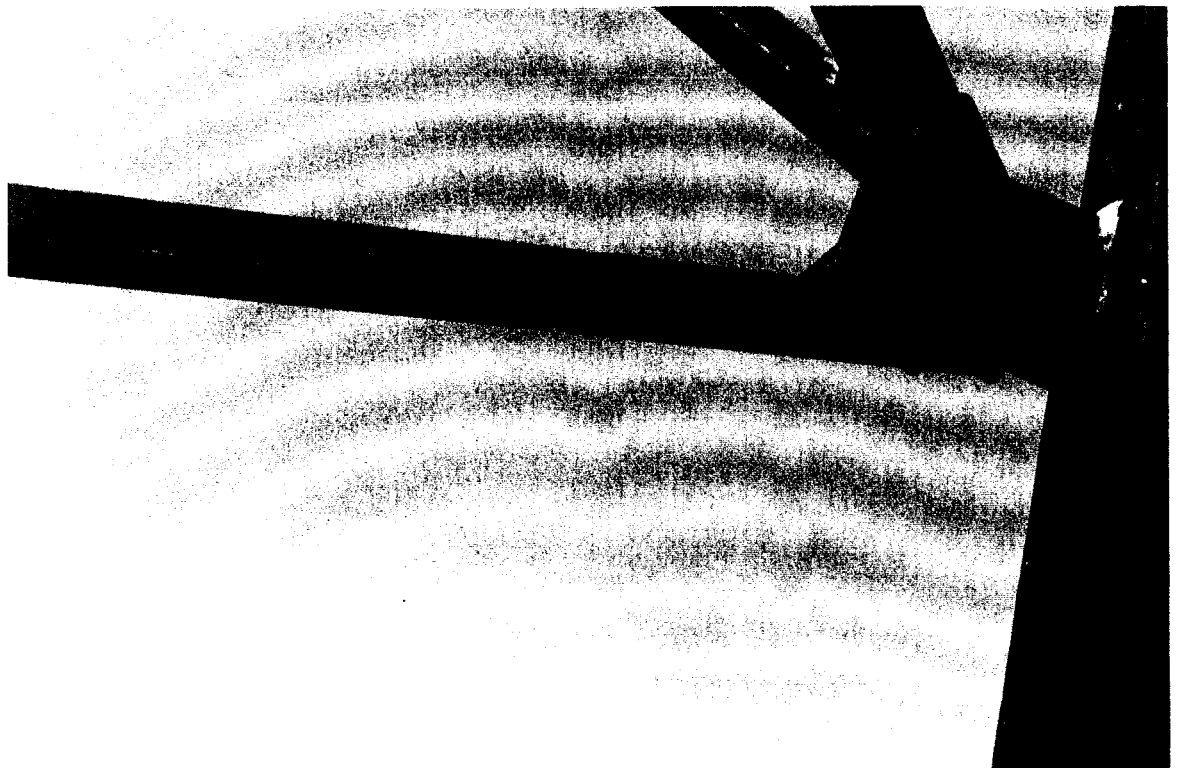


photo # 6

SITE: LANDRIENNE RADAR
2001-02-27

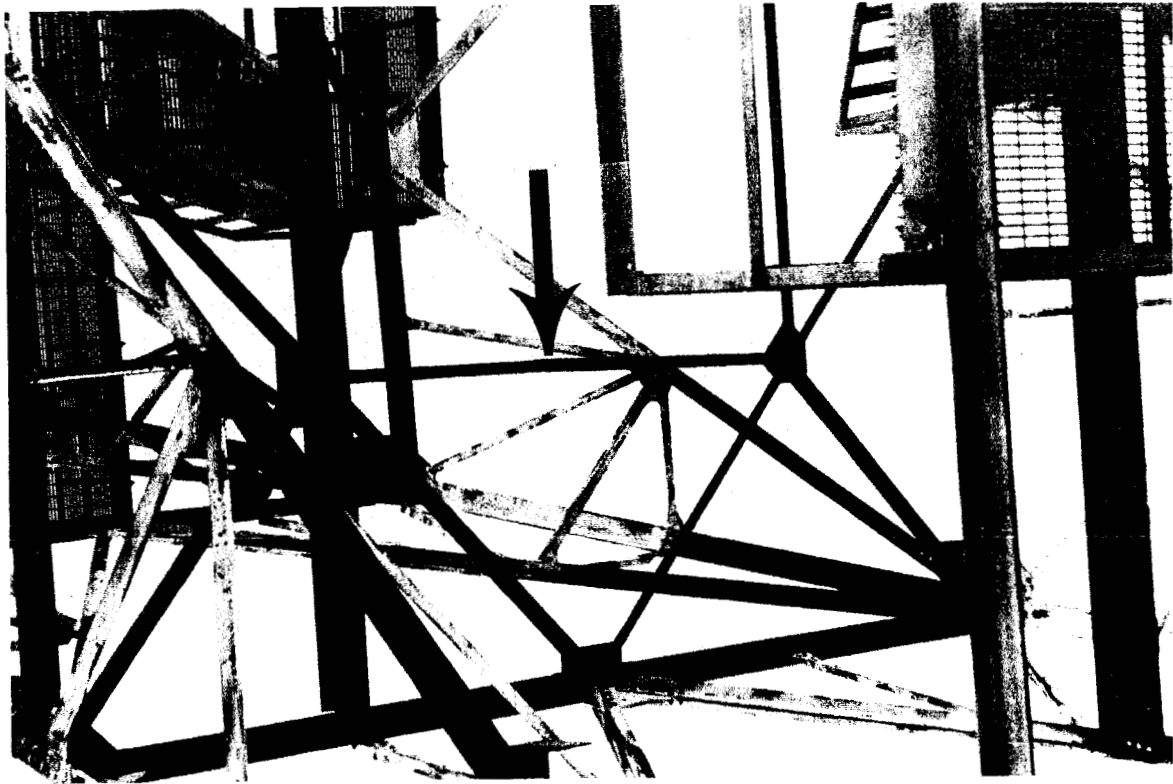


photo # 8



photo # 7

SITE: LANDRIENNE RADAR
2001-02-27

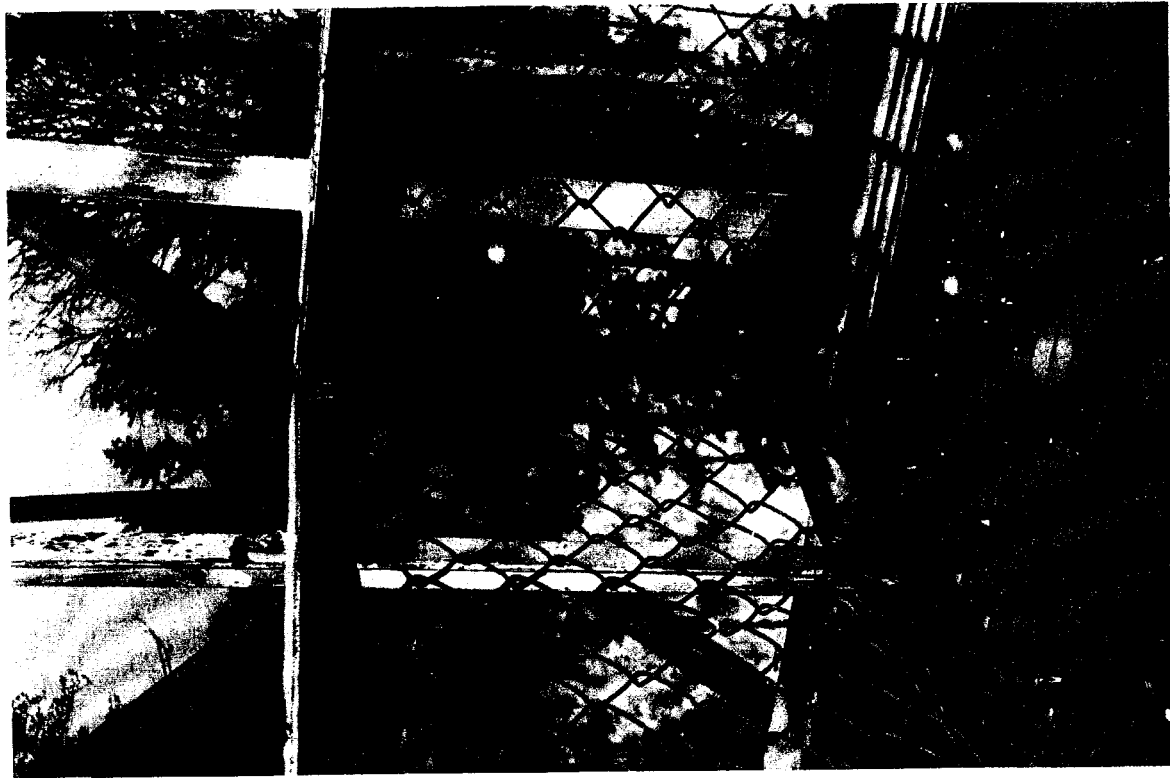


photo # 9



photo # 10



photo # 11



photo # 12

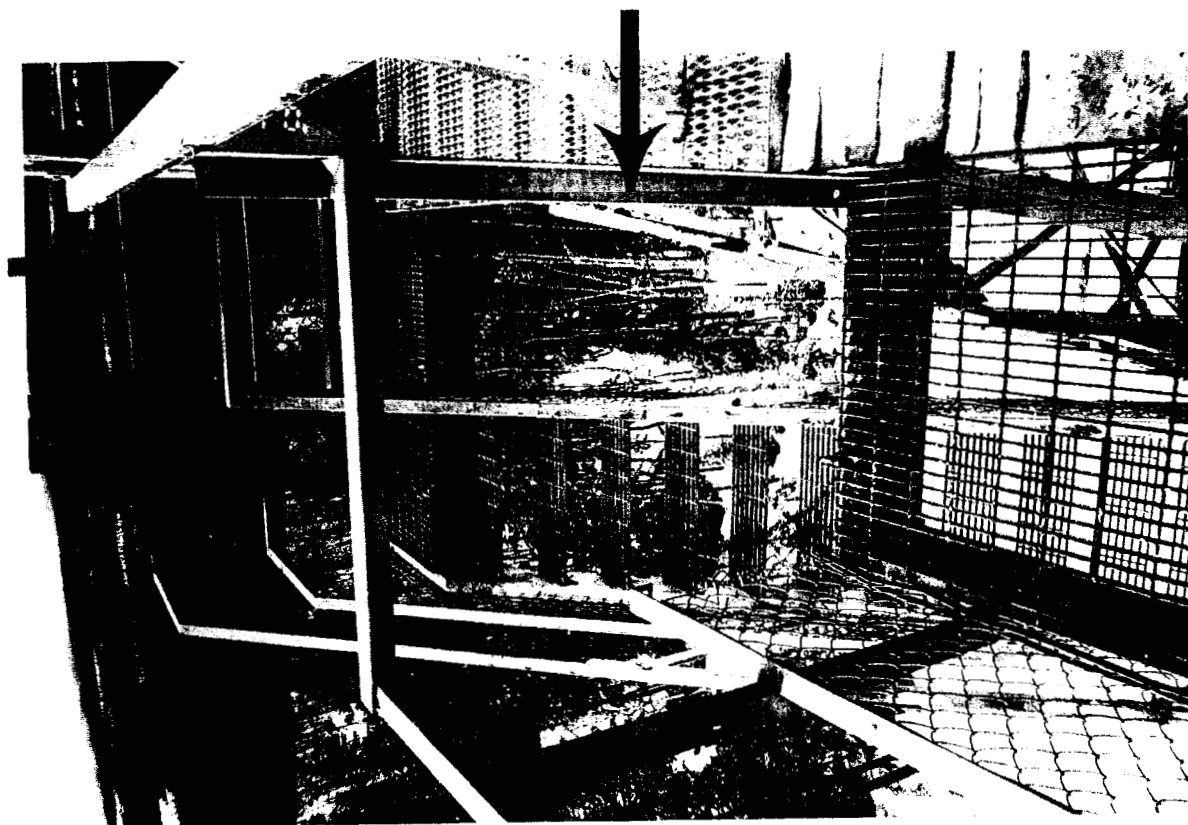


photo # 13



photo # 14

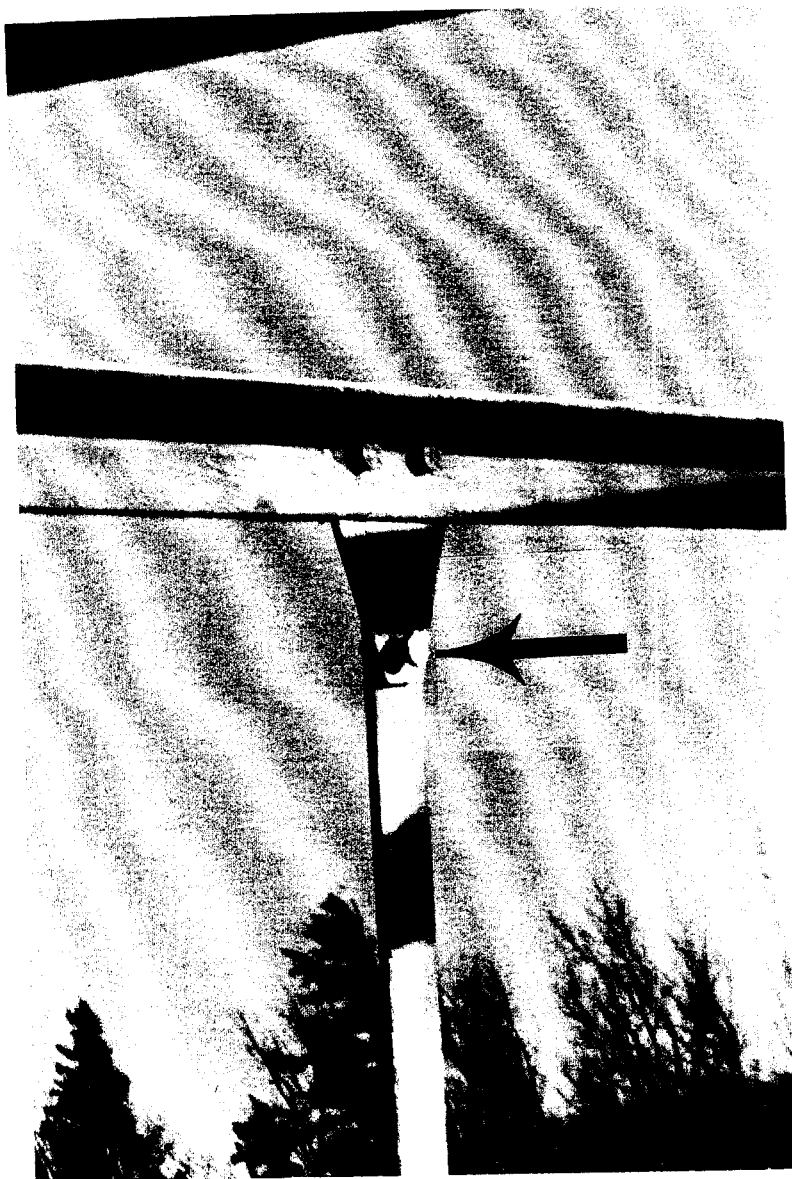


photo # 15



photo # 16

SITE: LANDRIENNE RADAR
2001-02-27

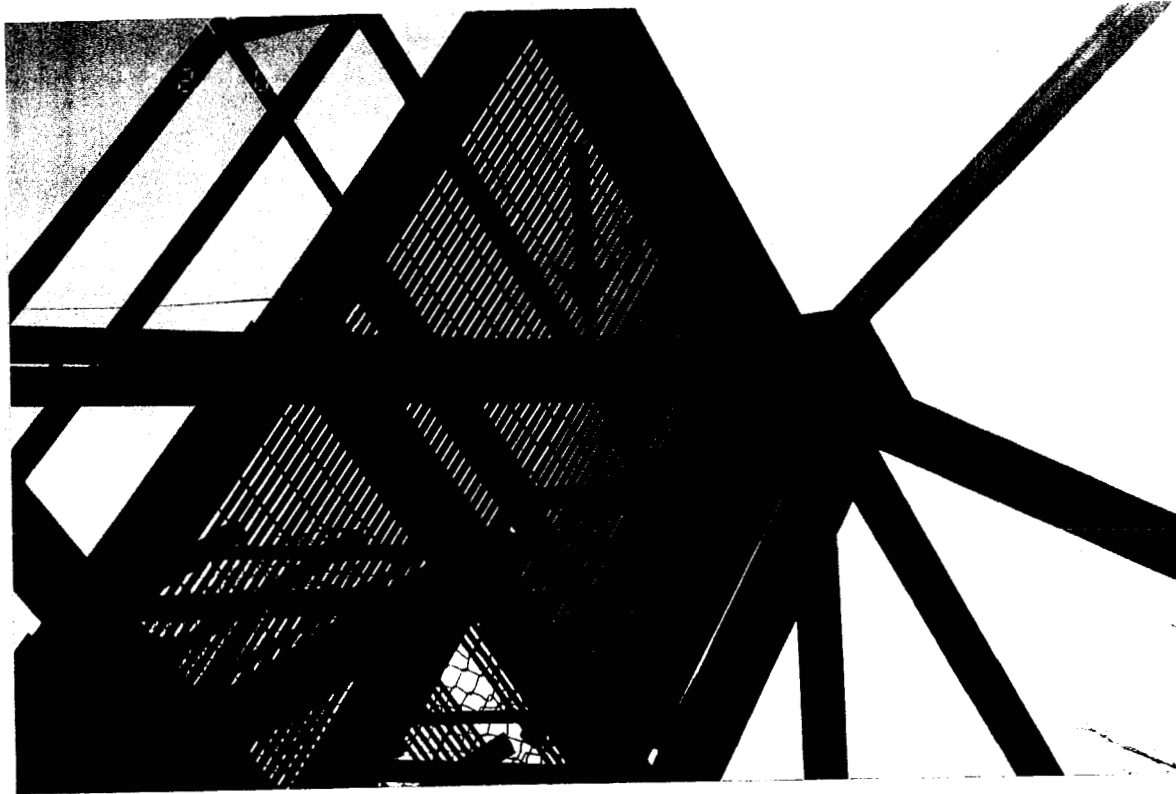


photo # 18



photo # 17



photo # 19

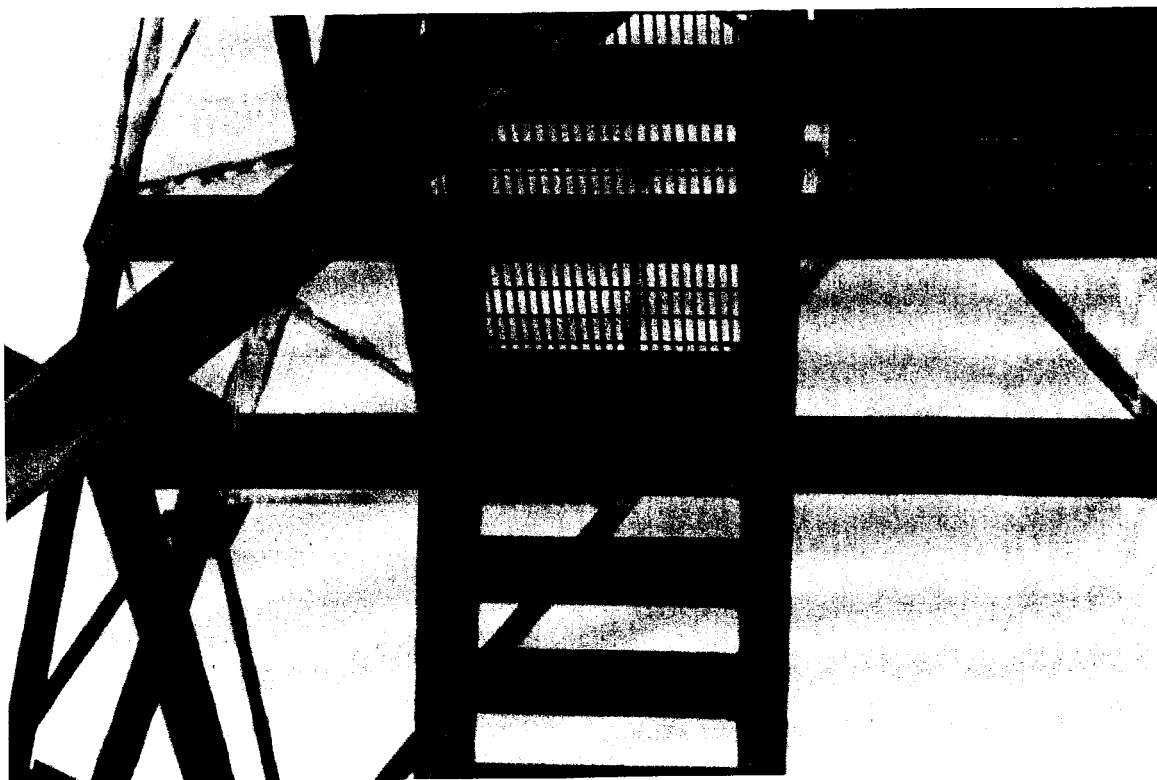


photo # 20

SITE: LANDRIENNE RADAR
2001-02-27



photo # 21

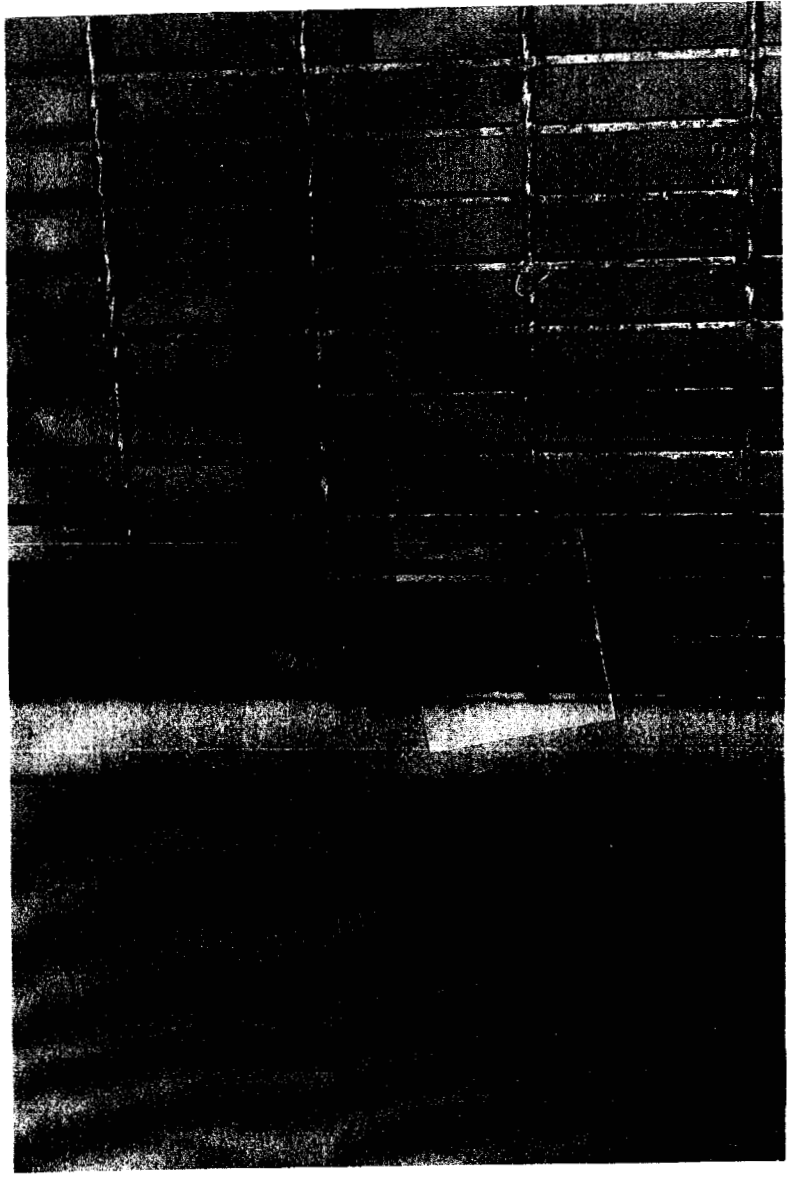


photo # 22

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2001-02-27

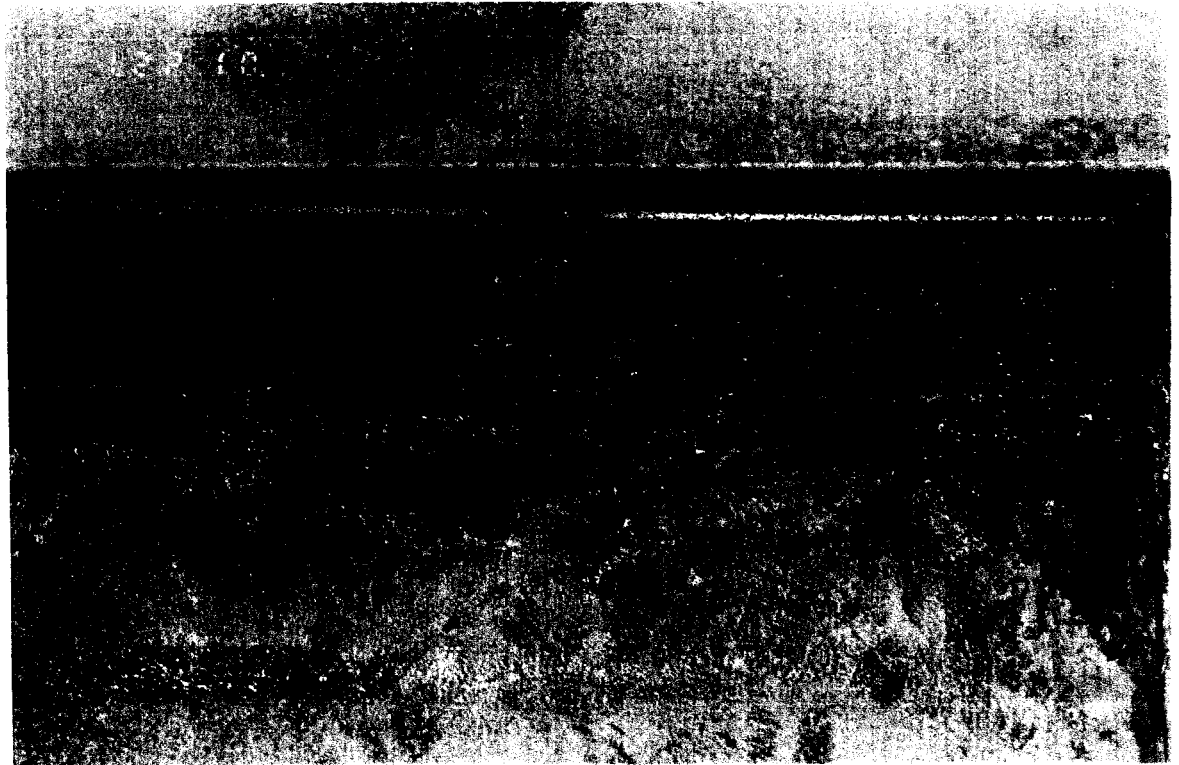


photo # 23

APPENDIX A

00-01-036-01
ATMOSHERIC ENVIRONMENT
20' RADAR TOWER EXTENSION
LANDRIENNE, PQ
FINAL DRAWING PACKAGE (R1)

DESCRIPTION			DRAWING NO.		REV.
<u>ERECTION DRAWINGS</u>					
NEW BASE SECTION			83ER1717_E01_01		1
INTERNAL FRAMING			83ER1717_E02_01		0
INTERNAL FRAMING DETAILS			83ER1717_E02_02		0
PLATFORM AND STAIR PLAN			83ER1717_E03_01		0
PLATFORM PLAN			83ER1717_E03_02		0
PLATFORM AND STAIR SECTIONS			83ER1717_E03_03		0
PLATFORM SECTIONS			83ER1717_E03_04		0
PLATFORM GRATING DETAILS			83ER1717_E04_01		0
ANCHOR BOLT TEMPLATE			83TP1717_E01_01		0
ANCHOR BOLT LAYOUT			83TP1717_E01_02		0
<u>MATERIAL LIST</u>			4 PAGES		