Committee Report

To:	Warden Hicks and Members of Grey County Council
Committee Date:	September 9, 2021
Subject / Report No:	TR-CW-24-21
Title:	Condition of Clarksburg Sand Dome
Prepared by:	Pat Hoy, Director of Transportation Services Jim Nicoll, Maintenance Manager
Reviewed by:	Kim Wingrove, CAO
Lower Tier(s) Affected:	
Status:	Adopted as presented by Committee of the Whole through Resolution CW151-21; Endorsed by County Council CC70-21

Recommendation

1. **That Report TR-CW-24-21 Condition of Clarksburg Sand Dome be received for information**.

Executive Summary

Transportation Services will require an additional $110,000 of unbudgeted 2021 funds to complete additional emergency repairs at the Clarksburg dome that were noted in the Engineer's report.

Background and Discussion

The Clarksburg dome is a self-supporting structure and functions similar to an igloo with upgraded support. Each panel is plywood on a wooden frame that is its own structural member, leaning on the others for additional support. Each piece of plywood is placed with the wood grain vertical, glued and nailed for additional support.

The CAO has approved the emergency repairs with input from the Purchasing Manager through the Purchasing Policy 7-1.

Immediate Maintenance Requirements

The Clarksburg Dome is located at 827489 Grey Road 40, 1 kilometer west of Grey Road 13. It is approximately 35 years old and constructed from wood and shingles. An additional inspection carried out on July 16th, 2021 and has determined that $110,000 of structural repairs are required in addition to the $40,000 requested in report TR-CW-14-21 (July 8, 2021). If these repairs are not completed there is a possibility that the dome may collapse due to snow load.

Due to emergency circumstances the repairs to the dome have been approved by CAO

Wingrove, Purchasing and Finance to award to as a single source.

Future Replacement Considerations

Grey County domes will be inspected on a yearly basis by an Engineer to ensure that the life cycle of each dome will be safely met. It is estimated that a new building in Clarksburg will be required in 7 years. Transportation Services is currently putting $156,100 into reserve annually for future construction costs.

Legal and Legislated Requirements

Approval for these emergency repairs is authorized through the Purchasing Policy 7-1 (By-law 5074-20) Under (4.0) Procurement Methods, (4.3) Other Processes, (h.) Procurement in Emergencies and, (i) Process for emergency purchase.

Financial and Resource Implications

If insufficient surplus exists at year-end, a total of $110,000 will be funded from the Transportation Services Facilities – Depots & Domes Reserve to complete this work.

Should reserve funding be required for these unanticipated projects, the Transportation Services Facilities – Depots & Domes Reserve will have a projected balance of $346,692 at year-end.

Relevant Consultation

☒ Internal: Finance Department

☐ External:

Appendices and Attachments

Clarksburg Dome Structural Inspection Report

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July 22, 2020

Mr. Jim Nicoll
Maintenance Manager - Transportation Services
The County of Grey
595 9th Avenue East
OWEN SOUND, Ontario
N4K 3E3

Re: Structural Inspection of 116 ft. Sand Dome
Clarksburg Works Yard of Grey County
827469 Grey Road 40, N0H 1J0

Dear Mr. Nicoll:

We have completed detailed "finger-tip" inspection and assessment of the captioned sand dome. This work was undertaken pursuant to your May 27, 2021 email Request for Proposal, our email response of the same day and your July 16, 2021 email authorization.

Inspection was undertaken by Aron Van Pelt on July 19, 2021 and was conducted to locate, identify and assess any distress, deterioration, defects and/or damage that may exist.

This is the Report of our findings and recommendations.

1.0 Description, Background and Limitations

1.1 Description

The dome reportedly dates from the early 1980s. It is a 116 ft. diameter dome with one 15 ft. rectangular doorway. The dome is supported atop a (nominal) 4 ft. high, battered* concrete foundation wall. This foundation wall is a tension ring that floats on grade; the only below-grade concrete is the tie across

the doorway. The stored sand is retained against the wall's inside face.

*"Battered" reflects the fact that the wall tapers in thickness from 2 ft. at grade to 1 ft. at the top of wall. All taper occurs in the outer face, i.e., the inside face is plumb.

There are twenty-four sectors of panels in the dome, with each sector consisting of nine panels. For purposes of this Report:

a) Panels are numbered from No. 1 at the dome base to No. 9 at the dome peak. This panel numbering scheme matches that of the original dome drawings.
b) Sectors are numbered in an anticlockwise fashion, beginning with Sector 1 immediately east of the south-facing doorway. Hence the doorway is in Sector 24.
c) Read SXPY as Panel Y of Sector X.)

1.2 Background

The impetus for this inspection dates from late 2020 when the entire dome was reroofed by a contractor pursuant to an RFQ issued by the County. We understand that said reroofing was completed in mid-to-late December.

On February 16, 2021 the County advised Mr. Van Pelt of local distress and failure of S1P1 and S2P1 and requested that he attend on site to advise re remedial action. Pursuant to the County's request and authorization Mr. Van Pelt attended on site on February 17 to do a preliminary assessment. At that time damage/distress was limited to just the panels noted above.

Repairs and strengthening were required

Thereafter the writer and Mr. Van Pelt visited the site on February 24 to gather all data pertinent to designing, prescribing, and effecting repairs. On our arrival on site the damage was discovered to now be much more significant and widespread in that panels S1P1 to S1P3 and S2P1 to S2P3 were collapsed and beyond repair. Also significantly damaged was the truss on the doorway's east wall, bracing at the doorway, P4 at SI and S2, and P4 at 81 to S4.

Noted within both the collapse debris and the still-standing panels was the fact that much plywood had been replaced as part of the 2020 reroofing. Moreover much of the new plywood appeared to be inadequately installed in that:

a) plywood is not glued to the lumber framing;
b) plywood nailing is much inferior to the standard of nailed domes, i.e., Fitzpatrick domes, that are not structurally compliant with the building code;

c) some plywood is installed as other than full sheets; and
d) some plywood is installed with face grain horizontal rather than vertical; and
e) some plywood is too small to fill the opening within the panels and therefore does not, and cannot, contact the panels' lumber framing.

All of these conditions were identified in the writer's March 1, 2021 Report. Individually and collectively they all compromise the structural capacity of the panels containing such defects, as well as that of the dome itself.

Strengthening of the collapsed dome was undertaken in April 2021 in accordance with a repair protocol specified by the writer. As a result of that process it became evident that defects (a) to (e) were common in all panels directly affected by the collapse.

The current "finger-tip" inspection was therefore requested and undertake primarily to locate, identify and record any and all such defects present in the entire dome. *Inter alia*, availability of such information is essential to any attempt to design and effect repair to restore Code compliance to the dome.

1.3 Inspection and Limitations

Inspection inside and outside was made from grade and from an articulated-boom man-lift that provided finger-tip access to all of the dome structure. Access inside was augmented by climbing the sand pile as/where it existed. Paint marks confirming our presence and this inspection were left at S14P8.

The following limitations applied to this inspection.
a) Access to the sill plates was unavailable outside as all are hidden by the intact roofing.
b) Unimpeded access to some sill plates, anchor bolts and/or bottom panels inside was unavailable due to fact of local overfilling.

Notwithstanding all of the above, it was our opinion that the dome was sufficiently accessible that adequate assessment was possible.

2.0 Roofing and Weatherproofing

2.1 The roofing on the dome is 3-tab Dual Brown asphalt shingles that were new in December 2020. Some widely dispersed shingles (both regular shingles plus ridge caps) are lost or damaged; local repair/replacement is required.

2.2 Other features of the existing roofing and/or weatherproofing are as follows.

a) The metal components, i.e., drip edge, fascia, trim, etc. are in generally good condition.
b) The trim on the west 3-2X6 doorway column is locally damaged.
c) A vent is located at PS in all sectors.

3.0 Dome Structure

3.1 Generally the dome shell describes the constant and continuous bi-directional curvature as is shown on the original drawings. However there are two areas of significant distortions and/or deflections requiring remedial measures.

a) Depression in P7 to P9 at S1 and S2.
b) Sag at P8 and P9 of S13 and S14.

3.2 General repairs are not recommended or required for the concrete foundation.

a) The exterior face is in generally good condition, albeit there are the usual scrapes, gouges, etc. that are common of foundation walls of this type and age.
b) The interior face of the concrete was partly hidden by the stored sand. That which was accessible was as at (a).

Notwithstanding (a) and (b) there is delamination and related deterioration of the concrete in both wing walls. Recommended repairs are to consist of chipping to sound concrete, restoration of corroded rebar and restoration of chipped voids with an epoxy or suitable cementitious compound.

3.3 Overall the remaining original dome structure is in fair condition with a general appearance of being "tired". The large quantity of new, fresh plywood is visually misleading as it is generally not adequate to serve its intended structural function.

3.4 As noted above the primary purpose of this inspection was to locate, assess and record deficiencies vis-a-vis the 2020 plywood installation. This Item No. 3.4 addresses only this issue wherein (A) to (E) denote the following defects being present and **(X?)** denotes the number of plywood sheets affected in any given panel.

A - no glue
B - nailing less than standard
C - plywood horizontal rather than vertical
D - plywood as part sheets
E - plywood does not fit opening and does not contact lumber

a) S1P6 - A and B (X1)
b) S1P7 - A and B (X1)
c) S1P9 - A, B and C (X1)

d) S2P5 - A (X1)
e) S2P7 - A (X1)
f) S2P8 - A and C (X1)
g) S2P9 - A and C (X1)
h) S3P5 - A and B (X1
i) S3P5 - A, Band E (X1)
j) S9P7 - A (X1)
k) S9P8 A and E (X1).
l) S13P6 - A (X1)
m) S13P8 - A and D (X1)
n) S13P9 - A, C and D (X1)
o) S14P3 - A (X1)
p) S14P4 - A (X1)
q) S14P7 - A (X2)
r) S14P8 - A and D (X2)
s) S14P9 - A (X1)
t) S15P3 - A (X1)
u) S15P5 - A (X1)
v) S16P2 - A (X2)
w) S16P4 - A (X2)
x) S16P5 - A (X2)
y) S17P7 - A (X1)
z) S17P8 - A (X1)
aa) S17P3 - A (X1)
ab) S17P4 - A (X1)
ac) S17P5 - A (X1)
ad) S17P6 - A (X1)
ae) S17P7 - A (X1)
af) S17P8 - A (X2)
ag) S18P3 - A (X2)
ah) S18P4 - A (X1)
ai) S18P5 - A (X1)
aj) S18P7 - A (X2)
ak) S18P8 - A (X2)
al) S19P1 - A (X2)
am) S19P2 - A (X2)
an) S19P3 - A (X2)
ao) S19P4 - A)X1)
ap) S19P6 - A (X1)
aq) S19P7 - A (x1)
ar) S19P8 - A (X1)
as) S20P1 - A (X2)
at) S20P2 - A (X2)
au) S20P3 - A (X2)
av) S20P4 - A (X1)
aw) S20PS - A (X1)
ax) S20P6 - A (X1)
ay) S20P7 - A (X2)
az) S21P2 - A (X2)
ba) S21P3 - A (X2)

bb) S21P4 - A (X2)
bc) S21P5 - A (X1)
bd) S21P6 - A (X1)
be) S21P7 - A (X2)
bf) S21P8 - A (X1)
bg) S22P1 - A (X1)
bh) S22P2 - A (X2)
bi) S22P3 - A (X2)
bj) S22P4 - A (X1)
bk) S22P5 - A (X1)
bl) S22P6 - A (X1)
bm) S22P7 - A (X2)
bn) S23P1 - A (X2)
bo) S23P2 - A (X2)
bp) S24P4 - A (X3)
bq) S24P5 - A (X2)
br) S24P6 - A (X1)
bs) S24P7 - A (X2)
bt) S24P8 - A (X2)
bu) S24P9 - A (X1)

3.5 Further to No. 3.4, the following issues of decay, damage or deterioration requiring repair were noted. Most if not all of these would have existed prior to the 2020 reroofing. We are not privy to the details of the 2020 Contract and do not imply responsibility to any party for these matters not having been addressed. (Refer to the Standard Details.)

Notes:
1. Some of the recommended work is required to correct previous incorrect/inadequate repairs. This is generally noted below by "redo".
2. Herein the words repair, replace, improve and strengthen are used interchangeably. All are to be read as requiring repair work per the specific cited Standard Details.

a) S1P6 - decayed T.rail (X1 Detail 6B)
b) S1P7 - decayed B.rail (X1 Detail 6B)
c) S2P5 - original glue failed at plywood (X1 Detail 5)
d) S2P6 - plywood decayed (X2 Detail 3)
e) S2P7 - MHH broken (X1 Detail 4)
f) S4P4 - repair split right B.rail (X1 Detail 6A)
g) S4P8 - repair split B.rail (X1 Detail 6B)
h) S5P1 - plywood pushed out (X2 reseat and Details 4 to 8)
i) S5P5 - repair broken MHH (X1 Detail 4)
j) S6P7 - repair left B.rail (X1 Detail 6A)
k) S7P4 - repair right B.rail (X1 Detail 6A); repair split T.rail (X1 Detail 6B)
l) S7P5 - repair split B.rail (X1 Detail 6B)

m) S8P4 - repair split S.rail (Xl Detail 7; repair split B.rail (Xl Detail 6A)
n) S8P6 - repair right B.rail (Xl Detail 6A)
o) S9P4 - repair left S.rail (Xl Detail 7)
p) S10P7- repair split B.rail (Xl Detail 6B)
q) S11P4 - repair left S.rail (Xl Detail 7)
r) S11P6 - repair B.rail (Xl Detail 6B); repair right MHH (Xl Detail 4)
s) S12P3 - repair split T.rail (Xl Detail 6B)
t) S12P4 - redo repair of B.rail (Xl Detail 6B)
u) S13Pl - reseat middle 4X4 (Xl Detail 8)
v) S13P4 - repair right S.rail (Xl Detail 7); repair right B.rail (Xl Detail 6A)
w) S13PS - repair right S.rail (Xl Detail 7); repair right B.rail (Xl Detail 6A)
x) S13P6 - repair right B.rail (Xl Detail 6A)
y) S13P7 - replace decayed plywood (X2 Detail 6); repair split B.rail (Xl Detail 6B)
z) S14P3 - replace decayed plywood (Xl Detail 3)
aa) S14P4 - repair split B.rail (Xl Detail 6B); repair split left S.rail (Xl Detail 7)
ab) S14PS - replace decayed plywood (Xl Detail 3)
ac) S14P6 - repair split left B.rail (Xl Detail 6B)
ad) S14P7 - repair split B.rail (Xl Detail 6A)
ae) S15P2 - replace decayed plywood (Xl Detail 3)
af) S15 P4 - replace decayed plywood (Xl Detail 3); repair split B.Rail (Xl Detail 6B)
ag) S15P6 - repair split B.rail (Xl Detail 6B); repair split right S. Rail (Xl Detail 7)
ah) S16P2 - repair broken 4X4 (Xl Detail 8.
ai) S16P6 - repair split B.rail (Xl Detail 6A)
aj) S16P8 - repair split MHH (Xl Detail 4)
ak) S17P2 - repair damaged 4x4 (Xl Detail 8); replace decayed plywood (X2 Detail 3)
al) S17P3 - replace decayed plywood (Xl Detail 3)
am) S17P4 - redo damaged 4X4 (Xl Detail 8)
an) S18PS - repair split B.rail (Xl Detail 6A)
ao) S17P6 - repair split B.rail (Xl Detail 6A)
ap) S17P7 - replace decayed plywood (Xl Detail 3)
aq) S18P2 - replace decayed plywood (X2 Detail 3); replace decayed 4X4 (Xl Detail 8)
ar) S18P5 - Replace split B.rail (Xl Detail 6A) ; repair broken 4X4 (Xl Detail 8)
as) S18P6 - repair split B.rail (Xl Detail 6A); replace decayed plywood (Xl Detail 3)
at) S18P7 - repair split B.rail (Xl Detail 6A)
au) S19P5 - replace decayed plywood (Xl Detail 3); repair split 4X4 (Xl Detail 8)
av) S19P6 - replace decayed plywood (Xl Detail 3
aw) S19P7 - replace decayed plywood (Xl Detail 3)

ax) S20P4 - replace decayed plywood (X1 Detail 3); repair split B.rail (X1 Detail 6A); repair split 4X4 (X1 Detail 8)
ay) S20P8 - replace decayed plywood (X1 Detail 3); replace decayed 4X4 (X1 Detail 8)
az) S21P1 - repair split MHH X1 Detail 4); repair decayed 4X4 (X1 Detail 8)
ba) S21P2 - repair decayed 4X4 (X1 Detail 8)
bb) S21P4 replace decayed plywood (X1 Detail 3); repair decayed 4X4 (X1 Detail 8)
bc) S22P1 - repair decayed 4X4 (X1 Detail 8)
bd) S22P2 - repair centre 4X4 (X1 Detail 8)
be) S22P3 - repair centre 4X4 (X1 Detail 8)
bf) S22 P9 - tighten loose bolts
bg) S23P3 - replace decayed plywood (X1 Detail 3); replace decayed 4X4 (X1 Detail 8)
bh) S23P4 - repair split MHH (X1 Detail 4)
bi) S23P8 - repair split MHH (X1 Detail 4)
bj) S24P7 - repair split B.rail (X1 Detail 6A)
bk) S214P8 - repair broken 4X4 (X1 Detail 8)
bl) S24 - replace damaged plywood at west truss

3.6 Further to No. 3.5 it is likely that some additional local issues requiring repair would be found to be required once the dome is stripped of shingles and full access is available to the panels' outside face. Hence any future contract to repair, improve and/or reroof the dome should allow for additional workto be done on a Unit Price basis, including:

a) plywood in dome panels and elsewhere;
b) lumber in dome panels and elsewhere;
c) canopy roof joists;
d) sill plates c/w new anchor bolts; and
e) isolated damaged anchor bolts.

3.7 Panels P1 of the following sectors were inaccessible due to the stored sand: S8, S9, S10, S14, S15, S16, and S18.

3.8 Bolt tightness is variable and inadequate. We recommend a full maintenance bolt tightening be completed as part of the dome's repair and rehabilitation.

3.9 The dome is equipped with a 2-part wood plug at the peak. This condition conforms to the present standard. Further improvement and/or modification is not required.

3.10 A double layer of overlapping 2X6 scissor bracing is installed at the base of Panel No. 7. This bracing is installed per the current standard. Further improvement is not required.

I trust all of the above to be as you require.

I shall take no further action re this matter pending receipt of your further direction.

Yours very truly,

James Knight, M.Sc.F., P.Eng.
21-984

Encl . #1 - Standard Details
#2 - Album of photographs (As separate email only.)

Copy: Aron Van Pelt
Van Pelt Construction