

Seismic Project Identification Report

REPORT NO. SPIR- 39-033

for

BLOCK #47-1 (1910/12 Classrooms)

Lord Tennyson Elementary School

1936 West 10th Avenue, Vancouver, BC, V6J 2B2

Facility No: 3939047

School District No. 39

Vancouver School District

**Structural Engineering Guidelines for the
Performance-based Seismic Assessment and Retrofit of
Low-rise British Columbia School**

The Seismic Project Identification Report (SPIR) is a new report format that documents the seismic retrofit concepts proposed for a high risk school block.

The Ministry of Education (Ministry) requires that a School District submit an SPIR for any school block as the first step in the District's request for seismic retrofit funding.

APEGBC, as the Ministry's technical advisor for the Seismic Mitigation Program, was requested by the Ministry to develop the format and technical requirements for the SPIR.

SPIRs are due diligence documents that are designed to present seismic upgrading options to assist seismic safety planning by both the School District and the Ministry. The expectation is that SPIR information will guide the seismic upgrading of school blocks in a safe and cost-effective manner.

Ongoing feedback from engineering practitioners is encouraged to advance future refinements in the format for the SPIR document.

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Figure 1.1: North Elevation – Front Entrance



Figure 1.2: West Wing Elevation



Figure 1.3: South Elevation with Change Room and Gym Blocks in Front of Classroom Block



Figure 1.4: East Elevation

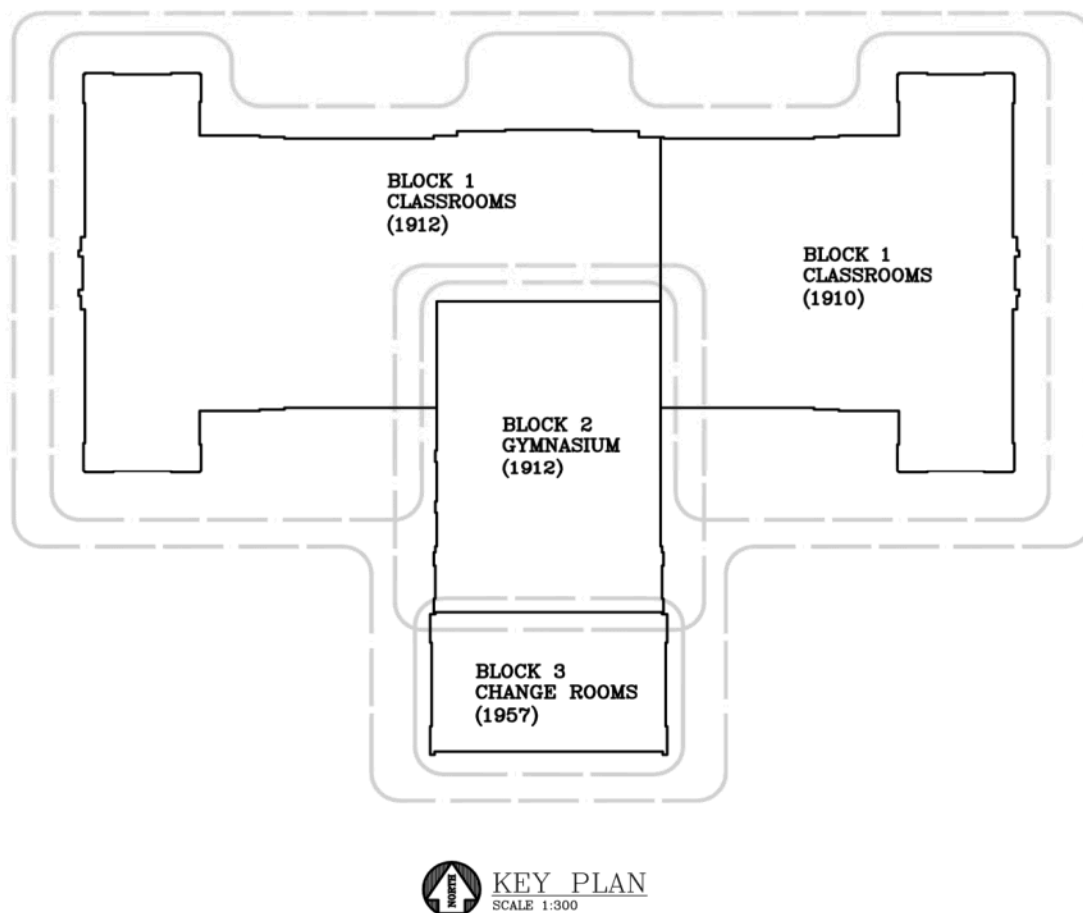


Figure 2.1: Key Plan for Lord Tennyson Elementary

Identification of Retrofit Block (Box #2-1)

Block #1—Classrooms (1910 / 1912)

Adjacency (Box #2-2)

- ☒ No Significant Adjacency Issues
- ☐ Significant Adjacency Issues

Adjacency Comments (Box #2-3)

Available structural drawings show that this Classroom Block was built integrally with Block #2—Gymnasium which has a double height floor between the Main Floor and Attic Slab. The East Wing of the Classroom Block was missing from the available drawings and was shown to be an existing building.

Document from the City of Vancouver Heritage Conservation Program show that the Classroom Block was built in two stages, and site visit had confirmed a joint at this location. From previous experience, it is believed that proper connections between the East Wing and the Main Classroom Block do not exist. Floor slabs either side are at the same elevations which can be easily tied together in a retrofit. Therefore, it is not considered a significant adjacency issue if the retrofit is performed.

School District (Box #3-1)

SD 39—Vancouver

Block Name (Box #3-2)

Block 1—Classrooms

Structural Firm (Box #3-3)

Genivar

Engineer-of-Record (Box #3-4)

Jim Shuttleworth, P.Eng. Struct.Eng.

Years of Construction (Box #3-5)

1910 / 1912

Floor Area (Box #3-6)3890 m²**Construction Type (Box #3-7)**

13—Non-ductile frame

Site Classification (Box #3-8)D (no geotechnical available
hence default was used)**Comments on Construction Type (Box #3-9)**

Non-ductile frame with brick partitions

Number of Storeys (Box #3-10)

3

Clear Storey Heights (Box #3-11)Basement—3200 mm
First Floor—3800 mm
Second Floor—3800 mm**Previous Seismic Upgrade (Box #3-12)**

<input checked="" type="checkbox"/>	No
<input type="checkbox"/>	Yes

Previous Seismic Upgrade Details (Box #3-13)

N/A

(1) Vertical Load-bearing Supports (VLS)**VLS Type (Box #4-1)**

Non-Ductile Reinforced Concrete Columns

VLS DDL (Box #4-2)

1.25%

Supports Description (Box #4-3)

Concrete columns are 300mm x 300mm at the interior and 250mm x 300mm at the perimeter. No information on rebar and concrete strength available.

(2) LDRSs**Number of LDRS Prototypes (Box #4-4)**

1

LDRS Prototype Details (Box #4-5)

Shaking Direction	Prototype No.	LDRS Prototype Description	Max DDL	Capacity
E-W	C-3	Non-ductile Concrete Moment Frame	1.5%	2% W
N-S	C-3	Non-ductile Concrete Moment Frame	1.5%	2% W

Comments on LDRS Prototypes (Box #4-6)

Concrete VLS columns also double as part of a moment frame. No information on rebar and concrete strength available. From experience of other blocks built during the same period, reinforcement is likely smooth bars with large tie spacing and low concrete strength.

(3) Out-of-Plane URM Walls**URM Walls (Box #4-7)**

- ☐ No
- ☒ Yes

Out-of-Plane Prototype Details (Box #4-8)

Prototype No.	Prototype Description	Max. Height	Wall Thickness	Surcharge
OP-2	URM Wall with inadequate connection at top	3800	200	minimal

Comments on Out-of-Plane Prototypes (Box #4-9)

Connectivity at top is unknown. Bricks assumed to be built up to the underside of the beam or slab; a minimal surcharge can be expected.

(4) Roof Diaphragm**Roof Diaphragm Material (Box #4-10)**

- ☐ Wood ☒ Concrete
- ☐ Steel Deck ☐ Braced Steel

Roof Diaphragm Prototype Details (Box #4-11)

Prototype No.	Roof Diaphragm Prototype Description	Span	Max. Movement	Capacity
N/A	Rigid			

Comments on Roof Diaphragm (Box #4-12)

A short built-up wood roof sits on top of a concrete attic slab 100mm thick minimum. No information on rebar and concrete strength available. Also, one can expect that there are no connections at the joint between the East Wing to the rest of the Classroom Block.

(5) Floor Diaphragm**Floor Diaphragm Material (Box #4-13)**

- ☐ Wood ☒ Concrete
- ☐ Steel Deck with Concrete Topping

Floor Diaphragm Prototype Details (Box #4-14)

Prototype No.	Floor Diaphragm Prototype Description	Span	Max. Movement	Capacity
N/A	Rigid			

Comments on Floor Diaphragm (Box #4-15)

Concrete slab with a minimum thickness of 100mm. No information on rebar and concrete strength available.

(5) Connections**Adequate Connections (Box #4-16)**

Roof Diaphragm / LDRS	<input type="checkbox"/>	Yes
	<input type="checkbox"/>	No
LDRS / Foundation	<input type="checkbox"/>	Yes
	<input type="checkbox"/>	No

Comments on Connections (Box #4-17)

No information on rebar detail, hence connections adequacy cannot be determined.

Risk Assessment Results (Box #5-1)

Principal Element	Prototype No.	Prototype Description	PDE
LDRS	C-3	Non-ductile Concrete Moment Frame	50%
Out-of-plane Walls	OP-2	200mm brick partition with inadequate restraint at top	24.6%
Maximum LDRS PDE (refer to GDL note below)			50%
Existing Block Retrofit Priority Ranking			H1
Note:			

Comments on Seismic Deficiencies, Recommended Testing and Risk Assessment Results (Box #5-2)

Structural drawings are available; however information such as reinforcement and concrete strength are missing.

Seismic Deficiencies:

- Very weak Non-ductile Concrete Moment Frame LDRS in both directions. The LDRS is also the VLS; hence, this building is at risk of total collapse.
- Partition walls and exterior walls likely do not meet out-of-plane requirements. Noted that if site specific geotechnical investigation determines a soil site class C, the PDE for OP-2 (out-of-plane URM partition and exterior walls) will reduce to 10% which has a H2 ranking.
- Basement short columns around perimeter extending half storey from the top of basement walls would be heavily damaged with inadequate ductile detailing.

Testing and further investigation:

- Site specific geotechnical investigation to determine soil site class and bearing capacity.
- Removal of parapet flashing to expose construction of parapet walls.
- Removal of wall finish and drilling to determine the composition of interior partition walls and connectivity to the underside of the existing concrete beams.
- Removal of wall finish and drilling to determine the composition of exterior walls and connectivity to the underside of the existing concrete beams.
- Testing to determine rebar type and arrangement and concrete properties.

Retrofit Options Documented (Box #6-1)

No.	Retrofit Performance Level	Chapter
1	Phased Retrofit	7
2	Life-Safety Retrofit	8

Comments on Documented Retrofit Options (Box #6-2)

Enhanced Performance Retrofit is not considered in this report because this is not a gymnasium block.

Phased Retrofit uses the same retrofit concept as Life Safety Retrofit with reduction in forces on the LDRS. It results only in reduction of shear walls and footings. The addition of secondary gravity columns, the strong backing of heavy perimeter walls and the replacement of heavy partition walls will still be required.

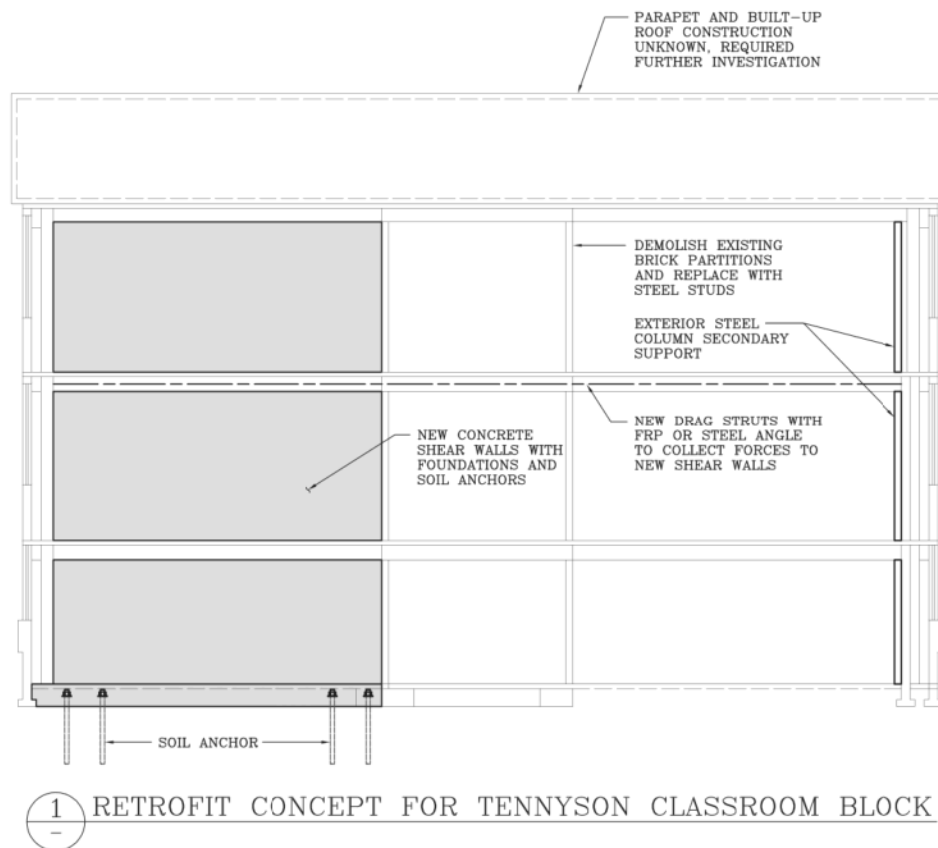
(1) **Retrofit Concept**

Figure 7.1: Typical Section –

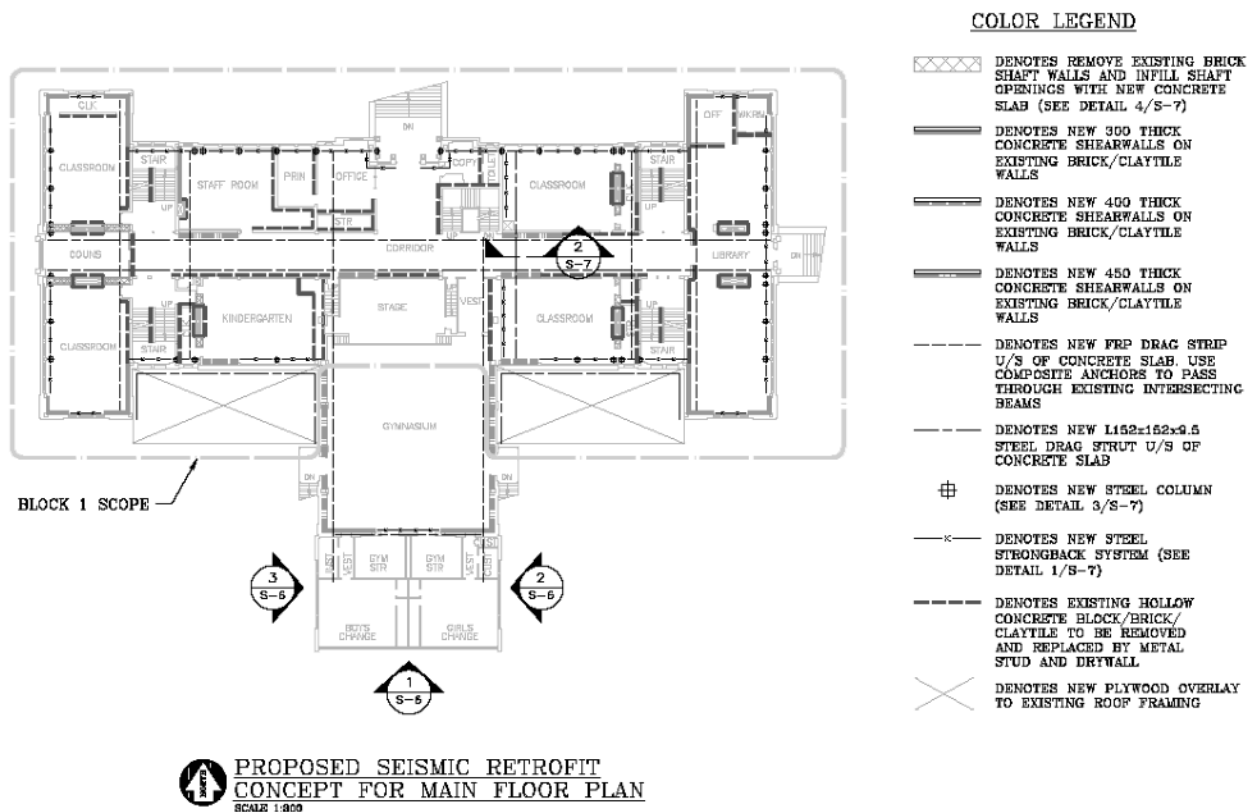


Figure 7.2: Typical Plan –

Comments on Figure 7.1 and Figure 7.2 (Box #7-1)

Provide new Concrete Moderate Ductile Shear Wall LDRS and remediation of all brick and HCT walls.

- New concrete shear walls with foundations and soil anchors
- New drag struts to collect diaphragm forces to the new walls and improve on load paths
- Around the perimeter, new steel columns to provide secondary supports in the event of excessive damage of the short columns (because of constraints from basement walls).
- Strong back exterior walls
- New steel stud partitions to replace existing brick partitions where possible, otherwise strong back existing brick partitions.
- New plywood to overlay play area cover and provide connections back to walls in Classroom Block.
- Infill portions of the existing long shaft openings to improve on diaphragm connection.

This is the same philosophy as in the Life-Safety Retrofit, the only difference is a reduction in shear wall and footing quantities because of a forces reduction in LDRS.

(2) Retrofit LDRSs**Number of Retrofit LDRS Prototypes (Box #7-2)**

1

Retrofit LDRS Prototype Details (Box #7-3)

Shaking Direction	Prototype No.	LDRS Prototype Description	Max PDE	Max DDL	R _m
Both	C-6	Moderate Ductile Shear Wall	5%	1%	14.6%

Comments on Retrofit LDRS Prototypes (Box #7-4)

New shear walls spaced out reasonably evenly to limit eccentricity and diaphragm forces.

(3) SPiR Benchmarks**Benchmark SPiRs (Box #7-5)**

Benchmark SPiR No.	Benchmark SPiR Description	Retrofit Cost (\$ / m ²)
Comments:		

(4) Scope of Retrofit

Refer to Appendix A for details on the scope of work for both the structural and non-structural retrofits.

(5) Retrofit Cost Estimate

Refer to Appendix B for details on the retrofit cost estimate for the phased retrofit. A summary of the phased retrofit is given in Chapter 10.

(6) Schedule**Schedule (Box #7-7)**

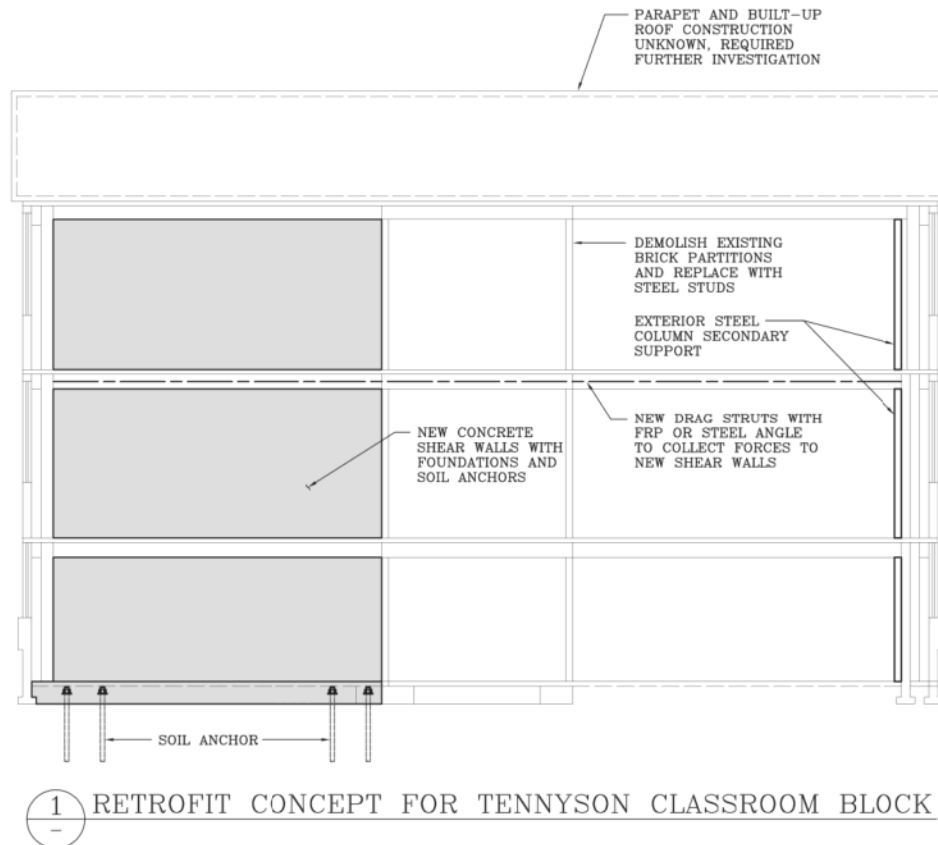
No.	Schedule Issue	Value
1	Temporary Accommodations	Unknown
Comment on Operational Disruption: The phased retrofit will require this block to be vacated for an estimated time of one school year. As this is a classroom block temporary accommodations will have to be provided for regular school functions to continue.		

(7) Construction Risks**Risks (Box #7-8)**

Risk Description	Significant Risk			
Asbestos	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No
Vermiculite	<input type="checkbox"/>	Yes	<input checked="" type="checkbox"/>	No
Lead Paint	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No

Risk Management Comments (Box #7-9)

Asbestos and lead paint risks appeared to be present as observed during site visit. Material testing to identify the extent such risks shall be considered before a representative budget can be finalized.

(1) Retrofit Concept**Figure 8.1: Typical Section –**

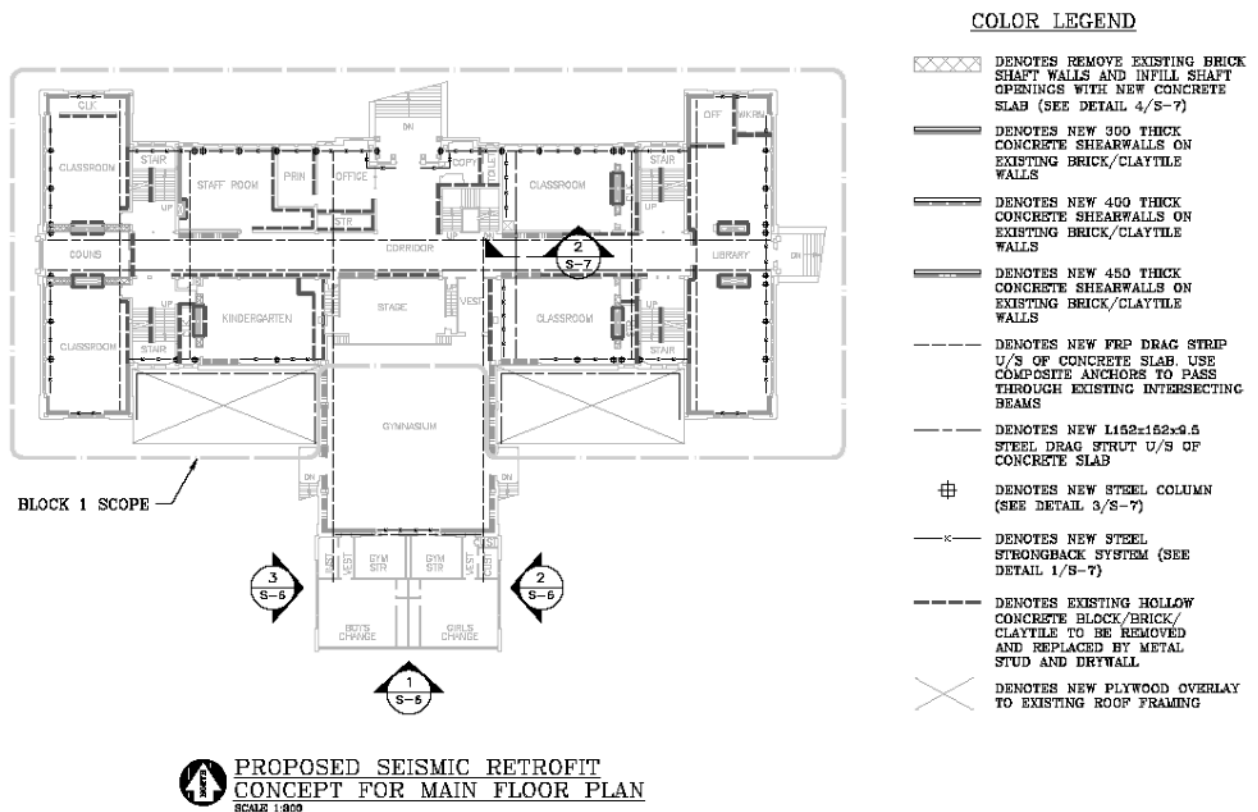


Figure 8.2: Typical Plan –

Comments on Figure 8.1 and Figure 8.2 (Box #8-1)

Provide new Concrete Moderate Ductile Shear Wall LDRS and remediation of all brick and HCT walls.

- New concrete shear walls with foundations and soil anchors
- New drag struts to collect diaphragm forces to the new walls and improve on load paths
- Around the perimeter, new steel columns to provide secondary supports in the event of excessive damage of the short columns (because of constraints from basement walls).
- Strong back exterior walls
- New steel stud partitions to replace existing brick partitions where possible, otherwise strong back existing brick partitions.
- New plywood to overlay play area cover and provide connections back to walls in Classroom Block.
- Infill portions of the existing long shaft openings to improve on diaphragm connection.
- See Appendix C for complete drawings of the proposed seismic retrofit concept.

(2) Retrofit LDRSs**Number of Retrofit LDRS Prototypes (Box #8-2)**

1

Retrofit LDRS Prototype Details (Box #8-3)

Shaking Direction	Prototype No.	LDRS Prototype Description	Max PDE	Max DDL	R _m
Both	C-6	Moderate Ductile Shear Wall	2%	1%	23.4% W

Comments on Retrofit LDRS Prototypes (Box #8-4)

New shear walls spaced out reasonably evenly to limit eccentricity and diaphragm forces.

(3) SPIR Benchmarks**Benchmark SPIRs (Box #8-5)**

Benchmark SPIR No.	Benchmark SPIR Description	Retrofit Cost (\$ / m ²)
SPIR-B-002	Block #60-1: 1913 Classroom Block David Livingstone Elementary School	\$592 / m ²

Comments:

The benchmark is of similar vintage and construction however with a pitched wood roof. The retrofit cost included the introduction of wood shear wall in the attic space which will not be required in this block.

(4) Scope of Retrofit

Refer to Appendix A for details on the scope of work for both the structural and non-structural retrofits.

(5) Retrofit Cost Estimate

Refer to Appendix B for details on the retrofit cost estimate for the life safety retrofit. A summary of the life safety retrofit is given in Chapter 10.

(6) Schedule**Schedule (Box #8-7)**

No.	Schedule Issue	Value
1	Temporary Accommodations	Unknown
Comment on Operational Disruption: The life-safety retrofit will require this block to be vacated for an estimated time of one school year. As this is a classroom block temporary accommodations will have to be provided for regular school functions to continue.		

(7) Construction Risks**Risks (Box #8-8)**

Risk Description	Significant Risk			
Asbestos	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No
Vermiculite	<input type="checkbox"/>	Yes	<input checked="" type="checkbox"/>	No
Lead Paint	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No

Risk Management Comments (Box #8-9)

Asbestos and lead paint risks appeared to be present as observed during site visit. Material testing to identify the extent such risks shall be considered before a representative budget can be finalized.

Summary of Enhanced Performance Retrofit (Box #9-1)

Enhanced Performance Retrofit is not considered in this report.

Conclusions (Box #10-1)**1. Type of Block**

This retrofit concept is for a three-storey block with a Non-ductile Moment Frame gravity and lateral system. The exterior walls are of brick / HCT and the interior partitions are of brick and HCT. Field visit reviewed that work has been done to the parapet; however no record is available, further investigation is required to determine if parapet requires strong backing.

Because the Gym Block is integral to this Block, any retrofit work between the Blocks is required to be performed together.

The Block is classified as a high risk (H1) block. In terms of heritage classification, it is registered as category B on the City of Vancouver Heritage Register, and has a score of 19 out of 25 from the Vancouver School Board heritage assessment by Commonwealth Historic Resource Management Ltd on March 2008.

2. Retrofit Options

Phased and Life-safety retrofits are considered in this report. Both retrofits will provide new Concrete Moderate Ductile Shear Wall LDRS and remediation of all brick and HCT walls. The only difference between the options is a reduction of shear wall and footing quantities because of some 35% reduction in forces to the LDRS.

3. Schedule

Estimated construction period of 14 months for both Phased and Life-Safety Retrofit.

4. Risks

Hazardous materials are present and there is a potential of low concrete strength. Testing will be required to clearly define the scope.

Conclusions: Retrofit Cost Estimates (Box #10-2)

Phased Retrofit: \$10,852,200 (\$2,790/m²)

Life-Safety Retrofit: \$12,162,700 (\$3,127/m²)

Recommendations (Box #10-3)

Should seismic upgrade be considered, material testing should be done to provide more information prior to detailed design.

Seismic Project Identification Report

APPENDIX A

SCOPE OF RETROFIT DETAILS

for

BLOCK #47-1 (1910 / 1912 Classrooms)

Lord Tennyson Elementary School

Table A.1: Scope of Structural Phased Retrofit

No.	Retrofit Detail	Construction Activity	Approx. Quantity
Similar to Drawings S-1 to S-7 for Life-Safety Retrofit concept			
1	CSW # 1	New concrete shear walls (dowelled to existing brick / HCT walls)	200 mm x 50 m x 10.8 m high 250 mm x 12.7 m x 10.8 m high 300 mm x 17.2 m x 10.8 m high
2	CSW # 3	New footings for shear walls	205 m ² x 800 mm deep
3	CSW # 3	Soil anchors for new footings	58
4	Det 2 / S-7	Steel angle L152x152x9.5 drag struts / connections to new walls	Main 220 m; Second 204 m; Roof 148 m
5	CD # 1	FRP drag strips to new walls (including drag to Gym Block walls)	Main 164 m; Second 156 m; Roof 164 m
6	Det 3 / S-7	New secondary HSS columns along perimeter	36 (all floors)
7	WD # 1	New plywood diaphragm for play area cover	220 m ²
8	Det 4 / S-7	Remove existing brick shaft walls and infill shaft with concrete slab	Main Floor at 5 shafts—total 39 m wall removal & 8 m ² slab infill Second Floor at 8 shafts—total 63 m wall removal & 12 m ² slab infill
See Table A-4 for Non-structural Retrofits which form part of this Phased Retrofit.			
See also SPIR 39-034 for Gym Block Construction Activities which are required to be performed along with this Block			

Table A.2: Scope of Structural Life Safety Retrofit

No.	Retrofit Detail	Construction Activity	Approx. Quantity
See Drawings S-1 to S-7 for complete proposed retrofit concept			
1	CSW # 1	New concrete shear walls (dowelled to existing brick / HCT walls)	300 mm x 50 m x 10.8 m high 400 mm x 12.7 m x 10.8 m high 450 mm x 17.2 m x 10.8 m high
2	CSW # 3	New footings for shear walls	330 m ² x 800 mm deep
3	CSW # 3	Soil anchors for new footings	58
4	Det 2 / S-7	Steel angle L152x152x9.5 drag struts / connections to new walls	Main 220 m; Second 204 m; Roof 148 m
5	CD # 1	FRP drag strips to new walls (including drag to Gym Block walls)	Main 164 m; Second 156 m; Roof 164 m
6	Det 3 / S-7	New secondary HSS columns along perimeter	36 (all floors)
7	WD # 1	New plywood diaphragm for play area cover	220 m ²
8	Det 4 / S-7	Remove existing brick shaft walls and infill shaft with concrete slab	Main Floor at 5 shafts—total 39 m wall removal & 8 m ² slab infill Second Floor at 8 shafts—total 63 m wall removal & 12 m ² slab infill
See Table A-4 for Non-structural Retrofits which form part of this Life Safety Retrofit.			
See also SPIR 39-034 for Gym Block Construction Activities which are required to be performed along with this Block			

Table A.3: Scope of Structural Enhanced Performance Retrofit

No.	Construction Activity	Approx. Quantity
	Enhanced Performance Retrofit not considered	

Table A.4: Scope of Non-Structural Retrofits

No.	Non-structural Hazard and Retrofit Detail	Description of Non-structural Upgrading	Approx. Quantity
1	Out-of-plane Det 1 / S-7	Strong back steel studs at existing perimeter HCT walls	144 m (all floors)
2	Out-of-plane URM # 2	Strong back steel studs at existing brick partitions not to be removed	Basement 27.2 m; Main 15.8 m; Second 15.8 m
3	Out-of-plane URM # 1	New steel stud partitions to replace existing brick partitions	Basement 260 m; Main 282 m; Second 223 m
These non-structural retrofits are part of the Life Safety Retrofit.			

Seismic Project Identification Report

APPENDIX B

RETROFIT COST ESTIMATE REPORT

for

BLOCK #47-1 (1910 / 1912 Classrooms)

Lord Tennyson Elementary School

Retrofit Cost Estimate Report

Facility Code	3939047
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SEISMIC RETROFIT ESTIMATE - PROJECT SUMMARY

	LIFESAFETY RETROFIT BLOCK 1 (CLASSROOM)	PHASED RETROFIT BLOCK 1 (CLASSROOM)
Building Construction Type	13 - Non Ductile Frame	13 - Non Ductile Frame
Seismic Risk	H1	H1
Site Class	D	D
Number of Stories	3	3
Gross Floor Area (m2)	3,890	3,890
CONSTRUCTION COST ESTIMATE		
Site Development	\$76,900	\$76,900
SEISMIC UPGRADE WORK		
Selective Demolition:	\$1,009,800	\$952,800
Earthwork	\$777,900	\$482,200
Concrete Work- Foundations & shearwalls	\$1,668,500	\$1,034,500
Soils Anchors	\$610,000	\$610,000
Masonry & URM, Include brick restraint	\$661,300	\$661,300
Diaphragm Upgrades & Connections	\$200,900	\$200,900
Other	\$0	\$0
Roofing	\$48,000	\$48,000
Exterior Wall Cladding, Windows & Doors	\$25,000	\$25,000
Partitions & Doors	\$591,300	\$591,300
Finishes	\$515,000	\$515,000
Millwork, Specialties	\$277,600	\$277,600
Electrical Work	\$700,200	\$700,200
Mechanical Work	\$1,586,100	\$1,586,100
Asbestos & Lead Paint Remediation	\$408,500	\$408,500
Required CODE Upgrades	\$0	\$0
Non Structural Items	Not Included	Not Included
Site Specific PHASING COSTS	\$0	\$0
Contractor Site Overheads & Markup	\$1,419,300	\$1,266,400
Design Contingency & Unspecified Risk 15%	\$1,586,400	\$1,415,500
TOTAL CONSTRUCTION (excl. Tax)	\$3,126.66	\$12,162,700
		\$2,789.77
		\$10,852,200

TEMPORARY ACCOMMODATION, Portables	Excluded
SOFT COSTS, Design Fees, Contingency, Permits, Payable Taxes	Excluded

Facility Code	3939047
LIFESAFETY RETROFIT	

SEISMIC RETROFIT ESTIMATE		BLOCK 1 (CLASSROOM)		
Building Construction Type	13 - Non Ductile Frame	Seismic Risk	H1	1910-1912 Two Storey plus Basement Classroom Block
Overview Description of Work		Site Class	D	New CIP Shear Walls, Foundations and Minipiles, Dragstrut connections, Restrain/replace HCB/URM, New Steel Posts to support short columns, Plywood overlay to Covered Play
		GROSS FLOOR AREA 3,890 m2		
Site Development		\$76,900		
Re/re existing pavement, site works for seismic foundations		640 m2	85.00	54,400
Other Related Site Work - Footing Drains		150 m	150.00	22,500
Fire Water Main				0
SEISMIC UPGRADE WORK		\$3,106.89 /m2 \$12,085,800		
Selective Demolition:		1,009,800		
Interior Finishes, Specialties, Fittings etc. (full gut interior)		3,890 m2	105.00	408,500
Interior finishes, millwork etc below window		105 m	135.00	14,200
Interior slab removal - strip 1.8m wide for grade beam		83 m	225.00	18,700
Interior slab removal - strip 4.5m wide for grade beam		128 m	576.00	73,700
Strip finishes of existing Ext wall at NEW Shearwalls (3 floors)		219 m	203.00	44,500
Strip finishes of existing Ext wall at Strongback (3 floors)		360 m	203.00	73,100
Strip finishes of existing HCB/URM walls to be strongbacked/FRP		59 m	157.50	9,300
Demol URM walls for replacement		765 m	300.30	229,700
Demol Brick Shaftwalls		102 m	122.50	12,500
Ceiling finishes 2.0m w at perimeter of interior wall upgrades				incl. above
Remove Classroom Whiteboards/Cubbies/Shelving etc				incl. above
Demol at Washrooms - Main Girls/Boy (Basement)		2 No.	Item	27,600
Demol at Washrooms - Unit WC		4 No.	Item	6,000
Miscell demolition		10%	Item	92,000
Earthwork		777,900		
Earthwork - interior for footing (800mm deep)		272 m3	350.00	95,200
Earthwork - exterior for footing (avg3.5m deep - 2:1 slope)		1,922 m3	150.00	288,300
Hand trim adjacent existing footing		256 hrs	45.00	11,500
Demol existing footing projection at exterior		128 m	80.00	10,200
Exacavtion at boiler room (lower)		184 m3	400.00	73,500
Backfilling, make good, compact		1,989 m3	125.00	248,700
Disposal offsite		505 m3	100.00	50,500
Concrete Work- Foundations & shearwalls		1,668,500		
Concrete Foundations incl. 10% for outrigger fndns		388 m3	1,350.00	524,200
Concrete Shearwalls (Fndn to Roof) 300		540 m2	880.00	475,200
Concrete Shearwalls (Fndn to Roof) 400		137 m2	915.00	125,500
Concrete Shearwalls (Fndn to Roof) 450		186 m2	932.50	173,200
Concrete Slab reinstatement, make good		725 m2	150.00	108,800
Concrete slab infil at shaft incl. drilled anchors at perim		13 No.	1,500.00	19,500
Coring existing slab for rebar/conc at 300cntrs		1,280 No.	85.00	108,800
Additional concrete work at boiler room			Allow	50,000
Anchors, drilled/dowel anchors to existing foundations		512 No.	21.00	10,800
Anchors, drilled/dowel anchors to existing walls		3,452 No.	21.00	72,500
Soils Anchors		610,000		
GEWI Soil Anchors / Mini-Piles		54 No	10,000.00	540,000
Premium inside location - Boiler room		4 No	17,500.00	70,000
Masonry & URM, Include brick restraint, FRP		661,300		
Metal stud strongback/restrain walls incl. drilled anchors	URM#2	223 m2	85.00	19,000
FRP strips to NEW walls incl. prep (drag struts)		484 m	291.00	140,800
Steel strong back to exterior wall		360 m	542.50	195,300
HSS column at exterior walls		108 No.	800.00	86,400
Drilled/epoxy Hilti anchors		3,264 No.	21.00	68,500
Metal stud framing to replaced paritions		2,751 m2	55.00	151,300

Facility Code	3939047
LIFESAFETY RETROFIT	

SEISMIC RETROFIT ESTIMATE		BLOCK 1 (CLASSROOM)		
Diaphragm Upgrades & Connections		200,900		
Floor Diaphragm Upgrade				0
Roof Diaphragm Upgrade	Covered Play	220 m2	68.00	15,000
Steel angle L152x152x9.5 drag strut/connection		572 m	325.00	185,900
Other		0		
Exterior Building Envelope Work		\$18.77 73,000		
<u>Roofing</u>				
Re/re Roofing	Covered Play	220 m2	218.00	48,000
Re/re roofing in strips - top of new shear wall				0
<u>Exterior Wall Cladding, Windows & Doors</u>				
Cladding new exterior shear walls				
Windows			Remain in place - NO Work	
Miscell envelope remedial work			Allow	25,000
New framed wall/sheathing				0
Doors			Remain	
Overhangs, Soffits				0
Interior Work		\$355.76 1,383,900		
<u>Partitions & Doors</u>				
New Studs, Drywall, Insulation, VB on exterior walls		1,368 m2	105.00	143,600
New Drywall on upgraded strong backed walls	1 layer/furring	707 m2	68.00	48,100
New Drywall on replaced walls	avge 2.5 layers D/W, 30% batts	6,878 m2	31.00	213,200
Stairs - Remedial work due to new walls		10 Flt	6,000.00	60,000
Doors/Frames/Hardware	replace	80 No.	1,580.00	126,400
<u>Finishes</u>				
Reinstate Floor Finishes	replace 50%	1,945 m2	78.00	151,700
Reinstate Floor Finishes - nominal repair/remedial in remain	10%		Item	29,200
Reinstate Ceilings	replace 50%	1,945 m2	58.00	112,800
Remedial ceiling work adjacent areas & paint exposed struct.	15%		Item	37,900
Wall Finish - paint drywall		7,577 m2	12.00	90,900
Wall Finish - wood panel /dado (corridor, 1 wall classroom)		380 m	140.00	53,200
Wall Finish - Tectum acoustic	Music			15,000
Wall Finish - ceramic tile		231 m2	105.00	24,300
<u>Millwork, Specialties</u>				
Re/re Millwork		20 Clrm	6,500.00	130,000
Re/re Whiteboards. Cloak Rm etc.		20 Rms	3,200.00	64,000
Washrooms		12 Stall	2,100.00	25,200
Specialties etc.		3,890 m2	15.00	58,400
Electrical Work		\$180.00 700,200		
Elec work - redo all power in walls/50% lighting/50% systems		3,890 m2	180.00	700,200 (FULL REPLACEMENT \$1.10MIL)
Mechanical Work		\$407.74 1,586,100		
Plumbing	Sinks/WC's etc	55 Fxt		156,800 (FULL REPLACEMENT \$480k)
Sprinklers - re/re		3,890 m2	31.00	120,600
HVAC - replace heating pipework, ductwork, louvre/diffusers		3,890 m2	285.00	1,108,700 (FULL REPLACEMENT \$1.80MIL)
Boiler room work incl. flue				200,000
Asbestos & Lead Paint Remediation		\$105.00 408,500		
Required CODE Upgrades		0		
Non Structural Items		Not Included		
Site Specific PHASING COSTS		0		
	Block Vacated		0%	
Contractor Site Overheads & Markup (incl. on site)		15.5% 1,419,300		
Design Contingency & Unspecified Risk (incl. on site)		15% 1,586,400		
TOTAL CONSTRUCTION (Excluding HST)		\$3,126.66 \$12,162,700		

Facility Code	3939047
PHASED RETROFIT	

SEISMIC RETROFIT ESTIMATE		BLOCK 1 (CLASSROOM)		
Building Construction Type	13 - Non Ductile Frame	Seismic Risk	H1	1910-1912 Two Storey plus Basement Classroom Block
Overview Description of Work		Site Class	D	New CIP Shear Walls, Foundations and Minipiles, Dragstrut connections, Restrain/replace HCB/URM, New Steel Posts to support short columns, Plywood overlay to Covered Play
		GROSS FLOOR AREA 3,890 m2		
Site Development		\$76,900		
Re/re existing pavement, site works for seismic foundations		640 m2	85.00	54,400
Other Related Site Work - Footing Drains		150 m	150.00	22,500
Fire Water Main				0
SEISMIC UPGRADE WORK		\$2,770.00 /m2 \$10,775,300		
Selective Demolition:		952,800		
Interior Finishes, Specialties, Fittings etc. (full gut interior)		3,890 m2	105.00	408,500
Interior finishes, millwork etc below window		105 m	135.00	14,200
Interior slab removal - strip 1.8m wide for grade beam		51 m	225.00	11,600
Interior slab removal - strip 4.5m wide for grade beam		79 m	576.00	45,700
Strip finishes of existing Ext wall at NEW Shearwalls (3 floors)		136 m	203.00	27,600
Strip finishes of existing Ext wall at Strongback (3 floors)		360 m	203.00	73,100
Strip finishes of existing HCB/URM walls to be strongbacked/FRP		59 m	157.50	9,300
Demol URM walls for replacement		765 m	300.30	229,700
Demol Brick Shaftwalls		102 m	122.50	12,500
Ceiling finishes 2.0m w at perimeter of interior wall upgrades				incl. above
Remove Classroom Whiteboards/Cubbies/Shelving etc				incl. above
Demol at Washrooms - Main Girls/Boy (Basement)		2 No.	Item	27,600
Demol at Washrooms - Unit WC		4 No.	Item	6,000
Miscell demolition		10%	Item	87,000
Earthwork		482,200		
Earthwork - interior for footing (800mm deep)		169 m3	350.00	59,000
Earthwork - exterior for footing (avg3.5m deep - 2:1 slope)		1,192 m3	150.00	178,700
Hand trim adjacent existing footing		159 hrs	45.00	7,100
Demol existing footing projection at exterior		79 m	80.00	6,300
Exacavtion at boiler room (lower)		114 m3	400.00	45,600
Backfilling, make good, compact		1,233 m3	125.00	154,200
Disposal offsite		313 m3	100.00	31,300
Concrete Work- Foundations & shearwalls		1,034,500		
Concrete Foundations incl. 10% for outrigger fndns		241 m3	1,350.00	325,000
Concrete Shearwalls (Fndn to Roof) 300		335 m2	880.00	294,600
Concrete Shearwalls (Fndn to Roof) 400		85 m2	915.00	77,800
Concrete Shearwalls (Fndn to Roof) 450		115 m2	932.50	107,400
Concrete Slab reinstatement, make good		450 m2	150.00	67,500
Concrete slab infil at shaft incl. drilled anchors at perim		8 No.	1,500.00	12,100
Coring existing slab for rebar/conc at 300cntrs		794 No.	85.00	67,500
Additional concrete work at boiler room			Allow	31,000
Anchors, drilled/dowel anchors to existing foundations		317 No.	21.00	6,700
Anchors, drilled/dowel anchors to existing walls		2,140 No.	21.00	44,900
Soils Anchors		610,000		
GEWI Soil Anchors / Mini-Piles		54 No	10,000.00	540,000
Premium inside location - Boiler room		4 No	17,500.00	70,000
Masonry & URM, Include brick restraint, FRP		661,300		
Metal stud strongback/restrain walls incl. drilled anchors	URM#2	223 m2	85.00	19,000
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Other		0		
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<u>Roofing</u>				
Re/re Roofing	Covered Play	220 m2	218.00	48,000
Re/re roofing in strips - top of new shear wall				0
<u>Exterior Wall Cladding, Windows & Doors</u>				
Cladding new exterior shear walls				
Windows			Remain in place - NO Work	
Miscell envelope remedial work			Allow	25,000
New framed wall/sheathing				0
Doors			Remain	
Overhangs, Soffits				0
Interior Work		\$355.76 1,383,900		
<u>Partitions & Doors</u>				
New Studs, Drywall, Insulation, VB on exterior walls		1,368 m2	105.00	143,600
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<u>Millwork, Specialties</u>				
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Mechanical Work		\$407.74 1,586,100		
Plumbing	Sinks/WC's etc	55 Fxt		156,800 (FULL REPLACEMENT \$480k)
Sprinklers - re/re		3,890 m2	31.00	120,600
HVAC - replace heating pipework, ductwork, louvre/diffusers		3,890 m2	285.00	1,108,700 (FULL REPLACEMENT \$1.80MIL)
Boiler room work incl. flue				200,000
Asbestos & Lead Paint Remediation		\$105.00 408,500		
Required CODE Upgrades		0		
Non Structural Items		Not Included		
Site Specific PHASING COSTS		0		
	Block Vacated		0%	
Contractor Site Overheads & Markup (incl. on site)		15.5% 1,266,400		
Design Contingency & Unspecified Risk (incl. on site)		15% 1,415,500		
TOTAL CONSTRUCTION (Excluding HST)		\$2,789.77 \$10,852,200		

Seismic Project Identification Report

APPENDIX C

REPRESENTATIVE STRUCTURAL DETAILS


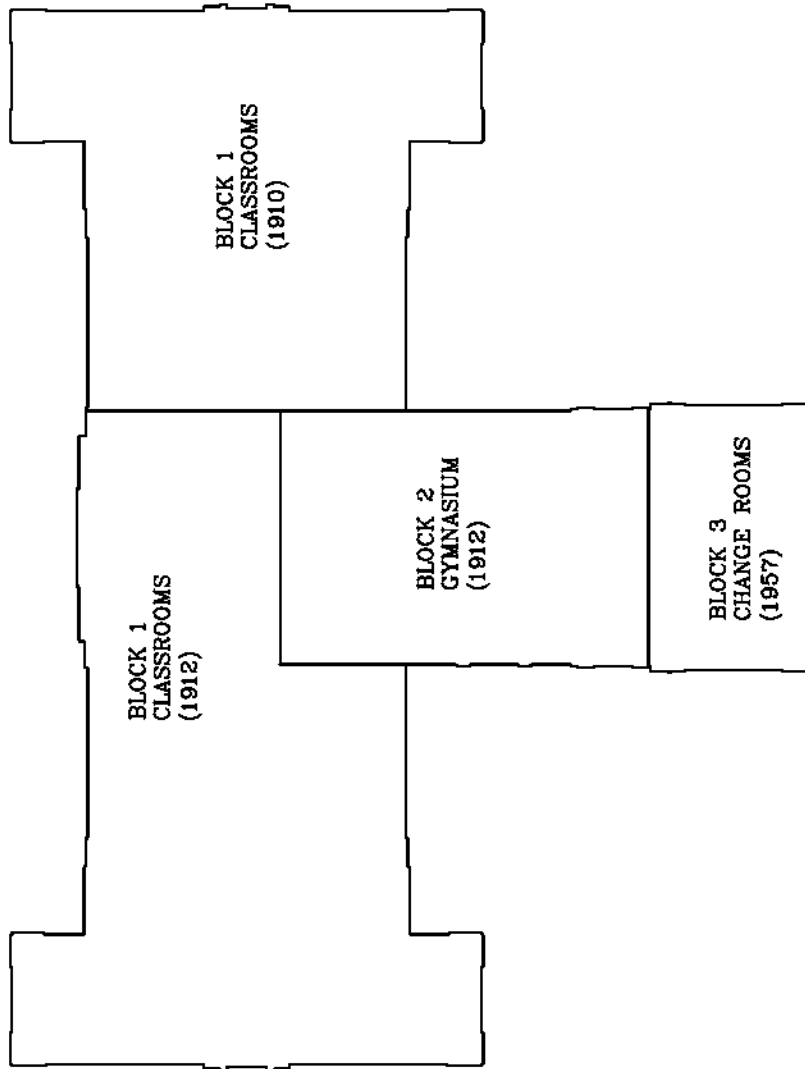
for

BLOCK #47-1 (1910 / 1912 Classrooms)

Lord Tennyson Elementary School

Representative Structural Details

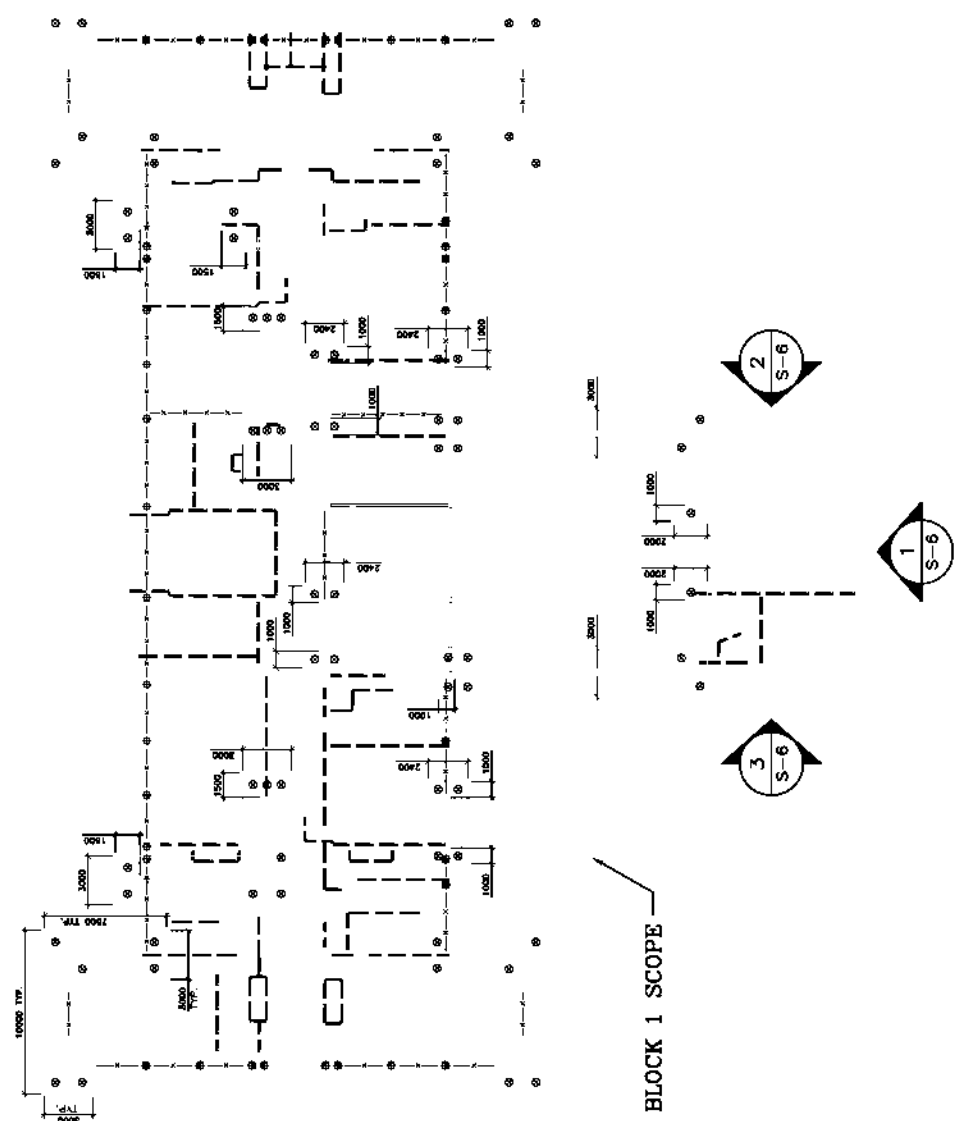
JOB NO. 1212240300	DWG NO. S-1
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KEY PLAN
SCALE 1:300

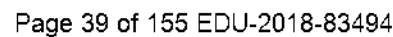
COLOR LEGEND

- | | |
|-----|---|
| == | DENOTES NEW REINFORCED CONCRETE FOOTING |
| == | DENOTES NEW 300 THICK CONCRETE SHEARWALLS ON EXISTING BRICK/CLAYTILE WALLS |
| --- | DENOTES NEW 400 THICK CONCRETE SHEARWALLS ON EXISTING BRICK/CLAYTILE WALLS |
| --- | DENOTES NEW 450 THICK CONCRETE SHEARWALLS ON EXISTING BRICK/CLAYTILE WALLS |
| --- | DENOTES EXISTING HOLLOW CONCRETE BLOCK/BRICK/CLAYTILE TO BE REMOVED AND REPLACED BY METAL STUD AND DRYWALL |
| | DENOTES EXISTING BRICK PARTITION TO BE REMOVED AND REPLACED BY NEW 200 THICK REINFORCED CONCRETE BLOCK WALL |
| ⊗ | DENOTES SOIL ANCHOR |
| ⊕ | DENOTES NEW STEEL COLUMN |
| —x— | DENOTES NEW STEEL STRONGBACK SYSTEM |



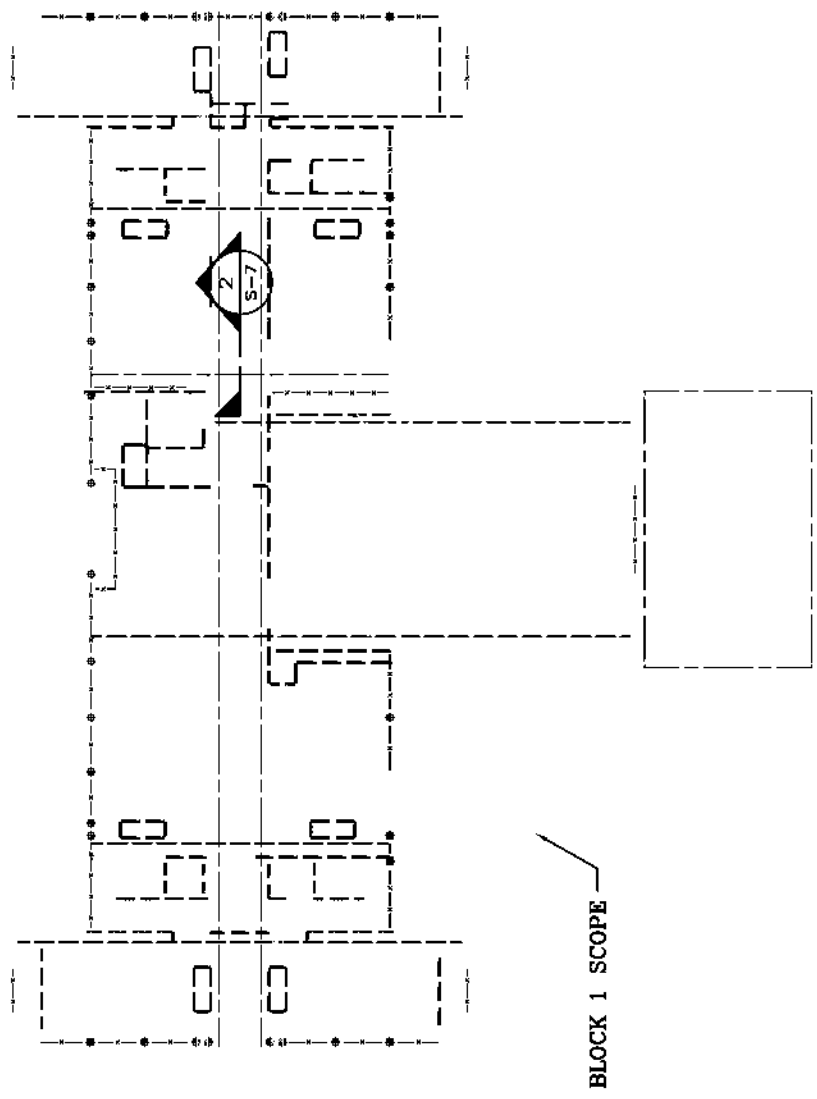
PROPOSED SEISMIC RETROFIT CONCEPT
FOR BASEMENT FLOOR PLAN

SCALE 1:300



COLOR LEGEND

- DENOTES REMOVE EXISTING BRICK SHAFT WALLS AND INFILL SHAFT OPENINGS WITH NEW CONCRETE SLAB (SEE DETAIL 4/S-7)
- DENOTES NEW 300 THICK CONCRETE SHEARWALLS ON EXISTING BRICK/CLAYTILE WALLS
- DENOTES NEW 400 THICK CONCRETE SHEARWALLS ON EXISTING BRICK/CLAYTILE WALLS
- DENOTES NEW 450 THICK CONCRETE SHEARWALLS ON EXISTING BRICK/CLAYTILE WALLS
- DENOTES NEW FRP DRAG STRIP U/S OF CONCRETE SLAB. USE COMPOSITE ANCHORS TO PASS THROUGH EXISTING INTERSECTING BEAMS
- DENOTES NEW L152x152x9.5 STEEL DRAG STRUT U/S OF CONCRETE SLAB
- ⊕ DENOTES NEW STEEL COLUMN (SEE DETAIL 3/S-7)
- x— DENOTES NEW STEEL STRONGBACK SYSTEM (SEE DETAIL 1/S-7)
- DENOTES EXISTING HOLLOW CONCRETE BLOCK/BRICK/CLAYTILE TO BE REMOVED AND REPLACED BY METAL STUD AND DRYWALL
- DENOTES NEW PLYWOOD OVERLAY TO EXISTING ROOF FRAMING

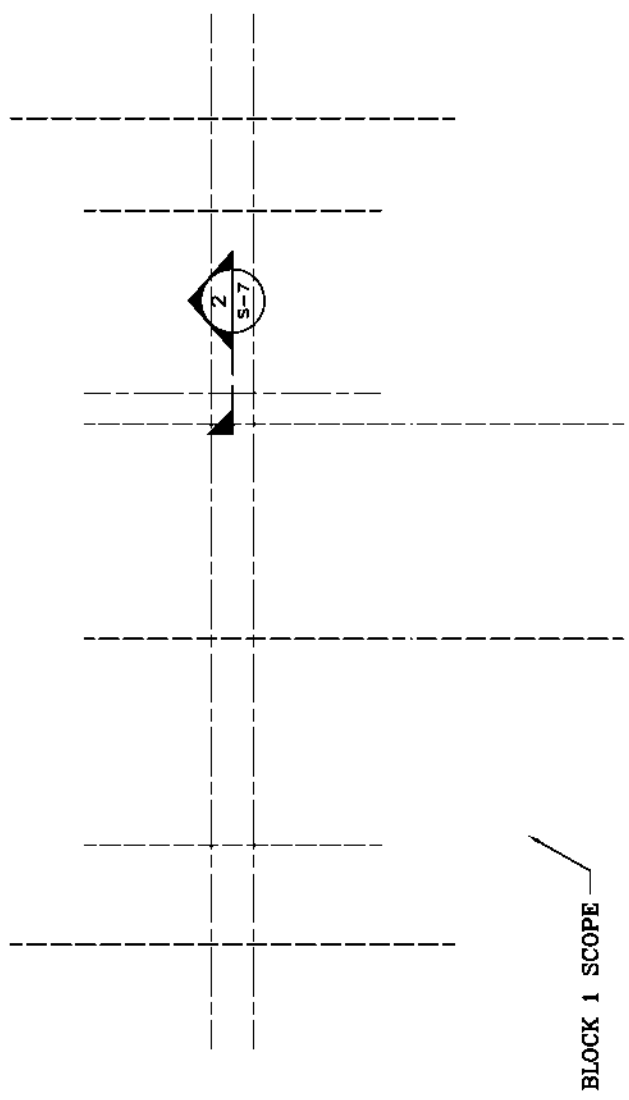


BLOCK 1 SCOPE

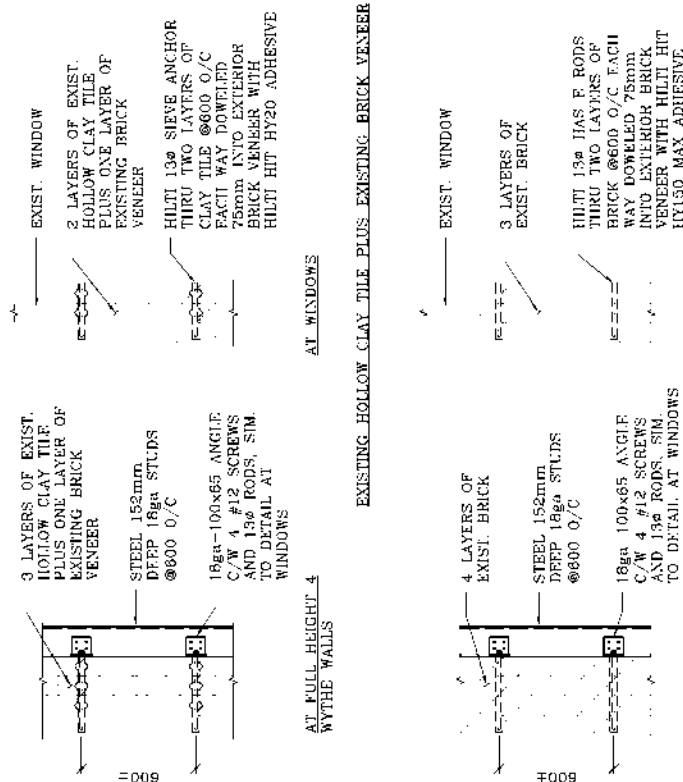

 PROPOSED SEISMIC RETROFIT
 CONCEPT FOR 2nd FLOOR PLAN
 SCALE: 1:500

COLOR LEGEND

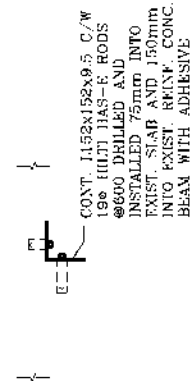
- DENOTES NEW FRP DRAG STRIP U/S OF CONCRETE SLAB. USE COMPOSITE ANCHORS TO PASS THROUGH EXISTING INTERSECTING BEAMS
- DENOTES NEW L152x152x9.5 STEEL DRAG STRUCT U/S OF CONCRETE SLAB



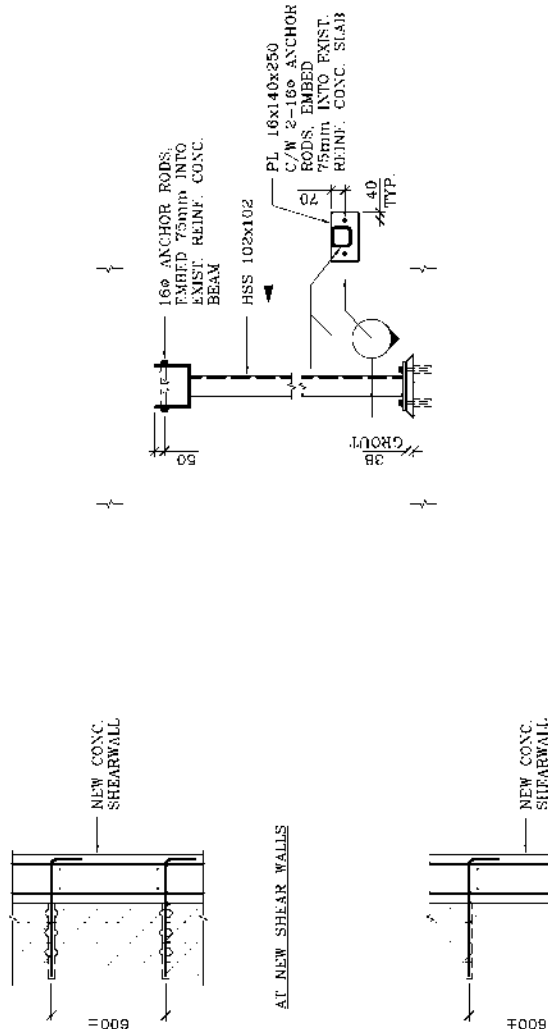

 PROPOSED SEISMIC RETROFIT
 CONCEPT FOR ATTIC SLAB
 SCALE 1:300



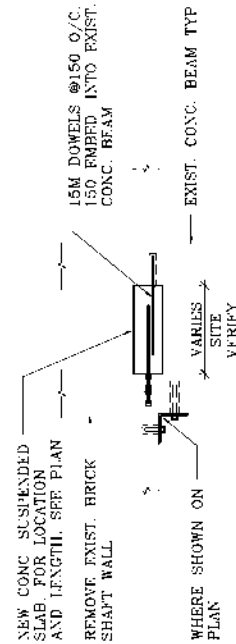
1 TYPICAL EXTERIOR WALL UPGRADE DETAIL



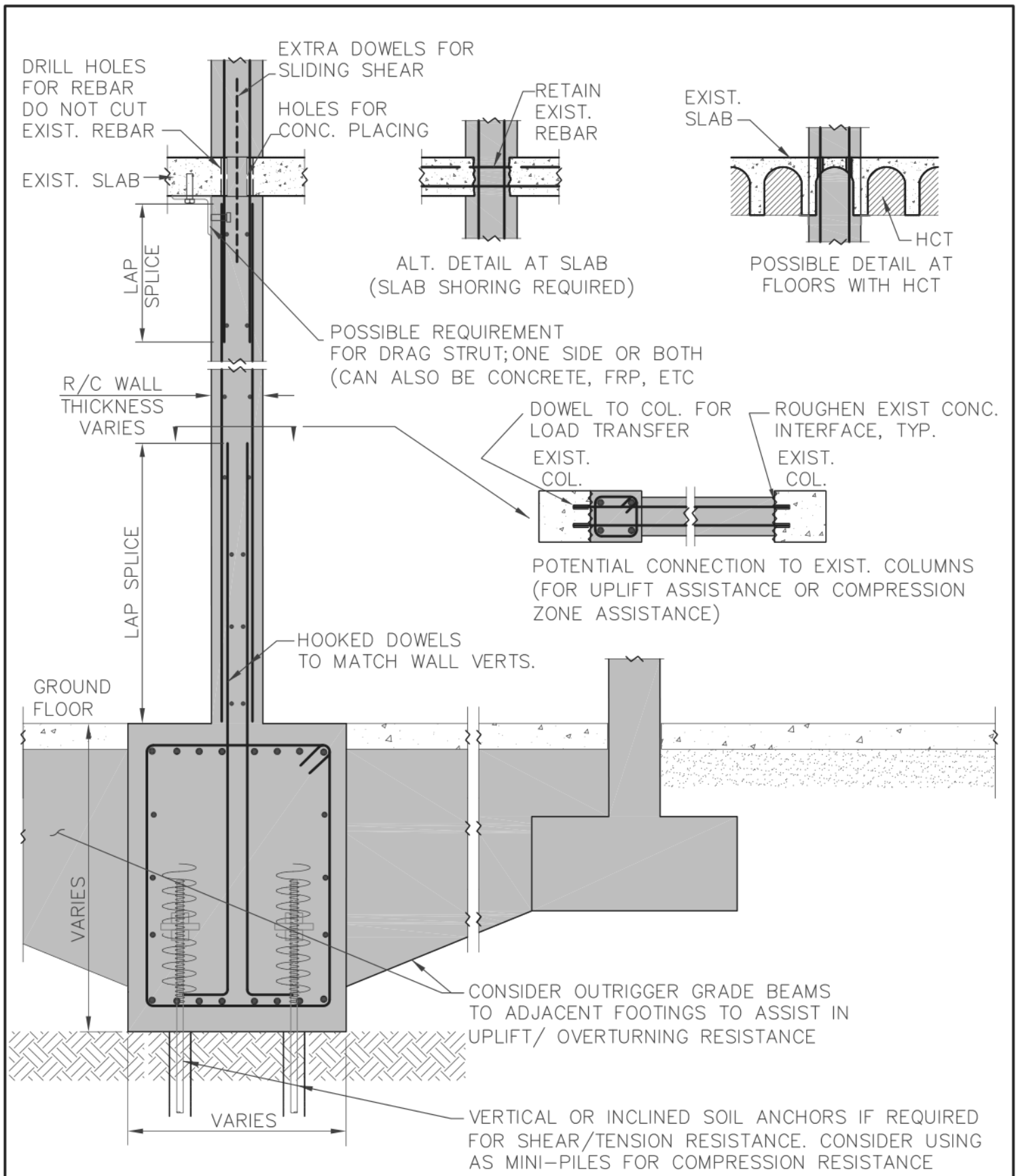
2 TYPICAL ANGLE DIAPHRAGM DRAG STRUT CONNECTION



3 DETAIL



4 TYPICAL FLOOR SLAB DIAPHRAGM INFILL



SEISMIC RETROFIT GUIDELINES FIRST EDITION

LIBRARY OF RETROFIT DETAILS

APRIL 2011

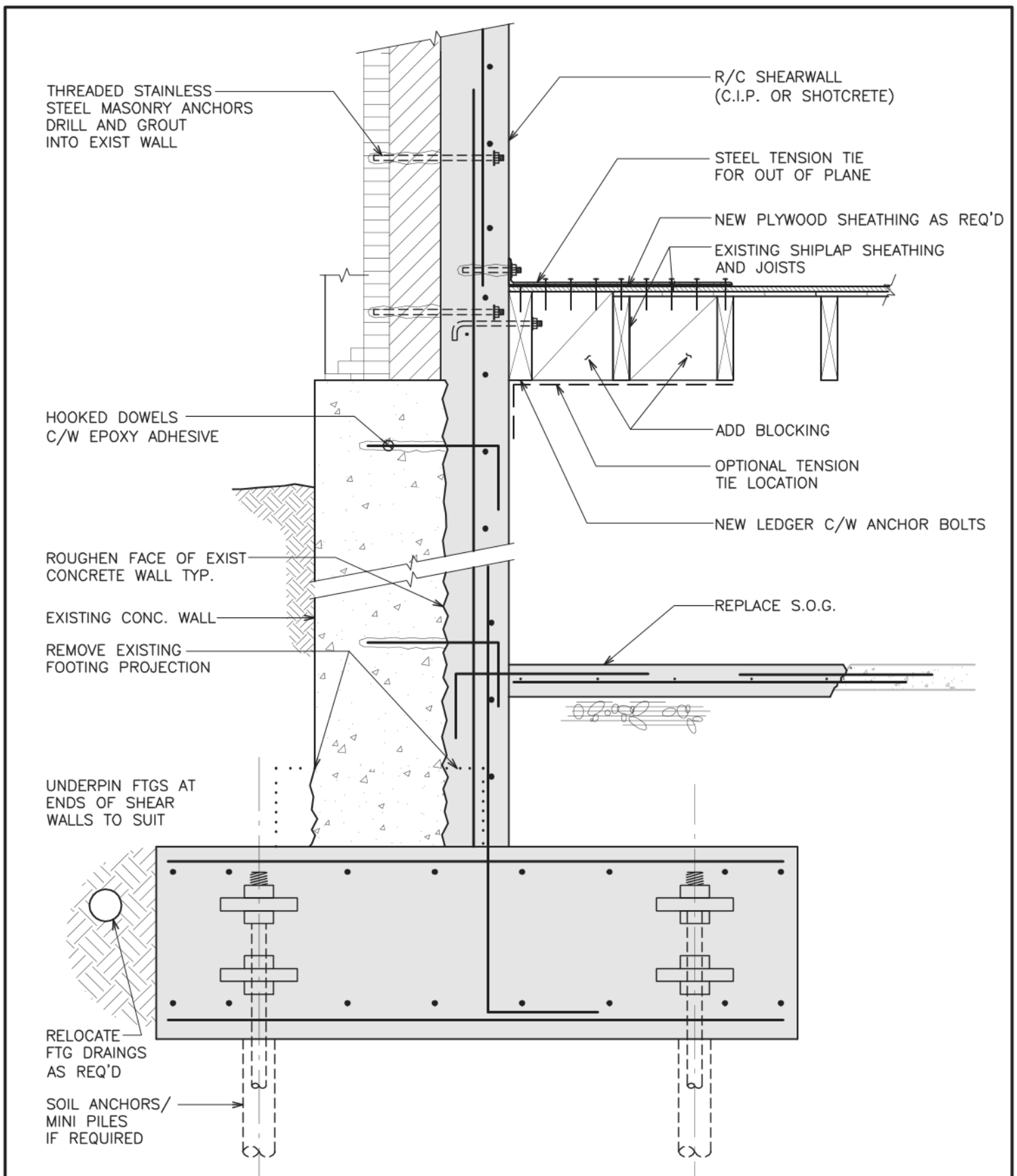
CONCRETE SHEAR WALL #1

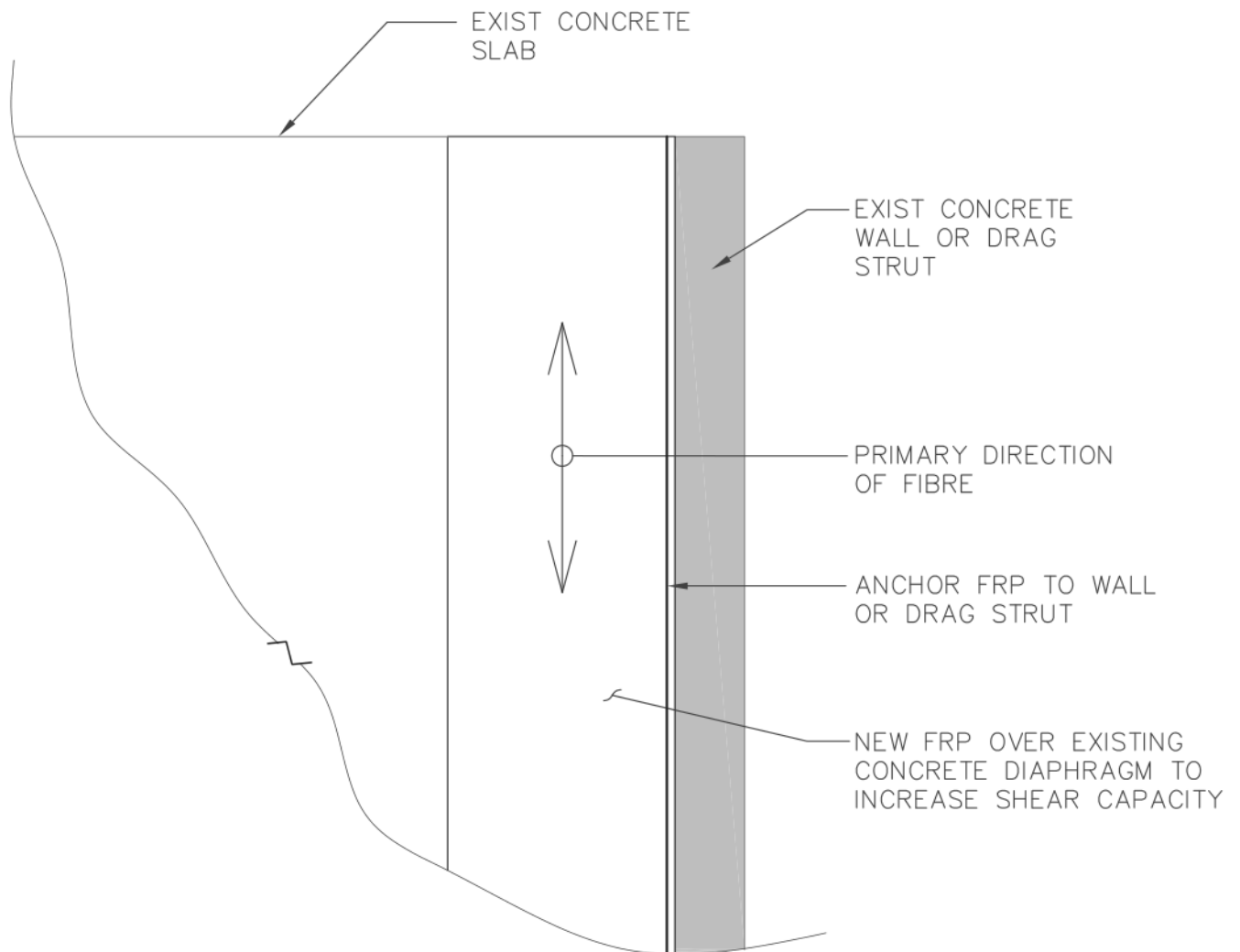
NEW CONCRETE SHEARWALL WITH FDN
AND POSSIBLY SOIL ANCHORS

SCALE
1:20

SHEET No.

CSW
#1



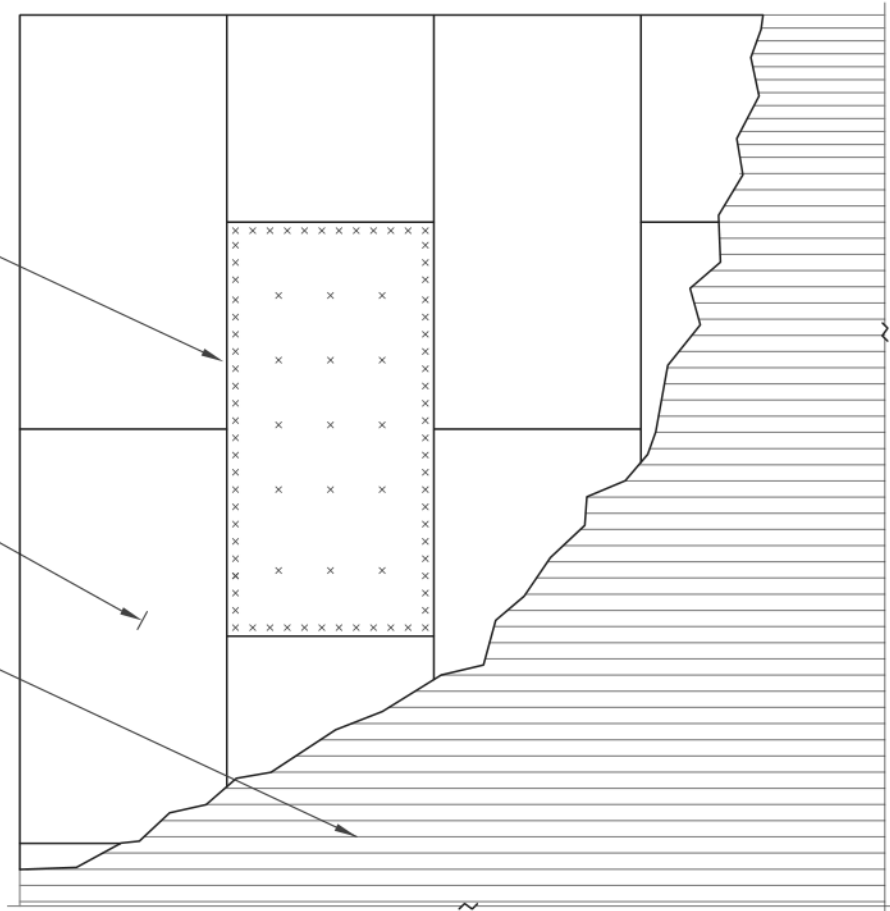


NOTE: ALL FRP TO BE INSTALLED AS PER MANUFACTURERS SPECIFICATIONS. CONTRACTOR TO PROVIDE SIGNED & SEALED SHOP DRAWINGS BY A PROFESSIONAL ENGINEER REGISTERED IN THE PROVINCE OF BRITISH COLUMBIA

NAILS ALONG
PLYWOOD PANEL
EDGES +
INTERIOR FIELD

PLYWOOD AS REQ'D
STAGGER JOINTS

EXISTING
WOOD DECKING



NOTES

1. ROOF SHEATHING TO BE NAILED WITH 64 NAILS (3.3mm \emptyset). DO NOT USE THIN GAUGE GUN NAILING STAPLES OR NAILS. NOTCHED HEAD NAILS ARE NOT ACCEPTABLE.
2. DO NOT NAIL THROUGH EXISTING JOINTS IN TONGUE AND GROOVE DECKING.
3. STAGGER JOINTS AND ORIENT PLYWOOD PANELS PERPENDICULAR TO DIRECTION OF TONGUE AND GROOVE DECKING.
4. NAIL TO CHORDS, DRAG STRUTS AND SHEAR WALLS

SEISMIC RETROFIT GUIDELINES FIRST EDITION

LIBRARY OF RETROFIT DETAILS

APRIL 2011

WOOD DIAPHRAGM #1
SHEATH EXISTING ROOF WITH NEW PLY
AND ADD SHEET METAL STRAPS

SCALE
N.T.S

SHEET No.

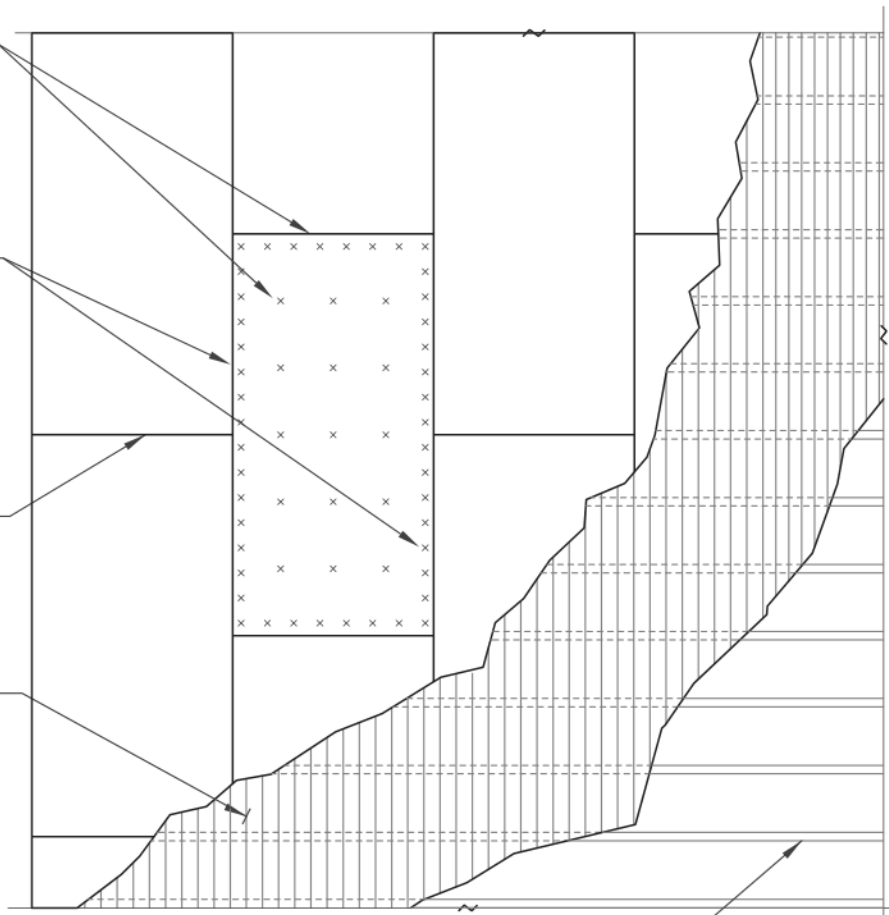
WD
#1(1/3)

75 NAILS @100 O.C.
ALONG PLYWOOD
PANEL EDGE
AND @300 O.C. AT
INTERMEDIATE
SUPPORTS

38 NAILS @100 O.C.
ALONG PLYWOOD
PANEL EDGES
RUNNING
PERPENDICULAR
TO SUPPORTS

LOCATE PLYWOOD
JOINTS OVER EXIST.
JOISTS / STRAPPING
TYPICAL

EXISTING SHIP LAP



EXISTING ROOF
JOISTS

NOTE:

NAILING FOR ILLUSTRATION ONLY,
DESIGN TO SUIT SPECIFIC REQMT'S

SEE SHT 1/3 FOR ADDITIONAL NOTES

SEISMIC RETROFIT GUIDELINES FIRST EDITION

LIBRARY OF RETROFIT DETAILS

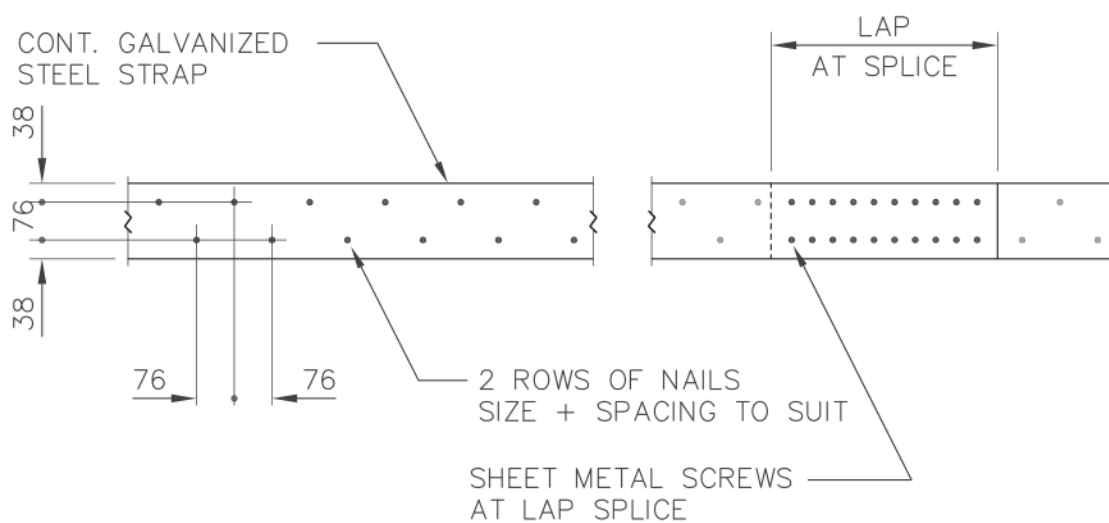
APRIL 2011

WOOD DIAPHRAGM #1
SHEATH EXISTING ROOF WITH NEW PLY
AND ADD SHEET METAL STRAPS

SCALE
N.T.S

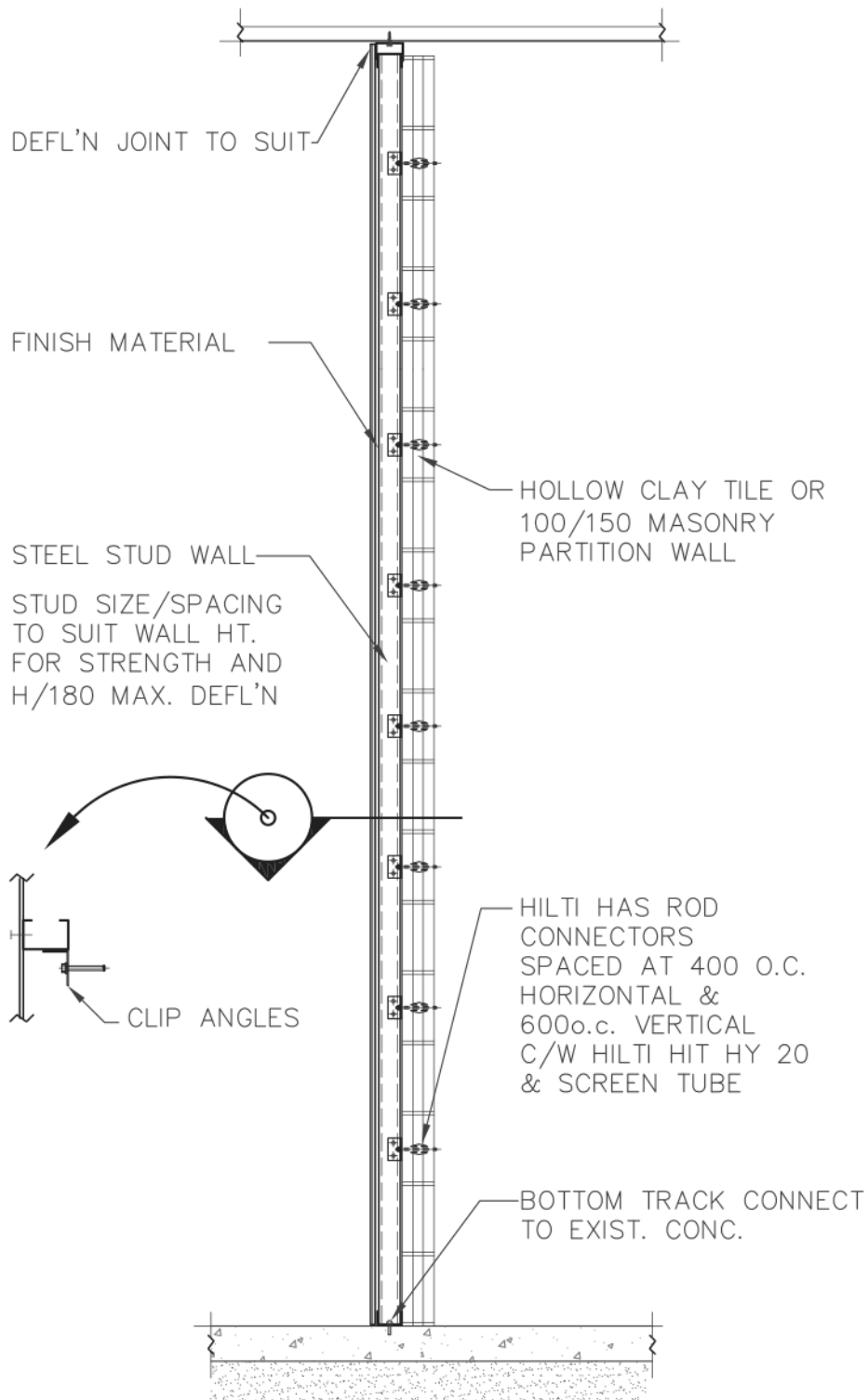
SHEET No.

WD
#1(2/3)



NOTES

1. CONTINUOUS GAUGE STEEL STRAP TO BE CENTRED OVER WALLS OR BLOCKING
2. FASTEN TO PLYWOOD SHEATHING WITH 2 ROWS OF NAILS AND SPLICE AS PER DETAILS.



SEISMIC RETROFIT GUIDELINES FIRST EDITION

LIBRARY OF RETROFIT DETAILS

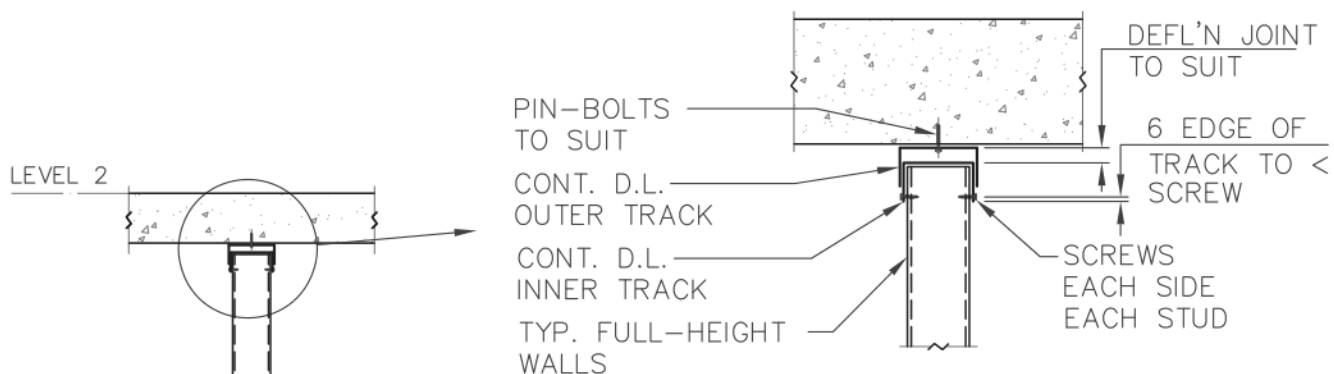
APRIL 2011

URM/HCT PARTITION #2
MECHANICALLY FASTEN WALL TO
NEW STEEL STUDS ON ONE SIDE

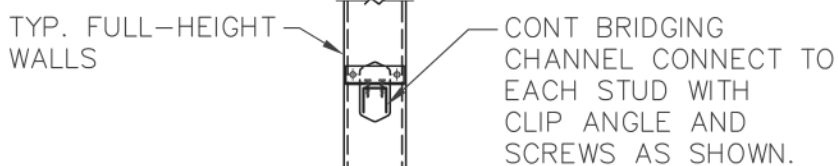
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SHEET No.

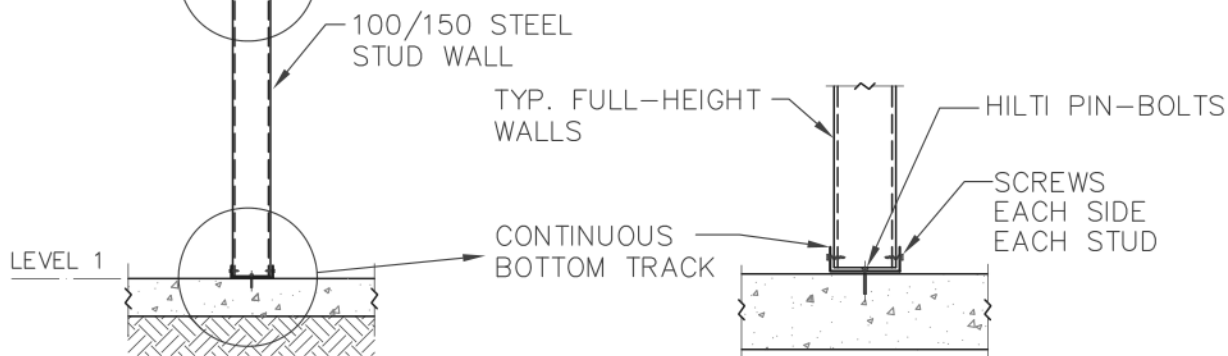
URM
#2



TYPICAL DEFLECTION HEAD DETAIL
CONCRETE OPTION EXTERIOR WALLS



TYPICAL BRIDGING DETAIL



TYPICAL BASE DETAIL

SEISMIC RETROFIT GUIDELINES
FIRST EDITION

LIBRARY OF RETROFIT DETAILS

APRIL 2011

URM/HCT PARTITION #1

REMOVE AND REPLACE WALL
WITH STEEL STUD WALL

SCALE
N.T.S.

SHEET No.

URM
#1

Seismic Project Identification Report

APPENDIX D PHOTOGRAPHS for BLOCK #47-1 (1910 / 1912 Classrooms) Lord Tennyson Elementary School

Photographs

Figure 1: North Elevation--East Wing



Figure 2: North Elevation--Front Entrance



Figure 3: North Elevation--West Wing



Figure 4: West Elevation

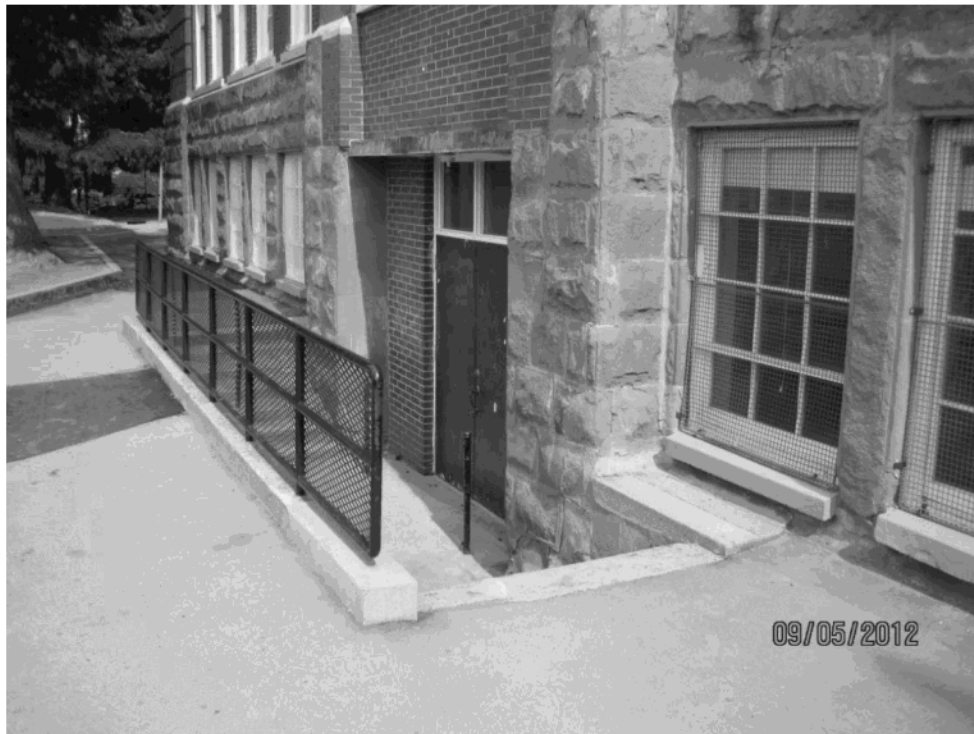


Figure 5: Exit at West Elevation



Figure 6: Play Area Cover at South Elevation



Figure 7: Play Area Cover



Figure 8: Play Area Cover Attachment to Classroom Wall



Figure 9: Play Area Cover from Underside



Figure 10: Gap Between Cover and South Wall of Classroom Block



Figure 11: Gym and Change Room Blocks South of Classroom Block



Figure 12: South Elevation--East Wing



Figure 13: East Elevation



Figure 14: Close-up of Brick and Sandstone Façade



Figure 15: Main Floor Corridor



Figure 16: Basement Corridor



Figure 17: Basement Windows



Figure 18: Basement Classrooms



Figure 19: Stair Shaft



Figure 20: Electrical Room in Basement



Figure 21: Joint between Phases of Classroom Block Construction

Seismic Project Identification Report

REPORT NO. SPIR- 39-034

for

BLOCK #47-2 (1912 Gymnasium)

Lord Tennyson Elementary School

1936 West 10th Avenue, Vancouver, BC, V6J 2B2

Facility No: 3939047

School District No. 39

Vancouver School District

**Structural Engineering Guidelines for the
Performance-based Seismic Assessment and Retrofit of
Low-rise British Columbia School**

The Seismic Project Identification Report (SPIR) is a new report format that documents the seismic retrofit concepts proposed for a high risk school block.

The Ministry of Education (Ministry) requires that a School District submit an SPIR for any school block as the first step in the District's request for seismic retrofit funding.

APEGBC, as the Ministry's technical advisor for the Seismic Mitigation Program, was requested by the Ministry to develop the format and technical requirements for the SPIR.

SPIRs are due diligence documents that are designed to present seismic upgrading options to assist seismic safety planning by both the School District and the Ministry. The expectation is that SPIR information will guide the seismic upgrading of school blocks in a safe and cost-effective manner.

Ongoing feedback from engineering practitioners is encouraged to advance future refinements in the format for the SPIR document.

CHAPTER	Section Title	Page
	PREFACE	(ii)
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Figure 1.1: 2-Storey Change Room Block in Front of 3-Storey Gym Block at South Elevation



Figure 1.2: Gymnasium (West Elevation)



Figure 1.3: Gymnasium (East Elevation)

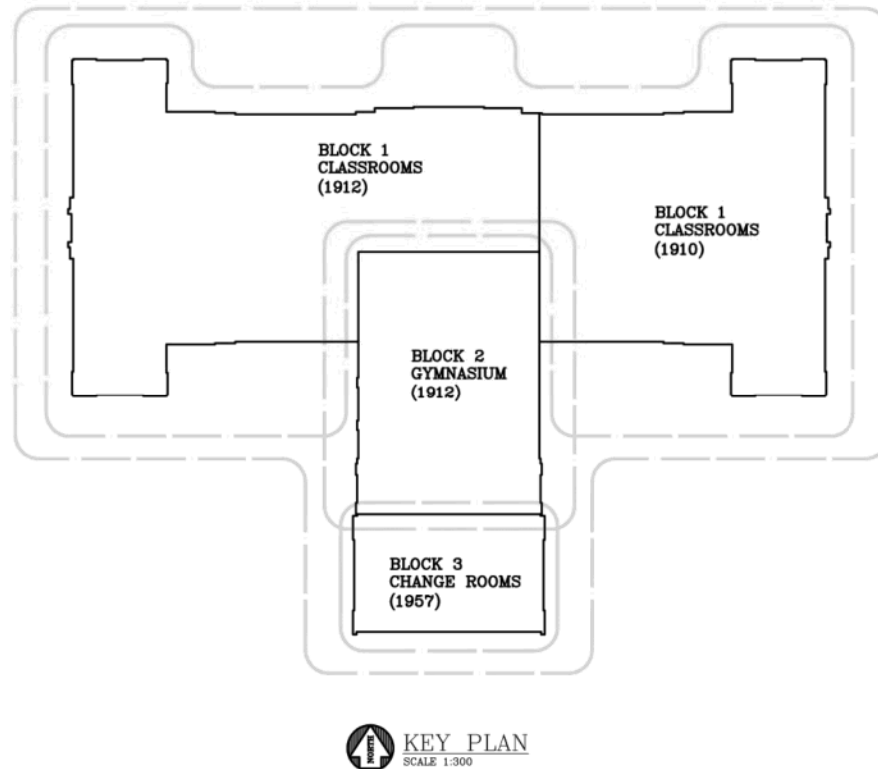


Figure 2.1: Key Plan for Lord Tennyson Elementary School

Identification of Retrofit Block (Box #2-1)

Block #2: Gymnasium (1912)

Adjacency (Box #2-2)

- ☐ No Significant Adjacency Issues
- ☒ Significant Adjacency Issues

Adjacency Comments (Box #2-3)

Block #2—Gymnasium was built integral with the Block #1—Classroom. The Gym Block is double height from the Main Floor to Roof, while the Classroom Block has a Second Floor in between. Block #3—Change Room Block has a lower wood roof with neither a gap nor obvious connections to the Gym Block. The basement floor elevations are all different between the blocks with the Gym Block being at the lowest. All other levels are of same elevations. Pounding in the N-S direction would occur between the Change Room and the Gym Block.

School District (Box #3-1)

SD 39—Vancouver

Block Name (Box #3-2)

Block 2—Gymnasium

Structural Firm (Box #3-3)

Genivar

Engineer-of-Record (Box #3-4)

Jim Shuttleworth, P.Eng., Struct.Eng.

Years of Construction (Box #3-5)

1912

Floor Area (Box #3-6)710 m²**Construction Type (Box #3-7)**

13 Non-ductile frame

Site Classification (Box #3-8)D (no geotechnical available
hence default was used)**Comments on Construction Type (Box #3-9)**

Non-ductile frame with brick partitions

Number of Storeys (Box #3-10)

2

Clear Storey Heights (Box #3-11)

Basement 4700 mm; Main 7500 mm

Previous Seismic Upgrade (Box #3-12)

<input checked="" type="checkbox"/>	No
<input type="checkbox"/>	Yes

Previous Seismic Upgrade Details (Box #3-13)

N/A

(1) Vertical Load-bearing Supports (VLS)**VLS Type (Box #4-1)**

Non-Ductile Reinforced Concrete Columns

VLS DDL (Box #4-2)

1.25%

Supports Description (Box #4-3)

The Gym roof and floor are supported on concrete columns 300mm x 300mm and 375mm x 500mm typical; however, information on rebar arrangement and concrete strength is not available.

(2) LDRSs**Number of LDRS Prototypes (Box #4-4)**

1

LDRS Prototype Details (Box #4-5)

Shaking Direction	Prototype No.	LDRS Prototype Description	Max DDL	Capacity
All Direction	C-3	Non-ductile Concrete Moment Frame	1.25%	2% W

Comments on LDRS Prototypes (Box #4-6)

Same as the Classroom Block concrete VLS columns also double as part of a moment frame. No information on rebar and concrete strength available. From experience of other blocks built during the same period, reinforcement is likely smooth bars with large tie spacing and low concrete strength.

(3) Out-of-Plane URM Walls**URM Walls (Box #4-7)**

- ☐ No
- ☒ Yes

Out-of-Plane Prototype Details (Box #4-8)

Prototype No.	Prototype Description	Max. Height	Wall Thickness	Surcharge
OP-2	URM Wall with inadequate connection at top in basement	4700	200	minimal

Comments on Out-of-Plane Prototypes (Box #4-9)

Connectivity at top is unknown. Bricks assumed to be built up to the underside of the beam or slab; a minimal surcharge can be expected.

(4) Roof Diaphragm**Roof Diaphragm Material (Box #4-10)**

- ☐ Wood ☒ Concrete
- ☐ Steel Deck ☐ Braced Steel

Roof Diaphragm Prototype Details (Box #4-11)

Prototype No.	Roof Diaphragm Prototype Description	Span	Max. Movement	Capacity
N/A	Rigid			

Comments on Roof Diaphragm (Box #4-12)

Gym Block roof diaphragm is of concrete and is part of the Classroom Block diaphragm. A short built-up wood roof sits on top of a concrete attic slab 100mm thick minimum. No information on rebar and concrete strength available.

(5) Floor Diaphragm**Floor Diaphragm Material (Box #4-13)**

- ☐ Wood ☒ Concrete
- ☐ Steel Deck with Concrete Topping

Floor Diaphragm Prototype Details (Box #4-14)

Prototype No.	Floor Diaphragm Prototype Description	Span	Max. Movement	Capacity
N/A	Rigid			

Comments on Floor Diaphragm (Box #4-15)

Concrete slab with a minimum thickness of 100mm. No information on rebar and concrete strength available.

(5) Connections**Adequate Connections (Box #4-16)**

Roof Diaphragm / LDRS	<input type="checkbox"/>	Yes
	<input type="checkbox"/>	No
LDRS / Foundation	<input type="checkbox"/>	Yes
	<input type="checkbox"/>	No

Comments on Connections (Box #4-17)

Same as Classroom Block, there is no information on rebar detail, hence connections adequacy cannot be determined.

Risk Assessment Results (Box #5-1)

Principal Element	Prototype No.	Prototype Description	PDE
LDRS	C-3	Non-ductile Concrete Moment Frame	50%
Out-of-plane Walls	OP-2	200mm brick partition with inadequate restraint at top	28.4%
Maximum LDRS PDE (refer to GDL note below)			50%
Existing Block Retrofit Priority Ranking			H1
Note:			

Comments on Seismic Deficiencies, Recommended Testing and Risk Assessment Results (Box #5-2)

Same as Block 1: Classroom, structural drawings are available; however information such as reinforcement and concrete strength are missing.

Seismic Deficiencies:

- Very weak Non-ductile Concrete Moment Frame LDRS in both directions. The LDRS is also the VLS; hence, this building is at risk of total collapse.
- Partition walls and exterior walls likely do not meet out-of-plane requirements.
- Basement short columns around perimeter extending half storey from the top of basement walls seems to be in-filled with URM which would likely be lack of connections and do not meet out-of-plane requirement.

Testing and further investigation:

- Site specific geotechnical investigation to determine soil site class and bearing capacity.
- Removal of parapet flashing to expose construction of parapet walls.
- Removal of wall finish and drilling to determine the composition of interior partition walls and connectivity to the underside of the existing concrete beams.
- Removal of wall finish and drilling to determine the composition of exterior walls and connectivity to the underside of the existing concrete beams.
- Testing to determine rebar type and arrangement and concrete properties.

Retrofit Options Documented (Box #6-1)

No.	Retrofit Performance Level	Chapter
1	Phased Retrofit	7
2	Life-Safety Retrofit	8

Comments on Documented Retrofit Options (Box #6-2)

Enhanced Performance Retrofit is not considered in this report. Because the gym portion is interconnected to the Classroom Block 1 and all the LDRS elements are shared, Enhance Performance Retrofit will not have the same benefit from that for a stand-alone gym.

Phased Retrofit uses the same retrofit concept as Life Safety Retrofit with reduction in forces on the LDRS. It results only in reduction of shear walls and footings. The strong backing of heavy perimeter walls and the replacement of heavy partition walls will still be required.

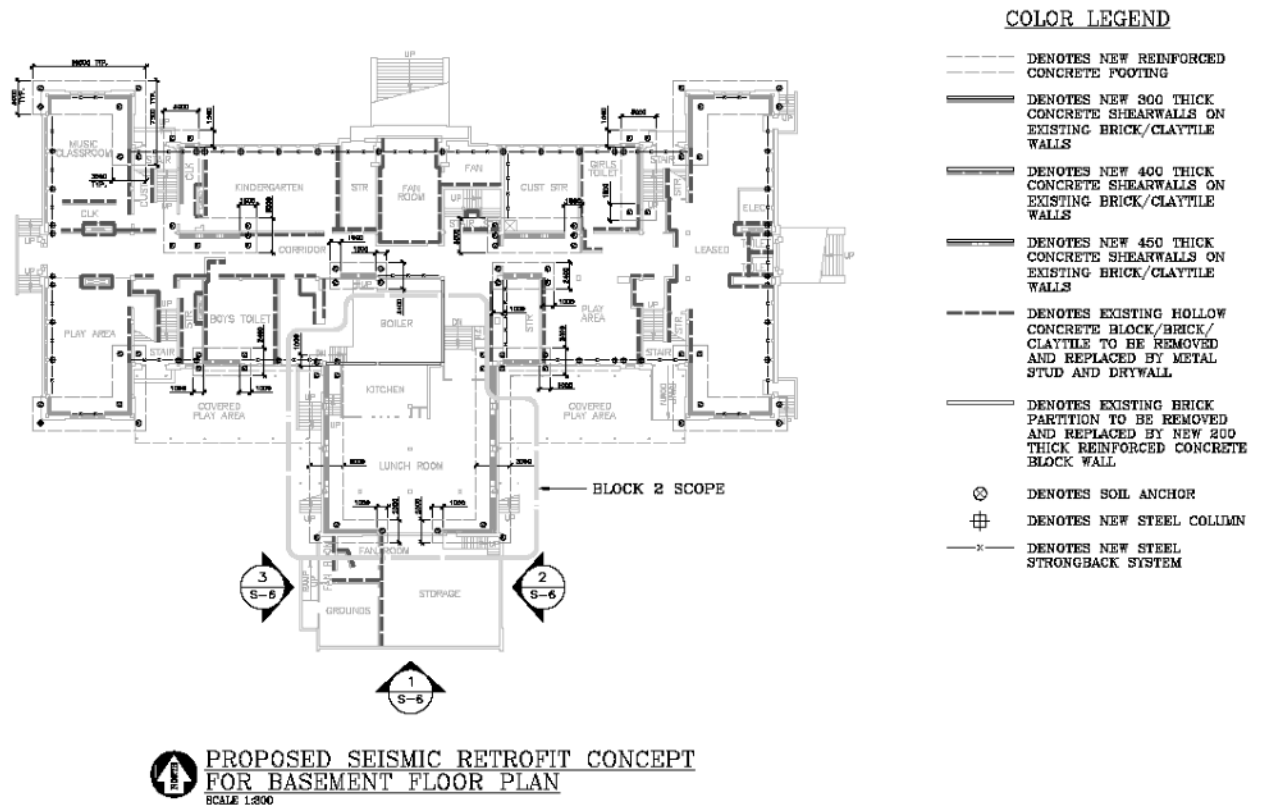
(1) Retrofit Concept

Figure 7.1: Typical Plan –

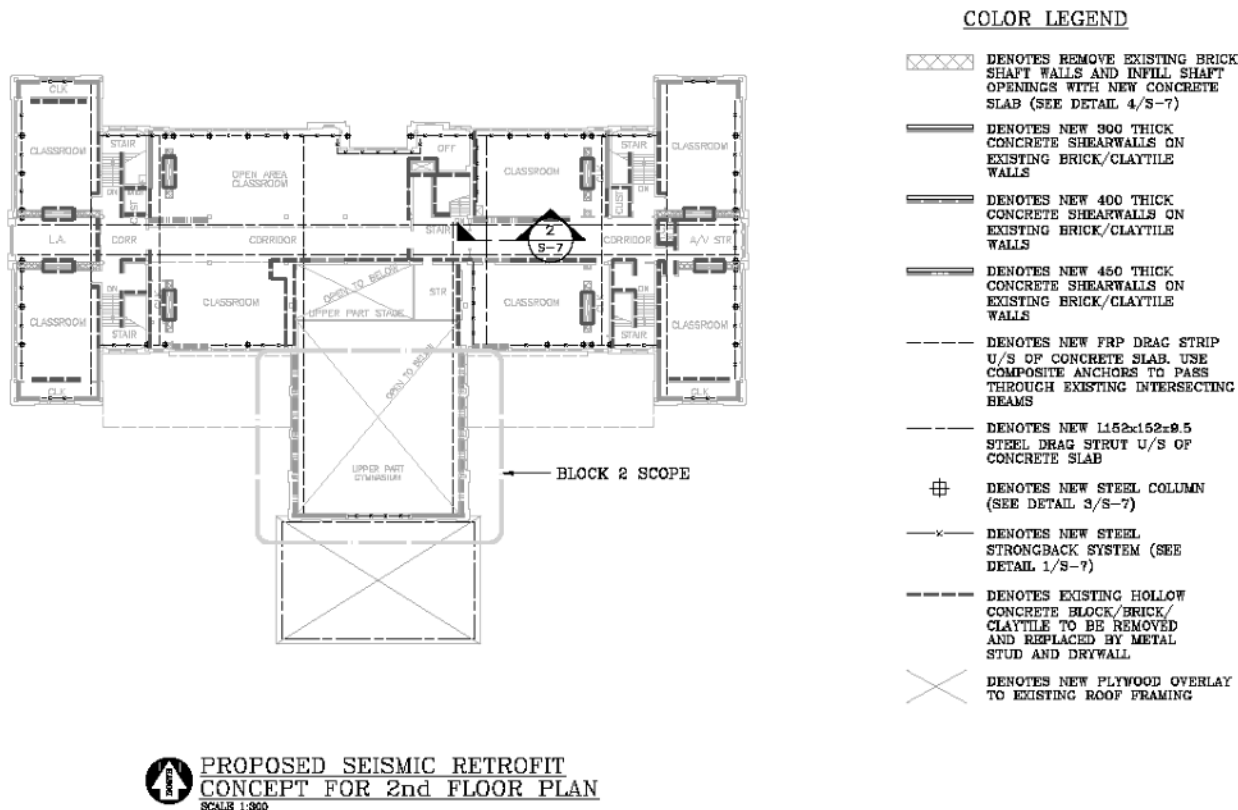


Figure 7.2: Typical Plan –

Comments on Figure 7.1 and Figure 7.2 (Box #7-1)

Provide new Concrete Moderate Ductile Shear Wall LDRS and remediation of all brick and HCT walls.

- New concrete shear walls with foundations and soil anchors
- New drag struts to collect diaphragm forces to the new walls and improve on load paths
- Strong back exterior walls
- New steel stud partitions to replace existing brick partitions in the basement.

This is the same philosophy as in the Life-Safety Retrofit, the only difference is a reduction in shear wall and footing quantities because of a forces reduction in LDRS.

(2) Retrofit LDRSs**Number of Retrofit LDRS Prototypes (Box #7-2)**

1

Retrofit LDRS Prototype Details (Box #7-3)

Shaking Direction	Prototype No.	LDRS Prototype Description	Max PDE	Max DDL	R _m
Both	C-6	Moderate Ductile Shear Wall	5%	1%	14.6% W

Comments on Retrofit LDRS Prototypes (Box #7-4)

New shear walls on the perimeters of the gym with small number discrete openings for doors or windows.

(3) SPiR Benchmarks**Benchmark SPiRs (Box #7-5)**

Benchmark SPiR No.	Benchmark SPiR Description	Retrofit Cost (\$ / m ²)
Comments:		

(4) Scope of Retrofit

Refer to Appendix A for details on the scope of work for both the structural and non-structural retrofits.

(5) Retrofit Cost Estimate

Refer to Appendix B for details on the retrofit cost estimate for the phased retrofit. A summary of the phased retrofit is given in Chapter 10.

(6) Schedule**Schedule (Box #7-7)**

No.	Schedule Issue	Value
1	Temporary Accommodations	Unknown
Comment on Operational Disruption: The phased retrofit will require this block to be vacated for an estimated time of one school year.		

(7) Construction Risks**Risks (Box #7-8)**

Risk Description	Significant Risk			
Asbestos	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No
Vermiculite	<input type="checkbox"/>	Yes	<input checked="" type="checkbox"/>	No
Lead Paint	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No

Risk Management Comments (Box #7-9)

Asbestos and lead paint risks appeared to be present as observed during site visit. Material testing to identify the extent of such risks shall be considered before a representative budget can be finalized.

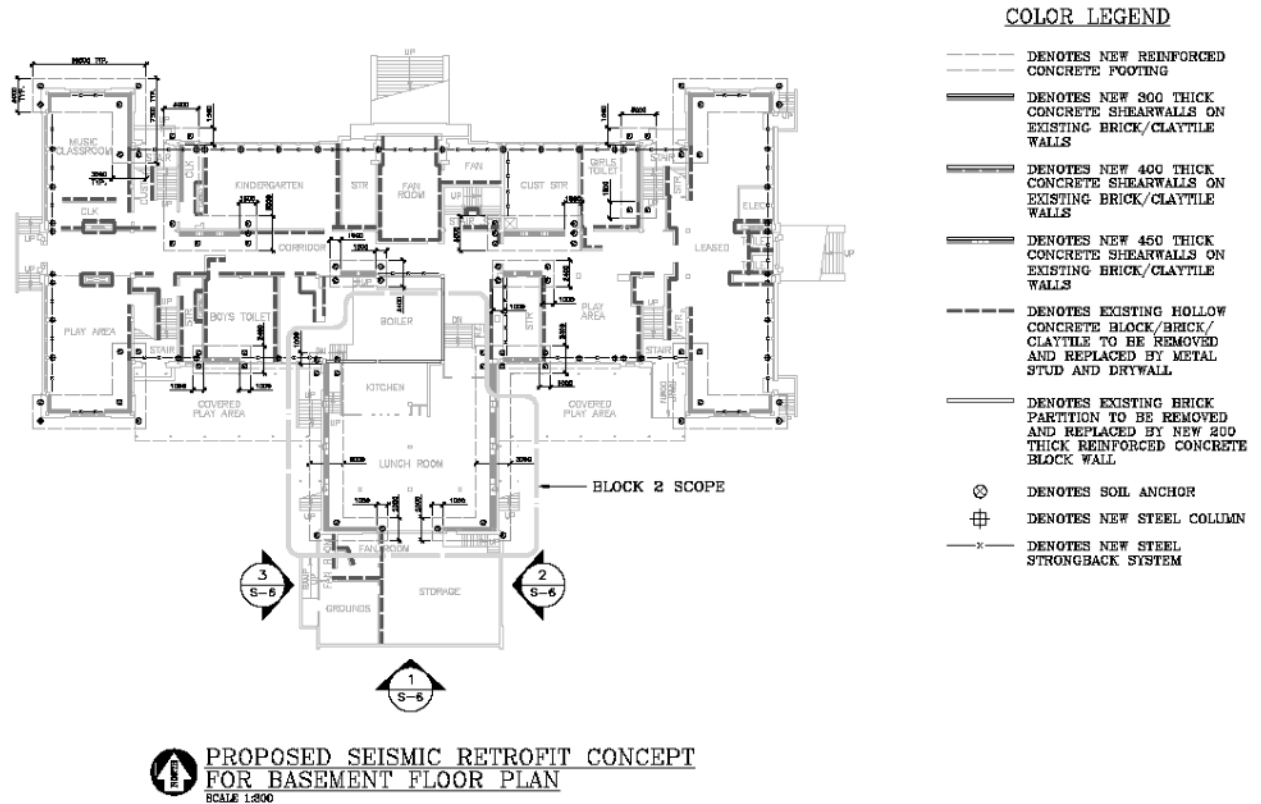
(1) Retrofit Concept

Figure 8.1: Typical Plan –

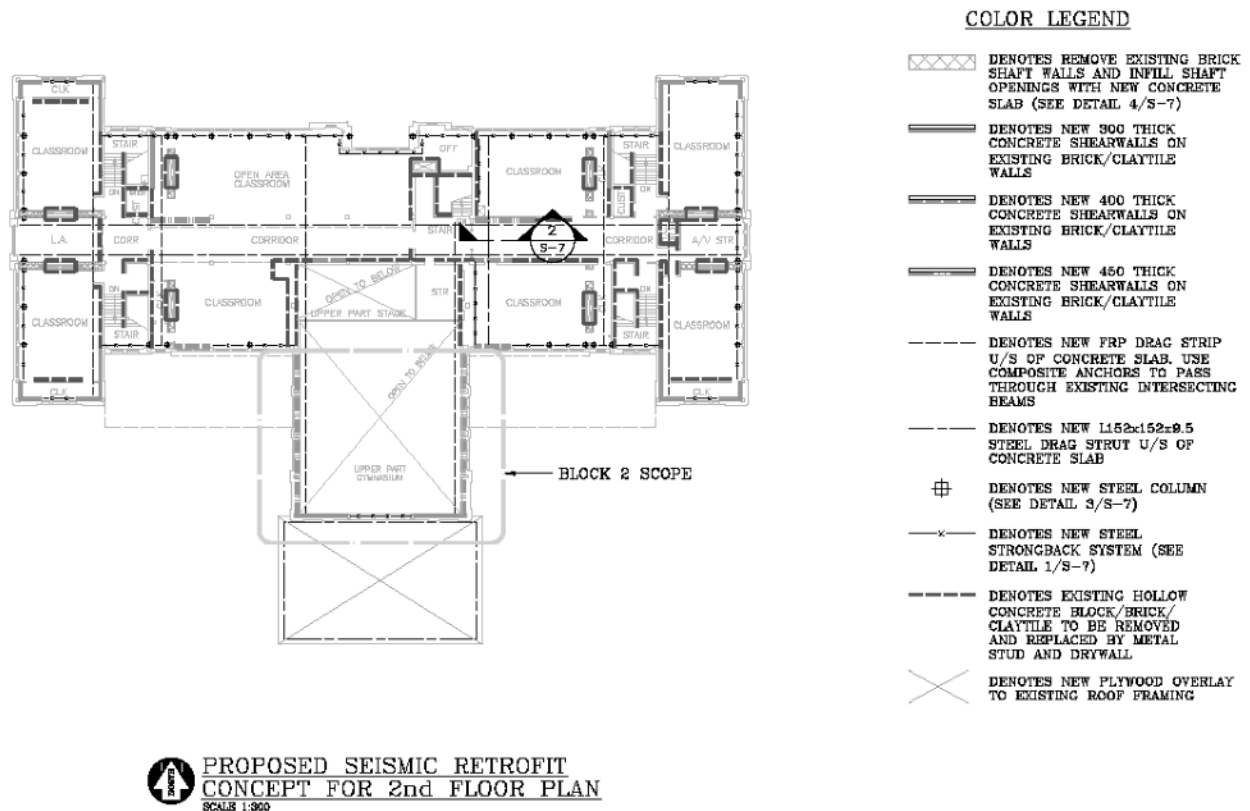


Figure 8.2: Typical Plan –

Comments on Figure 8.1 and Figure 8.2 (Box #8-1)

Provide new Concrete Moderate Ductile Shear Wall LDRS and remediation of all brick and HCT walls.

- New concrete shear walls with foundations and soil anchors
- New drag struts to collect diaphragm forces to the new walls and improve on load paths
- Strong back exterior walls
- New steel stud partitions to replace existing brick partitions in the basement.
- See Appendix C for complete drawings of the proposed seismic retrofit concept.

(2) Retrofit LDRSs**Number of Retrofit LDRS Prototypes (Box #8-2)**

1

Retrofit LDRS Prototype Details (Box #8-3)

Shaking Direction	Prototype No.	LDRS Prototype Description	Max PDE	Max DDL	R _m
Both	C-6	Moderate Ductile Shear Wall	2%	1%	23.4% W

Comments on Retrofit LDRS Prototypes (Box #8-4)

New shear walls on the perimeters of the gym with small number discrete openings for doors or windows.

(3) SPIR Benchmarks**Benchmark SPIRs (Box #8-5)**

Benchmark SPIR No.	Benchmark SPIR Description	Retrofit Cost (\$ / m ²)
SPIR-B-002	Block #60-1: 1913 Classroom Block David Livingstone Elementary School	\$592 / m ²

Comments:

The benchmark is of similar vintage and construction however with a pitched wood roof. The retrofit cost included the introduction of wood shear wall in the attic space which will not be required in this block.

(4) Scope of Retrofit

Refer to Appendix A for details on the scope of work for both the structural and non-structural retrofits.

(5) Retrofit Cost Estimate

Refer to Appendix B for details on the retrofit cost estimate for the life safety retrofit. A summary of the life safety retrofit is given in Chapter 10.

(6) Schedule**Schedule (Box #8-7)**

No.	Schedule Issue	Value
1	Temporary Accommodations	Unknown
Comment on Operational Disruption: The life-safety retrofit will require this block to be vacated for an estimated time of one school year.		

(7) Construction Risks**Risks (Box #8-8)**

Risk Description	Significant Risk			
Asbestos	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No
Vermiculite	<input type="checkbox"/>	Yes	<input checked="" type="checkbox"/>	No
Lead Paint	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No

Risk Management Comments (Box #8-9)

Asbestos and lead paint risks appeared to be present as observed during site visit. Material testing to identify the extent of such risks shall be considered before a representative budget can be finalized.

Summary of Enhanced Performance Retrofit (Box #9-1)

Enhanced Performance Retrofit is not considered in this report.

Conclusions (Box #10-1)**1. Type of Block**

This retrofit concept is for a two-storey block with a Non-ductile Moment Frame gravity and lateral system. The exterior walls are of brick / HCT and the interior partitions are of brick and HCT. Field visit reviewed that work has been done to the parapet; however no record is available, further investigation is required to determine if parapet requires strong backing.

Because the Gym Block was built integral to the Classroom Block, the retrofit work is required to be performed together see SPIR 39-033 for details of the Classroom Block retrofit.

The Block is classified as a high risk (H1) block. In terms of heritage classification, it is registered as category B on the City of Vancouver Heritage Register, and has a score of 19 out of 25 from the Vancouver School Board heritage assessment by Commonwealth Historic Resource Management Ltd on March 2008.

2. Retrofit Options

Phased and Life-safety retrofits are considered in this report. Both retrofits will provide new Concrete Moderate Ductile Shear Wall LDRS and remediation of all brick and HCT walls. The only difference between the options is a reduction of shear wall and footing quantities because of some 35% reduction in forces to the LDRS.

3. Schedule

Estimated construction period of 14 months for both Phased and Life-Safety Retrofit which is concurrent to Block 1 retrofit.

4. Risks

Hazardous materials are present and there is a potential of low concrete strength. Testing will be required to clearly define the scope.

Conclusions: Retrofit Cost Estimates (Box #10-2)

Phased Retrofit: \$1,518,300 (\$2,138/m²)

Life-Safety Retrofit: \$2,020,600 (\$2,846/m²)

Recommendations (Box #10-3)

Should seismic upgrade be considered, material testing should be done to provide more information prior to detailed design.

Seismic Project Identification Report

APPENDIX A SCOPE OF RETROFIT DETAILS for BLOCK #47-2 (1912 Gymnasium) Lord Tennyson Elementary School

Table A.1: Scope of Structural Phased Retrofit

No.	Retrofit Detail	Construction Activity	Approx. Quantity
Similar to Drawings S-1 to S-7 for Life-Safety Retrofit concept.			
1	CSW # 1	New concrete shear walls (dowelled to existing brick / HCT walls)	200 mm x 9.4 m x 12.2 m high 300 mm x 29.2 m x 12.2 m high
2	CSW # 3	New footings for shear walls	75 m ² x 800 mm deep
3	CSW # 3	Soil anchors for new footings	12
See Table A-4 for Non-structural Retrofits which form part of this Phased Retrofit.			
See also SPIR 39-033 for Classroom Block Construction Activities which are required to be performed along with this Block			

Table A.2: Scope of Structural Life Safety Retrofit

No.	Retrofit Detail	Construction Activity	Approx. Quantity
See Drawings S-1 to S-7 for complete proposed retrofit concept.			
1	CSW # 1	New concrete shear walls (dowelled to existing brick / HCT walls)	300 mm x 9.4 m x 12.2 m high 450 mm x 29.2 m x 12.2 m high
2	CSW # 3	New footings for shear walls	112 m ² x 800 mm deep
3	CSW # 3	Soil anchors for new footings	12
See Table A-4 for Non-structural Retrofits which form part of this Life Safety Retrofit.			
See also SPIR 39-033 for Classroom Block Construction Activities which are required to be performed along with this Block			

Table A.3: Scope of Structural Enhanced Performance Retrofit

No.	Construction Activity	Approx. Quantity
	Enhanced Performance Retrofit not considered	

Table A.4: Scope of Non-Structural Retrofits

No.	Non-structural Hazard and Retrofit Detail	Description of Non-structural Upgrading	Approx. Quantity
1	Out-of-plane MW # 3	New 200 masonry partitions to replace existing brick partitions around boiler room in basement	18m
These non-structural retrofits are part of the Life Safety Retrofit.			

Seismic Project Identification Report

APPENDIX B

RETROFIT COST ESTIMATE REPORT

for

BLOCK #47-2 (1912 Gymnasium)

Lord Tennyson Elementary School

Retrofit Cost Estimate Report

Facility Code	3939047
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SEISMIC RETROFIT ESTIMATE - PROJECT SUMMARY

	LIFESAFETY RETROFIT BLOCK 2 (GYMNASIUM)	PHASED RETROFIT BLOCK 2 (GYMNASIUM)
Building Construction Type	13 - Non Ductile Frame	13 - Non Ductile Frame
Seismic Risk	H1	H1
Site Class	D	D
Number of Stories	2	2
Gross Floor Area (m2)	710	710
CONSTRUCTION COST ESTIMATE		
Site Development	\$41,100	\$41,100
SEISMIC UPGRADE WORK		
Selective Demolition:	\$76,000	\$68,900
Earthwork	\$300,600	\$186,300
Concrete Work- Foundations & shearwalls	\$630,500	\$391,000
Soils Anchors	\$120,000	\$120,000
Masonry & URM, Include brick restraint	\$18,400	\$18,400
Diaphragm Upgrades & Connections	\$0	\$0
Other	\$0	\$0
Roofing	\$0	\$0
Exterior Wall Cladding, Windows & Doors	\$15,000	\$15,000
Partitions & Doors	\$14,200	\$14,200
Finishes	\$104,300	\$87,100
Millwork, Specialties	\$10,700	\$10,700
Electrical Work	\$53,300	\$53,300
Mechanical Work	\$76,700	\$76,700
Asbestos & Lead Paint Remediation	\$60,400	\$60,400
Required CODE Upgrades	\$0	\$0
Non Structural Items	Not Included	Not Included
Site Specific PHASING COSTS	\$0	\$0
Contractor Site Overheads & Markup	\$235,800	\$177,200
Design Contingency & Unspecified Risk 15%	\$263,600	\$198,000
TOTAL CONSTRUCTION (excl. Tax)	\$2,845.92	\$2,020,600
		\$2,138.45
		\$1,518,300

TEMPORARY ACCOMMODATION, Portables	Excluded
SOFT COSTS, Design Fees, Contingency, Permits, Payable Taxes	Excluded

Facility Code	3939047
LIFESAFETY RETROFIT	

SEISMIC RETROFIT ESTIMATE		BLOCK 2 (GYMNASIUM)		
Building Construction Type	13 - Non Ductile Frame	Seismic Risk	H1	1912 Single Storey GYMNASIUM plus Basement LUNCHROOM
Overview Description of Work		Site Class	D	New CIP Shear Walls, Foundations and Minipiles, Dragstrut connections, Restrain/replace HCB/URM, New Steel Posts to support short columns, Plywood overlay to Covered Play
		GROSS FLOOR AREA 710 m2		
Site Development		\$41,100		
Re/re existing pavement, site works for seismic foundations		342 m2	85.00	29,100
Other Related Site Work - Footing Drains		80 m	150.00	12,000
Fire Water Main				0
SEISMIC UPGRADE WORK		\$2,788.03 /m2 \$1,979,500		
Selective Demolition:		76,000		
Interior Finishes, Specialties, Fittings etc.		710 m2	45.00	32,000
Interior finishes, millwork etc below window				0
Interior slab removal - strip 1.8m wide for grade beam		38 m	225.00	8,600
Interior slab removal - strip 4.5m wide for grade beam				0
Strip finishes of existing Ext wall at NEW Shearwalls (2 floors)		77 m	203.00	15,600
Demol URM walls for replacement		18 m	300.30	5,400
Ceiling finishes 2.0m w at perimeter of interior wall upgrades		76 m	97.50	7,400
Remove Classroom Whiteboards/Cubbles/Shelving etc				0
Miscell demolition		10%	Item	7,000
Earthwork		300,600		
Earthwork - interior for grade beam		48 m3	350.00	16,600
Earthwork - exterior for grade beam		599 m3	285.00	170,600
Hand trim adjacent existing footing		76 hrs	45.00	3,400
Backfilling, make good		555 m3	180.00	99,900
Disposal offsite		119 m3	85.00	10,100
Concrete Work- Foundations & shearwalls		630,500		
Concrete Foundations		91 m3	1,350.00	123,100
Concrete Shearwalls (Fndn to Roof) 300		115 m2	880.00	100,900
Concrete Shearwalls (Fndn to Roof) 450		356 m2	932.50	332,000
Concrete Slab reinstatement, make good		68 m2	150.00	10,300
Coring existing slab for rebar/conc at 300cntrs		253 No.	85.00	21,500
Anchors, drilled/dowel anchors to existing foundations		152 No.	21.00	3,200
Anchors, drilled/dowel anchors to existing walls		1,883 No.	21.00	39,500
Soils Anchors		120,000		
GEWI Soil Anchors / Mini-Piles		12 No	10,000.00	120,000
Masonry & URM, Include brick restraint, FRP		18,400		
Metal stud strongback/restrain walls	URM#1			0
FRP strips to NEW walls incl. prep (drag struts)		52 m	291.00	15,100
Steel strong back to exterior wall		m	542.50	0
HSS column at exterior walls		No.	800.00	0
Drilled/epoxy Hilti anchors		0 No.	21.00	0
Metal stud framing to replaced paritions		60 m2	55.00	3,300

Facility Code	3939047
LIFESAFETY RETROFIT	

SEISMIC RETROFIT ESTIMATE		BLOCK 2 (GYMNASIUM)			
Diaphragm Upgrades & Connections		0			
Floor Diaphragm Upgrade		0			
Roof Diaphragm Upgrade		0			
Other		0			
Exterior Building Envelope Work		\$21.13 15,000			
<u>Roofing</u>		0			
Re/re Roofing		0			
Re/re roofing in strips - top of new shear wall		0			
<u>Exterior Wall Cladding, Windows & Doors</u>		Remain in place - NO Work			
Cladding new exterior shear walls		Allow 15,000			
Windows		0			
Miscell envelope remedial work		Remain			
New framed wall/sheathing		0			
Doors		0			
Overhangs, Soffits		0			
Interior Work		\$181.97 129,200			
<u>Partitions & Doors</u>		0 m2 105.00 0			
New Studs, Drywall, Insulation, VB on exterior walls		52 m2 68.00 3,500			
New Drywall on upgraded strong backed walls 1 layer/furring		150 m2 31.00 4,700			
New Drywall on replaced walls avge2.5 layers D/W, 30% batts		0			
Stairs - Remedial work due to new walls		replace 10 No. 600.00 6,000			
Doors/Frames/Hardware		355 m2 78.00 27,700			
<u>Finishes</u>		10% Item 5,300			
Reinstate Floor Finishes Perimeter		266 m2 58.00 15,400			
Reinstate Floor Finishes - nominal repair/remedial in remain		15% Item 6,900			
Reinstate Ceilings - perimeter		172 m2 12.00 2,100			
Remedial ceiling work adjacent areas & paint exposed struct.		50 m 937.50 46,900			
Wall Finish - paint drywall		0			
Wall Finish - wood panel /dado (to match existing)		0			
Wall Finish - Tectum acoustic		0			
Wall Finish - ceramic tile		0			
<u>Millwork, Specialties</u>		0			
Re/re Millwork		0			
Re/re Whiteboards. Cloak Rm etc.		0			
Washrooms		0			
Specialties, Gym Equipment etc.		710 m2 15.00 10,700			
Electrical Work		\$75.07 53,300			
Elec work - redo in walls		710 m2 75.00 53,300			
Mechanical Work		\$108.03 76,700			
Plumbing Sinks/WC's etc		Fxt 0			
Sprinklers - re/re		710 m2 18.00 12,800			
HVAC - replace heating pipework, ductwork, louvre/diffusers		710 m2 90.00 63,900			
Asbestos & Lead Paint Remediation		710 m2 \$85.00 60,400			
Required CODE Upgrades		0			
Non Structural Items		Not Included			
Site Specific PHASING COSTS		0%			
Block Vacated		0			
Contractor Site Overheads & Markup (incl. on site)		15.5%			
Design Contingency & Unspecified Risk (incl. on site)		15%			
TOTAL CONSTRUCTION (Excluding HST)		\$2,845.92 \$2,020,600			

Facility Code	3939047
PHASED RETROFIT	

SEISMIC RETROFIT ESTIMATE		BLOCK 2 (GYMNASIUM)		
Building Construction Type	13 - Non Ductile Frame	Seismic Risk	H1	1912 Single Storey GYMNASIUM plus Basement LUNCHROOM
Overview Description of Work		Site Class	D	New CIP Shear Walls, Foundations and Minipiles, Dragstrut connections, Restrain/replace HCB/URM, New Steel Posts to support short columns, Plywood overlay to Covered Play
		GROSS FLOOR AREA 710 m2		
Site Development		\$41,100		
Re/re existing pavement, site works for seismic foundations		342 m2	85.00	29,100
Other Related Site Work - Footing Drains		80 m	150.00	12,000
Fire Water Main				0
SEISMIC UPGRADE WORK		\$2,080.56 /m2 \$1,477,200		
Selective Demolition:		68,900		
Interior Finishes, Specialties, Fittings etc.		710 m2	45.00	32,000
Interior finishes, millwork etc below window				0
Interior slab removal - strip 1.8m wide for grade beam		24 m	225.00	5,300
Interior slab removal - strip 4.5m wide for grade beam				0
Strip finishes of existing Ext wall at NEW Shearwalls (2 floors)		77 m	203.00	15,600
Demol URM walls for replacement		18 m	300.30	5,400
Ceiling finishes 2.0m w at perimeter of interior wall upgrades		47 m	97.50	4,600
Remove Classroom Whiteboards/Cubbles/Shelving etc				0
Miscell demolition		10%	Item	6,000
Earthwork		186,300		
Earthwork - interior for grade beam		29 m3	350.00	10,300
Earthwork - exterior for grade beam		371 m3	285.00	105,800
Hand trim adjacent existing footing		47 hrs	45.00	2,100
Backfilling, make good		344 m3	180.00	61,900
Disposal offsite		74 m3	85.00	6,200
Concrete Work- Foundations & shearwalls		391,000		
Concrete Foundations		57 m3	1,350.00	76,300
Concrete Shearwalls (Fndn to Roof) 300		71 m2	880.00	62,600
Concrete Shearwalls (Fndn to Roof) 450		221 m2	932.50	205,800
Concrete Slab reinstatement, make good		42 m2	150.00	6,400
Coring existing slab for rebar/conc at 300cntrs		157 No.	85.00	13,400
Anchors, drilled/dowel anchors to existing foundations		94 No.	21.00	2,000
Anchors, drilled/dowel anchors to existing walls		1,167 No.	21.00	24,500
Soils Anchors		120,000		
GEWI Soil Anchors / Mini-Piles		12 No	10,000.00	120,000
Masonry & URM, Include brick restraint, FRP		18,400		
Metal stud strongback/restrain walls	URM#1			0
FRP strips to NEW walls incl. prep (drag struts)		52 m	291.00	15,100
Steel strong back to exterior wall		m	542.50	0
HSS column at exterior walls		No.	800.00	0
Drilled/epoxy Hilti anchors		0 No.	21.00	0
Metal stud framing to replaced paritions		60 m2	55.00	3,300

Facility Code	3939047
PHASED RETROFIT	

SEISMIC RETROFIT ESTIMATE		BLOCK 2 (GYMNASIUM)			
Diaphragm Upgrades & Connections		0			
Floor Diaphragm Upgrade		0			
Roof Diaphragm Upgrade		0			
Other		0			
Exterior Building Envelope Work		\$21.13 15,000			
<u>Roofing</u>		0			
Re/re Roofing		0			
Re/re roofing in strips - top of new shear wall		0			
<u>Exterior Wall Cladding, Windows & Doors</u>		Remain in place - NO Work			
Cladding new exterior shear walls		Allow 15,000			
Windows		0			
Miscell envelope remedial work		Remain			
New framed wall/sheathing		0			
Doors		0			
Overhangs, Soffits		0			
Interior Work		\$157.75 112,000			
<u>Partitions & Doors</u>		0 m2 105.00 0			
New Studs, Drywall, Insulation, VB on exterior walls		52 m2 68.00 3,500			
New Drywall on upgraded strong backed walls 1 layer/furring		150 m2 31.00 4,700			
New Drywall on replaced walls avge 2.5 layers D/W, 30% batts		0			
Stairs - Remedial work due to new walls		replace 10 No. 600.00 6,000			
Doors/Frames/Hardware		213 m2 78.00 16,600			
<u>Finishes</u>		10% Item 5,300			
Reinstate Floor Finishes Perimeter		160 m2 58.00 9,300			
Reinstate Floor Finishes - nominal repair/remedial in remain		15% Item 6,900			
Reinstate Ceilings - perimeter		172 m2 12.00 2,100			
Remedial ceiling work adjacent areas & paint exposed struct.		50 m 937.50 46,900			
Wall Finish - paint drywall		0			
Wall Finish - wood panel /dado (to match existing)		0			
Wall Finish - Tectum acoustic		0			
Wall Finish - ceramic tile		0			
<u>Millwork, Specialties</u>		0			
Re/re Millwork		0			
Re/re Whiteboards. Cloak Rm etc.		0			
Washrooms		0			
Specialties, Gym Equipment etc.		710 m2 15.00 10,700			
Electrical Work		\$75.07 53,300			
Elec work - redo in walls		710 m2 75.00 53,300			
Mechanical Work		\$108.03 76,700			
Plumbing Sinks/WC's etc		Fxt 0			
Sprinklers - re/re		710 m2 18.00 12,800			
HVAC - replace heating pipework, ductwork, louvre/diffusers		710 m2 90.00 63,900			
Asbestos & Lead Paint Remediation		710 m2 \$85.00 60,400			
Required CODE Upgrades		0			
Non Structural Items		Not Included			
Site Specific PHASING COSTS		0%			
Block Vacated		0			
Contractor Site Overheads & Markup (incl. on site)		15.5%			
Design Contingency & Unspecified Risk (incl. on site)		15%			
TOTAL CONSTRUCTION (Excluding HST)		\$2,138.45 \$1,518,300			

Seismic Project Identification Report

APPENDIX C



REPRESENTATIVE STRUCTURAL DETAILS

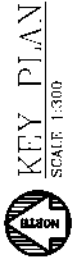
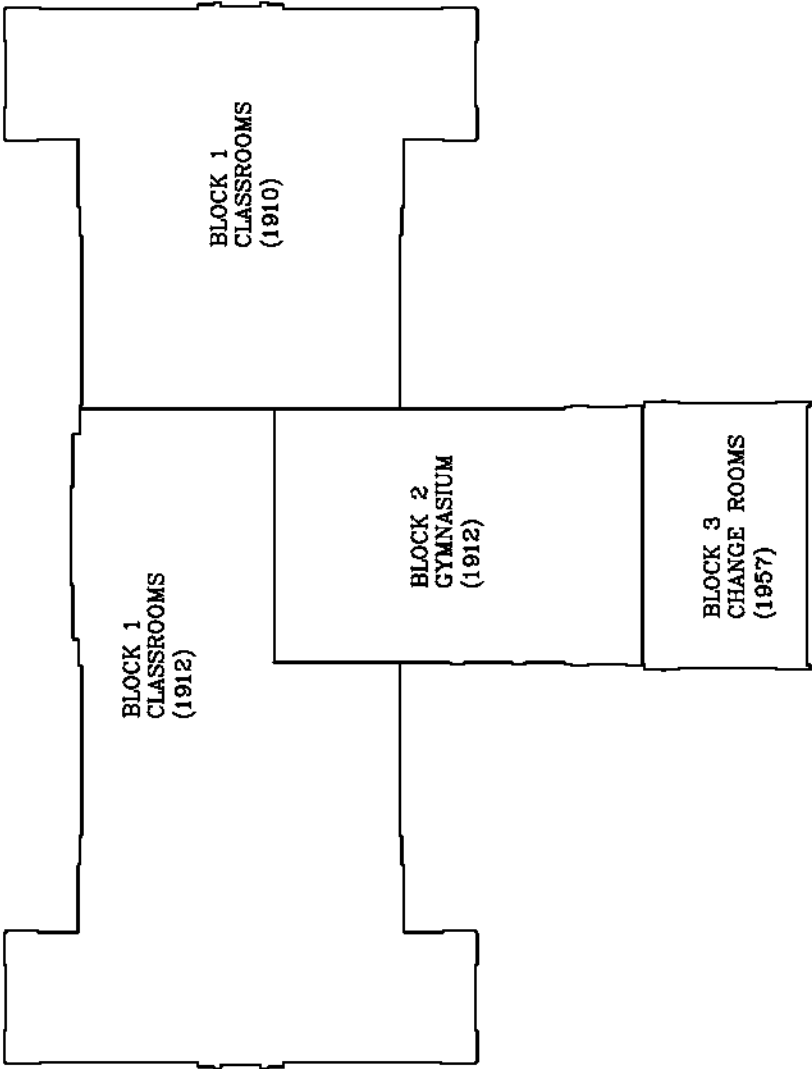
for

BLOCK #47-2 (1912 Gymnasium)

Lord Tennyson Elementary School

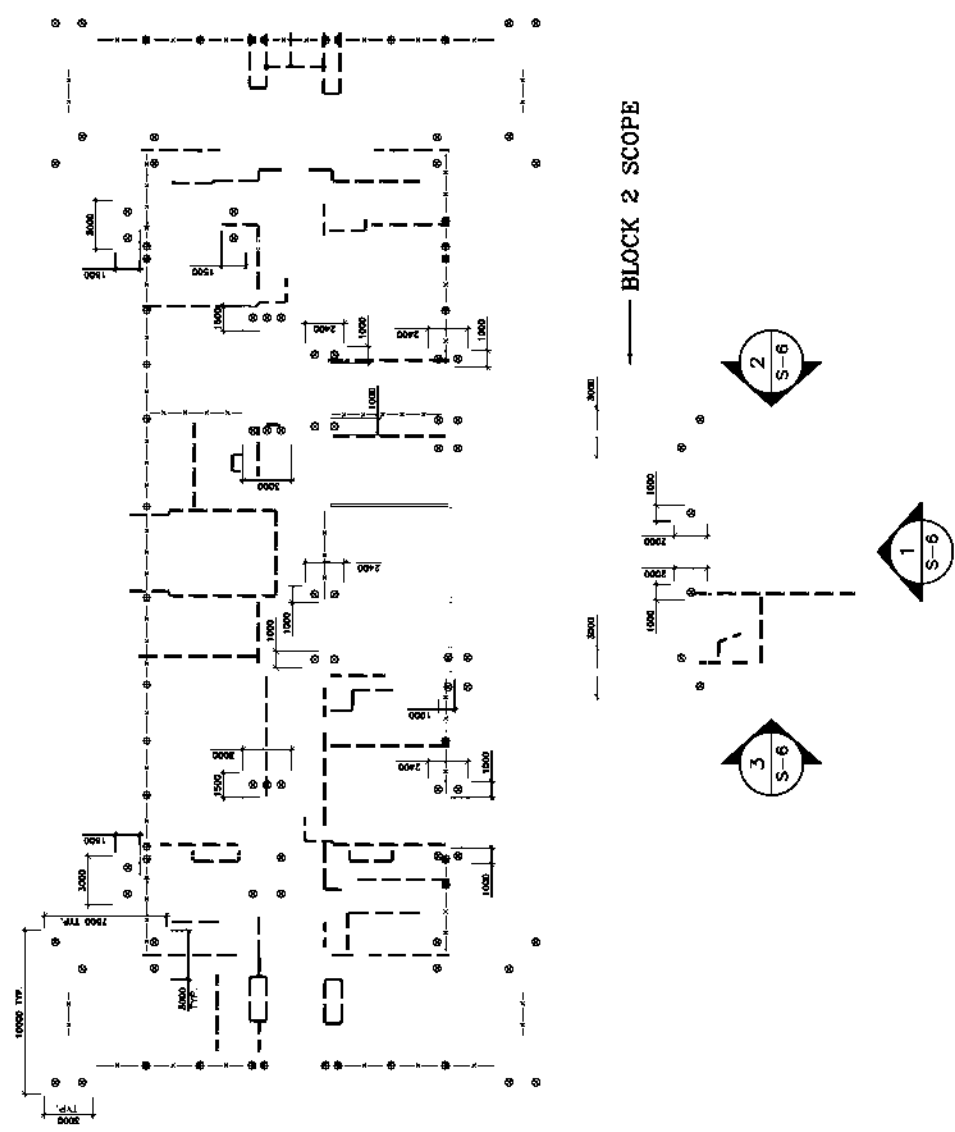
Representative Structural Details

JOB No. 1212240300 DWG No. S-1	LORD TENNYSON ELEMENTARY SCHOOL DISTRICT #39 - VANCOUVER SEISMIC PROJECT IDENTIFICATION REPORT	SCALE 1:300 DRAWN SM DATE 06.17.12 REV.	 GENIVAR <small> 800-361-4629 604-261-4629 1000-108-1000 </small>	 <small> VSB VULNERABILITY STUDIES & SEISMIC ANALYSIS CONSULTING </small>
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COLOR LEGEND

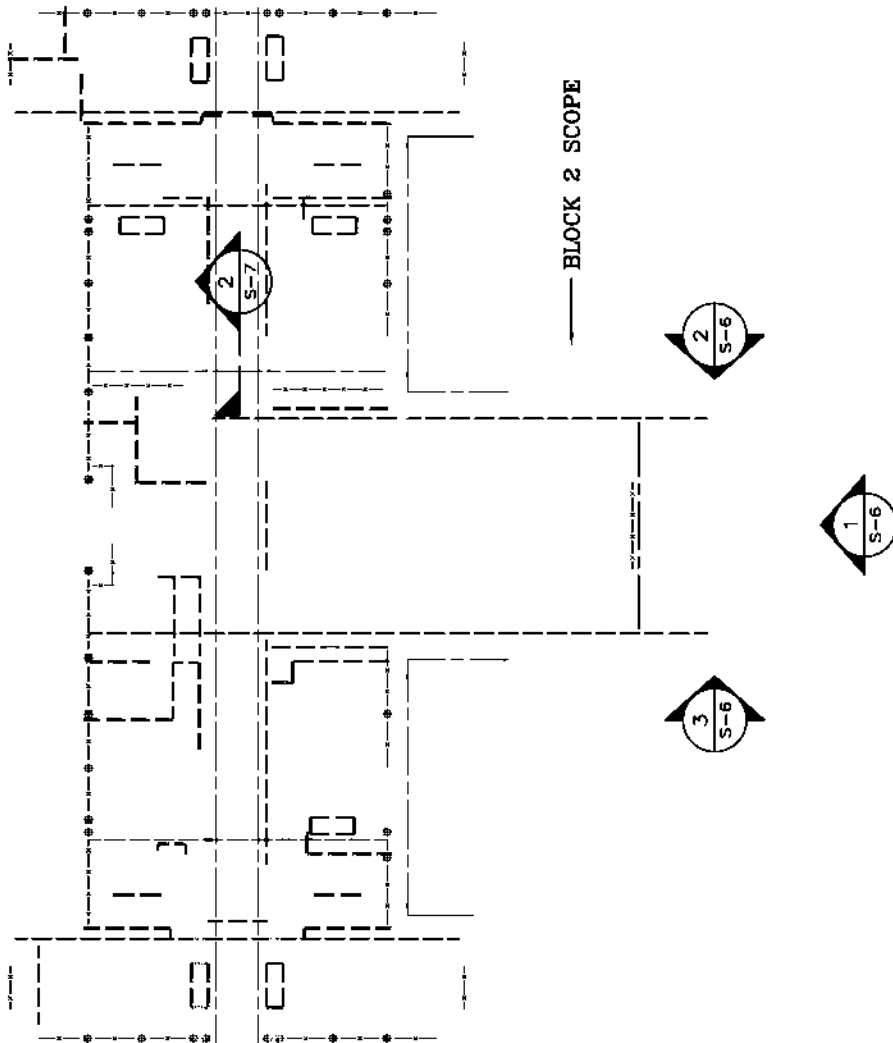
==	DENOTES NEW REINFORCED CONCRETE FOOTING
==	DENOTES NEW 300 THICK CONCRETE SHEARWALLS ON EXISTING BRICK/CLAYTILE WALLS
---	DENOTES NEW 400 THICK CONCRETE SHEARWALLS ON EXISTING BRICK/CLAYTILE WALLS
---	DENOTES NEW 450 THICK CONCRETE SHEARWALLS ON EXISTING BRICK/CLAYTILE WALLS
---	DENOTES EXISTING HOLLOW CONCRETE BLOCK/BRICK/CLAYTILE TO BE REMOVED AND REPLACED BY METAL STUD AND DRYWALL
	DENOTES EXISTING BRICK PARTITION TO BE REMOVED AND REPLACED BY NEW 200 THICK REINFORCED CONCRETE BLOCK WALL
⊗	DENOTES SOIL ANCHOR
⊕	DENOTES NEW STEEL COLUMN
—x—	DENOTES NEW STEEL STRONGBACK SYSTEM




PROPOSED SEISMIC RETROFIT CONCEPT
FOR BASEMENT FLOOR PLAN

COLOR LEGEND

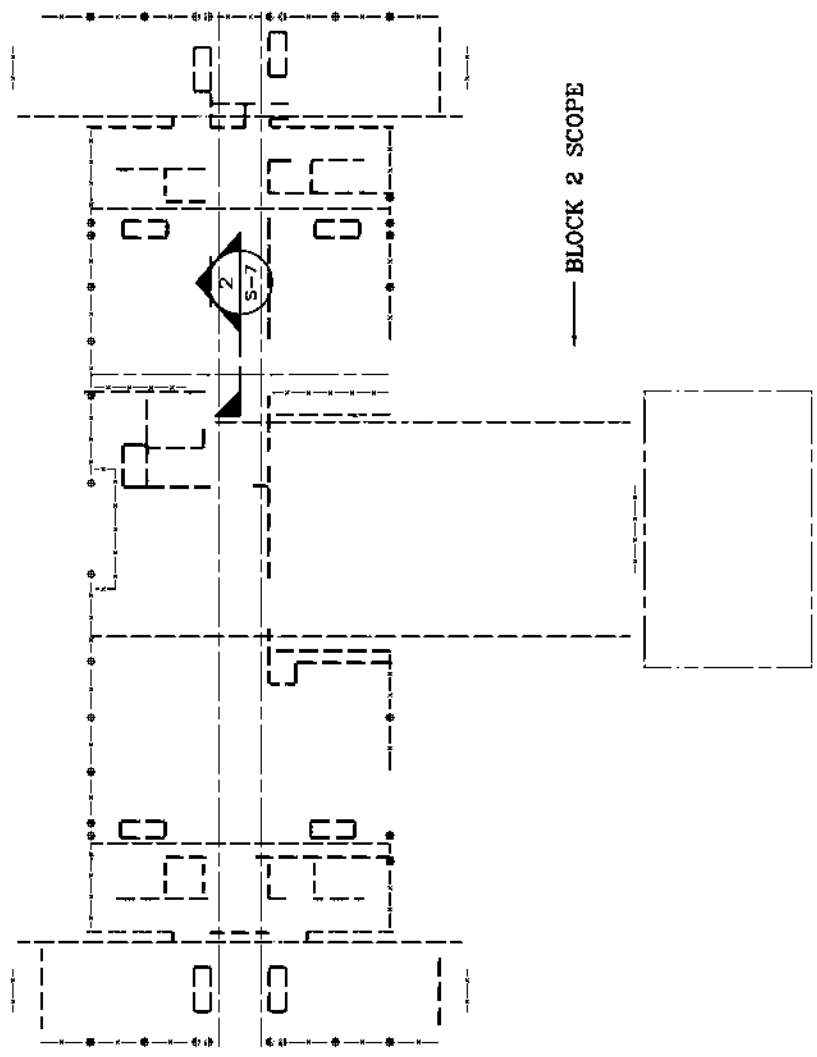
- DENOTES REMOVE EXISTING BRICK
 SHAFT WALLS AND INFILL. SHAFT
 OPENINGS WITH NEW CONCRETE
 SLAB (SEE DETAIL 4/S-7)
- DENOTES NEW 300 THICK
 CONCRETE SHEARWALLS ON
 EXISTING BRICK/CLAYTILE
 WALLS
- DENOTES NEW 400 THICK
 CONCRETE SHEARWALLS ON
 EXISTING BRICK/CLAYTILE
 WALLS
- DENOTES NEW 450 THICK
 CONCRETE SHEARWALLS ON
 EXISTING BRICK/CLAYTILE
 WALLS
- DENOTES NEW FRP DRAG STRIP
 U/S OF CONCRETE SLAB. USE
 COMPOSITE ANCHORS TO PASS
 THROUGH EXISTING INTERSECTING
 BEAMS
- DENOTES NEW L152x152x9.5
 STEEL DRAG STRUT U/S OF
 CONCRETE SLAB
- 
 DENOTES NEW STEEL COLUMN
 (SEE DETAIL 3/S-7)
- x —
 DENOTES NEW STEEL
 STRONGBACK SYSTEM (SEE
 DETAIL 1/S-7)
- DENOTES EXISTING HOLLOW
 CONCRETE BLOCK/BRICK/
 CLAYTILE TO BE REMOVED
 AND REPLACED BY METAL
 STUD AND DRYWALL
- DENOTES NEW PLYWOOD OVERLAY
 TO EXISTING ROOF FRAMING




 PROPOSED SEISMIC RETROFIT
 CONCEPT FOR MAIN FLOOR PLAN
 SCALE: 1:300

COLOR LEGEND

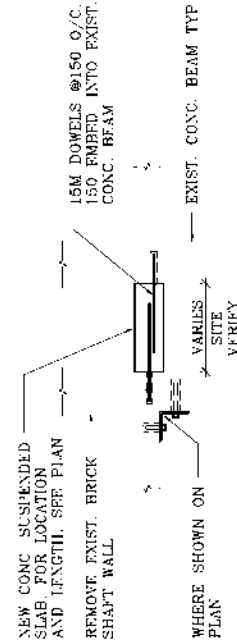
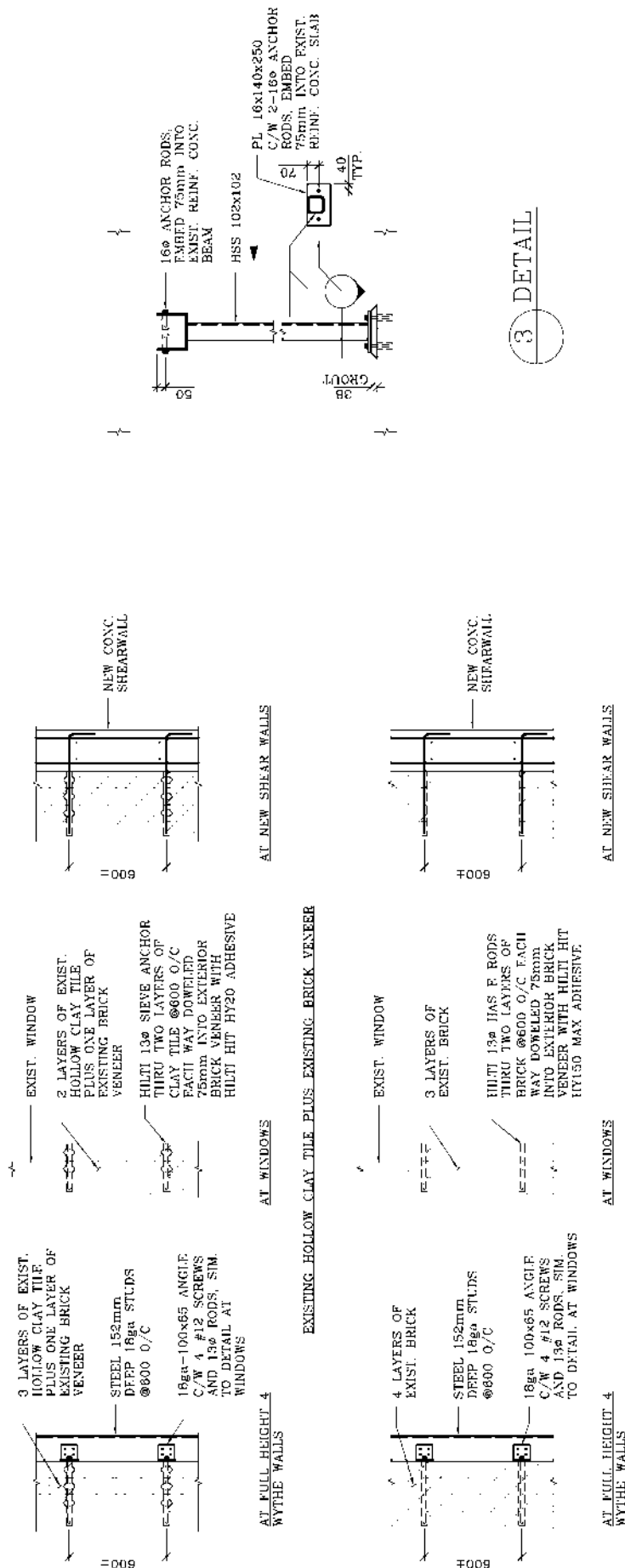
- DENOTES REMOVE EXISTING BRICK SHAFT WALLS AND INFILL SHAFT OPENINGS WITH NEW CONCRETE SLAB (SEE DETAIL 4/S-7)
- DENOTES NEW 300 THICK CONCRETE SHEARWALLS ON EXISTING BRICK/CLAYTILE WALLS
- DENOTES NEW 400 THICK CONCRETE SHEARWALLS ON EXISTING BRICK/CLAYTILE WALLS
- DENOTES NEW 450 THICK CONCRETE SHEARWALLS ON EXISTING BRICK/CLAYTILE WALLS
- DENOTES NEW FRP DRAG STRIP U/S OF CONCRETE SLAB. USE COMPOSITE ANCHORS TO PASS THROUGH EXISTING INTERSECTING BEAMS
- DENOTES NEW L152x152x9.5 STEEL DRAG STRUT U/S OF CONCRETE SLAB
- ⊕ DENOTES NEW STEEL COLUMN (SEE DETAIL 3/S-7)
- x--- DENOTES NEW STEEL STRONGBACK SYSTEM (SEE DETAIL 1/S 7)
- DENOTES EXISTING HOLLOW CONCRETE BLOCK/BRICK/CLAYTILE TO BE REMOVED AND REPLACED BY METAL STUD AND DRYWALL
- DENOTES NEW PLYWOOD OVERLAY TO EXISTING ROOF FRAMING



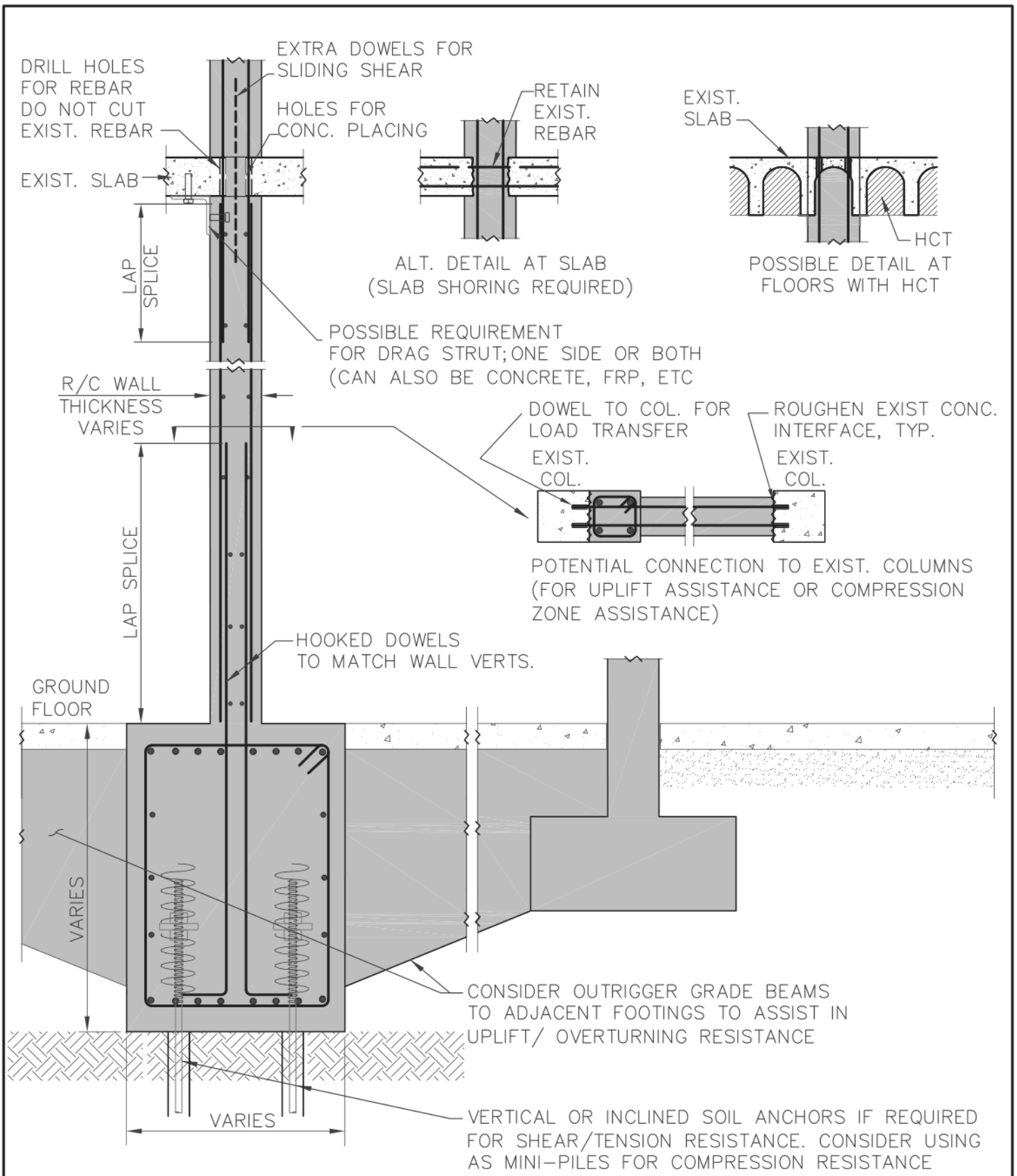
--- BLOCK 2 SCOPE

PROPOSED SEISMIC RETROFIT
 CONCEPT FOR 2nd FLOOR PLAN
 SCALE 1:500

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TYPICAL ANGLE DIAPHRAGM
DRAG STRUT CONNECTION

4 TYPICAL FLOOR SLAB DIAPHRAGM INFILL



SEISMIC RETROFIT GUIDELINES FIRST EDITION

LIBRARY OF RETROFIT DETAILS

APRIL 2011

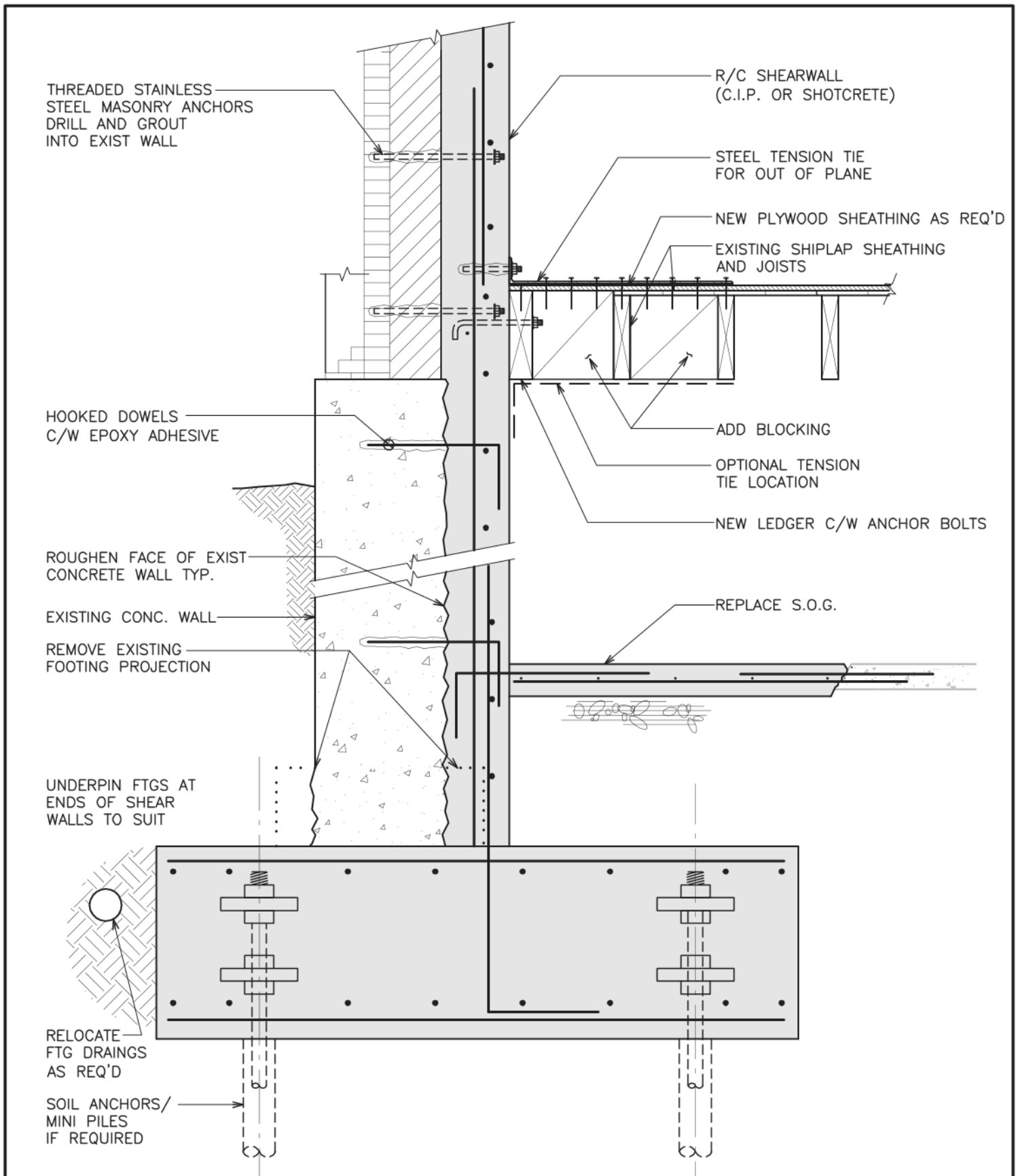
CONCRETE SHEAR WALL #1

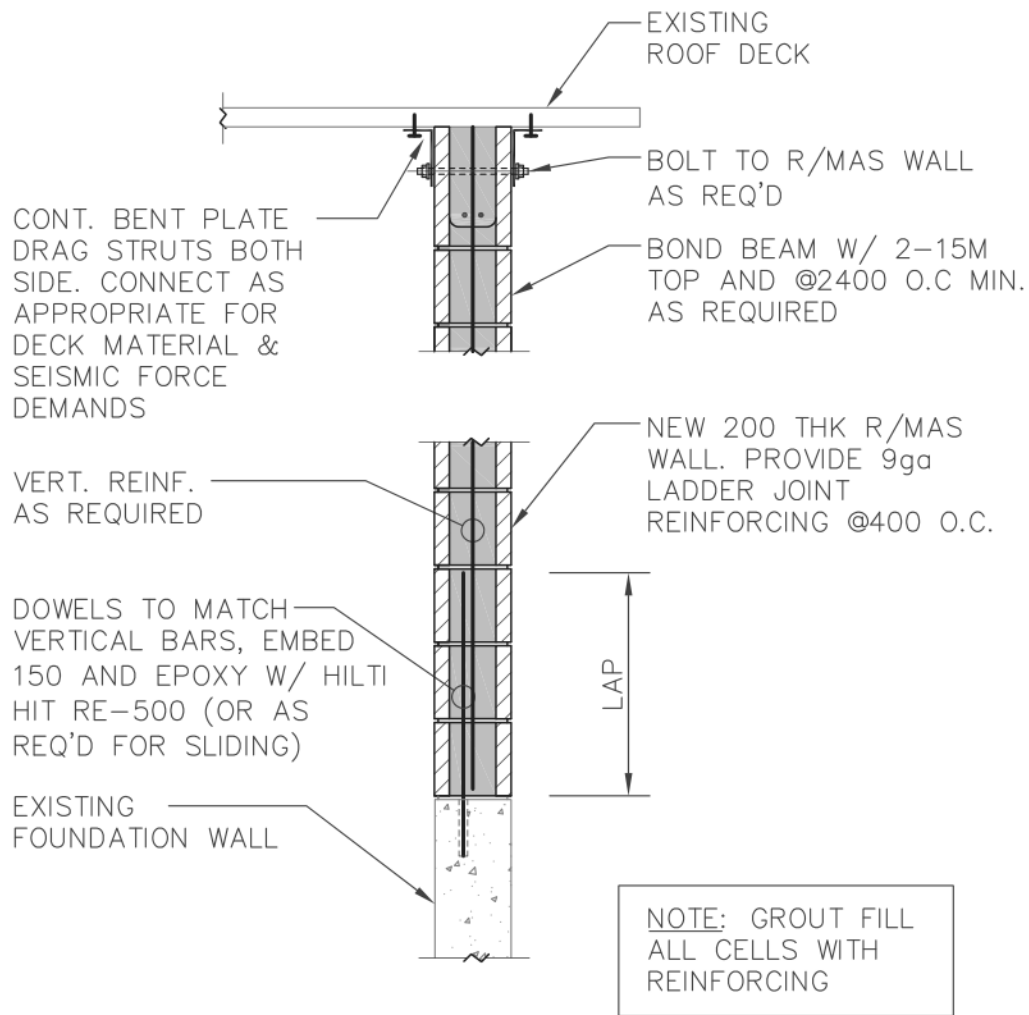
NEW CONCRETE SHEARWALL WITH FDN
AND POSSIBLY SOIL ANCHORS

SCALE
1:20

SHEET No.

CSW
#1





**SEISMIC RETROFIT GUIDELINES
FIRST EDITION**

LIBRARY OF RETROFIT DETAILS

APRIL 2011

MASONRY WALLS #3
NEW REINFORCED MASONRY WALL

SCALE
1:20

SHEET No.

**MW
#3**

Seismic Project Identification Report

APPENDIX D PHOTOGRAPHS for BLOCK #47-2 (1912 Gymnasium) Lord Tennyson Elementary School

Gymnasium Block Photographs



Figure 1: West Elevation of Gym



Figure 2: East Elevation of Gym



Figure 3: Inside Gymnasium

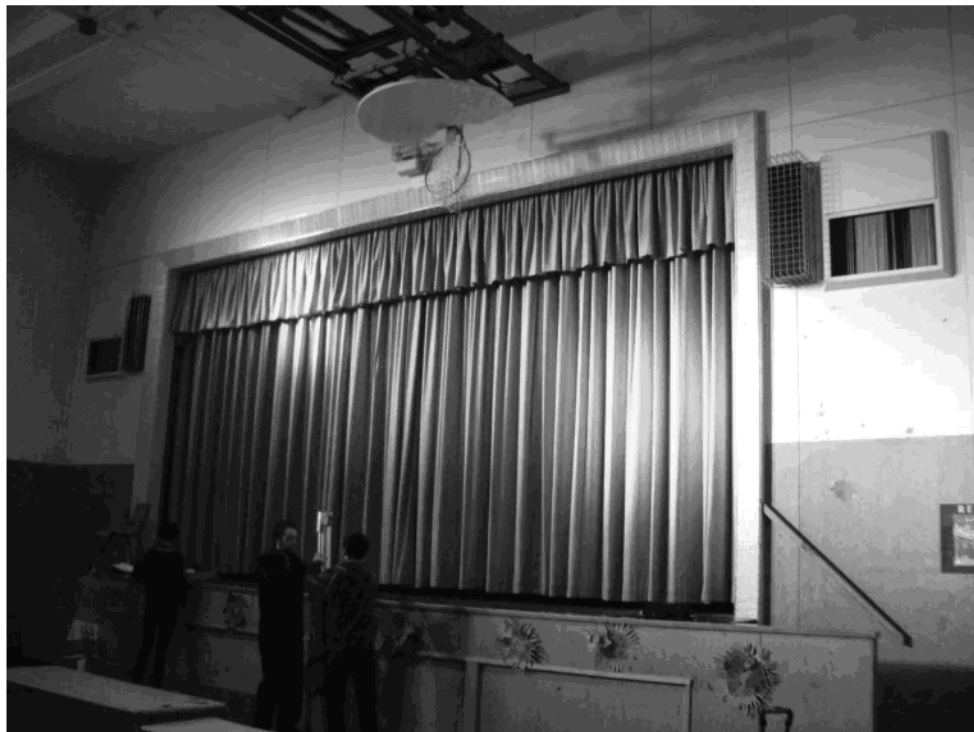


Figure 4: Wood Stage inside Gym



Figure 5: Entrance Stairs to Lunch Room in Basement of Gym Block



Figure 6: Inside Lunch Room



Figure 7: Boiler Room in Basement of Gym Block



Figure 8: North Wall of Boiler Room

Seismic Project Identification Report

REPORT NO. SPIR- 39-035

for

BLOCK #47-3 (1957 Change Rooms)

Lord Tennyson Elementary School

1936 West 10th Avenue, Vancouver, BC, V6J 2B2

Facility No: 3939047

School District No. 39

Vancouver School District

**Structural Engineering Guidelines for the
Performance-based Seismic Assessment and Retrofit of
Low-rise British Columbia School**

The Seismic Project Identification Report (SPIR) is a new report format that documents the seismic retrofit concepts proposed for a high risk school block.

The Ministry of Education (Ministry) requires that a School District submit an SPIR for any school block as the first step in the District's request for seismic retrofit funding.

APEGBC, as the Ministry's technical advisor for the Seismic Mitigation Program, was requested by the Ministry to develop the format and technical requirements for the SPIR.

SPIRs are due diligence documents that are designed to present seismic upgrading options to assist seismic safety planning by both the School District and the Ministry. The expectation is that SPIR information will guide the seismic upgrading of school blocks in a safe and cost-effective manner.

Ongoing feedback from engineering practitioners is encouraged to advance future refinements in the format for the SPIR document.

CHAPTER	Section Title	Page
	PREFACE	(ii)
1.0	BLOCK PHOTOGRAPHS	1-1
2.0	KEY PLAN AND ADJACENCY	2-1
3.0	BASIC EXISTING BLOCK DATA	3-1
4.0	PRINCIPAL ELEMENTS OF EXISTING BLOCK	
	Vertical Load-bearing Supports (VLS)	4-1
	LDRSs	4-1
	Out-of-Plane URM Walls	4-2
	Roof Diaphragm	4-2
	Floor Diaphragm	4-3
	Connections	4-3
5.0	RETROFIT PRIORITY RANKING FOR EXISTING BLOCK	5-1
6.0	RETROFIT OVERVIEW	6-1
7.0	PHASED RETROFIT	
	Retrofit Concept	7-1
	Retrofit LDRSs	7-3
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	Scope of Retrofit	7-3
	Retrofit Cost Estimate	7-3
	Schedule	7-4
	Construction Risks	7-4
8.0	LIFE SAFETY RETROFIT	
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	Retrofit LDRSs	8-3
	SPIR Benchmarks	8-3
	Scope of Retrofit	8-3
	Retrofit Cost Estimate	8-3
	Schedule	8-4
	Construction Risks	8-4
9.0	ENHANCED PERFORMANCE RETROFIT	9-1
10.0	RETROFIT SUMMARY	10-1
	APPENDIX A: SCOPE OF RETROFIT DETAILS	A-1
	APPENDIX B: RETROFIT COST ESTIMATE REPORT	B-1
	APPENDIX C: REPRESENTATIVE STRUCTURAL DETAILS	C-1
	APPENDIX D: PHOTOGRAPHS	D-1



Figure 1.1: 2-Storey Change Room Block in Front of 3-Storey Gym Block at South Elevation



Figure 1.2: Change Room (West Elevation)



Figure 1.3: Change Room (South Elevation)



Figure 1.4: Change Room (East Elevation)

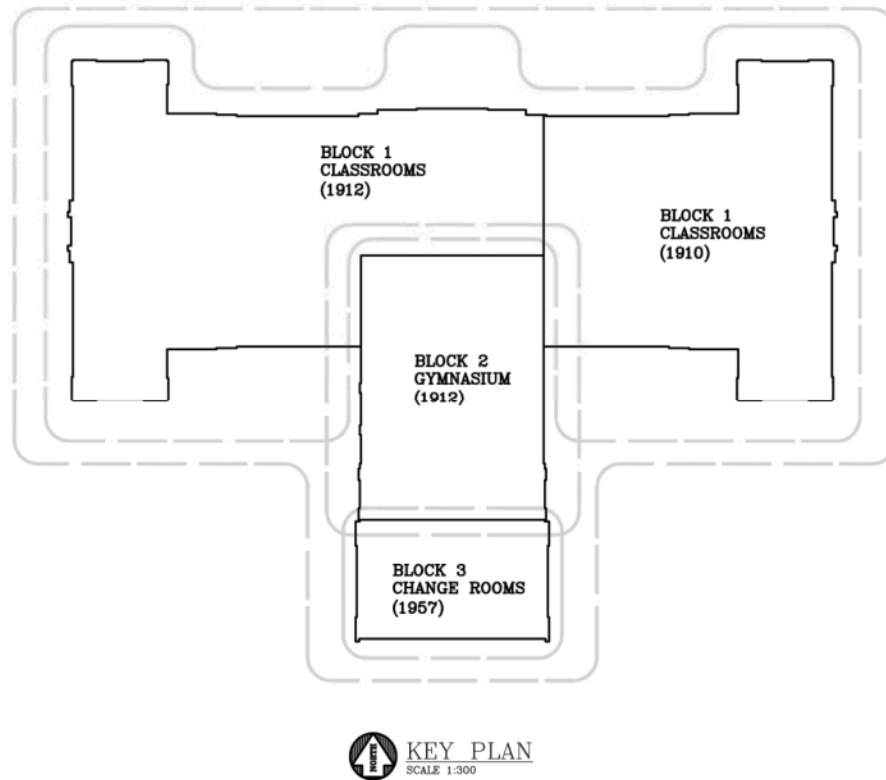


Figure 2.1: Key Plan for Lord Tennyson Elementary School

Identification of Retrofit Block (Box #2-1)

Block #3: Change Rooms (1957)

Adjacency (Box #2-2)

- ☐ No Significant Adjacency Issues
- ☒ Significant Adjacency Issues

Adjacency Comments (Box #2-3)

Block #3—Change Room has a lower wood roof with neither a gap nor obvious connections to the Block #2—Gym. The basement floors elevations are different; however, the main floors elevations are the same. Pounding in the N-S direction would occur between the blocks.

School District (Box #3-1)

SD 39—Vancouver

Block Name (Box #3-2)

Block 3—Change Rooms

Structural Firm (Box #3-3)

Genivar

Engineer-of-Record (Box #3-4)

Jim Shuttleworth, P.Eng., Struct.Eng.

Years of Construction (Box #3-5)

1957

Floor Area (Box #3-6)330 m²**Construction Type (Box #3-7)**

12 Concrete shearwalls w/ wood roof

Site Classification (Box #3-8)D (no geotechnical available
hence default was used)**Comments on Construction Type (Box #3-9)**

Concrete perimeter walls in east, south and west faces of the block. However, in the E-W direction the concrete wall stops below a continuous line of glazing underside of the roof. There is no apparent LDRS in the E-W direction from the Main Floor to the Roof except for the interior laminated wood partition which may only be sheathed with plywood for wall finishing.

Number of Storeys (Box #3-10)

2

Clear Storey Heights (Box #3-11)

Basement 2510mm; Main 3050mm

Previous Seismic Upgrade (Box #3-12)

<input checked="" type="checkbox"/>	No
<input type="checkbox"/>	Yes

Previous Seismic Upgrade Details (Box #3-13)

N/A

(1) Vertical Load-bearing Supports (VLS)**VLS Type (Box #4-1)**

Basement of Change Rooms: Non-Ductile
Reinforced Concrete Columns

Main Level of Change Rooms: Platform
Construction

VLS DDL (Box #4-2)

Non-Ductile Reinforced Concrete Cols: 1.25%

Platform Construction: 6.0%

Supports Description (Box #4-3)

The Change Rooms has a wood roof supported on 2x4 and 2x6 laminated walls sitting on concrete slabs and slab bands on the Main Floor which is then supported on concrete columns of 300mm x 300mm.

(2) LDRSs**Number of LDRS Prototypes (Box #4-4)**

2

LDRS Prototype Details (Box #4-5)

Shaking Direction	Prototype No.	LDRS Prototype Description	Max DDL	Capacity
Main-E-W	W-3 similar	Laminated wall with plywood finish	3.0%	1% W
Main N-S	C-4	Concrete Squat Wall	1.0%	40% W
Basement all direction	C-4	Concrete Squat Wall	1.0%	40% W

Comments on LDRS Prototypes (Box #4-6)

Concrete perimeter walls in east, south and west faces of the block act as squat shear walls. However, in the E-W direction the concrete wall stops below a linear line of glazing just under the roof. There is no apparent LDRS in the E-W direction from the Main Floor to the Roof except for the interior laminated wood partition which may only be sheathed with plywood for wall finishing.

(3) Out-of-Plane URM Walls**URM Walls (Box #4-7)**

- ☐ No
- ☒ Yes

Out-of-Plane Prototype Details (Box #4-8)

Prototype No.	Prototype Description	Max. Height	Wall Thickness	Surcharge
OP-2	URM Wall with inadequate connection at top in basement	2510	200	minimal

Comments on Out-of-Plane Prototypes (Box #4-9)

Connectivity at top is unknown. Bricks assumed to be built up to the underside of the beam or slab; a minimal surcharge can be expected.

(4) Roof Diaphragm**Roof Diaphragm Material (Box #4-10)**

- ☒ Wood ☐ Concrete
- ☐ Steel Deck ☐ Braced Steel

Roof Diaphragm Prototype Details (Box #4-11)

Prototype No.	Roof Diaphragm Prototype Description	Span	Max. Movement	Capacity
D-3	38mm x 127mm Tongue and Groove Decking N-S Dir.	16 m		1.6% Wd
D-3	38mm x 127mm Tongue and Groove Decking E-W Dir.	13 m		1% Wd

Comments on Roof Diaphragm (Box #4-12)

38mm x 127mm tongue and groove decking.

(5) Floor Diaphragm**Floor Diaphragm Material (Box #4-13)**

- ☐ Wood ☒ Concrete
- ☐ Steel Deck with Concrete Topping

Floor Diaphragm Prototype Details (Box #4-14)

Prototype No.	Floor Diaphragm Prototype Description	Span	Max. Movement	Capacity
N/A	Rigid			

Comments on Floor Diaphragm (Box #4-15)

Reinforced concrete slabs 150mm thick and slab bands 600mm x 450mm.

(5) Connections**Adequate Connections (Box #4-16)**

Roof Diaphragm / LDRS	<input type="checkbox"/>	Yes
	<input checked="" type="checkbox"/>	No
LDRS / Foundation	<input checked="" type="checkbox"/>	Yes
	<input type="checkbox"/>	No

Comments on Connections (Box #4-17)

Existing wood tongue and groove roof decking has no apparent load path to either the concrete perimeter walls or the interior wood laminated partition walls. However, the concrete floor slabs has shown to be well connected to the perimeter walls with hooked rebars. Connections to foundation are adequate; however, in the N-S Direction footing is expected to rock.

Risk Assessment Results (Box #5-1)

Principal Element	Prototype No.	Prototype Description	PDE
LDRS	C-4	Concrete Squat Shear Walls	0.2%
E-W LDRS	W-3	Wood Laminated Walls with Lath and Plaster	25%
N-S LDRS	R-1	Footing Rocking	15.6%
Roof Diaphragm N-S	D-3	38mm x 127mm Tongue and Groove Decking	41%
Roof Diaphragm E-W	D-3	38mm x 127mm Tongue and Groove Decking	34%
Out-of-plane Walls in Basement	OP-2	200mm brick partition with inadequate restraint at top	17.6%
Maximum LDRS PDE (refer to GDL note below)			25%
Existing Block Retrofit Priority Ranking			H1
Note: PDE of diaphragms are higher than LDRS			

Comments on Seismic Deficiencies, Recommended Testing and Risk Assessment Results (Box #5-2)

Drawings for concrete structure are available with rebar arrangement detailed; however, concrete strength and rebar type are unknown. Deformed bar of 275 MPa and concrete strength of 15 MPa were assumed. Main level wood framing are shown on architectural drawings.

Seismic Deficiencies:

- Absence of load path from roof diaphragm to LDRS.
- Very weak and high eccentric Wood Lath and Plaster LDRS in E-W directions above Main Floor.
- High eccentric Concrete Squat Wall LDRS in E-W directions because there is only the south wall in this direction but no wall where this block meet the Gym Block at the North.
- (4) independent 300 mm concrete shear walls in N-S direction have very little rocking resistance because of the small footings.
- Partition walls in basement likely do not meet out-of-plane requirements.

Testing and further investigation:

- Site specific geotechnical investigation to determine soil site class and bearing capacity.
- Testing to determine rebar and concrete strength.

Retrofit Options Documented (Box #6-1)

No.	Retrofit Performance Level	Chapter
1	Life-Safety Retrofit	8

Comments on Documented Retrofit Options (Box #6-2)

Enhanced Performance Retrofit is not considered in this report.

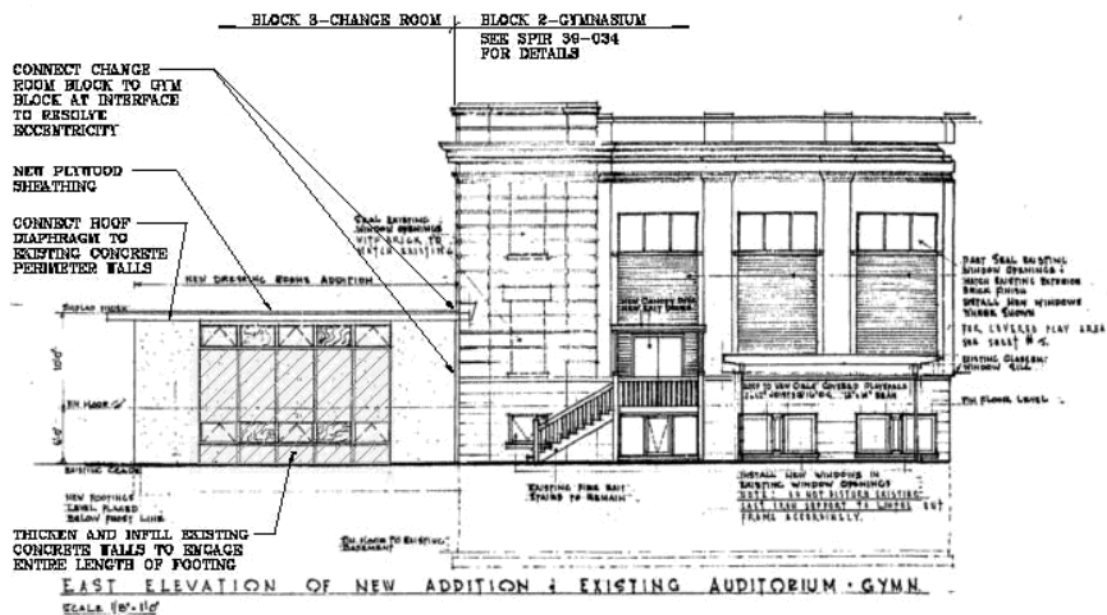
Phased Retrofit is not considered in this report. Except for the existing concrete walls in the N-S direction, all other elements have a H1 retrofit priority. However, the small footings under these concrete end walls acting individually are susceptible to overturning and also have a H1 retrofit priority. Rather than doing work to the footings, retrofit to the concrete walls to tie the two ends together such that they act as single units are included in the Life-Safety Retrofit.

However, if site specific geotechnical investigation determines a soil site class C, the PDE for R-1 (rocking of low-aspect ratio wall) and OP-2 (out-of-plane brick partition walls) will reduce to 8.6% and 7.5% respectively, as well as, to a H2 ranking. In such case, Phased Retrofit may be considered without retrofitting of the N-S direction concrete walls and the brick partitions.

(1) **Retrofit Concept**

Phased Retrofit is not Considered in this Report
as discussed in Box #6-2

(1) Retrofit Concept



RETROFIT CONCEPT FOR TENNYSON
GYM AND CHANGE ROOM BLOCK

Figure 8.1: Typical Section –

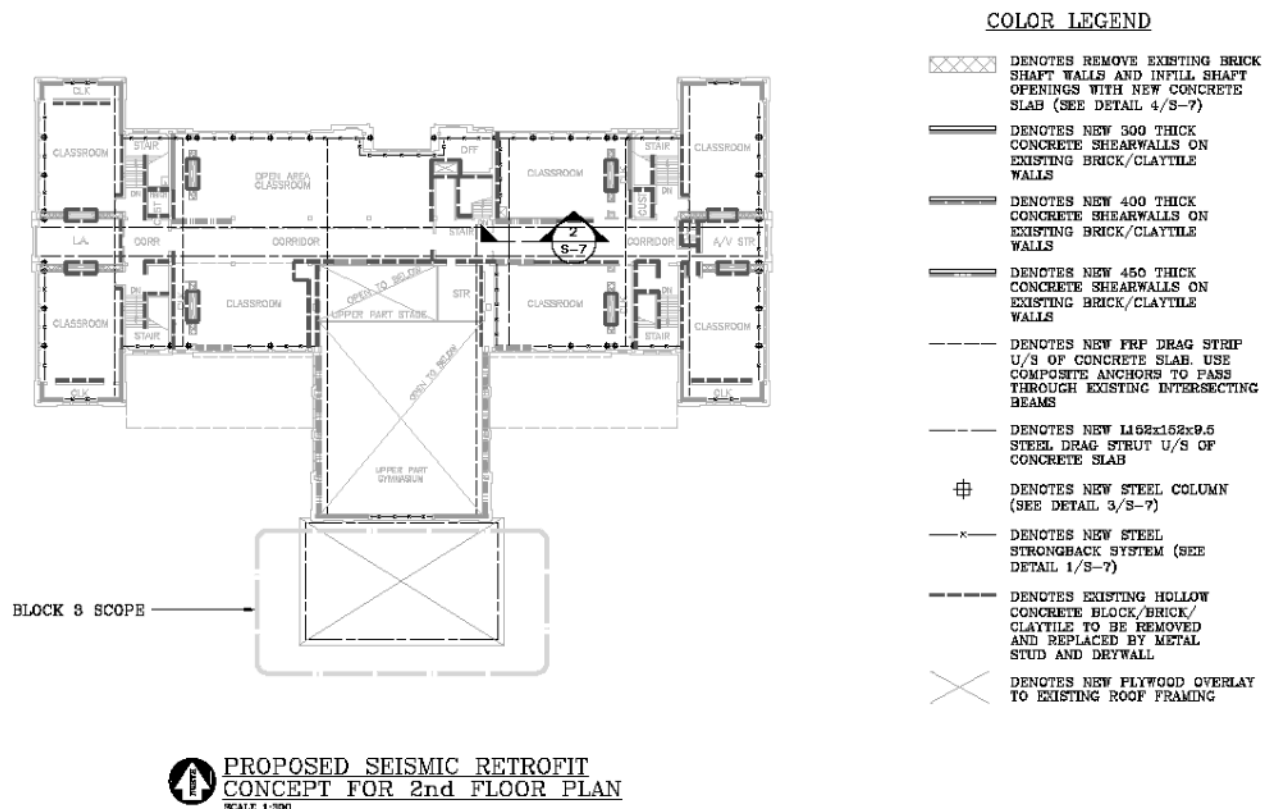


Figure 8.2: Typical Plan –

Comments on Figure 8.1 and Figure 8.2 (Box #8-1)

- Provide new plywood sheathing overlay to existing roof along with blocking and connections to perimeter concrete walls which will be used as Squat Shear Walls.
- Connect this block both at Main Floor and at Roof to the Gym Block to solve eccentricity and pounding issues.
- Thicken existing concrete wall and infill window openings between the 300 walls each end along the east and west face to engage the entire length of footing to resist uplift.
- New steel stud partitions to replace existing brick partitions in basement.
- See Appendix C for complete drawings of the proposed seismic retrofit concept.

(2) Retrofit LDRSs**Number of Retrofit LDRS Prototypes (Box #8-2)**

1

Retrofit LDRS Prototype Details (Box #8-3)

Shaking Direction	Prototype No.	LDRS Prototype Description	Max PDE	Max DDL	R _m
Both	C-4	Concrete Squat Shear Wall	2%	1%	22.5% W

Comments on Retrofit LDRS Prototypes (Box #8-4)

Use existing perimeter walls as concrete squat shear wall.

(3) SPiR Benchmarks**Benchmark SPiRs (Box #8-5)**

Benchmark SPiR No.	Benchmark SPiR Description	Retrofit Cost (\$ / m ²)
N/A		
Comments:		

(4) Scope of Retrofit

Refer to Appendix A for details on the scope of work for both the structural and non-structural retrofits.

(5) Retrofit Cost Estimate

Refer to Appendix B for details on the retrofit cost estimate for the life safety retrofit. A summary of the life safety retrofit is given in Chapter 10.

(6) Schedule**Schedule (Box #8-7)**

No.	Schedule Issue	Value
1	Temporary Accommodations	Unknown
Comment on Operational Disruption: The life-safety retrofit will require this block to be vacated for an estimated time of two months.		

(7) Construction Risks**Risks (Box #8-8)**

Risk Description	Significant Risk			
Asbestos	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No
Vermiculite	<input type="checkbox"/>	Yes	<input checked="" type="checkbox"/>	No
Lead Paint	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No

Risk Management Comments (Box #8-9)

Asbestos and lead paint risks appeared to be present as observed during site visit. Material testing to identify the extent of such risks shall be considered before a representative budget can be finalized.

Summary of Enhanced Performance Retrofit (Box #9-1)

Enhanced Performance Retrofit is not considered in this report.

Conclusions (Box #10-1)

1. Type of Block

The Change Room Block has a wood roof on a concrete box with walls on only 3 sides. The side that is adjacent to the Gym Block has no seismic gap or connection which makes this Block highly eccentric. The Block is classified as a high risk (H1) block. Retrofit Options

Only Life-safety retrofit is considered in this report. This retrofit will upgrade existing perimeter walls to be used as Concrete Squat Shear Wall LDRS. The upgraded blocks would have a Low Seismic Risk.

2. Schedule

Estimated construction period of 2 months.

3. Risks

Hazardous materials are present and there may be a potential of low concrete strength. Testing will be required to clearly define the scope.

Conclusions: Retrofit Cost Estimates (Box #10-2)

Life-Safety Retrofit: \$365,800 (\$1,108/m²)

Recommendations (Box #10-3)

Should seismic upgrade be considered, material testing should be done to provide more information prior to detailed design.

Seismic Project Identification Report

APPENDIX A SCOPE OF RETROFIT DETAILS for BLCK #47-3 (1957 Change Rooms) Lord Tennyson Elementary School

Table A.1: Scope of Structural Phased Retrofit

No.	Construction Activity	Approx. Quantity
	Phased Retrofit not considered in this report	

Table A.2: Scope of Structural Life Safety Retrofit

No.	Retrofit Detail	Construction Activity	Approx. Quantity
See Drawings S-1 to S-7 for complete proposed retrofit concept.			
1	Dwg S-6	Thicken existing perimeter walls from 200 mm to 300 mm	45 m ²
2	Dwg S-6	New concrete infill to replace existing windows	200 mm x 2.6 m ² 300 mm x 3.6 m ²
3	Dwg S-6	New concrete infill to replace existing concrete blocks	300 mm x 4.4 m ²
4	CD # 1	FRP strips to tie main floors of Change Rooms and Gym	Main Floor 20 m
5	Det 2 / S-7	Steel angle L152x152x9.5 connections to shear walls in this Block and Gym Block	Main Floor 16 m Roof 58 m
6	WD # 1	New plywood roof diaphragm	202 m ²
See Table A-4 for Non-structural Retrofits which form part of this Life Safety Retrofit.			

Table A.3: Scope of Structural Enhanced Performance Retrofit

No.	Construction Activity	Approx. Quantity

Table A.4: Scope of Non-Structural Retrofits

No.	Non-structural Hazard and Retrofit Detail	Description of Non-structural Upgrading	Approx. Quantity
1	Out-of-plane URM # 1	New steel stud partitions to replace existing brick partitions in basement	21m
These non-structural retrofits are part of the Life Safety Retrofit.			

Seismic Project Identification Report

APPENDIX B

RETROFIT COST ESTIMATE REPORT

for

BLOCK #47-3 (1957 Change Rooms)

Lord Tennyson Elementary School

Retrofit Cost Estimate Report

SEISMIC RETROFIT ESTIMATE - PROJECT SUMMARY

	LIFESAFETY RETROFIT	PHASED RETROFIT
	BLOCK 3 (CHANGE ROOM)	BLOCK 3 (CHANGE ROOM)
Building Construction Type	12	
Seismic Risk	H1	
Site Class	D	
Number of Stories	2	
Gross Floor Area (m2)	330	
CONSTRUCTION COST ESTIMATE		
<u>Site Development</u>	\$7,900	
<u>SEISMIC UPGRADE WORK</u>		
Selective Demolition:	\$28,100	
Earthwork	\$8,100	
Concrete Work- Foundations & shearwalls	\$66,800	
Soils Anchors	\$0	
Masonry & URM, Include brick restraint	\$11,600	
Diaphragm Upgrades & Connections	\$37,800	
Other	\$0	
Roofing	\$43,400	
Exterior Wall Cladding, Windows & Doors	\$25,300	
Partitions & Doors	\$7,100	
Finishes	\$7,000	
Millwork, Specialties	\$0	
Electrical Work	\$10,700	
Mechanical Work	\$11,700	
Asbestos & Lead Paint Remediation	\$9,900	
Required CODE Upgrades	\$0	
Non Structural Items	Not Included	
Site Specific PHASING COSTS	\$0	
Contractor Site Overheads & Markup	\$42,700	
Design Contingency & Unspecified Risk 15%	\$47,700	
TOTAL CONSTRUCTION (excl. Tax)	\$1,108.48	\$365,800

TEMPORARY ACCOMMODATION, Portables	Excluded
SOFT COSTS, Design Fees, Contingency, Permits, Payable Taxes	Excluded

Facility Code	3939047
LIFESAFETY RETROFIT	

SEISMIC RETROFIT ESTIMATE		BLOCK 3 (CHANGE ROOM)		
Building Construction Type	12	Seismic Risk	H1	1957 Two Storey Change Room Block
Overview Description of Work		Site Class	D	New CIP Shear Walls, Foundations, Dragstrut connections, Restrain/replace HCB/URM
		GROSS FLOOR AREA 330 m2		
Site Development		\$7,900		
Re/re existing pavement, site works for seismic foundations		30 m2	85.00	2,600
Other Related Site Work - Footing Drains		35 m	150.00	5,300
Fire Water Main				0
SEISMIC UPGRADE WORK		\$1,084.55 /m2 \$357,900		
Selective Demolition:		28,100		
Interior Finishes, Specialties, Fittings etc.		165 m2	45.00	7,400
Interior finishes, millwork etc below window				0
Interior slab removal - strip 1.8m wide for grade beam				0
Interior slab removal - strip 4.5m wide for grade beam				0
Strip finishes of existing Ext wall at NEW Shearwalls		45 m2	60.00	2,700
Strip finishes of existing Ext wall at Strongback		m	203.00	0
Demol URM walls for replacement		21 m	300.30	6,300
Ceiling finishes 2.0m w at perimeter of interior wall upgrades		36 m	97.50	3,500
Remove Windows		8 No.	Item	5,200
Miscell demolition		10%	Item	3,000
Earthwork		8,100		
Earthwork - interior for grade beam				
Earthwork - exterior wall thickening		12 m	400.00	4,800
Hand trim adjacent existing footing		24 hrs	45.00	1,100
Backfilling, make good		12 m3	180.00	2,200
Disposal offsite		0 m3	85.00	0
Concrete Work- Foundations & shearwalls		66,800		
Concrete Foundations				0
Concrete Thickening existing wall - 100mm		45.0 m2	1,100.00	49,500
Concrete infil openings		9.1 m2	1,152.50	10,500
Anchors, drilled/dowel anchors to existing walls		325 No.	21.00	6,800
Soils Anchors		0		
GEWI Soil Anchors / Mini-Piles				
Masonry & URM, Include brick restraint, FRP		11,600		
Metal stud strongback/restrain walls	URM#1			0
FRP strips to NEW walls incl. prep (drag struts)		20 m	436.50	8,700
Steel strong back to exterior wall		0 m	542.50	0
HSS column at exterior walls		No.	800.00	0
Drilled/epoxy Hilti anchors		0 No.	21.00	0
Metal stud framing to replaced paritions		53 m2	55.00	2,900

Facility Code	3939047
LIFESAFETY RETROFIT	

SEISMIC RETROFIT ESTIMATE		BLOCK 3 (CHANGE ROOM)		
Diaphragm Upgrades & Connections		37,800		
Floor Diaphragm Upgrade				0
Roof Diaphragm Upgrade	202 m2	68.00	13,700	
Steel angle L152x152x9.5 drag strut/connection	74 m	325.00	24,100	
Other		0		
Exterior Building Envelope Work		\$208.18 68,700		
<u>Roofing</u>				
Re/re Roofing	202 m2	215.00	43,400	
Re/re roofing in strips - top of new shear wall			0	
<u>Exterior Wall Cladding, Windows & Doors</u>				
Cladding new exterior shear walls	54 m2	375.00	20,300	
Windows		Remain in place - NO Work		
Miscell envelope remedial work		Allow	5,000	
New framed wall/sheathing			0	
Doors			Remain	
Overhangs, Soffits			Remain	
Interior Work		\$42.73 14,100		
<u>Partitions & Doors</u>				
New Studs, Drywall, Insulation, VB on exterior walls	0 m2	105.00	0	
New Drywall on upgraded strong backed walls 1 layer/furring	m2	68.00	0	
New Drywall on replaced walls avge 2.5 layers D/W, 30% batts	133 m2	31.00	4,100	
Stairs - Remedial work due to new walls			0	
Doors/Frames/Hardware replace	2 No.	1,500.00	3,000	
<u>Finishes</u>				
Reinstate Floor Finishes			0	
Reinstate Floor Finishes - nominal repair/remedial in remain	10%	Item	2,500	
Reinstate Ceilings - perimeter			0	
Remedial ceiling work adjacent areas & paint exposed struct.	15%	Item	3,200	
Wall Finish - paint drywall	106 m2	12.00	1,300	
Wall Finish - wood panel /dado (to match existing)			0	
Wall Finish - Tectum acoustic			0	
Wall Finish - ceramic tile			0	
<u>Millwork, Specialties</u>				
Re/re Millwork			0	
Re/re Whiteboards. Cloak Rm etc.			0	
Washrooms			0	
Specialties,	165 m2	15.00	0	
Electrical Work		\$32.42 10,700		
Elec work - redo in walls	165 m2	65.00	10,700	
Mechanical Work		\$35.45 11,700		
Plumbing Sinks/WC's etc	Fxt		0	
Sprinklers - re/re	165 m2	11.00	1,800	
HVAC - replace heating pipework, ductwork, louvre/diffusers	165 m2	60.00	9,900	
Asbestos & Lead Paint Remediation		165 m2 \$60.00 9,900		
Required CODE Upgrades		0		
Non Structural Items		Not Included		
Site Specific PHASING COSTS Block Vacated		0% 0		
Contractor Site Overheads & Markup (incl. on site)		15.5% 42,700		
Design Contingency & Unspecified Risk (incl. on site)		15% 47,700		
TOTAL CONSTRUCTION (Excluding HST)		\$1,108.48 \$365,800		

Seismic Project Identification Report

APPENDIX C

REPRESENTATIVE STRUCTURAL DETAILS

for

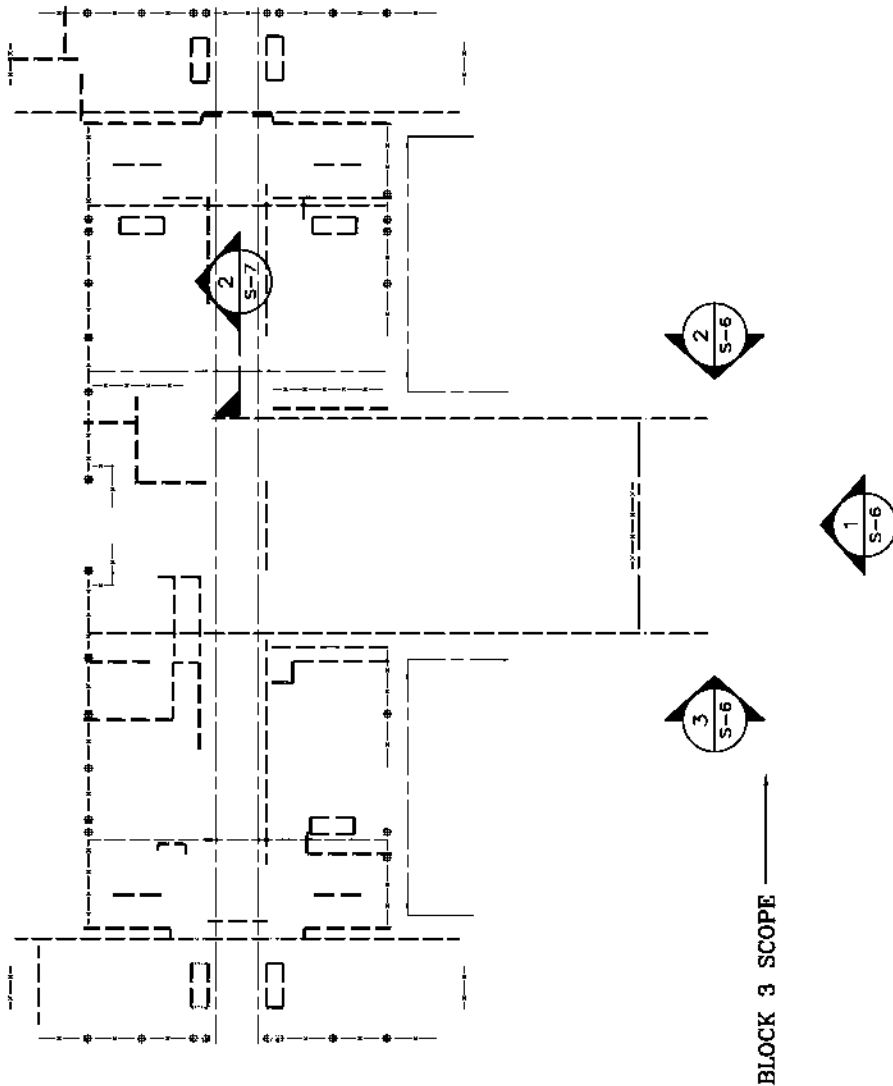
BLOCK #47-3 (1957 Change Rooms)

Lord Tennyson Elementary School

Representative Structural Details

COLOR LEGEND

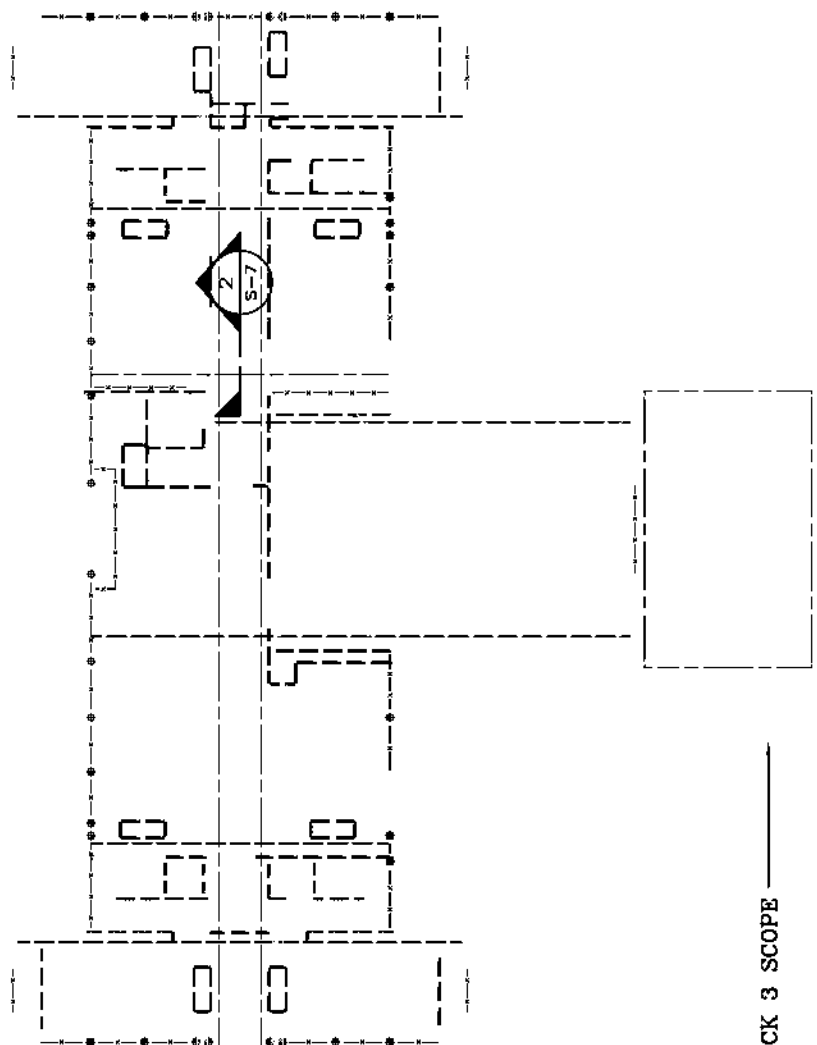
- _____ DENOTES REMOVE EXISTING BRICK SHAFT WALLS AND INFILL. SHAFT OPENINGS WITH NEW CONCRETE SLAB (SEE DETAIL 4/S-7)
- _____ DENOTES NEW 300 THICK CONCRETE SHEARWALLS ON EXISTING BRICK/CLAYTILE WALLS
- _____ DENOTES NEW 400 THICK CONCRETE SHEARWALLS ON EXISTING BRICK/CLAYTILE WALLS
- _____ DENOTES NEW 450 THICK CONCRETE SHEARWALLS ON EXISTING BRICK/CLAYTILE WALLS
- _____ DENOTES NEW FRP DRAG STRIP U/S OF CONCRETE SLAB. USE COMPOSITE ANCHORS TO PASS THROUGH EXISTING INTERSECTING BEAMS
- _____ DENOTES NEW L152x152x9.5 STEEL DRAG STRUT U/S OF CONCRETE SLAB
- ⌘ DENOTES NEW STEEL COLUMN (SEE DETAIL 3/S-7)
- x — DENOTES NEW STEEL STRONGBACK SYSTEM (SEE DETAIL 1/S-7)
- _____ DENOTES EXISTING HOLLOW CONCRETE BLOCK/BRICK/CLAYTILE TO BE REMOVED AND REPLACED BY METAL STUD AND DRYWALL
- _____ DENOTES NEW PLYWOOD OVERLAY TO EXISTING ROOF FRAMING





 PROPOSED SEISMIC RETROFIT
 CONCEPT FOR MAIN FLOOR PLAN
 SCALE: 1:300

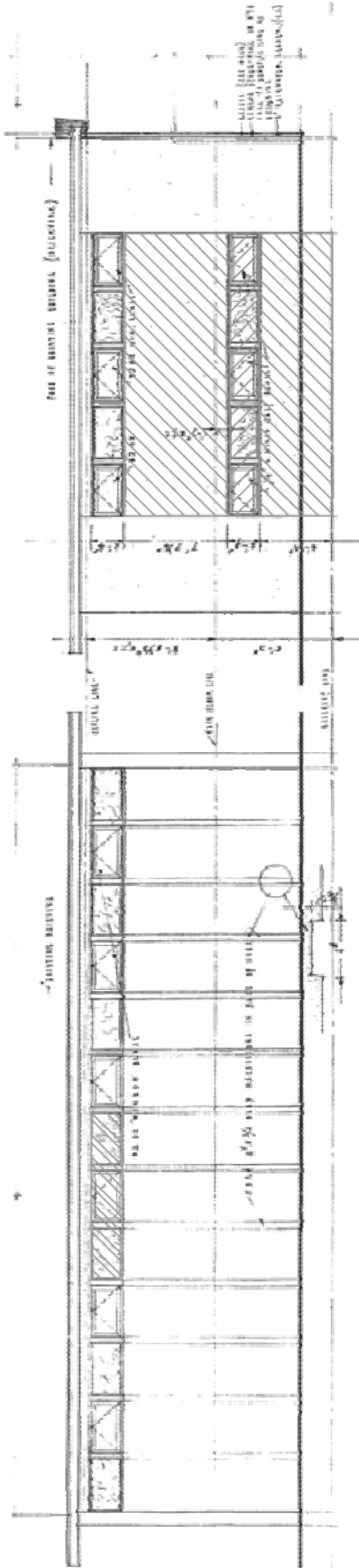
COLOR LEGEND

- DENOTES REMOVE EXISTING BRICK SHAFT WALLS AND INFILL SHAFT OPENINGS WITH NEW CONCRETE SLAB (SEE DETAIL 4/S-7)
- DENOTES NEW 300 THICK CONCRETE SHEARWALLS ON EXISTING BRICK/CLAYTILE WALLS
- DENOTES NEW 400 THICK CONCRETE SHEARWALLS ON EXISTING BRICK/CLAYTILE WALLS
- DENOTES NEW 450 THICK CONCRETE SHEARWALLS ON EXISTING BRICK/CLAYTILE WALLS
- DENOTES NEW FRP DRAG STRIP U/S OF CONCRETE SLAB. USE COMPOSITE ANCHORS TO PASS THROUGH EXISTING INTERSECTING BEAMS
- DENOTES NEW L152x152x9.5 STEEL DRAG STRUT U/S OF CONCRETE SLAB
- ⊕ DENOTES NEW STEEL COLUMN (SEE DETAIL 3/S-7)
- x— DENOTES NEW STEEL STRONGBACK SYSTEM (SEE DETAIL 1/S 7)
- DENOTES EXISTING HOLLOW CONCRETE BLOCK/BRICK/CLAYTILE TO BE REMOVED AND REPLACED BY METAL STUD AND DRYWALL
- DENOTES NEW PLYWOOD OVERLAY TO EXISTING ROOF FRAMING



BLOCK 3 SCOPE

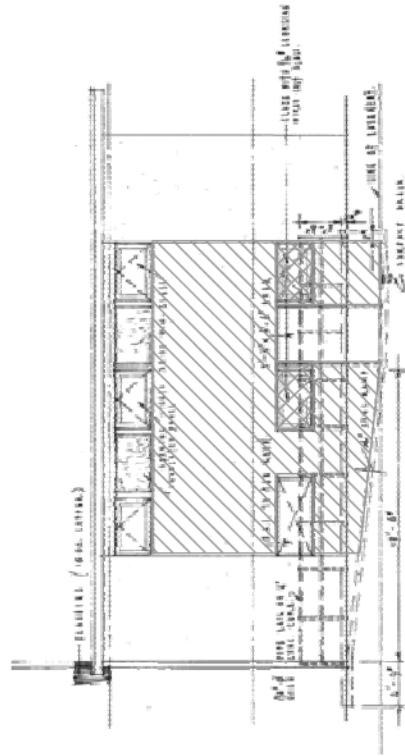

 PROPOSED SEISMIC RETROFIT
 CONCEPT FOR 2nd FLOOR PLAN
 SCALE 1:500



1 SOUTH ELEVATION CHANGE ROOM
S-2 N.T.S.







2 EAST ELEVATION CHANGE ROOM
S-2 N.T.S.

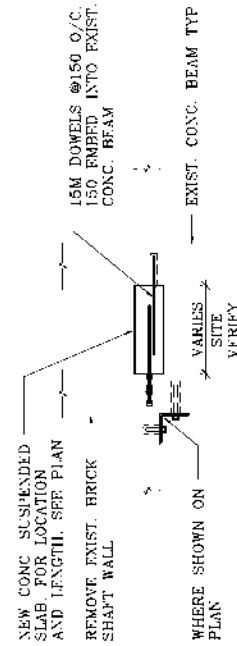
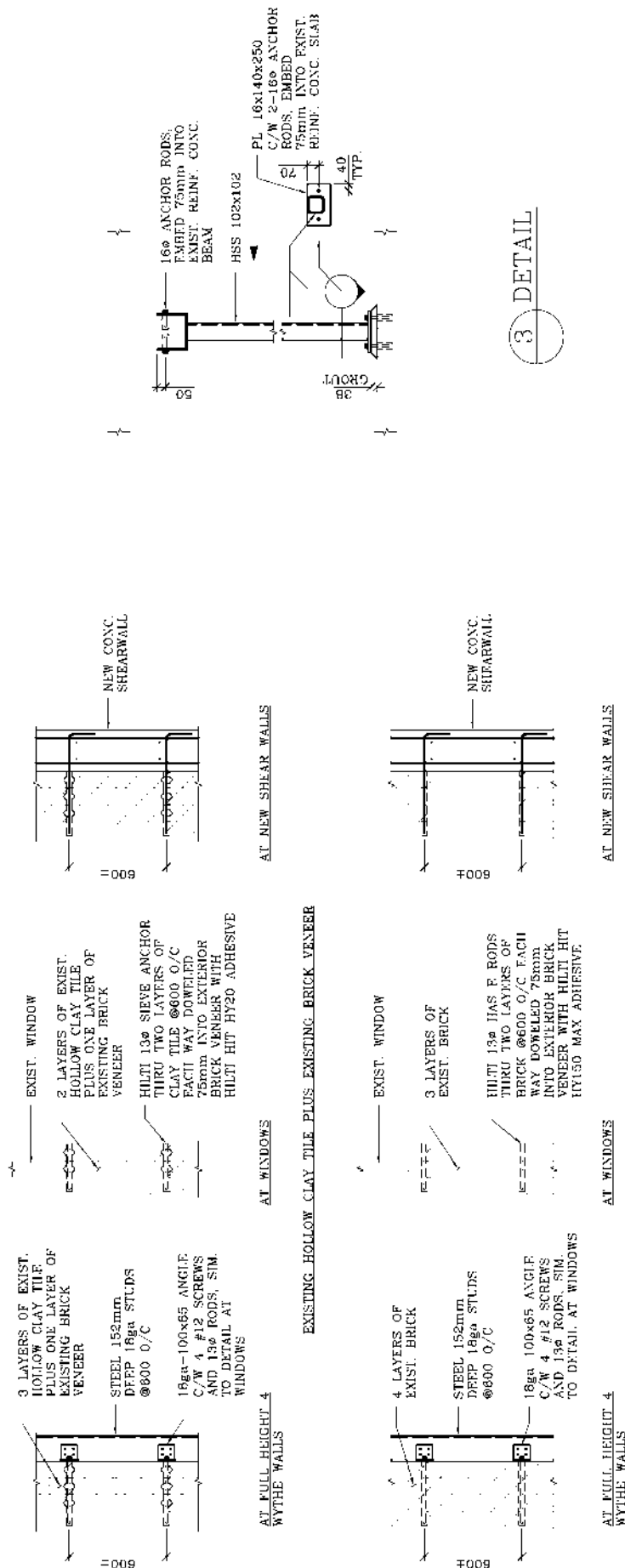


3 WEST ELEVATION CHANGE ROOM
S-2 N.T.S.

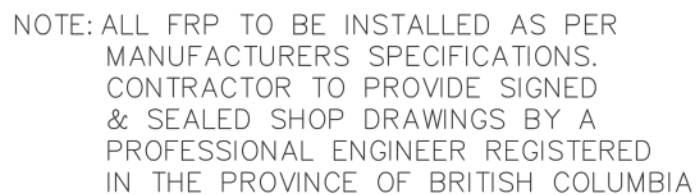


COLOR LEGEND

-  DENOTES CAST 100 NEW CONCRETE AGAINST OUTSIDE FACE OF EXISTING 200 CONCRETE WALL
-  DENOTES REMOVE EXISTING WINDOWS AND INFILL WITH 200 CONCRETE WALL
-  DENOTES REMOVE EXISTING WINDOWS AND INFILL WITH 300 CONCRETE WALL
-  DENOTES REMOVE EXISTING BLOCKS AND INFILL WITH 300 CONCRETE WALL

TYPICAL ANGLE DIAPHRAGM
DRAG STRUT CONNECTION

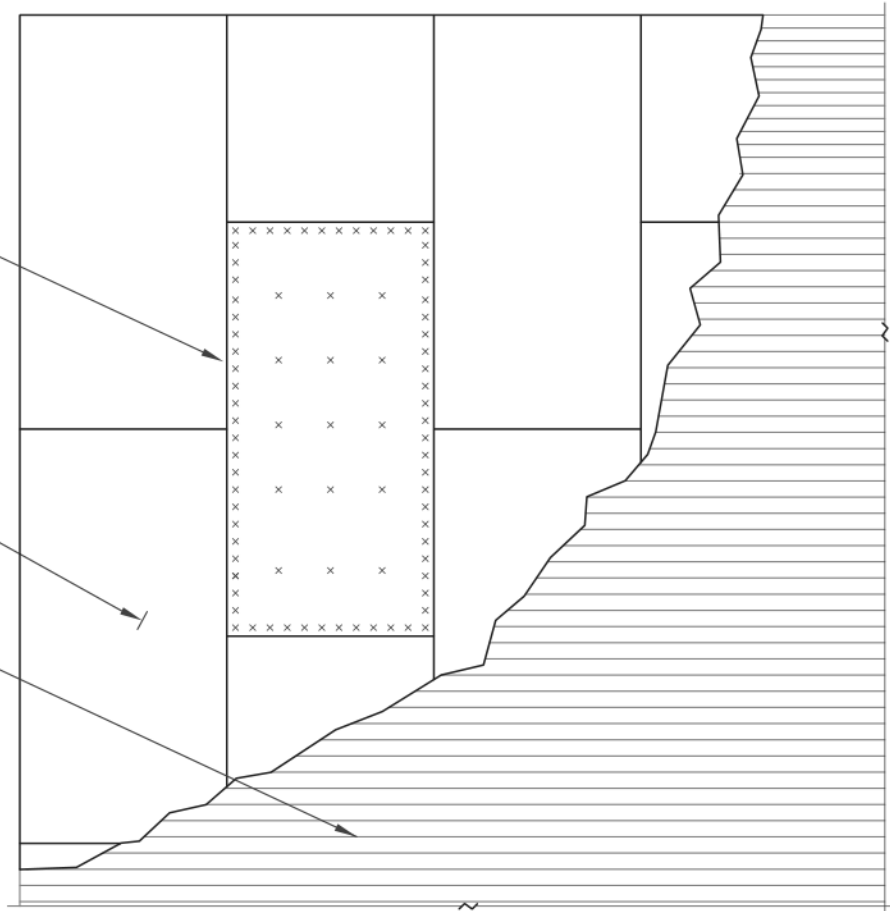
4 TYPICAL FLOOR SLAB DIAPHRAGM INFILL



NAILS ALONG
PLYWOOD PANEL
EDGES +
INTERIOR FIELD

PLYWOOD AS REQ'D
STAGGER JOINTS

EXISTING
WOOD DECKING



NOTES

1. ROOF SHEATHING TO BE NAILED WITH 64 NAILS (3.3mm \emptyset). DO NOT USE THIN GAUGE GUN NAILING STAPLES OR NAILS. NOTCHED HEAD NAILS ARE NOT ACCEPTABLE.
2. DO NOT NAIL THROUGH EXISTING JOINTS IN TONGUE AND GROOVE DECKING.
3. STAGGER JOINTS AND ORIENT PLYWOOD PANELS PERPENDICULAR TO DIRECTION OF TONGUE AND GROOVE DECKING.
4. NAIL TO CHORDS, DRAG STRUTS AND SHEAR WALLS

SEISMIC RETROFIT GUIDELINES
FIRST EDITION

LIBRARY OF RETROFIT DETAILS

APRIL 2011

WOOD DIAPHRAGM #1
SHEATH EXISTING ROOF WITH NEW PLY
AND ADD SHEET METAL STRAPS

SCALE
N.T.S

SHEET No.

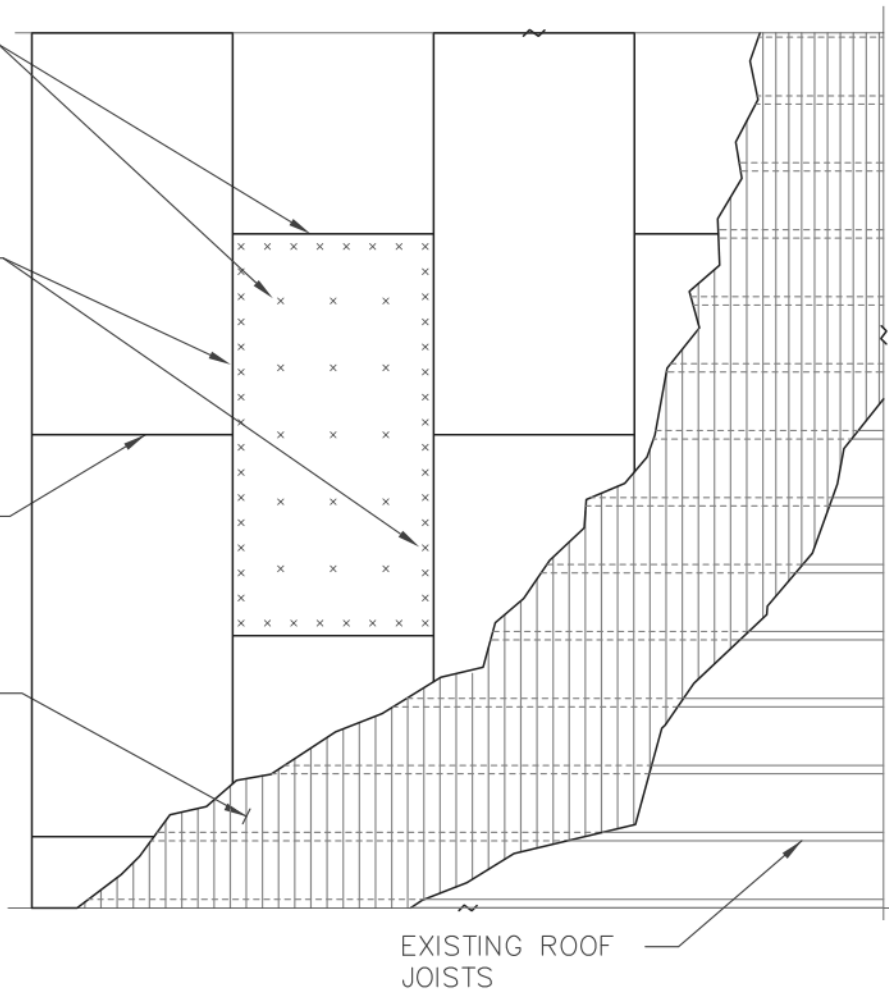
WD
#1(1/3)

75 NAILS @100 O.C.
ALONG PLYWOOD
PANEL EDGE
AND @300 O.C. AT
INTERMEDIATE
SUPPORTS

38 NAILS @100 O.C.
ALONG PLYWOOD
PANEL EDGES
RUNNING
PERPENDICULAR
TO SUPPORTS

LOCATE PLYWOOD
JOINTS OVER EXIST.
JOISTS / STRAPPING
TYPICAL

EXISTING SHIP LAP



NOTE:
NAILING FOR ILLUSTRATION ONLY,
DESIGN TO SUIT SPECIFIC REQMT'S

SEE SHT 1/3 FOR ADDITIONAL NOTES

SEISMIC RETROFIT GUIDELINES FIRST EDITION

LIBRARY OF RETROFIT DETAILS

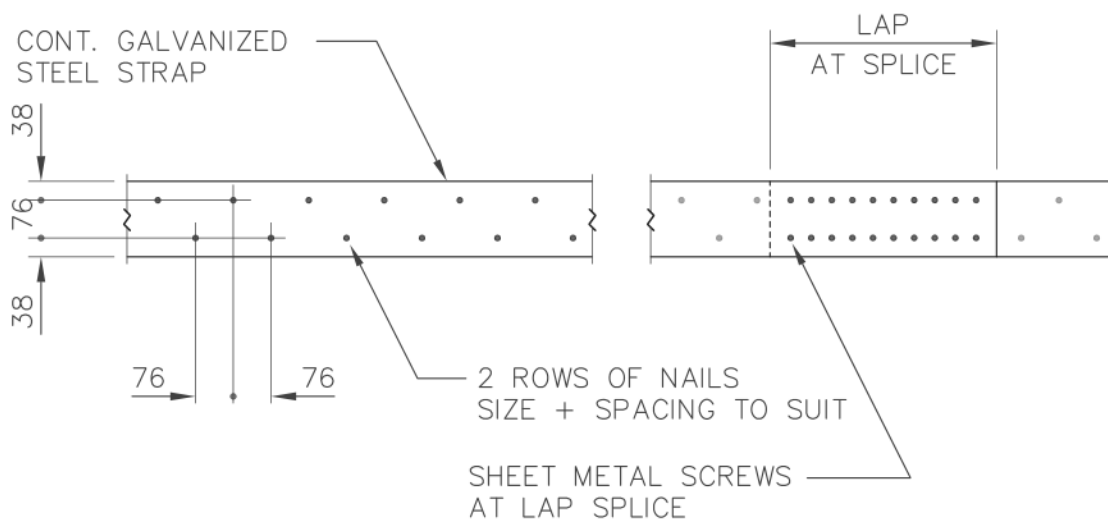
APRIL 2011

WOOD DIAPHRAGM #1
SHEATH EXISTING ROOF WITH NEW PLY
AND ADD SHEET METAL STRAPS

SCALE
N.T.S

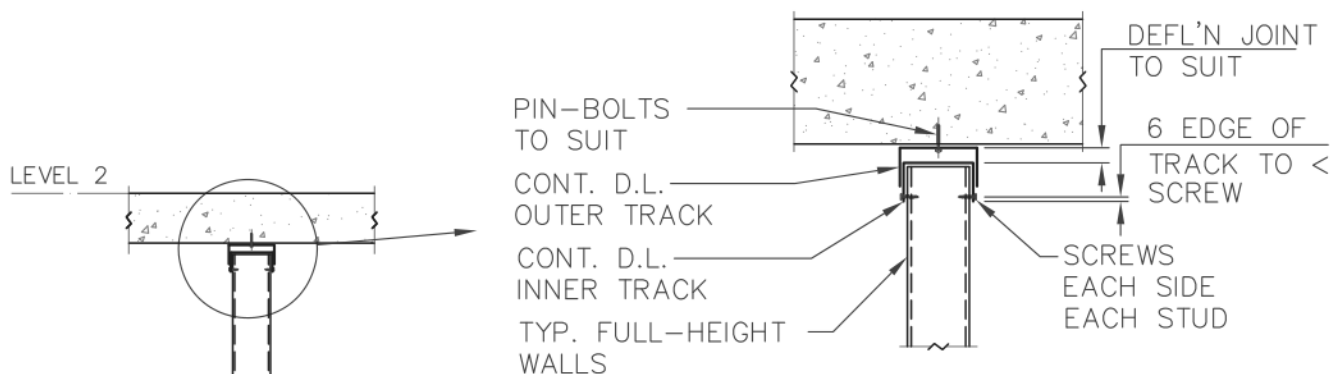
SHEET No.

WD
#1(2/3)

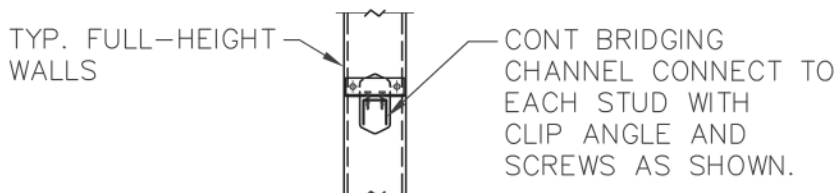


NOTES

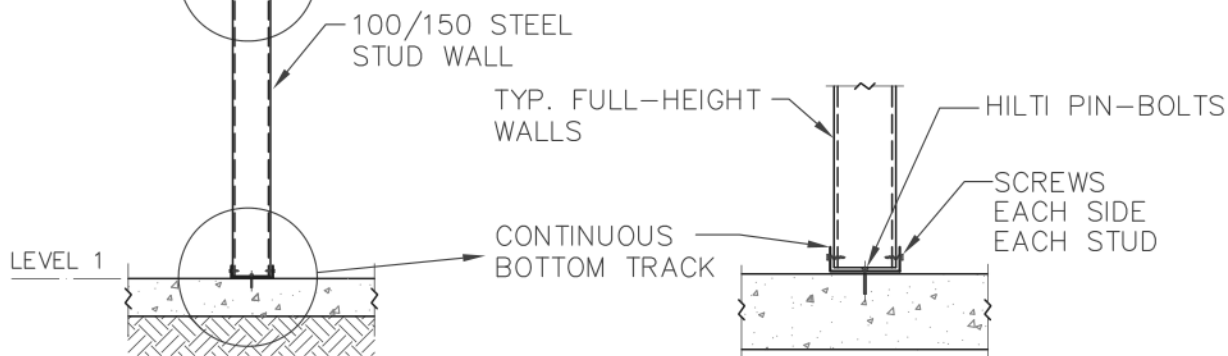
1. CONTINUOUS GAUGE STEEL STRAP TO BE CENTRED OVER WALLS OR BLOCKING
2. FASTEN TO PLYWOOD SHEATHING WITH 2 ROWS OF NAILS AND SPLICE AS PER DETAILS.



TYPICAL DEFLECTION HEAD DETAIL
CONCRETE OPTION EXTERIOR WALLS



TYPICAL BRIDGING DETAIL



TYPICAL BASE DETAIL

SEISMIC RETROFIT GUIDELINES
FIRST EDITION

LIBRARY OF RETROFIT DETAILS

APRIL 2011

URM/HCT PARTITION #1

REMOVE AND REPLACE WALL
WITH STEEL STUD WALL

SCALE
N.T.S.

SHEET No.

URM
#1

Seismic Project Identification Report

APPENDIX D PHOTOGRAPHS for BLOCK #47-3 (1957 Change Rooms) Lord Tennyson Elementary School

Change Room Block Photographs



Figure 1: Change Room Block West Wall



Figure 2: Change Room Block South Wall



Figure 3: Change Room Block East Wall