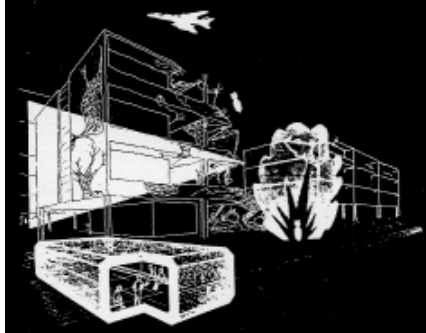


Eytan Building Design Consultancy Services

in the design of protective structures and systems



E.B.D is an international consulting architect-engineer firm specializing in the design of protective structures and systems capable of withstanding the effects of various types of weapons.

Our firm provides consulting services concerning the hardening and protection of structures against conventional, chemical, biological or atomic warfare, terrorist, commando attacks and sabotage.

We have vast experience in the design of hardening and protection systems for both new and existing structures.

- **Field and coastal fortifications:** Weapons emplacements, fighting and communication trenches, personnel shelters, observation posts, gun batteries, ammunition bunkers, functional structures: command posts, headquarters, communication centers, etc.
- **Military structures in forward areas:** Command posts, headquarters, communication centers, observation and radar centers, hospital and first-aid facilities.
- **Structures containing materials which can cause accidental explosions:** Munitions storage, chemical plants, production facilities, oil storage and refineries, fuel and gas pipelines.
- **Civil defense shelters and protected spaces for population.**
- **Town and rural settlements needing protection:** Along borders, near important military and civil targets.
- **Important civil structures requiring hardening:** Hospitals, airport facilities, hotels, governmental and official buildings, computer centers, nuclear and conventional power plants, communication centers, important industrial facilities.
- **Military functions in rear areas:** Military bases, storage facilities, military equipment production, repairs and service centers, air bases and airfield installations, operation and control centers, transport facilities, personnel shelters.
- **All types of high rise structures:** Prevention of progressive collapse and of severe injuries from glazing fragments.



EYTAN BUILDING DESIGN LTD.
27 Motta Gur St., Tel Aviv 69694, Israel
Tel: 972-3-6428480, 972-3-6418381, Fax: 972-3-6429355
www.ebd.co.il
e-mail: ebd@netvision.net.il

Eytan Building Design

Company Profile

EYTAN BUILDING DESIGN LTD.

President & Chief Engineer:

Reuben Eytan

Director & Chief Architect:

Micaela Eytan

Number of employees: 14

Date established: 1974

Ownership: Private (Reuben & Micaela Eytan)

The company is an architect-engineer consulting firm specializing in the design of protective structures to withstand the effects of different attacks.

We are involved in research and development, computer-assisted analysis of threats, vulnerability, risk assessment and optimization of protective measures, design of physical security measures, hardening of structures and installations as well as recommendations of the most cost-effective protective measures. We have vast practical experience and are involved in many projects worldwide.

List of clients - in Israel

Ministry of Defense.

Air Force.

Corps of Engineers.

Military Construction Department.

Home Front Command .

Navy.

Police.

Prisons Authority.

Israel Aircraft Industries.

Israel Military Industries.

Ministry of Finance.

Ministry of Housing.

Atomic Energy Commission.

Municipalities.

Commercial and industrial facilities owners.

High tech facilities owners.

Entrepreneurs and Contractors.

Architects and Consulting Engineers.



EYTAN BUILDING DESIGN LTD.

27 Motta Gur St., Tel Aviv 69694, Israel

Tel: 972-3-6428480, 972-3-6418381, Fax: 972-3-6429355

www.ebd.co.il

e-mail: ebd@netvision.net.il

Eytan Building Design

Practical Experience

Dear reader,

I have compiled this summary of the Israeli practical experience in the design of protective structures, withstanding the effects of weapons and explosive charges, by using my own "generation-long" (33 years) involvement in the various aspects of protective design.

I owe my structural engineering training to the Israeli Institute of Technology, Haifa, Israel, where I received my M.Sc. in 1968 and my knowledge in the field of protective structures to the Israeli Corps of Engineers and the Military Construction Center, of which I was a member in active as well as reserve duty for my whole professional life.

Like with every man, you should look for the woman with him - "cherchez la femme". It is my wife and partner, Micaela, the architect, who had the vision to establish our architect-engineer design and consulting firm - Eytan Building Design (EBD) in 1974 and to focus our works in the specialized field of protective structures.

Our practical experience comes from participating in the design of numerous projects, including protective structures for our military, defense, government, municipal and private clients.

For us, in Israel, the protective design is not theoretical, as very often our protective structures are subjected to real attacks and then our work is thoroughly tested. Our satisfaction is great when the protective design has actually contributed to saving lives and reducing the levels of injuries and the property damages.

Until now we had a challenging, stressful but also rewarding and satisfactory professional real-life experience and I tried to convey to you in this summary some of our practical findings and achievements.

Finally, I hope that you will not have to actually experience the weapons and explosive charges effects on your protective structures (and on yourself, if you happen, like me, to be inside one during the attack), but live in peace now and forever.

But, as Israeli Home Front Command states: *"He who is prepared, is safe!"*

Reuben Eytan



EYTAN BUILDING DESIGN LTD.
27 Motta Gur St., Tel Aviv 69694, Israel
Tel: 972-3-6428480, 972-3-6418381, Fax: 972-3-6429355
www.ebd.co.il
e-mail: ebd@netvision.net.il

Eytan Building Design

Practical Experience

EBD's Observed Damages to Structures (ODS) database

Since 1968, we at EBD have compiled the ODS database in which we constantly input the observed damages to structures from real attacks. This unique database, of which the summary table is presented below, is obviously proprietary and not for detailed publication or sale. However, we base the consultancy services to our clients also on the extensive unique practical experience contained in the ODS data base.

Type of attacks	Number of events	Number of observed damages to civilian structures		
		Unhardened	With hardened internal areas	With hardened structure envelope
Shooting of small arms, machine guns, etc	3,461	957	52	232
Direct hits of shaped-charge projectiles (RPG, anti-tank, etc)	4,115	420	55	42
Direct hits / near misses of mortar shells, rockets and missiles	10,356	3,641	2,215	389
Direct hits / near misses of artillery shells	12,511	1,753	459	75
Direct hits / near misses of air bombs	3,481	875	690	38
Direct hits / near misses of ground-to-ground missiles	105	2,353	857	42
Explosive devices of up to 20 kg TNT	4,536	4,270	85	30
Car bombs containing up to 200 kg TNT	361	623	78	28
Car bombs containing more than 200 kg TNT	68	426	24	11
Total events	38,994	15,318	4,515	887
		Total: 20,720 civilian structures		



EYTAN BUILDING DESIGN LTD.
 27 Motta Gur St., Tel Aviv 69694, Israel
 Tel: 972-3-6428480, 972-3-6418381, Fax: 972-3-6429355
 www.ebd.co.il
 e-mail: ebd@netvision.net.il

Eytan Building Design

Practical Experience

General Summary of EBD's Practical Experience

Since 1974, EBD has been involved in the design of numerous protective structures.

We have participated in the protective design of all types of structures listed in the EBD Home Page.

To date, our firm has been involved in the protective design of:

- hundreds of protective structures and installations.
- thousands of civil defense shelters and military fortifications.
- tens of thousands of protected spaces and hardened internal areas.

Many of the structures including our protective design recommendations have been actually subjected to real attacks.

The record shows that all of the above structures have performed as designed, providing adequate protection, saving lives and minimizing damage to property.



EYTAN BUILDING DESIGN LTD.
27 Motta Gur St., Tel Aviv 69694, Israel
Tel: 972-3-6428480, 972-3-6418381, Fax: 972-3-6429355
www.ebd.co.il
e-mail: ebd@netvision.net.il

Eytan Building Design

Projects in Israel

Detailed design

- several hardened structures in the new three airbases in the Negev.
- sophisticated super-hardened military complex.
- countrywide border fortifications.
- civilian shelters and protected spaces.
- different structures hardened against terrorist attacks.
- several types of ammunition magazines.
- strengthening existing structures against earthquake and weapons/explosion effects.



Modern office buildings designed to prevent progressive collapse from terrorist attacks

Hardening consultancy

- the Israeli Nuclear Power Station.
- numerous hardened structures for the Israeli Air Force.
- various hardened structures for the Israeli Army.
- various hardened structures for the Israeli Navy.
- various types of ammunition storage magazines and facilities.
- various hardened structures for several military and civil industrial facilities.
- all shelters and strengthened houses and public buildings in the town - Katzrin on the Golan Heights.
- protected spaces for various office buildings, commercial centers, high-tech buildings, industrial facilities.
- all new court houses and government office buildings throughout Israel since 1993.
- numerous buildings designed to withstand terrorist attacks.



EYTAN BUILDING DESIGN LTD.
27 Motta Gur St., Tel Aviv 69694, Israel
Tel: 972-3-6428480, 972-3-6418381, Fax: 972-3-6429355
www.ebd.co.il
e-mail: ebd@netvision.net.il

Eytan Building Design

Projects in Israel

Hardening and protection studies

- shelter master plan for the towns Tel Aviv and Haifa.
- shelters survey and master plan for 400 villages countrywide.
- survivability analysis for various important installations.



Government complex, designed to withstand various terrorist attacks

Projects summary

- | | |
|---|--------------------------|
| 1. detailed design
structures of approx value of | 540,000,000 US dollars |
| 2. hardening consultancy
structures of approx value of | 3,800,000,000 US dollars |
| 3. hardening and protection studies
studies of approx value of | 2,800,000 US dollars |



EYTAN BUILDING DESIGN LTD.
27 Motta Gur St., Tel Aviv 69694, Israel
Tel: 972-3-6428480, 972-3-6418381, Fax: 972-3-6429355
www.ebd.co.il
e-mail: ebd@netvision.net.il

Eytan Building Design

Overseas activities

1. Official supplier of hardening and protection know-how to overseas clients through the Israeli Defense Sales Department of the Ministry of Defense.
2. Active in 18 countries worldwide.
3. Overseas projects in the following fields:
 - a. detailed design of hardened structures.
 - b. hardening consultancy for all types of structures and installations.
 - c. hardening and protection studies.
4. Due to obvious security reasons no details of overseas projects can be presented.
5. We are often addressing international conferences and symposia where we are personally invited due to our extensive practical experience in the field of hardened structures.
6. We conduct training courses for architects and engineers on protective design of structures.



High rise building designed to withstand car bomb effects

Projects summary

- | | |
|---|---------------------------|
| 1. detailed design
structures of approx value of | 180,000,000 US dollars |
| 2. hardening consultancy
structures of approx value of | 18,600,000,000 US dollars |
| 3. hardening and protection studies
studies of approx value of | 5,700,000 US dollars |



EYTAN BUILDING DESIGN LTD.
27 Motta Gur St., Tel Aviv 69694, Israel
Tel: 972-3-6428480, 972-3-6418381, Fax: 972-3-6429355
www.ebd.co.il
e-mail: ebd@netvision.net.il

Eytan Building Design

List of publications

I. OBSERVED DAMAGES TO STRUCTURES FROM REAL ATTACKS AND FROM CONTROLLED EXPLOSIVE TESTS

1. Eytan, R., **Analysis of Observed Effects of Terrorist Attacks on Real Structures**, *Proceedings of the ASCE Specialty Conference on Structures for Enhanced Safety and Physical Security*, Arlington, Virginia, U.S.A., March 1989.
2. Eytan, R., **Response of Real Structures to Blast Loadings - The Israeli Experience**, *Proceedings of the Second International Conference on Structures Under Shock and Impact*, Portsmouth, United Kingdom, June 1992.
3. Eytan, R. and Sofrin, Y., **Full Scale Explosive Tests on a 5-storey Structure**, *Proceedings of the Eight International Symposium on Interaction of the Effects of Munitions with Structures*, McLean, Virginia, U.S.A., April 1997.
4. Eytan, R., **Development and Implementation of Innovative Cost Effective Retrofit Protective Measures in Existing Buildings**, *Proceedings of the Ninth International Symposium on Interaction of the Effects of Munitions with Structures*, Berlin, Germany, May 1999.

II. DESIGN OF PROTECTIVE STRUCTURES - TO WITHSTAND WEAPONS AND EXPLOSIVE CHARGES EFFECTS

1. Eytan, R., **New Developments in the Design against Conventional Direct Hits**, *Proceedings of the International Seminar on Design of Protective Structures*, Mannheim, Germany, September 1982.
2. Eytan, R., **Design of Layered Structures against Conventional Weapons**, *Proceedings of the Second International Symposium on Interaction of Non-Nuclear Munitions with Structures*, Panama City Beach, Florida, U.S.A., April 1985.
3. Eytan, R., **Practical Experience in the Analysis, Design and Construction of Structures Hardened to Withstand Car Bomb Attacks**, *Proceedings of the Conference on Securing Installations against Car Bomb Attacks*, Arlington, Virginia, U.S.A., May 1986.
4. Eytan, M. and Eytan, R., **Architectural-Engineering Protective Design of Computer and Communications Facilities to Withstand Terrorist Attacks**, *Proceedings of the Fifth Worldwide Congress on Computer and Communications Security and Protection*, Paris, France, March 1987.



EYTAN BUILDING DESIGN LTD.
27 Motta Gur St., Tel Aviv 69694, Israel
Tel: 972-3-6428480, 972-3-6418381, Fax: 972-3-6429355
www.ebd.co.il
e-mail: ebd@netvision.net.il

Eytan Building Design

List of publications

5. Eytan, R., **Government Installations - Practical Experience in Architectural-Engineering Security Measures**, *Proceedings of the Fourth Annual Joint Government-Industry Symposium on Security Technology*, Virginia Beach, Virginia, U.S.A., June 1988.
6. Eytan, M. and Eytan, R., **Architectural-Structural Protective and Hardening Measures to Counter Terrorist Attacks**, *Seminar on Building against Terrorism*, London, United Kingdom, October 1988.
7. Eytan, R., **Real Structures Designed and Built with Enhanced Physical Security to Withstand Terrorist Attacks**, *Proceedings of the ASCE Specialty Conference on Structures for Enhanced Safety and Physical Security*, Arlington, Virginia, U.S.A., March 1989.
8. Eytan, M. and Eytan, R., **Practical Experience in the Design of Rapid Erectable Pre-Engineered Hardened Structures**, *Proceedings of the Second International Symposium on Interaction of Non-Nuclear Munitions with Structures*, Panama City Beach, Florida, U.S.A., April 1985.
9. Eytan, R., **State-of-the-Art/State-of-the-Practice of Protective Structures**, *Defense Technology Seminar*, MINDEF, Singapore, November 1990.
10. Eytan, R., **Practical Use of Prefabricated Concrete Elements in Blast-Resistant Structures**, *Proceedings of the Twenty-Ninth Explosives Safety Seminar*, New Orleans, U.S.A., July 2000.

III. DESIGN OF PROTECTIVE STRUCTURES - PROTECTIVE RETROFIT OF EXISTING STRUCTURES.

1. Eytan, R. and Kolodkin, A., **Practical Strengthening Measures for Existing Structures to Increase their Blast Resistance**, *Proceedings of the Sixth International Symposium on Interaction of the Effects of Munitions with Structures*, Panama City Beach, Florida, U.S.A., May 1993.
2. Eytan, M. and Eytan, R., **Practical Measures for Retrofit of Existing Structures to Increase their Blast Resistance**, *Proceedings of the Specialty Symposium on Structures Response to Impact and Blast*, Tel Aviv, Israel, October 1996.
3. Eytan, R., **Development and Implementation of Innovative Cost Effective Retrofit Protective Measures in Existing Buildings**, *Proceedings of the Ninth International Symposium on Interaction of the Effects of Munitions with Structures*, Berlin, Germany, May 1999.



EYTAN BUILDING DESIGN LTD.
27 Motta Gur St., Tel Aviv 69694, Israel
Tel: 972-3-6428480, 972-3-6418381, Fax: 972-3-6429355
www.ebd.co.il
e-mail: ebd@netvision.net.il

Eytan Building Design

List of publications

IV. DESIGN OF PROTECTIVE STRUCTURES - AMMUNITION STORAGE MAGAZINES AND EXPLOSIVE FACILITIES

1. Eytan, R., **Optimal Design of Ammunition Storage Facilities to Withstand Conventional Weapons Effects**, *Proceedings of the Twenty-Second Explosives Safety Seminar*, Anaheim, California, U.S.A., August 1986.
2. Eytan, R., **Optimal Design of Ammunition Facilities for Conflicting Requirements of Survivability and Safety**, *Proceedings of the Twenty-Third Explosives Safety Seminar*, Atlanta, Georgia, U.S.A., August 1988.
3. Eytan, R., **Strengthening Structural Elements for Existing Explosive Facilities to Reduce the Risks to Adjacent Installations**, *Proceedings of the Twenty-Fourth Explosives Safety Seminar*, St Louis, Missouri, U.S.A., August 1990.
4. Reid, R., Sofrin, Y. and Eytan, R., **Reinforced Soil Ammunition Magazine Full Scale Tests**, *Proceedings of the Twenty-Sixth Explosives Safety Seminar*, Miami, Florida, U.S.A., August 1994.
5. Eytan, R., **Cost Effective Strengthening Measures to Increase the Blast Resistance of Structures Adjacent to Explosive Facilities**, *Proceedings of the Twenty-Sixth Explosives Safety Seminar*, Miami, Florida, U.S.A., August 1994 .

V. DESIGN OF PROTECTIVE STRUCTURES - OPTIMAL DESIGN

1. Eytan, R., **The Use of Practical Experience in the Optimal Design of Structures Hardened against Conventional Weapons**, *Proceedings of the Third International Symposium on Interaction of the Effects of Munitions with Structures*, Mannheim , Germany , March 1987.
2. Eytan, R., **Optimal Design of Protective Structures Using Computer-Aided Risk Analysis**, *Proceedings of the Fifth International Symposium on Interaction of the Effects of Munitions with Structures*, Mannheim , Germany , April 1991.
3. Eytan, R., **Practical Experience in Designing Structures to Optimally Withstand Explosion Effects**, *Proceedings of the Structural Engineers World Congress*, San Francisco, California, U.S.A., July 1998.



EYTAN BUILDING DESIGN LTD.
27 Motta Gur St., Tel Aviv 69694, Israel
Tel: 972-3-6428480, 972-3-6418381, Fax: 972-3-6429355
www.ebd.co.il
e-mail: ebd@netvision.net.il

Eytan Building Design

List of publications

VI. DESIGN OF PROTECTIVE STRUCTURES - NON STRUCTURAL ELEMENTS

1. Eytan, R., **Protection of Sensitive Equipment in Structures Subjected to Conventional Weapons Effects**, *Proceedings of the 60th Shock and Vibration Symposium*, Norfolk, Virginia, U.S.A., November 1989.
2. Eytan, R., **Innovative Blast Resistant Structural Systems, Windows and Doors – Development and Implementation**, *Proceedings of the Seventh International Symposium on Interaction of the Effects of Munitions with Structures*, Mannheim, Germany, April 1995.
3. Eytan, R., **Practical Experience in Blast Mitigation for Non Structural Elements**, *Proceedings of the 2001 Structures Congress*, Washington DC, U.S.A., May 2001.



EYTAN BUILDING DESIGN LTD.
27 Motta Gur St., Tel Aviv 69694, Israel
Tel: 972-3-6428480, 972-3-6418381, Fax: 972-3-6429355
www.ebd.co.il
e-mail: ebd@netvision.net.il

Eytan Building Design

List of publications

DESIGN OF PROTECTIVE STRUCTURES

Manuals with the involvement of Mr. Reuben Eytan

ISRAELI DESIGN MANUALS

1. **MANUAL FOR DESIGN OF PROTECTIVE STRUCTURES**
by the Israeli Corps of Engineers
2. **MANUAL FOR DESIGN OF PROTECTIVE STRUCTURES IN AIR FORCE
INSTALLATIONS**
by the Israeli Air Force
3. **MANUAL FOR DESIGN OF FIELD FORTIFICATIONS**
by the Israeli Corps of Engineers
4. **MANUAL FOR DESIGN OF CHEMICAL/BIOLOGICAL PROTECTION OF
STRUCTURES**
by the Israeli Corps of Engineers
5. **MANUAL FOR DESIGN AND CONSTRUCTION OF PROTECTED SPACES**
by the Israeli Home Front Command

INTERNATIONAL DESIGN MANUALS COMPILED BY EYTAN BUILDING DESIGN (EBD) Ltd.

6. **ADVANCED MANUAL ON SECURITY OF NATIONAL KEY POINTS**
7. **OPTIMAL DESIGN OF BLAST WALLS - AN ENGINEERING DESIGN MANUAL**
8. **DESIGN MANUAL - STRENGTHENING EXISTING BUILDINGS**



EYTAN BUILDING DESIGN LTD.
27 Motta Gur St., Tel Aviv 69694, Israel
Tel: 972-3-6428480, 972-3-6418381, Fax: 972-3-6429355
www.ebd.co.il
e-mail: ebd@netvision.net.il