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Editorial

De Facto Language of Data Science: The R Project

Kerim Goztepe

Dear Readers,

This is the last issue of the year 2016. Another year has come to an end. I want to confess that this year has not been as successful as we expected.

I always support science for humanity and environment. Besides, I dream the world to be a more livable place. But my dreams may be another topic for another paper. Before you get bored, I want to talk about the R Project, whose popularity is increasing every year, in this letter.

As you know, data science has taken the world by storm. Firms, people, states produce a great amount of data every day (Berry and Linoff, 1999). Every field of science and business realizes the value of the incredible quantities of data (Lumley et al., 2002; Chen et al., 2012). The matter is not to produce data, it is to extract value from those data. A data analysis must have data science abilities in order to cope with validation of data. Here, the importance of R appears. Most of the statisticians, optimizers, and data analyzer are well aware of the R programming language (Muenchen, 2012). They probably confess, it has become the de facto programming language for data science. Because of its flexibility, it is sophisticated, highly configurable, and has no cost (open source). Plus, many scientists not only use it but also, contribute to amazing R environment for better problem solutions. With R you can It is possible to write functions, do sophisticated calculations, create simple or complicated graphs, use almost any available statistical techniques and even write your own scripts for a purpose. A great number of researchers supports R and many research institutes, companies, and universities have migrated to R.

It is not easy for me to mention or explain the R project in a letter. But I can refer a fast introduction to the R and give you some references about it. Below you can follow a basic introduction to R step by step.

Step 1. Do not hurry

R is not so easy to learn. But once you learn, it opens a new horizon to you. Do not hurry. Be patient and learn every day some issue about it. Many researchers see the R as a one of the main language of science.

Step 2. Visit R website

If you are interested in the R project, you should visit the official website of R first and examine the eco-system of R. Official website of R is https://www.r-project.org/about.html. R is not only a software for statistics. It provides a platform for many different implementations, it has fuzzy logic, neural network, data mining, image processing tools for instance. R can be extendable with different packages.

Step 3. Install R and read basic documents

You may download R for Windows, Linux and Mac OS X operating systems using https://cran.r-project.org/mirrors.html website. Open this site and select a mirror for downloading R. Read basic R documents after installation. Do not give up reading and understand R idea. Some of my literature recommendations are given below(Table.1).

Table.1. Some references for beginners

Author	Reference	Level
Paradis, E. (2002)	R for Beginners.	Beginner
Matloff, N. (2009)	The art of R programming.	Beginner, Intermediate

Goztepe,K. (2016). De Facto Language of Data Science: The R Project, Journal of Military and Information Science, Vol.4(4),104-107

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Chang, W. (2012)	*R graphics cookbook*. " O'Reilly Media, Inc.".	Intermediate, Advanced
Stowell, S. (2014)	*Using R for statistics*. Apress.	Intermediate, Advanced
Venables, W. N., Smith, D. M., & R Development Core Team. (2004)	An introduction to R.	Beginner
Gentleman, R., Hornik, K., & Parmigiani, G. (2009)	Use R!.	Beginner, Intermediate

Web sites	**Info**
https://www.r-project.org/	Official R Project site
https://www.rdocumentation.org/	Documents about R usage, manuals etc.
https://www.r-bloggers.com/	Best blogger site for R
http://stat.ethz.ch/R-manual/R-devel/library/datasets/html/00Index.html	Supports data for R
https://journal.r-project.org/	R Journal
http://adv-r.had.co.nz/	For advanced R users.

Step 4. Do not hesitate to use R

You can start using soon after installation R. Read some "immediate starting references" and use examples given in them. There are many examples in related books from simple to advanced. I tried to give some basic samples below.

Sum of two plus two,

```
> 2+2
[1] 4
```

Suppose you want to calculate the logarithm of 3 with base 10. You may type

```
> log(3)
[1] 1.098612
```

Assign a value to q,

```
> q <- 12*5+3
> q
[1] 63
```

Combine values into a vector x,

```
> x <- c(1,2,3,4)
> x
[1] 1 2 3 4
```

```
> help(c) #if you want to learn to combine command (c) use help
```

Let say $y= x^2$ and we request graphic of it,

```
> y <- x^2
> y
[1]  1  4  9 16
> plot(y, col=34, lwd=2, pch=10) #this command gives you graphics of y= 1,4,9,16 (Fig.1)
```

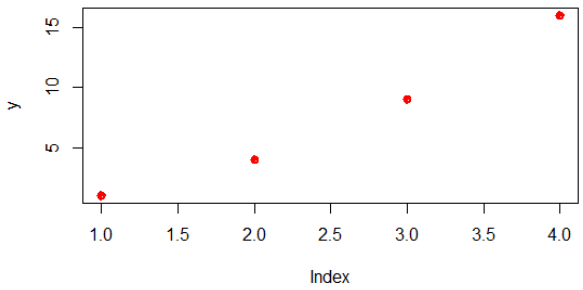

Fig.1. Plot of y.

Step 5. Use datasets during learning phase

You can apply ready to use preinstalled datasets in R. Especially in the learning phase, you do not need to find data. I used "women" data here.

```
> data("women")
> women
   height weight
1      58    115
2      59    117
3      60    120
4      61    123
5      62    126
----------------# there are 15 data in this sample.
```

Lets' use data "women" for linear regression.

```
>names(women)   #use it to get or set the names of an object.
[1] "height" "weight"
> dim(women)   #gives dimension of data. There are 15 rows, 2 columns in data "women"
[1] 15  2
> x←women$height #height values copied in x
> y←women$weight #weight values copied in y
```

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> lm(x~y) # create linear model for x and y
The simple linear regression model is $y = \beta_0 + \beta_1 x_1 + \varepsilon_i$ where β_0 is the intercept and β_1 is the slope of the linear relationship assumed between the response and explanatory variables and ε_i is an error term.

```
Call:
lm(formula = x ~ y)

Coefficients:
(Intercept)            y
   25.7235       0.2872
```

>mymodel←lm(x~y) # output of lm is copied to "mymodel"
> summary(mymodel) # this gives you summary of "mymodel"

```
Call:
lm(formula = x ~ y)
Residuals:
     Min       1Q   Median       3Q      Max
-0.83233 -0.26249  0.08314  0.34353  0.49790

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 25.723456   1.043746   24.64 2.68e-12 ***
y            0.287249   0.007588   37.85 1.09e-14 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.44 on 13 degrees of freedom
Multiple R-squared:  0.991,    Adjusted R-squared:  0.9903
F-statistic:  1433 on 1 and 13 DF,  p-value: 1.091e-14
```

Our model explains if there is a relation between women height and weight. We can obtain some plot of data as seen below (Fig.2,Fig.3, Fig.4, Fig.5)

> plot(height ~ weight, data = women) # This produces a scatterplot of velocity and distance as seen Fig.2

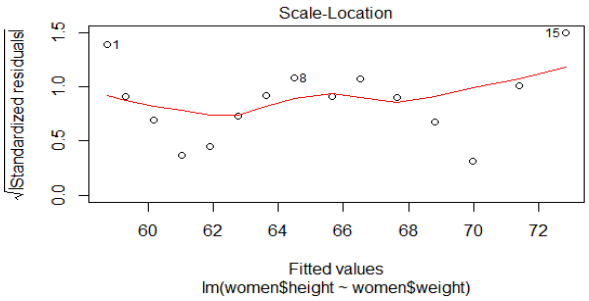

Fig.2. Scatterplot of fitted values.

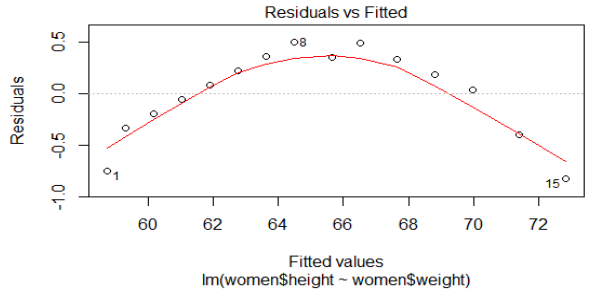

Fig.3. Plot of residuals against fitted values.

You can try other ways to obtain plot of your study.

>plot(height, weight, main="Scatterplot Example",
+ xlab="Weight ", ylab="Height", col=34, pch=19)
> abline(lm(height~weight), col="red") # regression l ine (height-weight) data is women.
> lines(lowess(height, weight), col="blue") # lowess l ine (height-weight)

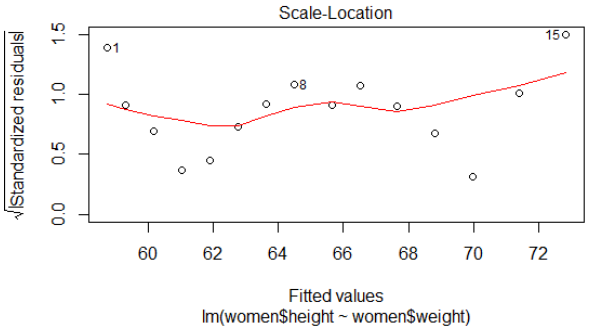

Fig.4. Fitted values.

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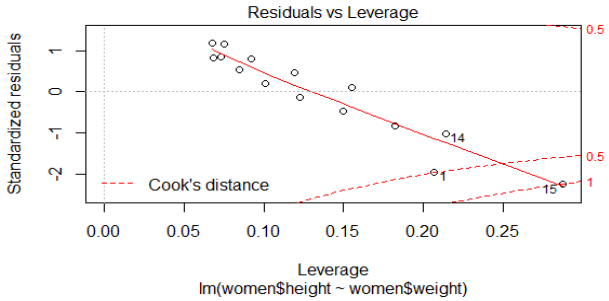

Fig5. Index plot of Cook's distances for data.

I tried to write a fast beginning letter for the people who are interested in R language.

I would like to thank our authors and reviewers. I believe that none of our successes would have been possible if their efforts had not been of the authors who submitted their quality papers.

I thank our reviewers who tirelessly supervised the review process and, on occasions, provided me with great suggestions and advice. Prof.Dr. Cengiz Kahraman, Prof.Dr. Şeref Sağıroğlu, Prof.Dr. Orhan Torkul, Dr. Alper Kayaalp and Serhan Ateş deserve special thank for their valuable support.

I look forward to another successful year; meanwhile, please feel free to contact me with your suggestions and comments.

Sincerely,

Kerim Goztepe, IE, Ph.D
Editor-in-Chief
Journal of Military and Information Science

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Web sites

Best blogger site for R, https://www.r-bloggers.com/

Documents about R usage, manuals etc.,https://www.rdocumentation.org/

Official R Project site, https://www.r-project.org/

R Journal, https://journal.r-project.org/

Supports data for R, http://stat.ethz.ch/R-manual/R-devel/library/datasets/html/00Index.html

For advanced R users., http://adv-r.had.co.nz/

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Promises and Perils of Regional Organizations in Southeastern Europe: Lessons Learned from SEDM and SEEBRIG

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Abstract- Regional organizations are one of the most important demonstrations of the high level economic and political cooperation between states. Today, in the international arena, there are numerous regional organizations shaped by the regional conditions and the regionalist perceptions of the founder states. This study explores the lessons learned from the experiences of Southeastern Europe Defence Ministerial (SEDM) Process and its operational/military body, namely Southeastern Europe Brigade (SEEBRIG). It analyzes the challenges and limits which those initiatives face and explores the motivations for the current attempts in different problematic areas. For this aim, firstly a conceptual framework for the integration projects and regional organizations are provided. Then, a brief examination on SEDM and SEEBRIG and their historical performance is depicted. A number of lessons learned that can be drawn from the unique and common experiences of the SEDM Process and SEEBRIG as a multinational/regional military body is represented afterward. Main issues are then examined under the bullets of the concept of military operation, clear and functional mandate, international credibility, the degree of both commitment and cohesiveness among members, the institutional identity, and organizational structure.

Keywords- Regionalization; Regional Organizations; Southeastern Europe, SEDM, SEEBRIG.

1. Introduction

In 21st Century, under the influence of globalization, international organizations' importance and functions are growing of day by day. Especially coming into prominence of regional organizations. The effectiveness European Union (EU) and similar organizations have been increased in international relations. The increasing effectiveness of international organizations has accelerated the emergence of regional integrations.

Balkan countries took steps towards political and economic union after gaining their independence with a view towards gaining recognition in Europe and developing future policies. This region was called South-Eastern Europe (SEE) and steps were taken to implement European projects to achieve objectives. Initial regional and multiparty collaborations were consolidated under the South-Eastern Europe Defence Ministerial Process. This study investigates the cooperation efforts between former Yugoslavian countries to establish independence and gain recognition on an international level. The political, economic and security aspects of the SEDM and SEEBRIG worth to investigate. However, the applicability of economic and social cooperation in South-East Europe is problematic. The support of international players, as well as the nations involved in such regional organizations, are also important.

Since the end of the Cold War, regional institutions' role increased in world politics. From the 1990s onwards dissolution of ex-power blocks and changes in political orientations which were the features of Cold War. The rising of regional organizations became a significant dimension of global affairs since then (Lake and Morgan, 1997:1). From that now on, a set of efforts aimed at the cooperation among the newly independent states is witnessed. Driven by the practical needs of national security and economic development of those countries, not only ex-leaders in those countries but also mainly US-oriented initiatives deemed the creation of regional organizations as necessary for coping with the demise of the centralized communist state.

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In the same context, all the balances in the Balkans changed dramatically after the Yugoslavia's fall. The instability that is brought by this milestone risked the local, regional, and international peace. Thus, the Balkans experienced several internal wars and ethnic cleansing. Peace and stability could have been provided only after the intervention of external powers, such as US and NATO. The experiences gained from the post-Soviet and post-Yugoslavian countries with regional organizations drew attention from the *academia* because they provided a natural laboratory for studying the causes and effects of regional integration and disintegration and also their support to regional peace and stabilization. With the independence of Montenegro (2006) and Kosovo (2008), the borders of those new states in the Balkans have almost become definite. Economic integration, diplomatic and political interaction, security for every country in the region are accompanied by the principles of regional identity along with keeping of the multi-ethnic and multi-cultural social features in the region.

However, there can be observed not only promises but also perils of that kind of organizations. What are the driving forces behind the creation and endurance of regional organizations within the post-Soviet space and also in the Balkans? What can be learned from these experiences about the future of regional initiatives and beyond? This study will attempt to explore these questions along with the challenges and limits they face. The case which will be explored is the Southeastern Europe Defence Ministerial (SEDM) Process and its operational/military body, Southeastern Europe Brigade (SEEBRIG).

In the first section, a conceptual framework for the integration projects is provided. Then, a brief examination of SEDM and SEEBRIG and their performance is depicted. Section three presents a number of lessons that can be drawn from the unique and common experiences of the SEDM Process and SEEBRIG as a multinational/regional military body.

Main conclusions that are reached are that both SEDM and SEEBRIG proved to have certain challenges and limits in functional scope, institutional set-up, membership, commitment and organizational identity. The underlying causes explaining these perils are that they stem from respective states' dissimilar or disoriented expectations from this process, various political/military considerations, and concerns with the establishment of new regional orders/initiatives. The bottom line shall be that as long as there is a lack of decisive political intention and a clear political framework, its military achievements has to stay limited.

2. Conceptual Framework: Integration Projects and Regional Organizations

Current studies lack a certain consensus regarding the term of regional institution/organization. Both terms are generally used interchangeably. (Bures, 2006: 83). Boutros-Ghali defines subject organizations as "treaty-based organizations" stating "whether created before or after the founding of the United Nations, regional organizations for mutual security and defense." According to him, those organizations behave for general regional development and/or cooperation on a certain economic issue. Those groups are created to cope with a significant and determined political, economic or social concern. (Ghali, 1992).

However, regionalism is preferred to be defined as a process of institutionalization of interstate relations initiated by the governments within a geographic region where both coordination and cooperation occur as a result of inter-governmental bargaining (Omelicheva and Zubytska, 2012). The neo-liberal institutionalist theoretical approach has become a theoretical leader in the *academia* of inter-governmental cooperation. A key condition for the establishment and survival of a regional organization, according to this perspective, is the actors' belief that cooperation with produce respectively better results in the long run when compared to their unilateral actions. It is also put that a regional organization will assist the states in lowering transaction costs accompanying their efforts at cooperation by regularizing and monitoring interactions and facilitating the flows of information (Simmons and Martin, 2002).

However, the neo-liberal explanations have been rightfully criticized for conceptualizing inter-state organizations basically as welfare providing institutions (Gruber, 2000). The neo-liberal approaches in regional institutions/organizations often expect that various cooperative arrangements will guarantee the long-term utility effects for participating states. Regional unions and/or initiatives/organizations are supposed to improve the states' long-term national welfare through the optimization of interstate commerce, simplification of travel, or facilitation of the movement of labor. The failure to observe these gains is interpreted as the regional organizations' lack of success (Omelicheva and Zubytska, 2012). However, countries' motivation for regional and sub-regional

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cooperation, including shared economic, political, environmental, and social concerns, overlapping populations, and in some cases, the similarities of cultures, language, and developmental practices, there is not a single regional project who has lived up to its full potential (Olcott, et al, 2004).

It is little doubt that the long-term impact of policies deriving from regional cooperation is not neglected by the state elites. However, as the abundant evidence on political events demonstrates, their short-term interests in securing their positions in the government will always be of paramount importance. It would be argued that the democratically elected leaders will be more willing to the interests of core constituencies supplying them with sponsorship and electoral support. On the other hand, the authoritarian leadership will cater to those interests which are instrumental for maintaining their power (Gruber, 2000: 57). By taking regional organizations as instruments of political elites to maximize their term in office and personal political influence, one gains another analytical perspective to explain the continued existence of multiple regional organizations in the given region. That type of explanation points to the fact that political will and interests of those countries' leadership have been one of the determining factors of regional cooperation (Hurrell, 1995: 220). Support for regional initiatives has often been predicated on the assessment of the extent to which regional projects could contribute to the achievements of regional elite's pure personal aims (Roeder, 1997: 20). It should also be noted hereby that in the southeastern Europe sphere, the political, economic, and military dominance of US has been another important determinant of integration processes and the regional organization (Kubicek, 1997: 639) which would also pave the way for those countries' membership and integration to NATO.

3. SEDM and SEEBRIG as Regional Players: Background

3.1. SEDM:

As a result of the events of the last ten years and followed by missions that are led by NATO which aimed to construct as well as to keep peace and security, Southeastern Europe Europe Defence Ministerial (SEDM) was put in action in 1996 with the first meeting of Ministers of Defence held in Albania. An idea for a need of a robust regional cooperation process in this region emerged in the international society followed by that consequence. SEDM's participating nations include USA, Albania, Bosnia-Herzegovina, Bulgaria, Croatia, Italy, Montenegro, Romania, Serbia, Turkey, Ukraine and Greece. Georgia and Moldovia are observer nations. SEDM is a defined in its official writing as a "process". In that term, it is represented as a process of cooperation among the Ministries of Defence of Southeastern European participating and observer countries.

The actions taken within the scope of SEDM process are created with the consideration in a way to strengthen, and to enrich the political and military cooperation and to develop a stable environment and security in South Eastern Europe. The purpose is to promote regional cooperation and create neighborly interactions as well as to strengthen regional defense capacities. Besides, cooperation through collective efforts and making links between Euro-Atlantic institutions/organizations are also among the goals. Among SEDM organs, the most significant prominence is South-Eastern Europe Brigade (SEEBRIG) established with the MPFSEE Agreement.

It should be underlined that this initiative was energized and motivated by the US. Under the firm support of US in the backward, main players was Turkey and Greece which were the two already members of NATO. It could easily be predicted that the end state was to enlarge NATO in Balkans and make those states a member of NATO. Today, this end state is almost accomplished with an exception of Macedonia and Montenegro waiting for full membership.

3.2. Military Realm: SEEBRIG[†]

SEDM has a military/operational body constituted by the troop contributions of seven member nations. It works under the umbrella of SEDM. It was established in 1998 in order to develop cooperation and open the dialog channels between the founder nations. It is also presented as a declaration to support to regional security and stability, and to generate good neighborly relations within the region." It should be noted that it was firmly supported by the US. Its constituting document is Agreement on Multinational Peace Force South-Eastern Europe (MPFSEE) which was signed by the Ministers of Defense of the seven participating countries in Skopje/Macedonia. In accordance with MPFSEE Agreement, the South-Eastern Europe

[†] Information in this part is mainly provided from SEEBRIG's official web page as well as telephone interviews generated by the author with some officers from different member nations who are posted in SEEBRIG HQs. Subject interviews are realized between November-December 2015.

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Brigade (SEEBRIG) was activated by seven participating Nations in1999 in Plovdiv/Bulgaria. The current structure of SEEBRIG is a brigade-sized force of about 4000 personnel.

There has been a clear and substantial increase in involvement by regional organizations in both mediation and peacekeeping operations (Diehl and Cho, 2011). Indeed, the role of regional organizations as peacekeepers is not a novel one (Paliwal, 2010: 186). However, in order to establish an effective PSO, a regional organization shall obtain an understandable mandate, international legitimacy and adequate military capacity for enforcing peace. It is also vital that there should be cohesiveness within the organization in order to ensure commitment toward the mission, facing the requirements of organization for military ops (Baba and Slotter, 2014: 5). The ability of regional organizations to play significant roles in conflict management is largely conditioned on the authority provided to them by their members (Boehmer et al, 2005). However, SEEBRIG has some certain limits from above mentioned aspects.

According to the constituting Agreement, the aim of MPFSEE and the reason for its establishment is to make contributions to the regional security, stability and to develop relationships among the countries in SEE region within the scope of SEDM process. It acts in parallel with NATO Partnership for Peace (PfP) Programme. In compliance with the MPFSEE Agreement, the Brigade is designed to be open to being declared to UN and OSCE. It would be available, of course within the limits of its capacities, for deployment in conflict areas and in several PSO, like peace-keeping, peace-making, peace-building and humanitarian operations. It would also take part in UN and/or OSCE ops. It could also take duties in coalition type missions.

Brigade (SEEBRIG) is located in member countries on a four-year rotational basis. Currently, it is located in Larissa/Greece. However, not all units allocated to the SEEBRIG is in Greece with the HQs as it is the case for the other host countries. For the very moment, only 38 officers including the SEEBRIG Commander (a brigadier general) are posted in Greece as the "core" element of Brigade's HQs. All the other forces (personnel and units) are stationed at their national locations. It is due to the fact that, according to the MPFSEE Agreement, the troops which are affiliated to SEEBRIG by the respective nations remains at their home locations. They are gathered under a task force principle for exercises and operations purposes and/or requirements upon the decisions of the participating Nations under certain circumstances. In that case, a suitable joint direction and coordination are produced and distributed by Political and Military Steering Committee (PMSC). It is helpful to note that SEEBRIG has never "gathered" in that term its16-year-lifetime. As it will be discussed below, it has never formed up with its all bodies and units. Consequently, it would not be wrong to claim that it has never been a brigade in its military terms.

4. Some Parameters for the Performance of SEDM&SEEBRIG

Table 1 depicts SEEBRIG's position as the sole military and active body of SEDM Process with respect to Concept of Military Operation, Clear and Functional Mandate, International Credibility, Cohesiveness and Commitment among the Member States, The Institutional Identity, and Suitable Organizational Structure.

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5. Discussion

Official web page of SEEBRIG presents itself as a success story. For instance, it reads that "SEDM Process has been a success for more than years and has become an integral part of security policy and regional cooperation. Since its establishment in 1999, in the framework of the process, SEEBRIG proved to be an effective and important tool for promoting regional security, stability, and cooperation among the nations." Moreover, in his speech during the handover take over the ceremony, SEEBRIG Commander Brigadier General Neyko Nenov on 01 July 2005 states that "SEEBRIG is the longest-standing regional defense and security initiative in Southeastern Europe. It has brought together Armed Forces representatives from Ministerial to unit level to work towards common security goals. That is a significant accomplishment and one that could be used in the future as a tested model to bolster cooperation in other regions." (http://www.seebrig.org/ seebrig-speeches/item/203-1-brig-gen-giovanni-sulis-announ cement-at-the-take-over-ceremony-25-july-2003.html).

It is true that SEDM and SEEBRIG have undergone several changes in both their memberships and tasks over the years. In that context, Multinational Peace Force Agreement Southeastern Europe (MPFSEE) had five additional protocols each of which aimed to response several changes and challenges arising from either the environmental changes and/or member states will. However, it has to be mentioned hereby that the unique international operation to which SEEBRIG made contribution was to ISAF (Afghanistan) during its 17-years-life. In 2004, SEEBRIG HQs was deployed to Afghanistan under ISAF command. Except from this operation SEEBRIG did not participate any other international peacekeeping or disaster relief operation. It is surprising enough that SEEBRIG did not take any involvement in its own area of interest, which is the flood disaster in Serbia and in Bosnia-Herzegovina occurred in 2015, nor did there even happened any

Table 1. Parameters for the Performance of SEDM&SEEBRIG

Parameters	Remarks	SEEBRIG's Position
Concept of Military Operation	Basic for military aspects of an international military organization, deployment and missions.	MEDIUM (Mainly derived from NATO and UN standarts.)
Clear and Functional Mandate	A successful regional military force must have a clear and workable mandate for its efficiency and effectiveness.	LOW (Bureaucratic mill, slow decision making process.)
International Credibility	Requirement for international legitimacy, Iniative should be "in accordance with the UN Charter, international law and norms, and diplomatic conventions.	LOW (Low degree of cohesiveness and commitment among member/participating states. No active participation in international operations except from ISAF involvement in 2004.)
Cohesiveness and Commitment	High level of cohesiveness and commitment among its member states. Less variety in terms of individual interest and expectations of its members there is a higher possibility of a greater consensus	LOW (Political gaps, lack of political guidance)
The Institutional Identity	Organizations are to have identities and identity requirements. The identity of regional organizations differs from the notion of "regional identity" as it has been more widely studied in international relations.	LOW (Political and cultural dissimilarities and gaps.)
Suitable Organizational Structure	Requirement for an appropriate organizational structure. It has to be suitable for a peacekeeping operation where and when needed/decided to do so.	LOW (Mainly derived from NATO organizational structre, while never gathered under a regular basis.)

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initiative to bring its involvement onto the table. This, of course, depicts the degree of overall commitment and cohesiveness of each state towards SEDM and SEEBRIG as well as the degree of organizational/institutional identity.

6. Conclusion

If there is not a clear and forceful identity among the organization, its relevance and efficiency would tend to decrease. Though it has been argued that organizations become more than the sum of their members in their lifetime, SEDM and SEEBRIG suffer certain lack in that regard.

It was the final negative phenomena which SEEBRIG faced that one of the member and troop contributing nations, Italy, have denunciated from the SEEBRIG's founding agreement MPFSEE on July 26, 2015. This event marks a significant turning point for both SEDM and SEEBRIG in the sense that, after 17 years in progress one of the important nations decides not be a member of this regional initiative. It can be estimated that, although not stated in this way by Italy itself, this decision is mainly because of Ital's belief that it no more adds value. Although Italy declared that it is still a full member of its parent organization -SEDM, nevertheless, Italy's withdrawal from SEEBRIG marks a novel and important point in its negative term. The naming problem of member countries is a very good example of those weaknesses. According to MPFSEE Agreement, there is a rule that in all written documents either the capital cities of nations (i.e. Ankara instead of Turkey) or a number from one to seven (i.e. Nation-7 instead of Turkey) has to be used. It can be predicted that it is because of the naming issue between Macedonia and Greece. Even this single case shows how powerful is the founding principles of SEDM and SEEBRIG.

In this context, the fact that decisions are taken by 17 nations' unanimity cause a slow decision-making process. However, there is no political integrity within the states of the region. One of the greatest reason is that the newly independent states could not create an integrity within the region. Such a political integrity and an effective organization with the international force that includes all states within the SEE region. Whilst globalization continues, regional organization members or regional integration members have responded to the question of what this fact expresses for our purposes; regional organization members have stated the importance of understanding the flow of this concept from the theoretical plane to the practical world. During globalization, it is necessary to describe an exactly opposite concept, which refers to atomization and regionalization by all means. These atomizing global agents are not witnessed as acting independently, but on the contrary, they are spotted as reactionary to globalization. In this framework, while going through all the economic and political aspects of SEDM, it was observed that, it is in complete accordance with the globalizing principles and does not have even a single different aspect, but cannot be regarded as free of regional influence.

As a result, reading along with this decision of Italy, SEDM and its operational body SEEBRIG teaches that over the years, SEDM seems to be only a forum rather than a regional organization. The limits in its organizational identity and member states' commitment to the organization are the fundamental reasons for this. Moreover, the mandate of organizations and the level of institutionalization has boundaries. SEDM is also structurally weak, often no more than a forum for annual or bi-annual meetings. Until now, SEDM and SEEBRIG have shown no willingness to take action and expanded its influence in the region. Having noted that, it can be seen as a laboratory for other regional institutions to learn lessons.

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Assessment of Blast Induced Damage in Concrete Walls of Urban Metro Stations Using the Finite Elements Method

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Abstract- Structural engineers are faced with many different challenges when designing structures, especially in important reinforced concrete buildings that could be subjected to blast loads. The response of structures due to explosions are controlled by some parameters, such as mass and standoff distance of charge, dimensions and direction of structure, adjacency to other buildings, and important properties of the land. A common lateral load resisting system that is particularly vulnerable to blast loads is the internal reinforced concrete shear wall in urban metro stations. This study investigated the dynamic behavior of the internal wall in a metro station in the effect of blast loading. To assess the progressive collapse of these structures, the damaged walls should be modeled in software. The modeling of damage walls is complicated; therefore, in this study, after analysis of the area of damage, an equal wall was proposed to substitute for the damaged wall.

Keywords: Blast, Shear Wall, Finite Elements, Metro Station

1. Introduction

The subway metro is heavily used in urban transportation; thus, the possibility of explosions in stations, caused by terrorist attacks, also increases with the development of the subway and other underground structures (Feng et.al, 2015, Dowding, 1996). In some cases, metro stations are connected to important structures by a directly enclosed hallway. Consequently, the analysis of these structures due to explosion loads has great significance. Engineers have design concerns for explosions in recent years. In the design of structures that are resistant to explosions, it is important to prevent progressive collapse (Drake and Little, 1983; Buonsanti and Leonardi, 2012; Razaqpur et.al, 2007).

Several experiments and simulations have been conducted in recent years on the consequences of explosive charge detonation in underground tunnels and structures. Also, the ISC (Interagency Security Committee) of the GSA (General Services Administration) recently outlined specific standards for all leased buildings, which will affect any existing building considered for lease by the GSA (Wheaton, 2005; Dept.of Defense, 2005; Gen.Ser.Admn, 2003). In most studies that investigate the dynamic behavior of walls due to a blast, only the flexural behavior of the wall was considered, and the effect of the shear failure mechanism was not observed. This causes differences between the analyzed and real responses (Bao and Kunnath, 2010; Orakcal et.al, 2004; Dick, 2012; Baker, 1973).

This study assessed blast-induced damage in reinforced concrete walls of an urban metro station. Four different charge weights of TNT were modeled at a standoff distance of 3.5 meters from the reinforced concrete wall. ANSYS AUTODYN (Autodyn, 2009) was used to model and simulate the behavior of models that is subjected to air blast loading. There are no studies concerning the determination damage ratio of walls in metro stations due to a blast. This paper presents a

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method to determine equivalent of damaged walls of buildings. An equal wall with an opening was proposed to substitute for the damaged walls for modeling in nonlinear software. For modeling, the openings for the damaged area in models, three damage zones (heavy damage, moderate damage, and light damage) were identified in the results. Each zone is characterized by the damaged area, defined as the difference in the cross-section before and after the blast. The results of this research can be used to assess the progressive collapse and to retrofit reinforced concrete wall structures.

The architectural design of subway metro stations is a significant factor to decrease the impact of significant circumstances, such as blasts, as well as fire, which may also be involved.

For this study, a station of an urban metro that contains some interior walls was selected. Fig.1 shows the plan of the selected station in the lower level. In this station, the passengers stand between two trains. The metro station structure was three stories high with shear walls located in, around, and inside the station. The general view of the station is shown in Fig. 2.

2. Structure modelling

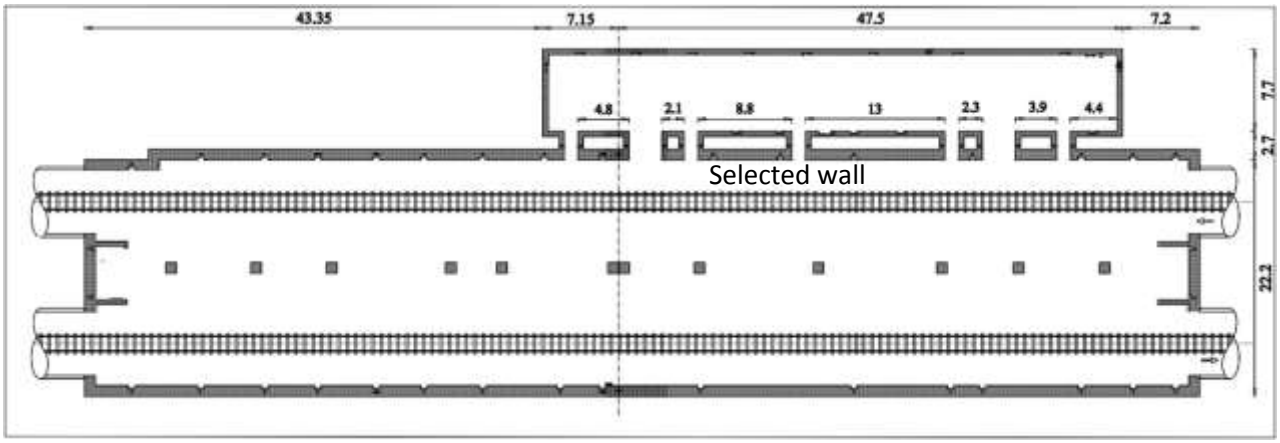

Fig.1. Plan of metro station

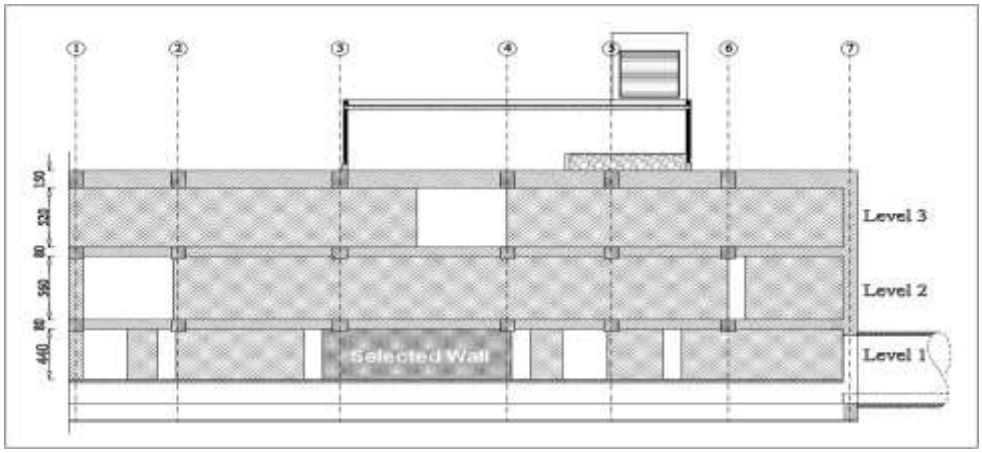

Fig.2. Elevation view of station

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According to Figs. 1 and 2 one of the internal walls was selected. The geometry and detail of the selected wall is shown in Fig 3.

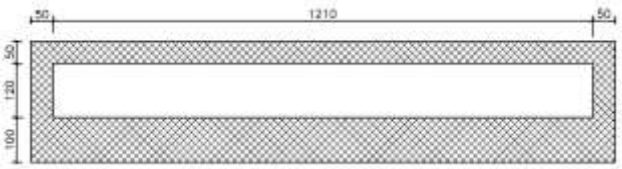

Figure 3. Geometry of selected wall

This wall has a box shape. The steel bars were a standard diameter 25 mm rebar with a nominal tensile strength of 60 ksi and a modulus of elasticity of 29,000 ksi. Each side of the wall contained two mats, and rebar was spaced at 25cm.
Autodyn is finite element software for analyzing non-linear systems including the resultant stresses emanated from explosive materials using the empirical Jones-Wilkins-Lee (JWL) equations. While reinforced concrete shear wall systems have been used to successfully resist the effects of lateral loads, such as earthquakes and the wind, the resistance to explosive loads has not been comprehensively examined. Shear walls are conventionally designed to resist lateral loads through in-plane action; however, blast forces typically generate out-of-plane loads. The large surface area of a wall provides an ideal area to capture blast pressures, resulting in a complex, dynamic structural response (Orakcal et.al, 2004; Mitelman and Elmo 2014).

A Lagrange sub-grid was used to model the reinforced concrete wall, while a Euler sub-grid solid element was used to model the air and the explosive. Material models are shown in Table 1.

Table 1. Material model used in the simulation

Material	Equation of State	Strength model	Density g.cm^{-3}	Shear Modulus kPa
Concrete 35Mpa	P-alpha	RHT	2.75	1.67e+7
Steel	Linear	Johnson Cook	7.9	8e+7

The equation for the RHT model that describes the behavior of concrete is shown in Eq. 1.

$$Y_{fail} = f_c(A\left(\frac{p}{f_c}-\frac{PHTL}{f_c}.\ F_{rate}\right)^N)R_3(\theta)F_{rate}(\varepsilon) \quad (1)$$

Where: fc is the compressive strength; PHTL is the tensile strength; A and N are the constant value; P is hydrostatic pressure; F_{Rate} is the strain rate factor, and $R_3(\Theta)$ is the internal resistance force for the concrete.
The yield stress of steel reinforcement in the Johnson Cook material model, subjected to an explosion, is shown in Eq. 2.

$$\sigma_y = (A + B\varepsilon^n)(1 + C\ ln\frac{\varepsilon\frac{p}{eq}}{\varepsilon_0})(1 - \left(\frac{T-T_r}{T_m-T_r}\right)^m) \quad (2)$$

Where: A, B, C are the constant value; T_m is the melting temperature of the material, and T_r is the reference temperature [11].

3. Impact Scenarios

An explosion is a very fast reaction that produces hot gasses; the hot gasses force the air around those gasses outwards, and these gasses are the outer most or top layer of the blast wave (Berg and Weerheijm 2006; Parisi, 2015). The outwards motion compresses the air that surrounds the gasses; the compressed air contains energy as a form of pressure from the explosion. As this explosion wave travels through the air, it decreases in energy as it travels further from the center of the explosion. According to Fig. 4, the momentum of the upper layer of gasses causes the air to over expand, causing the pressure to decrease below atmospheric conditions at the tail end of the blast wave (Jiang and Zhou, 2012; Lam and Mendis, 2004).

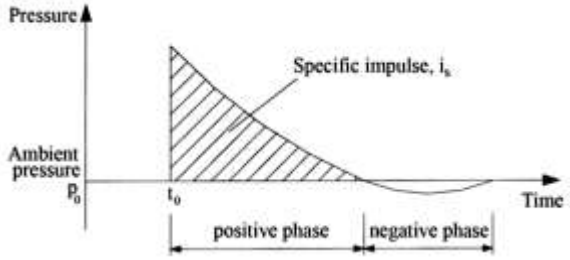

Fig. 4. Blast wave pressures

Drake and Little (1983) concluded that the pressure-time histories consist of a compressive pulse with a short rise

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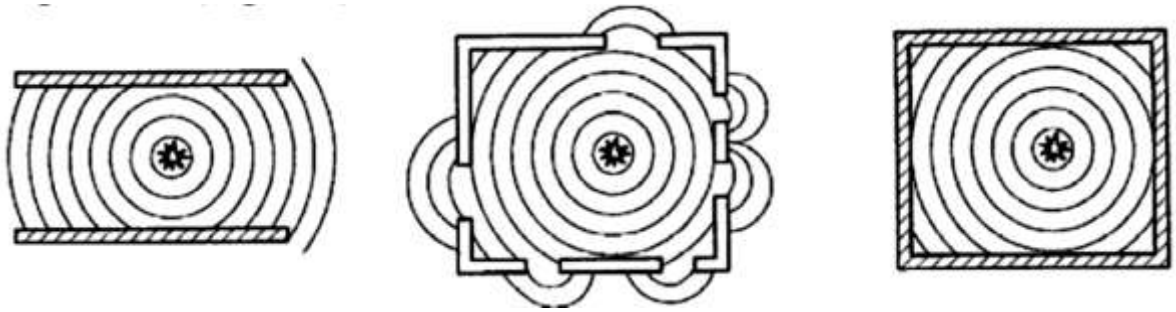
time followed by a negligible negative tensile pulse. The last major ingredient needed in the model is the blast action. Its load is defined by a pressure law that depends on time and position for each quantity of explosive. Defining the blast load is important to describe the damage from each blast and to predict how a panel will respond. Eq. 3 shows the normalized standoff distance.

$$Z = {R}/{W^{\frac{1}{3}}} \quad (3)$$

Where: Z is the normalized standoff distance, R is the standoff distance, and W is the weight of the TNT (Brode, 1955). This ratio normalizes the blast standoff distance to the weight of the charge (Tedesco et.al, 1987). According to Fig. 5, depending on the extent of venting, various types of confined explosions are possible (Ngo et. Al, 2007; Baker et al, 1983).



(a) (b) (c)

Fig.5. Various types of confined explosions a) Fully vented, b) Partially, vented c) Fully confined

The metro stations in the lower level are fully vented. The weight of the charge for this study was presented in the equivalent weight of TNT. The first steps of this study concluded that an explosion due to a less than 150 kg charge had no important effect on the damage of the selected wall. The minimum distance of the explosion to the selected wall is 3.5 meters, so four different charge weight of TNT was modeled at a standoff distance of 3.5 meters in front of the wall. The weight of the charge was modeled by 150, 200, 250, and 300 kg in Models 1 to 4.

In the modeling of the blast pressure, the TNT and air properties are based on the Autodyn material library and presented in Table 2. The equation of state for air is the ideal gas equation. The internal energy corresponding to the atmospheric pressure is assigned to the air material as an initial condition.

Table 2. TNT and air material properties

Material	Equation of State	Density g.cm^{-3}
TNT	JWL	1.63
Air	Ideal Gas	1.225

To model the expansion of explosive detonation of the charge, the JWL equation shown in Eq. 4 was used.

$$P = A\left(1 - \frac{w}{R_1 v}\right)e^{-R_1 v} + B\left(1 - \frac{w}{R_2 v}\right)e^{-R_2 v} + \frac{wE}{v} \quad (4)$$

Where: A, B, w, R_1 and R_2 are the empirically derived constants; v is the volume of the material at pressure divided by the initial volume of a unreacted explosive, and E is the internal specific energy (AUTODYN, 2009).

Kuhlmeyer and Lysmer (1973) concluded that in order to obtain acceptable results in dynamic simulations, the mesh size of the model should not be larger than one-eighth of the minimal wavelength. This criterion is used to select the mesh size for models. The hypothesis is also validated by performing a mesh sensitivity analysis, and results converged at a mesh size of 20 cm.

4. Analysis of models

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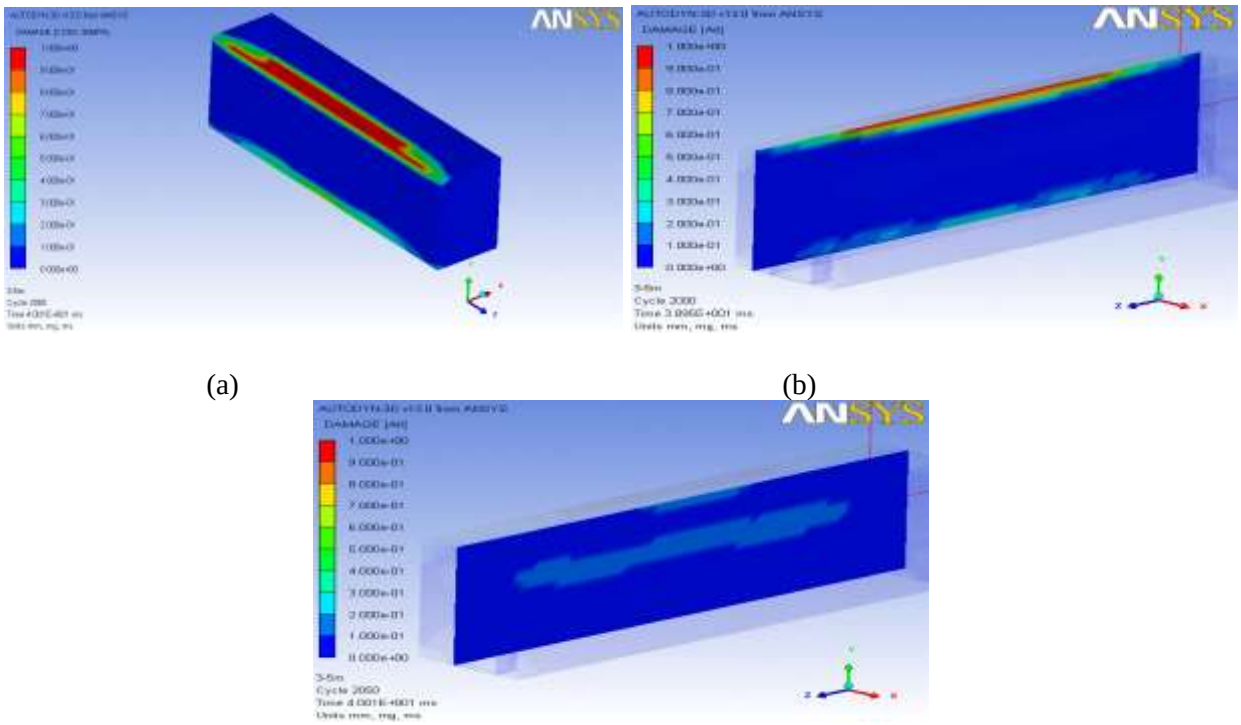
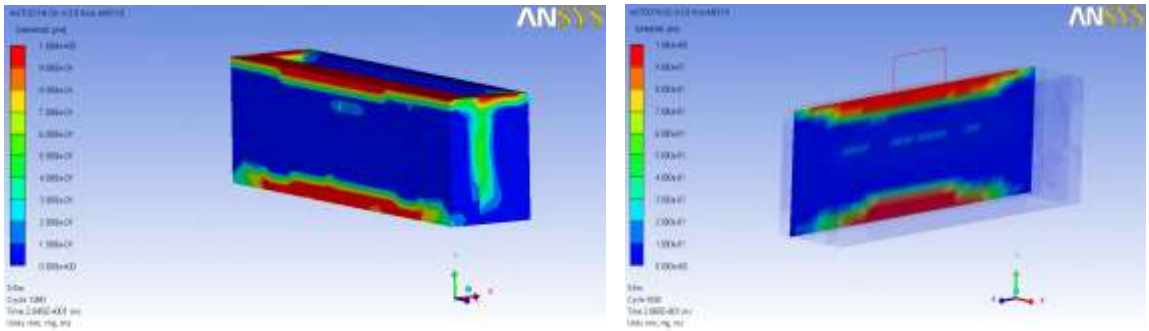
The damage ratios of each scenario in four models are shown in Figs. 6-9.



(a) (b)

(C)

Fig. 6. Damage results of model 1 a) front, b) middle, and c) back



(a) (b)

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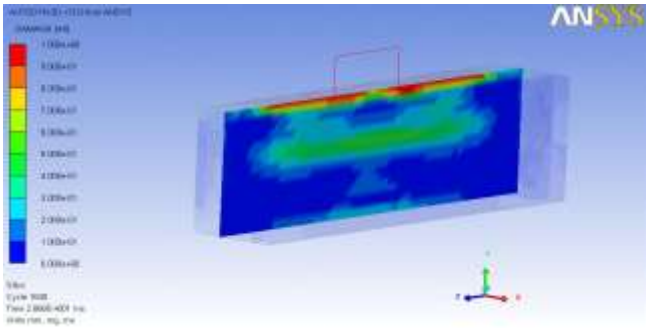
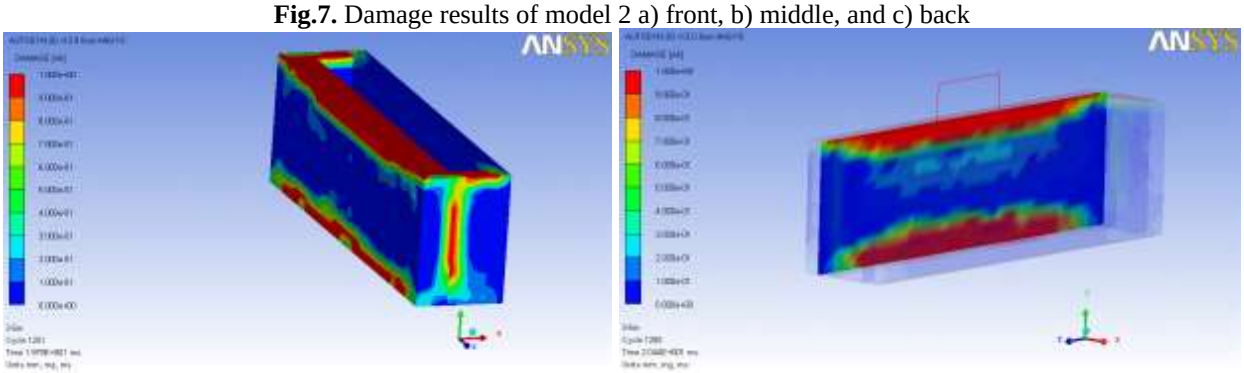
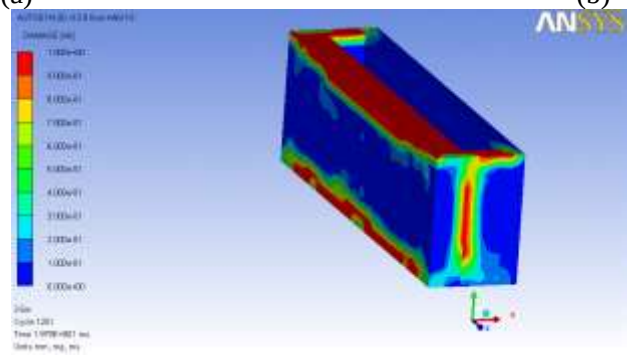


(c)

Fig.7. Damage results of model 2 a) front, b) middle, and c) back



(a) (b)



(c)

Fig. 8. Damage results of model 3 a) front, b) middle, and c) back

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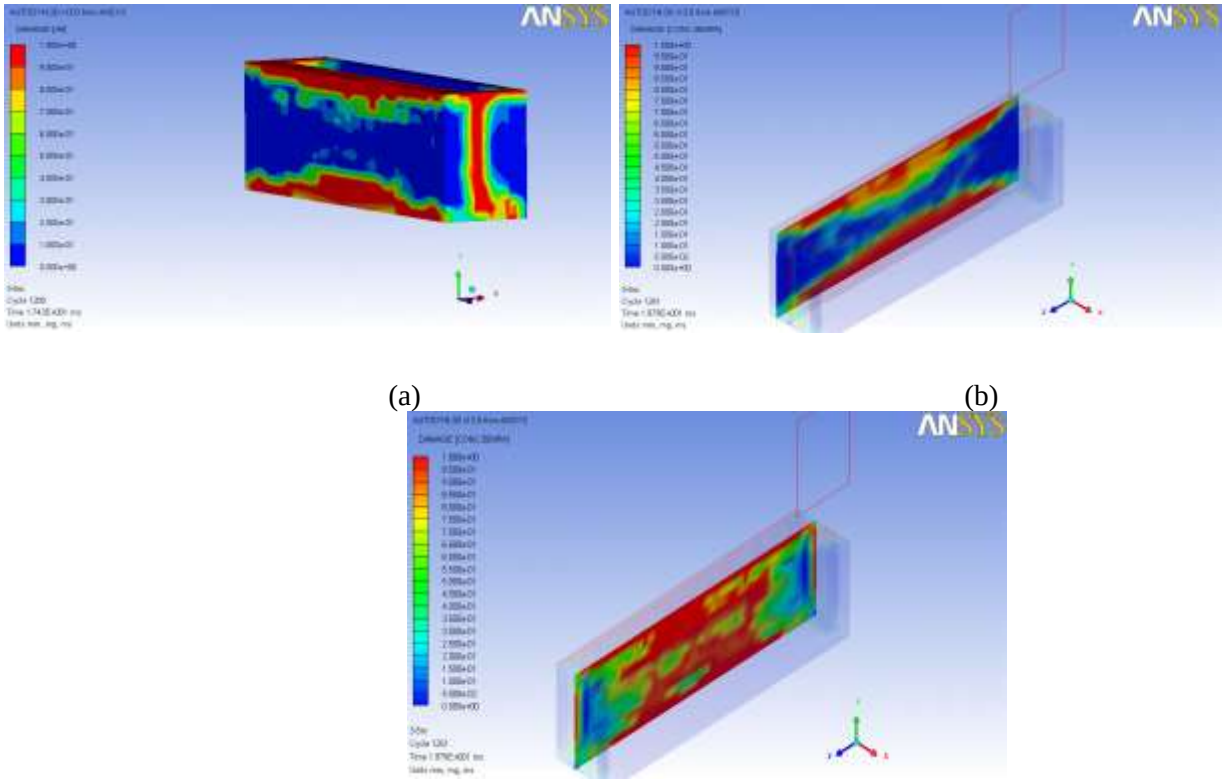

(a) (b)

(c)

Fig. 9. Damage results of model 4 a) front, b) middle, and c) back

One can conclude from the damage ratio of models that the applied blast pressure is greater on the top and bottom part of the wall and then decreases outwards from the ends. To model the openings for the damaged area in the models, three damage zones were identified in the results. The zones are categorized as follows:
(1) Zone 1: heavy damage (damage ratio more than 70%);
(2) Zone 2: moderate damage (damage ratio between 60% and 40%);
(3) Zone 3: light damage (damage ratio less than 30%).
Each zone is characterized by the damaged area, defined as the difference in cross-section before and after the blast. Table 3 shows the percentage of damage to the three sides of the walls (front, middle, and back) in each zone. Fig. 10 shows the damage ratio and scattering damages in each side of models. The modeling of damaged walls in design software is complicated. According to the damage ratio of the models, the equal wall presented in Figure 11.

Table 3. Damage ratio of the models

	Model 1			Model 2			Model 3			Model 4		
	Front	Middle	Back	Front	Middle	Back	Front	Middle	Back	Front	Middle	Back
Zone1	3.2	2.1	0.5	12.9	18	12	27.4	22	13.2	32	31	62
Zone2	11.2	6	2	13.3	13	35.4	16.2	10	39	23	24	27.7
Zone3	85.6	91.9	97.5	73.8	69	52.6	56.4	68	47.8	45	45	10.3

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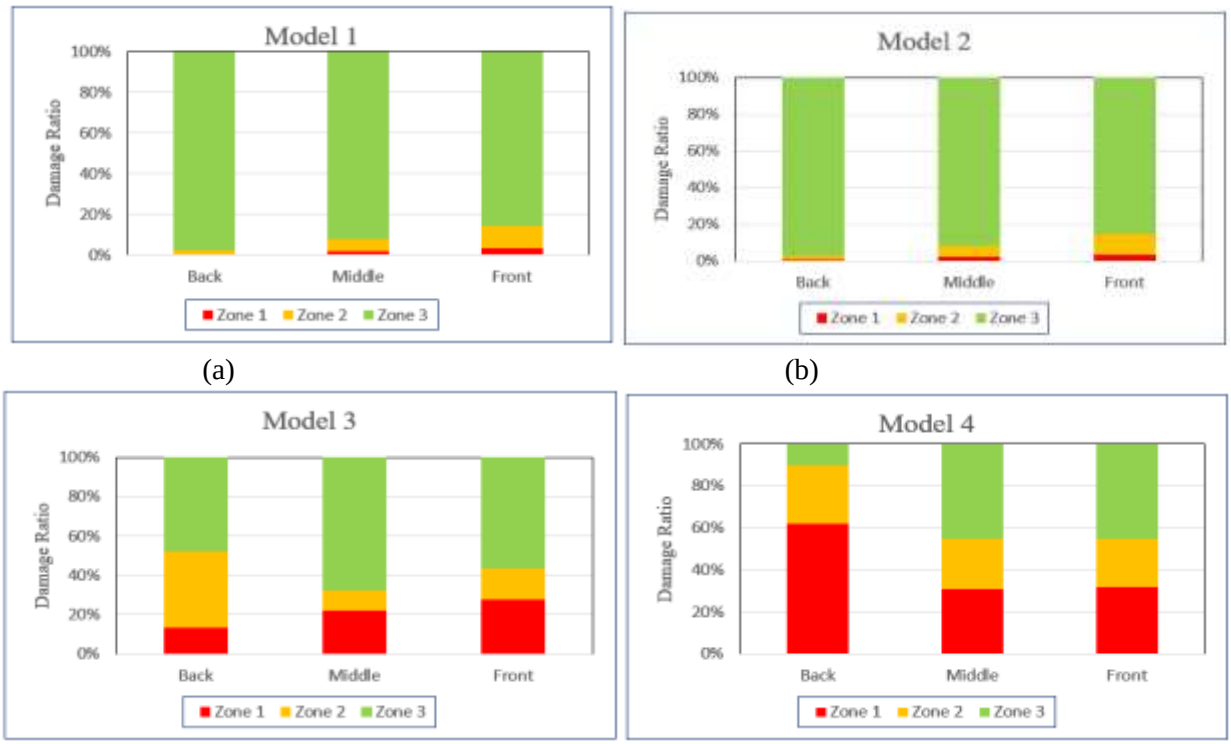

Fig. 10. Damage ratio of the models

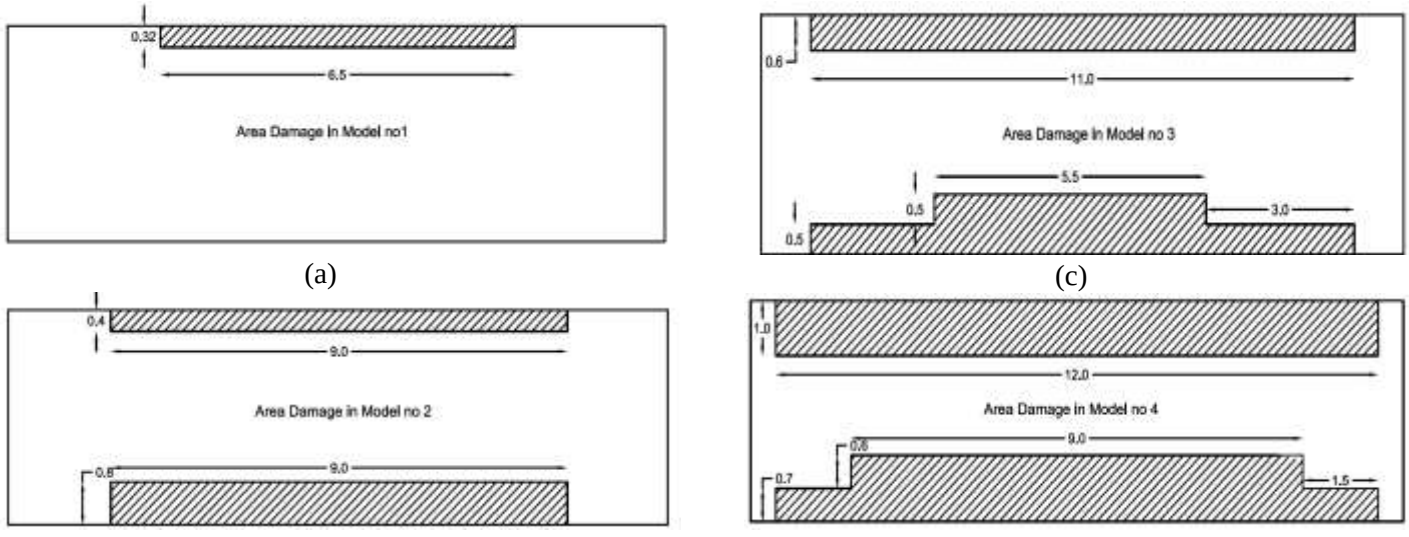

Fig. 11. Equal wall proposed for damaged models a) model 1, b) model 2, c) model 3, and d) model 4

The nonlinear behavior of a structure can be assessed by modelling the proposed damaged wall in software such as SAP2000, OpenSEES, or Perform 3D.

5. Conclusions

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Traffic infrastructure in urbanized areas is increasingly projected in urban subway metro. This development has significant consequences for the risks associated with terrorist attacks. It is obvious that the inner shear walls in subway metro stations are important structural elements. The loss of each of the inner walls will cause failure in a large area of the slab. To improve the performance of such structures, there are some solutions, such as anchoring the floor to the comer wall, designing the slab in cantilever conditions, or retrofitting the shear wall. Therefore, before conducting any rehabilitation methods, one must assess how the wall will be damaged and what amount of failure is associated with a given blast. This study examined the shear wall system in a metro station. Consideration was given to develop an efficient method that can be replicated in practice to model the damaged walls.

In the current study, the blast was modeled inside the structure; in another study, the behavior of the roof could be assessed by an external explosion. For future research, the shape of the wall can be changed, and more studies can concentrate on steel shear walls.

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